

## D2.2 - Topten ACT Criteria Paper

### Coffee machines

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**Topten ACT** aims at transforming the European market of energy-using products towards higher energy efficiency.

Topten ACT identifies the top energy-efficient products in 16 European countries, and makes this information available to consumers and large buyers on tailored national websites. The most energy efficient models in different product categories (such as household appliances, lighting, office equipment, consumer electronics, cars) are presented with comprehensive product information based on official labels and standardized declarations. Topten works with manufacturers and thus increases both market offer and consumer demand of high energy efficiency products. Topten is strictly neutral and independent from manufacturers and retailers, its selection criteria are always published online.

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More information and access to all national websites on the European site: [www.topten.eu](http://www.topten.eu)

WP2 European Product Analysis , Task 2.1 Determining energy efficiency criteria, D 2.2 Periodic Criteria Papers (second set)

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## 1. Overview on types of coffee machines

Coffee machines with electricity supply can be categorized according to their pressure: a) machines with high pressure (> 8 bar), b) low pressure (< 8 bar) and c) no pressure (see Table 1 and Figure 1). For the preparation of a real «espresso» 15 bar are optimal. Therefore, machines with more than 8 bar are synonymously often called «espresso machines». Coffee prepared with low or no pressure tastes more like drip-filter-coffee.

Type	Pressure	Quality of Coffee	Synonym
Fully automatic machines	High	Espresso	Espresso machine
Portioned machines: Capsule machines	High	Espresso	Espresso machine
	Low (e.g. Tassimo)	Drip-filter-like	----
Portioned machines: Pad machines	Low	Drip-filter-like	----
Machines with piston lever	High	Espresso	Espresso machine
Drip-filter machines	No pressure	Drip-filter-like	----
Combi machines (Piston lever/Drip-filter)	High/Low	Espresso/Drip-filter-like	----



Figure 1: Types of coffee machines

In the following the talk is about fully automatic machines and capsule and pad machines. Otherwise it is explicitly mentioned.

## 2. Topten.eu: coffee machines current selection criteria and products selected

Topten.eu presents the most efficient fully automatic machines and portioned machines for capsules and pads available on the European market. Not in the scope of Topten.eu are filter coffee machines, machines with piston lever, combi-machines and (commercial) appliances with a permanent water supply.

In order to qualify for Topten.eu, coffee machines must meet the following criteria:

- Auto-power-down function switching-off the permanent heating of the water after a certain delay time to “standby” or “off”
  - Delay time of the auto-power-down: Default (factory setting)
    - Portioned machines: max. 15 minutes
    - Fully automatic machines/piston machines: max. 30 minutes
  - Delay time of the auto-power-down: Programmable by the user
    - Portioned machines: max. 30 minutes
    - Fully automatic machines/piston machines: max 3 hours (It is planned that the programmable auto-power-time is further reduced and adapted to developments on the market)
  - The auto-power-down-function can not be deactivated by the users or any

function.

- Annual electricity consumption according to EN 60661:
  - Portioned machines: Energy class A+
  - Fully automatic machines/piston machines: Energy class A
- The required values are to be provided by the supplier. Otherwise there is no entitlement to a presentation of the appliance on Topten. The information may be checked by sampling measurement.
- Available in at least one European country.

#### Notes on the selection criteria:

- For capsule machines the Topten.eu-criteria for the delay time are more stringent than the requirements by the EU Ecodesign regulation (details see below), as very short times for this type of coffee machines is quite common.
- Topten.eu also sets requirements on the programmable delay time (more details see below).

In August 2018 in total 37 coffee machine models of 10 different brands are listed on Topten.eu (Bosch, Cremesso, DeLonghi, KOENIG, Krups, Magimix, Nespresso, Siemens, Tchibo, Turmix). 13 machines are fully automatics, 24 are capsule machines. Similar models have not been counted if from the same brand.

### **3. Expected selection criteria in 2019**

Until further notice Topten.eu applies the selection criteria listed in the box above (chapter 2).

The first A++ fully automatic machine was listed in 2018 (otherwise A products). If this technical innovation leads to a general jump in technologies, Topten selection criteria will be adjusted accordingly.

### **4. Technical background**

Energy using functions of coffee machines are the heating up of the cold tap water, production of a cup of coffee, keeping hot of the heated water (!), standby, electric motors, pumps and magnet valves.

Key parameters for high energy efficient coffee machines are (see also [1]):

#### **Short delay time until the machine automatically switches to standby or off**

Around ten years ago, almost no coffee machines switched-off automatically after a certain time after the brewing of a cup of coffee. The machines then kept the heated up water permanently at a temperature of 85°C to 90°C. Unless the consumer switched-off the machine manually, it always was «on». This «keeping hot»-function consumed a lot of energy.

Today all coffee machines entering the EU market have a function (power management), which automatically switches the machine to standby or off. The maximum default delay time after which the machine automatically has to switch into standby or off mode is regulated by the amending EU Ecodesign regulation (EU) No 801/2013 on Standby [2]. It is in force since January 2015 (details on the requirements see below).

However, an important point, which is not treated by the amending EU Ecodesign regulation (EU) No 801/2013 on Standby is the programmable delay time. There are many coffee machines – especially fully automatic machines – for which the default delay time can be re-programmed and prolonged excessively (up to 2h, 3h, 4h, 5h, 8h, 9h, 12h and even 15 hours as shown by a Topten-research in 2012). This untreated aspect leaves room for interpretation. Producers might (ab)use this loop hole to deliver the machine indeed in an energy efficient mode but to offer also a prolongation of the delay time, which then raises energy consumption. To restrict this practice, Topten.eu also sets requirements on the programmable delay time. The development of the market has to be observed carefully.

### **Low standby or zero consumption**

The allowed energy consumption in standby is regulated by the EU Ecodesign Regulation (EC) No 1275/2008 for standby and off-mode consumption [3].

#### **«Energy saving mode»**

Some coffee machines have an «energy saving mode» or «eco-mode» which is factory set or can be programmed in the menu. This mode lowers the temperature of the heating element after a certain time (e.g. after 5 minutes), from standard 90°C to about 60°C. The coffee machine then is no longer in a real ready-mode but requires some heating time before dispensing coffee. This then takes less heating time than heating up from the cold state.

### **Low thermal capacity of the heating unit**

A striking development towards super-efficient coffee machines was the introduction of flow-type heaters. With this brewing system only around 10 ml of water have to be heated up, which is energy saving. This type of coffee machines represents the current best available technology (BAT).

Thermo-blocks are another nowadays common type of heating unit (containing 10 to 20 ml of water, but several hundred grams of aluminium).

Coffee machines with an integrated boiler (containing several hundred ml of water) are, due to their comparatively high water content, very inefficient and therefore disappeared almost completely from the market.

### **Good insulation of hot parts**

This is a further measure to substantially reduce the thermal losses of the heaters.

### **Low amount of water to be heated for hygienic and quality purposes**

Most coffee machines heat up certain quantities of water for rinsing purposes when switched on or off, or they discard a small amount of coffee at the beginning of the brewing process, which might be not hot enough or not of sufficient quality. Decalcification and (automatic) cleaning also is an energy and resources (including chemicals) consuming aspect in the life cycle of coffee machines. There might be an additional saving potential, e.g. by using lower water temperatures and volumes for these processes.

## **5. Policy measures, standards and labels**

### **Energy label for coffee machines**

#### EU: no energy label for coffee machines

The commission decided to not introduce an EU Energy label for coffee machines for the time being. Its opinion is that requirements on the default delay times are sufficient (see [2]).

#### Switzerland: Swiss energy label for coffee machines

Switzerland designed its own Swiss energy label which is applied for coffee machines available on the Swiss market. It is mandatory since January 2015. However, the validity of



the Swiss-label is limited as almost all products are in the best class A. At the present time the machines are tested according to EN 60661 (see below) from 2016.

### **EU Ecodesign requirements on standby and off mode**

Based on the horizontal standby regulation No 1275/2008 [3], coffee machines in standby may use max. 0.5 W without display and max. 1 W with status display and max. 0.5 W in off mode.

Regulation No 801/2013 on networked standby, which is amending regulation No 1275/2008, contains a chapter on coffee machines, defining the maximum delay time when they must switch automatically into standby or off mode respectively. Since 1 January 2015, the delay time after which the coffee machine switches automatically into standby and off mode shall be as follows [2]:

- for domestic drip filter coffee machines storing the coffee in an insulated jug, a maximum of five minutes after completion of the last brewing cycle or 30 minutes after completion of a descaling or self-cleaning process,
- for domestic drip filter coffee machines storing the coffee in a non-insulated jug, a maximum of 40 minutes after completion of the last brewing cycle, or 30 minutes after completion of a descaling or self-cleaning process,
- for domestic coffee machines other than drip filter coffee machines, a maximum of 30 minutes after completion of the last brewing cycle, or a maximum of 30 minutes after activation of the heating element, or a maximum of 60 minutes after activation of the cup preheating function, or a maximum of 30 minutes after completion of a descaling or self-cleaning process, unless an alarm has been triggered requiring users' intervention to prevent possible damage or accident.

Note: As already mentioned above, the amending EU Ecodesign regulation on networked Standby [2] regulates only the maximum allowed default delay time for the auto-power-down (factory setting). However, many coffee machines – especially fully automatic machines – can be re-programmed. This point is not treated by the regulation. Manufacturers might (ab)use this loop hole to deliver the machine indeed in an energy efficient mode but to offer also an excessive prolongation of the delay time, which then raises energy consumption considerably.

Expected savings of these delay time limits for coffee machines are > 2 TWh in 2020 (additional to savings by the standby power limits, which however cannot be allocated to individual product categories).

### **Blue Angel: RAL-UZ 136 (Coffee Machines for Household Use)**

The Blue Angel labels environmentally friendly fully automatic coffee machines, porta filter coffee machines (semi-automatic), pod coffee machines and filter coffee machines. Capsule machines are not in the scope. Details see [4].

Currently one providers of coffee machines labelled with the Blue Angel.

### **Measurement standards**

#### Europe: EN 60661

Since 2014, for coffee machines the standard EN 60661 [5] is official. It allows measurements of the energy consumption. Filter coffee machines are also covered.

The testing according to EN 60661 in Switzerland from 2016 to serve the Swiss energy label for coffee machines might raised manufacturers' interest to test according to the new standard, as most of the coffee machines sold in Switzerland are also sold in the EU.

## 6. Market analysis

Roughly 20 million coffee machines are annually sold in Europe. For comfort and quality reasons, the trend goes towards espresso machines (fully automatic machines, portioned machines with high pressure) and pad machines. But also traditional drip-filter machines are still widespread (e.g. Germany, Netherlands). However, Topten.eu has only little experience with this type of coffee machines.

## 7. FAQ: common questions from manufacturers and consumers

*What is more ecological: portions (capsules/pads/fully automatics) or filter coffee?*

Coffee is a major international commodity. Coffee production and transportation has a considerable global impact on the environment through the consumption of energy, water, land and the loss of native forest.

The advantage of portions is that they use only as much coffee as needed (around 5 to 8 grams). Drip filter coffee machines are usually filled with quite a high amount of coffee powder for the preparation of an amount of coffee, that rarely is fully drunk. The leftover coffee usually is thrown away. The waste of drip filter prepared coffee therefore is assumed to be quite high.

A further advantage of capsules or pads (which e.g. wrapped in a single sachet until usage) is that the coffee keeps its taste, because it is enclosed until its usage. Coffee in large bags loses its taste soon after a while the bag was opened. This coffee might then be thrown away if it has become tasteless.

Regarding capsules it is often said that they harm the environment. Especially the aluminium capsules by Nespresso are of great concern for the consumers. However, an unpublished study by Oeko-Institute from 2010 showed that the production of aluminium capsules indeed is highly energy intensive but that in case the capsules are brought back to the shop for recycling their environmental life cycle assessment is better than the one of plastic capsules.

A disadvantage of capsules / pads is their price per kg coffee, which usually is higher than for coffee in a bag. Furthermore, capsules bind consumers to the accordingly system of the coffee machine for which the capsules are produced and of course also to the offered coffee. When using a drip filter coffee machine or a fully automatic machine, consumers are free in the selection of the coffee they like.

## 8. References and links

### Useful links

Topten.eu coffee machines product lists:

- *Fully automatics:*  
[http://www.topten.eu/english/household/coffee\\_machines/super\\_automatics.html](http://www.topten.eu/english/household/coffee_machines/super_automatics.html)
- *Capsule machines:*  
[http://www.topten.eu/english/household/coffee\\_machines/capsule\\_espresso\\_machines.html](http://www.topten.eu/english/household/coffee_machines/capsule_espresso_machines.html)

Topten.eu coffee machines selection criteria:

- [http://www.topten.eu/english/criteria/coffee\\_machine\\_ak.html&fromid=](http://www.topten.eu/english/criteria/coffee_machine_ak.html&fromid=)

Topten.eu coffee machines recommendations:

- [http://www.topten.eu/?page=recommendations\\_coffee\\_machines&fromid=](http://www.topten.eu/?page=recommendations_coffee_machines&fromid=)



- [http://www.topten.eu/uploads/File/131101\\_Topten\\_recommendations\\_Coffee\\_Machines.pdf](http://www.topten.eu/uploads/File/131101_Topten_recommendations_Coffee_Machines.pdf)

## References

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[http://www.topten.eu/uploads/File/038\\_Barbara\\_Josephy\\_final\\_Coffee.pdf](http://www.topten.eu/uploads/File/038_Barbara_Josephy_final_Coffee.pdf)
- [2] Commission Regulation (EU) No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment, and amending Regulation (EC) No 642/2009 with regard to ecodesign requirements for televisions.  
[http://www.topten.eu/uploads/File/Networked-Standby\\_Ecodesign-regu\\_801-2013.pdf](http://www.topten.eu/uploads/File/Networked-Standby_Ecodesign-regu_801-2013.pdf)
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- [4] The Blue Angel: RAL-UZ 136. Coffee Machines for Household Use. Edition April 2014.  
<https://www.blauer-engel.de/en/products/electric-devices/espresso-and-coffee-machines>
- [5] EN 60661. Methods for measuring the performance of electric household coffee makers.
- [6] Ecodesign of EuP: Non-tertiary coffee machines DG Tren Lot 25 (off-line)