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Lot 25
Non-Tertiary Coffee Machines

Task 1: Definition – Final version

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INTRODUCTION

The Ecodesign Directive

This study on non-tertiary coffee machines (the "Lot 25 study") is the preparatory study being carried out by BIO Intelligence Service for the European Commission in the context of the **Directive 2009/125/EC on the Ecodesign of Energy-related Products**. The Directive does not directly introduce binding requirements for specific products but defines conditions and criteria for setting, through subsequent implementing measures, requirements regarding environmentally relevant product characteristics.

According to the Directive, implementing measures can be proposed for product categories which meet the following criteria:

- Significant volume of products placed on the EU market (indicatively, more than 200 000 units per year)
- Significant environmental impact (indicatively, more than 1 000 PJ/year)
- Significant potential for improvement (indicatively, more than 20%)

The implementing measures are to be based on an environmental assessment taking into account product characteristics and functionality. Technologies available on the market should be taken as a reference.

The first step in considering whether and which Ecodesign requirements should be set for a particular product group is a preparatory study recommending ways to improve the environmental performance of the product. The preparatory study provides the necessary information to prepare for the next phases in the policy process (carried out by the Commission), in particular the impact assessment, the consultation forum and possible draft implementing measures laying down Ecodesign requirements.

As in all Ecodesign preparatory studies, a common and coherent methodology (MEEuP)[1] is used for analysing the environmental impact and improvement potential of the products, and Ecodesign options are analysed from a life-cycle cost perspective. This methodology consists of eight main tasks which will be conducted in an iterative manner:

- Task 1: Definition
- Task 2: Economic and market analysis
- Task 3: Consumer behaviour and local infrastructure
- Task 4: Technical analysis of existing products

1 VHK (2005) Methodology for Eco-design of Energy-using Products (MEEuP), Final Report, European Commission (DG ENTR). Available at: ec.europa.eu/enterprise/eco_design/finalreport1.pdf

- Task 5: Base cases
- Task 6: Technical analysis of BAT
- Task 7: Improvement potential
- Task 8: Final analysis: scenario, policy, impact and sensitivity analyses

1. TASK 1 – DEFINITION

The objective of this task is to discuss definition and scope issues related to the Ecodesign preparatory study for non-tertiary coffee machines: ENER Lot 25.[2] It consists of the categorisation of products, product definitions, identification of key parameters for the selection of products on which to perform more detailed analysis during subsequent steps of the study, and scope definition.

Existing harmonised test standards and sector-specific procedures for product testing will also be identified and discussed, including the test protocols for:

- Primary and secondary functional performance parameters (functional unit)
- Energy use during product life
- Safety (electricity, electromagnetic compatibility, stability of the product, etc.)
- Other product-specific test procedures.

Finally, this task will identify and analyse existing legislation, voluntary agreements, and labelling initiatives at EU level, in Member States (MS) and in countries outside the EU.

[2] Preparatory studies are being managed both by DG ENER (formerly DG TREN) and DG ENTR. In order to differentiate between the different lots, the prefix "ENER" is used here.

1.1. PRODUCT CATEGORY AND PERFORMANCE ASSESSMENT

The main objective of this subtask is to set a solid foundation by defining the product scope for non-tertiary coffee machines, and to develop an understanding of these products from functional, technical, environmental and economic points of view. This subtask will also structure appropriate product groups while providing a first screening on the basis of their sales and stock volumes, environmental impacts and improvement potential.

1.1.1. DEFINITIONS

- **General**

The first step for elaborating relevant product definitions is to review existing product categories that are commonly used to classify non-tertiary coffee machines. Possible definitions are derived from market statistics (e.g. PRODCOM[3]), technical standards (e.g. IEC), labelling schemes (e.g. Blue Angel) and legislation and are compiled for a comparative analysis that will serve as a reference.

The second step is the identification of additional criteria (technical, functional, design, market-based, etc.), which allows the scope of this preparatory study to be defined in a precise manner and complements the elaboration of the product definitions for the purpose of this study. The preliminary analysis[4] of the technical and functional parameters and expected environmental impacts of typical products provides the input for determining the functional unit.

Finally, an assessment of the product-system interactions from a broader perspective will identify if key parameters linked to the system can influence the environmental impacts and improvement potential linked to the products.

- **Criteria for defining the scope**

The coffee machine industry manufactures equipment and components for various coffee-making processes and complementary functionalities. The following parameters are considered before establishing product definitions:

- Application area: “non-tertiary”
- Energy source
- Coffee conditioning
- Brewing technology
- Drinking containers

[3] PRODCOM Classification: List of PRODucts of the European COMmunity
[4] A more detailed technical analysis of the products included in the scope of ENER Lot 25 will be performed in Task 4.

- Cup-warming plates
- Modes of use
- Auxiliary functionalities and options
- Automation of the process (for espresso machines only)
- EU trade classifications (such as PRODCOM categories)
- Classifications employed by standards organisations (such as EN or ISO standards)
- Existing legislation, labels and voluntary agreements

Each individual parameter may not provide enough information on the appliances to develop a relevant classification. Consequently, paying attention to all relevant parameters will be of key importance for later tasks, in particular for defining the base cases in Task 5.

◆ **Application area: "non-tertiary"**

"Non-tertiary" is understood as excluding commercial use. Accordingly, this study will focus on coffee machines used in households and coffee machines intended for domestic use that are used in offices. Some high quality and advanced espresso machines can be used for both household and tertiary purposes. These are not considered as machines strictly for non-tertiary use but could still fall within the scope of the study.

◆ **Energy source**

Coffee machines can be divided into two types depending upon the heat source: with an independent heat source, or without any independent heat source. Coffee machines within the scope of later tasks of this study should have an energy source (electricity) and not depend on energy supplied to another appliance (i.e. stove top percolator).

◆ **Coffee conditioning**

Although all coffee machines work by bringing water and ground coffee into contact, coffee can be inserted into the coffee machine with different degrees of conditioning. With the recent increased uptake of espresso machines, coffee conditioning has become more important and more diverse. The simplest form is to use the coffee beans directly, but that requires a grinding function, either in the coffee machine or via an accessory. Ground coffee remains the most popular form of coffee conditioning. Depending on the machine, ground coffee can be poured directly into the coffee machine filter, or inserted in specific containers – individual capsules of aluminium and/or plastic, or coffee pads.

Table 1-1: Coffee conditioning, examples

Coffee beans (Crown Coffee & Vending)	Ground coffee (New Internationalist Shop)	Pads (Arabicaffe)	Capsules (Nespresso)
			

- **Brewing technology**

Brewing technology is the way hot water passes through the ground coffee and acquires its flavour and colour. Water can be put in contact with ground coffee in different ways:

- Hot water can be percolated onto the ground coffee, and gravity makes the water pass through the coffee into the container below: this is the case for filter machines, also called drip coffee makers;
- Hot water or steam can be injected under pressure onto the ground coffee, and both pressure and gravity drive the beverage into the cup below: this is the case for example for drip filter and pad filter coffee machines (at low/middle pressure: approximately 3 bars) and espresso machines (at higher pressure: around 15 bars);
- Steam can be injected into the ground coffee from below, and gravity makes the beverage fall down into the receptacle: this is the case for percolators, vacuum brewers and moka pots (typically, it is very hot water injected by steam);
- Various combinations of these technologies also exist.

- **Drinking containers**

The beverage produced in the coffee machine is poured into a container, which can be of different kinds, according to the type of coffee machine and brewing technology:

- A coffee pot, mainly for drip filter coffee machines;
- One or two cup(s), mainly for espresso machines;
- A combination of cup(s) and coffee pot(s) for drip coffee machines, espresso machines or coffee machines combining both technologies;
- An insulated thermo jug (a thermal container, also called a *carafe*), mainly for drip filter coffee machines;

- No container: in this case, the drink remains in the machine itself, applies mainly to mokas or percolators.

Cup-warming plate

Drip filter coffee machines are often used to prepare coffee that is not drunk immediately. They usually have a warming plate under the coffee pot to keep the brewed coffee hot. Espresso machines may also be equipped with warming plates for heating empty cups, which can be heated electrically and then may be switched on/off manually or by menu.

Modes of use

It is important to take into account the modes of use of the machine when dealing with energy consumption, given that coffee machines are most often plugged in 24/7, and used only twice or three times a day for 20 to 100 minutes at a time. To tackle this, coffee machines present a range of different modes of use, such as ready mode, standby, on, off, etc. This section aims to describe the full range of possible coffee machine power modes. Conclusions can then be drawn as to which of the power modes will be considered in further calculations, and which might be left out for various reasons.

The definitions of the operating modes according to the Ecodesign Regulation on standby and off mode for electric power consumption[5] are:

- "Off mode" means that the equipment is connected to the main power source but is not functioning. The following shall also be considered as off mode:
    - Conditions providing only an indication of off-mode condition;
    - Conditions providing only functionalities intended to ensure electromagnetic compatibility pursuant to Directive 2004/108/EC.
- "Standby Mode" means that the equipment is connected to the main power source, depends on energy input from the main power source and provides only the following functions which may remain turned on for an indefinite period of time:
    - Reactivation function, and/or
    - Information or status display.
- "Information or status display" is a continuous function providing information or indicating the status of the equipment on display, including clocks.
- "Reactivation function" is a function that facilitates the activation of other modes, such as the on mode, activated by a remote switch, including remote control, internal sensor or timer to a condition providing additional functions, including the main function.

[5] Commission Regulation No 1275/2008, published in the OJEU on 18/12/2008.

As such, in considering the above presented definitions and those defined in other similar standards or test methods (e.g. RAL-UZ 136 from Germany or Measurement method for Swiss Energy label by FEA/CECED) described in this document, the modes applicable to coffee machines relevant to this study include:

- **Ready mode**: In this mode, coffee can be produced immediately by pushing a button (the process should begin in less than approximately three seconds). Coffee machines are still in ready mode when keeping coffee hot. Note that power input in ready mode is not constant; it can rise above 1 000 W when heating, then sink back to a low value between heating periods. If the cup-warming plate of a machine can be switched on or off in the programme menu, this results in two different ready mode values. New machines with flow-type heaters have no defined ready mode; the ready state may look like a standby mode.
- **Standby mode**[6]: When a coffee machine is not used, it is generally in standby mode or switched off. In standby mode, water heating is inactive. The coffee machine is still supplied with electricity, and a time-controlled function can be implemented. Some coffee machines can have two different standby values, e.g. before and after the auto-power down.
- **Off mode**[7]: Off mode is defined as the lowest power input when the mains switch of the machine is switched off. Some coffee machines still use energy in this mode. With a soft-off switch, the machine is switched off electronically and usually maintains a minimal power input for supplying the electronic circuit. A hard-off switch disconnects the machine from the mains, so that power input is zero.

◆ **Auxiliary functionalities and options**

Auto-power down (into standby mode) and auto-power off (into off mode): The auto-power down function consists in automatically ending the heating of a machine after a certain period of inactivity. In some models, different delays can be pre-programmed or set by the user using a menu; in others, there is no power management system or there is only one fixed setting. This should not be confused with an energy-saving function (see below), which reduces temperature only.

Energy-saving function ("eco-mode"): some models of coffee machine have this function, which consists in lowering the temperature of the heating elements after a

[6] According to the Standby Regulation (1275/2008), 'standby mode' means a condition where the equipment is connected to the mains power source, depends on energy input from the mains power source to work as intended and provides only the following functions, which may persist for an indefinite time:
- reactivation function, or reactivation function and only an indication of enabled reactivation function, and/or
- information or status display.

[7] According to the Standby Regulation (1275/2008), off mode' means a condition in which the equipment is connected to the mains power source and is not providing any function.

given delay of inactivity. The energy consumption of the machine is then lower than in ready mode and allows a quick preparation of coffee, if needed, as the heating elements are not cold as in the standby mode or off mode. The distinction between energy-saving mode and standby mode is that energy saving mode is a mid-way point between ready mode and standby, where heating functions are provided but at an optimised temperature to compromise between quick service upon re-initialisation and energy savings due to lower temperatures maintained over extended periods.

Activating: This means "waking" the machine from standby mode. The machine will be ready after heating up and possibly rinsing. Machines without ready mode are waked while preparing a cup of coffee.

Rinse function: Many coffee machines automatically dispense a small amount of water after heating up, in order to clean and warm the dispensing components. In some machines, this function can be switched on or off in the programme menu. In some cases, the rinse function has to be confirmed by pushing a button in response to a prompt on the display.

Coffee machines may have several other optional functions like:

- grinder
- milk heater, milk frother or froth attachment (for cappuccino making)
- programmer or timer
- HMI (human-machine interface (tactile)), LCD screen
- touch lift (to lift the cups)
- aroma selector (for aromatised coffee, for example with nut taste)

This first review of definition criteria already provides an insight into the main characteristics and differences that exist between the products covered by Lot 25 and will help refine the product definitions relevant for this study. However, further investigation will be necessary about the performance of the appliance not only in terms of electricity consumption but also in terms of e.g. the amount of water that will be necessary to make a given volume of coffee. This is done as part of the technical analysis in Task 4.

- **Automation of the process (for espresso machines only)**

Espresso machines aim to produce a single or several cup(s) of coffee. The steps to coffee-making (grinding the coffee if relevant, heating the water, brewing the coffee, pouring the coffee) may be more or less automatic, ranging from a completely manual process (press) to a completely automatic process (fully automatic espresso machine). In semi-automatic processes, ground coffee has to be inserted manually into a receptacle, which is then fixed to the machine, under the supply of hot water and above the empty cup.

- **EU trade classifications (such as PRODCOM categories)**

  - **PRODCOM Classification**

The PRODCOM code 27.51.24.30 groups all the different types of non-tertiary electric coffee machines: no differentiation is made regarding the brewing technology or anything else.

Table 1-2: PRODCOM classification of domestic electric coffee machines

PRODCOM Code	Description
27.51	*Other electro-thermic appliances*
27.51.24.10	Vacuum cleaners, including dry cleaners and wet vacuum cleaners (excluding with self-contained electric motor)
27.51.24.30	**Domestic electric coffee or tea makers (including percolators)**
27.51.24.50	Domestic electric toasters (including toaster ovens for toasting bread, potatoes or other small items)
27.51.24.90	Electro-thermic appliances, for domestic use (excluding hairdressing appliances and hand dryers, space-heating and soil-heating apparatus, water heaters, immersion heaters, smoothing irons, microwave ovens, ovens, cookers, cooking plates, boiling rings, grillers, roasters, coffee makers, tea makers and toasters)

- **Classifications employed by standard organisations (AHAM standards)**

The Association of Home Appliance Manufacturers (AHAM) released the American National Standards Institute (ANSI)/AHAM CM-1-2007 - Method for Measuring Performance of Household Coffee Makers, which is further defined in Section 1.2.3. This document aims to establish a standardised procedure for measuring specified product characteristics of household electric coffee machines. It is detailed later in this report, in Section 1.2.3.

The "AHAM CM-1-2005" standard, released two years earlier, used the following classification:

- Household Automatic Percolator
- Household Automatic Coffee Urn
- Household Automatic Drip Coffee Maker
- Household Espresso Maker

A coffee urn is a large size percolator. Typically, this appliance is capable of making from 30 to 100 cups of coffee, depending on the size of the urn. Thus, one may consider they are only dedicated to a tertiary purpose: weddings, banquets, conferences, etc.

Figure 1-1: Coffee urn (Hamilton Beach)

1.1.2. SCOPE OF THE STUDY

As shown above, a large variety of different products can be defined as coffee machines. It is necessary to determine the precise scope of the study in terms of products to be analysed further or to be excluded.

It is important to note that the scope, based on the analysis presented in the above sections, can be further refined when market and use data are investigated in Tasks 2 and 3, respectively. Further sub-categorisation may also be introduced based on the technical considerations that will be looked at in Task 4.

After the preliminary research and analysis of subtask 1.1.1, the following product types were identified:

- Drip/filter coffee machines
    - Independent heat source, normally internal electrical resistance
    - Warming function or no warming function
    - Insulated or non-insulated pots, single serving or several cups
    - Coffee may be in any form: beans, grounds
- "Pad filter" coffee machines (low-pressure portioned, also includes some models that use hard capsules, such as Tassimo)
- Espresso machines (high pressure)
    - Steam/non-pump espresso machine with independent heat source, or pump espresso machine (with piston lever) with independent electricity source for heating or other auxiliary purposes
    - Warming function or no warming function
    - Automatic, semi-automatic or manual with independent electricity source
    - Coffee may be in any form: beans, grounds, pads, capsules

- Electric percolator, electric moka pot, electric vacuum coffee machine
    - Electrical heating plate incorporated
    - No container, the coffee is prepared inside the machine
    - Coffee may be in any form, but ground coffee is the most common for this machine type
- Traditional coffee machines
    - Traditional percolator
    - Traditional moka pot
    - Traditional vacuum pot
    - Neapolitan flip coffee pot

In this study, coffee machines are defined as machines that heat water with built-in electric heating devices, and pass it through coffee so as to produce a hot drink. This coffee drink can be dispensed in various containers, such as cups, pots or in the machine itself.

The coffee machines entering into the scope of this study are detailed further below.

◆ **Drip filter coffee machines**

Drip coffee machines, which are also called filter coffee machines, can be divided into three categories, according to the coffee conditioning they require:

- Traditional filter coffee machines, using ground coffee

This type of coffee machine uses a range of drinking containers:

- pots (usually for 10 to 18 servings), 1 cup (single serving), 2 cups;
- standard or insulated thermal containers.

	Coffee pot	**1 cup**	**2 cups**
Non-insulated container	 From Black & Decker	 From Black & Decker	 From Princess

	Coffee pot	1 cup	2 cups
Insulated thermal container	 From Cuisinar	 From Black & Decker	 from Toastess International

Figure 1-2: Traditional filter coffee machine, using ground coffee

- Combo filter coffee machines: one can use either ground coffee or pad filter.

Figure 1-3: Combo filter coffee machine from Cuisinart

This type of coffee machine is dedicated to preparing one cup of coffee, from water and a pad of ground coffee.

- **Pad filter coffee machines**

Figure 1-4: Pad filter coffee machine from Senseo

This type of coffee machine is dedicated to preparing one or two cup(s) of coffee, from water and a pad filter of ground coffee. They are typically pressurised by a pump to approximately 3 bars (less than espresso machines but more than drip filter machines, which have no infusion pressure). This type of machine can also be called “portioned low pressure coffee machine”, since the category also includes some models that use hard capsules, such as Tassimo.

- **Espresso coffee machines**

Espresso machines exist with a variety of extraction methods, coffee conditionings and levels of automation. Considering the end-user, some of the household machines discussed here can also be used for tertiary purposes (e.g. in cafés, bars or restaurants), given the very high quality drinks produced. Two types of espresso coffee machines belong to the scope of this study, according to the extraction method (steam, pump automatic), while the third type, manual pump, is out of the scope of the study.

- Steam/non-pump espresso machines

Non-pump machines use pressure from steam, which is generated by boiling water in a sealed chamber, to extract pigments and flavours from ground coffee. Pressure can reach 15 bars, with water heated to above 200°C.

Figure 1-5: Steam/non-pump espresso machine from Krups

- Automatic espresso machines

This category of coffee machine exists in various types, depending on the coffee conditioning required, and the level of automation of the device:

  - Pump espresso machine, semi-automatic

These electric pump extraction machines automate the pump extraction process. The rest of the process is manual, such as the adding of pre-ground beans and of water, the stopping and starting of the pump (at the push of a button) and the cleaning of the portafilter.

  - Pump espresso machine, automatic

These electric pump extraction machines also automate the pump extraction process. The user does not control the extraction, since it is controlled automatically and has been pre-set by the user. The rest of the process, including adding the pre-ground beans, adding the water and cleaning the portafilter, is manual.

  - Pump espresso machine, fully automatic

These electric pump extraction machines automate the entire coffee-making process, from bean-grinding, to filter-tamping and espresso-brewing, so as to empty the used grounds into the waste unit, ready for the next cup. Three main subclasses of fully automatic espresso machines exist:

- Single boiler, dual use machines

This espresso machine has one boiler and two or more thermostats inside. One thermostat works to control the temperature of the water that is used to brew the coffee. The other thermostat is set at a higher temperature and is used for producing steam when steaming milk. A switch or button can be used to change thermostats. However, these machines cannot brew and steam simultaneously.

- Single boiler, heat exchanger machines

This type of espresso machine has a big boiler that keeps the water at high temperature and pressure is provided for making steam. A coiled tube acts as a heat exchanger, drawing water from the reservoir and through the tube where it reaches ideal brewing temperatures. These espresso machines can simultaneously brew and steam.

- Dual boiler machines

These espresso machines, the most expensive, have two independent boilers, or sometimes both a boiler and a thermo block. One boiler keeps the water at a brewing temperature while the other keeps the water at a steaming temperature. These espresso machines can simultaneously steam and brew.

- Hard cap espresso machines

Whereas other espresso machines work with coffee beans or ground coffee, these automatic espresso machines employ capsules that they are sealed and made from aluminium and/or plastics. This type of machine can also be called “portioned high pressure espresso machine”. Note that this category does not include Tassimo, since although it uses hard capsules it is a low pressure model.

Semi-automatic espresso machine from Briel	Fully automatic espresso machine from Saeco	Capsule espresso machine from Nespresso - Delonghi
		

Figure 1-6: Examples of automatic espresso machines

- **Combined coffee machines**

Figure 1-7: Combined coffee machine from Briel

These machines are composed of an espresso machine and a traditional filter coffee machine. They combine the two technologies. The two methods of use can be simultaneous or independent. There are two independent standby modes.

Appliances outside the scope of the Lot 25 study

Products that are out of the scope of this study include the following types.

- **Traditional coffee machines**

  - **Traditional manual coffee machines**

Manual coffee machines do not use energy directly, though they can influence the energy consumption of the hob depending on its characteristics, e.g. material type and thickness.

Most often one puts them on a hob. Although they don't have an independent source of energy, their energy consumption can be modified by their technical characteristics, like metal conductivity or breadth of the supporting metal plate. This is the case for traditional percolators, moka machines, vacuum coffee machines, as well as Neapolitan flip coffee pots, or "*Napoletanas*".

  - Traditional Percolator

A traditional percolator has no independent heating source and has to be placed upon a stove.

  - Traditional moka pot

A traditional moka pot is used on a stove; the heat from the burner boils the water and sends it up through the ground coffee and into the receptacle.

Figure 1-8: Traditional Moka pot (Aeternum)

- Vacuum coffee machine

Figure 1-9: Traditional vacuum coffee machine from Bodum

- The Neapolitan flip coffee pot

Figure 1-10: Neapolitan flip coffee pot (Napoletana Classica)

- Electric versions of traditional manual coffee machines
  - Electric percolator

A non-pressure driven percolator is usually placed on a stove, as it does not have its own source of heat. It consists of a pot with a small chamber at the bottom which is placed close to the heat source. A vertical tube leads from this chamber to the top of the percolator, which contains the ground coffee. Just below the upper end of this tube is a perforated chamber. It uses the pressure of the boiling water to force the water to a chamber above the grounds, but relies on gravity to pass the water down through the grounds, where it then repeats the process until shut off by an internal timer. An electric percolator has an independent heating stove.

- Electric moka pot

An electric moka pot has an independent heating stove, integrated into the base of the pot.

- Electric vacuum coffee machine

Similar to the electric version of the moka pot, the electric vacuum coffee machine is heated through an internal resistance below the machine instead of being heated on a stovetop.

- The Neapolitan flip coffee pot

The Neapolitan flip coffee pot is a drip brew coffee pot for the stovetop, which places it outside the scope of the study. The Neapolitan flip coffee pot consists of a bottom section filled with water, a filter section in the middle filled with ground coffee, and an upside-down pot placed on the top. When the water boils, the entire three-part pot is flipped over to let the water filter through the coffee grounds. Once the water has dripped through the grounds, the water-boiling and filter sections are removed, and the coffee is served from the remaining pot.

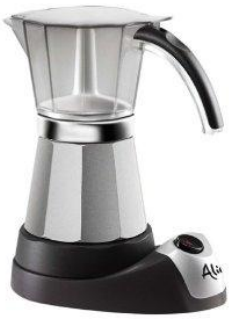
Electric percolator (Dualit)	Electric moka pot (Delonghi)	Electric vacuum coffee machine (Bodum)
		

Figure 1-11: Electric percolator, moka pot and vacuum coffee machine

- **Kettles**

Figure 1-12: Kettle (Tefal)

This type of machine is dedicated to preparing one cup of coffee. It produces hot water (automatic pump). The cup has to be filled with instant coffee powder.

The rest of the process is manual, including the adding of instant coffee and water, the stopping and starting of the pump (at the push of a button) and the cleaning.

- **Tertiary coffee machines**

The following devices are meant for tertiary use and would thus appear to be out of the scope:

- Coffee urns or large-capacity filter coffee machines

Figure 1-13: Large capacity drip coffee machine (Wilber Curtis)

- Filter coffee machines with one or several integrated warmer(s)

Figure 1-14: Coffee machines with warmer(s) (Bunn)

- Commercial espresso machines

Figure 1-15: Commercial espresso machines (Wega, Excelsior)

- Small vending machines

Figure 1-16: Small vending machine (Wittenborg)

Manual coffee machines, without any independent heat source

Coffee machines without any independent heat source shall be considered out of the scope of the study as they do not use energy directly. It should be specified that many of the manual coffee machines have an electric version, with an integrated heater (e.g. electric percolator, with an integrated stove), and these electric versions are under the scope of the study.

- Coffee machines employing hot water heated externally to be poured over the coffee, such as the French press and the Aeropress. Coffee machines without any independent heat source can potentially be considered out of the scope as they do not directly use energy.
- Press: It requires the user to apply a reasonable amount of pressure to force water through the grounds, which is a manual pump method of extraction.

French press

Figure 1-17: Presses (Creative Cookware, Aerobie)

- Pump espresso machine, manual (with piston lever): The functioning is the same as for presses, with manual pressure forcing water through the ground coffee. Further, manual pressure is not applied directly, but with a lever, which makes it easier to obtain the same pressure level.

Figure 1-18: Manual pump espresso machine (Gaggia 11400 Achille Lever-Operated Espresso Machine)

- **Functional unit for non-tertiary coffee machines**

The main function of a coffee machine is the preparation of a coffee-based beverage. The functional unit is thus related to the preparation of a certain number of coffees of a defined volume (a standard size for a cup of coffee is 80 g or 80 ml; under the current standard EN 60661 (not the draft version being elaborated), a large cup is 125 ml and an espresso is 35 ml) under a particular use scenario (time span within which the coffee is prepared, time the coffee is kept warm, etc.). The use scenario can be differentiated according to the type of coffee machine, for example by including:

- "Keeping warm" function (e.g. to maintain a cup of coffee at a serving temperature for a certain duration) in the case of drip filter machines; this is equivalent to the ready mode for espresso machines
- Standby function (e.g. maintaining standby functionality for one hour)

In this study, the functional unit is defined by a daily use pattern described in a draft CENELEC standard. Note that under the new standard, coffee sizes will be changed to 40 g for an espresso and 120 g for a large coffee.

Therefore, two main functional units can be defined depending on the type of coffee machine (see section 3.1.1.2 in Task 3 for more details):

- For drip filter coffee machines: "Brewing 1700mL of coffee per day, split into two equal coffee periods, and including a keeping warn duration"
- For pressure coffee machines: "Brewing 720mL of coffee per day, split into 3 equal coffee periods"

1.2. TEST STANDARDS

1.2.1. STANDARDS AT EUROPEAN COMMUNITY LEVEL

This subtask analyses the important test standards for non-tertiary coffee machines.

Product standards establish requirements relating to the design, manufacturing, construction, performance (energy efficiency and emissions of pollutants), and safety use instructions and marking, and also provide test methods. It is important to note that at present there are no European countries that regulate the energy efficiency of coffee machines and that there are no standards at the European level (CEN) related to the performance (energy efficiency) of coffee machines. Therefore, currently most European standards that concern ENER Lot 25 products address measurement standards and safety issues of electrical household appliances. These standards fall under EU directives such as the Low Voltage Directive (LVD). Many EN standards on ENER Lot 25 products also correspond to international standards. Overall, product-specific European standards are rather limited in relation to non-tertiary coffee machines. At this stage, European standards have been identified for coffee machines for domestic use with an independent heat source.

- **CEN**

There is one European test standard applicable to non-tertiary coffee machines and refers specifically to domestic coffee machines.

- **EN 13248:2002** - Coffee makers for domestic use with an independent heat source - Definitions, requirements and test methods

Prepared by: Technical Committee CEN/TC 194, "Ustensils in contact with food".

Date of implementation: Approved 23 October 2002, published December 2002

Description: This standard focuses only on traditional moka pot appliances with independent heating systems. Energy consumption is not considered. This standard deals with the following topics: normative references, terms and definitions, requirements, tests, marking and labelling, instructions for use and maintenance.

It defines safety requirements, requirements for design, manufacture and operation and corresponding tests, data for marking and instructions for use and maintenance of coffee machines. This standard is applicable to coffee machines for domestic use with an independent heating system employed for the production of mellow coffee infusion under steam pressure, whose pressure is over 50 kPa (0.5 bar) and under 250 kPa (2.5 bar) with a utilisation volume of less than 2 litres.

1.2.2. STANDARDS AT MEMBER STATE LEVEL

Non-harmonised standards of EU Member States applicable to coffee machines are listed below by the Member State which produced the standard.

- **Germany**

- **RAL-UZ 136 –** Espresso machines

Prepared by: RAL Deutsches Institut für Gütesicherung und Kennzeichnung e.V., the German Federal Ministry for Environment, The German Federal Environmental Agency

Date of implementation: May 2009

Description: This standard is for determining whether an appliance meets the criteria set forth for the German Blue Angel Eco-label (described in further detail in Section 1.3.2.). The types of machines covered by these criteria are automatic single-serve coffee machines, fully automatic coffee machines, pad coffee machines and portafilter coffee machines with high pump pressure that can brew "Italian-style" coffee. The measuring method and calculation formula for the power consumption of coffee machines for household use is from Euro-Topten / S.A.F.E, described in section 1.3.3.

The main power consumption criteria for this standard are as follows:[8]

[8] Basic Criteria for Award of the Environmental Label High-Pressure Espresso/Coffee Machines RAL-UZ 136, Edition May 2009 RAL gGmbH, Germany

- The equipment should have an auto-off function ("automatic switch-off function", "powersaving mode" or similar), by use of which the ready-to-use heating is automatically switched to "standby" or "Off" mode after an adjustable period of time.
- The factory-set delay time of the automatic switch-off function should not exceed 1 hour for fully automatic coffee machines and portafilter machines and 30 minutes for pad coffee machines.
- After automatic switch-off the power consumption in standby (or sleep)[9] mode should not exceed 1.0 W.
- The appliance must have a user-accessible mains switch. Power consumption in "Off" mode should not exceed 0.3 W.
- Energy consumption in "ready-to-use" mode until automatic switch off ("Ready-to-use"; designation E_{ber} according to the Euro-Topten measuring method[10]) should not exceed 35Wh for fully automatic machines and portafilter machines and 30Wh for pad coffee machines.

- **DIN 10764 – 10768 -** Analysis of coffee and coffee products

Prepared by: Deutsches Institut für Normung e.V.(DIN)

Date of implementation: March 2007

Description: The standards include testing methods and analysis for coffee-related products but do not appear to be directly related to coffee machines and energy use. The code and descriptions of each standard are given below for reference, but no further information has been collected:

  - DIN 10764 - Analysis of coffee and coffee products - Determination of loss in mass of soluble coffee - / Method using vacuum oven (routine method) / Method for soluble coffee and soluble coffee products by heating under atmospheric pressure (routine method) / Testing of coffee and coffee products; determination of dry matter content of soluble coffee, sea sand method
  - DIN 10765 - Analysis of coffee and coffee products; determination of particle size of ground roasted coffee, air-jet sieving method
  - DIN 10766 - Analysis of coffee and coffee products; determination of water content of green coffee, dioxane distillation, Karl Fischer titration
  - DIN 10767 - Analysis of coffee and coffee products; determination of chlorogenic acids content; HPLC method

[9] Commission Regulation No 1275/2008, published in the OJEU on 18/12/2008

[10] Euro-Topten and S.A.F.E. (2009) *Measuring Method and Calculation Formula for the Electricity Consumption of Coffee Machines for Household Use*. Available at: www.Topten.info/index.php?page=coffee_machine_ak&fromid=217

- DIN 10768 - Analysis of coffee and coffee products; determination of insoluble matter content of instant coffee

These standards are related to the ISO suite of standards regarding coffee described in the international standards section 1.2.4.

- **Germany DIN 10531**

Prepared by: Deutsches Institut für Normung e.V.(DIN)

Date of implementation: *not implemented yet*

Description: This standard specifies hygienic requirements for household appliances in order to ensure hygienic handling during manufacturing and preparation of foodstuffs.

This is a recent and advanced standard on coffee machines, with no direct effect on energy consumption but cleaning procedures could also cause some change in total energy consumption.

1.2.3. THIRD-COUNTRY STANDARDS

The previous section provides an overview of the standards relevant to Lot 25 products in countries outside Europe. National energy performance testing standards exist in non-EU countries such as Australia, Brazil, Canada, Chile, China, Japan, Russia, and the United States. Many of these countries produce specific interpretations of IEC and ISO standards. Countries which have standards relevant to the Lot 25 study are described below.

Table 1-3: Countries outside the EU with standards relevant to Lot 25

Country or State	Title of standardisation body or committee	Standard
USA	ANSI / AHAM	CM-1-2007
Switzerland	Euro-Topten and S.A.F.E.	Euro-Topten
Russia	Gosudarstvennyy Standart – State Standards	GOST 20888-81
Switzerland	FEA and CECED	FEA/CECED standard

- **United States**

- **ANSI[11]/ AHAM[12] CM-1-2007 -** Method for Measuring Performance of Household Coffee Makers

Prepared by: ANSI and AHAM[13]

[11] American National Standards Institute
[12] Association of Home Appliance Manufacturers
[13] AHAM maintains its status as an ANSI accredited Standards Developer Organization and submits many of its standards to the ANSI for approval as American National Standards. Each standard that gains ANSI recognition bears the ANSI/AHAM designation in the title of the standard.

Date of implementation: 2007

Description: This standard is a revision of a standard published in 2005, designed to establish a uniform, repeatable procedure for measuring specified product characteristics of household electric coffee machines.

The 2007 version of this document was not obtained for this study but the 2005 standard provides a means to compare and evaluate different brands and models of household electric coffee machines regarding characteristics significant to product use.

The main testing conditions and measurement parameters include:

- **Testing conditions:**
  - Standard electrical supply (North American standard 120V 60Hz as described in the standard)
  - Room temperature 23˚C ±5˚C
  - Electrical measurements accurate to ±1%
- **Performance tests parameters:**
  - Coffee machine operated with amount and grade of coffee equal to the maximum manufacturers recommended amount
  - Input water temperature at 15˚C ±3˚C
  - 150ml for standard cup size, 60ml for standard espresso cup
  - Coffee filters as per manufacturers recommendations
  - Allow brewing cycle to continue for manufacturer's recommended time
- **Measurements:**
  - Beverage temperature – recommended to be between 77˚C and 96˚C
  - Accuracy of output cup markings
  - Output water temperature
  - Temperature of coffee grounds during brewing
  - Pouring spout performance
  - Frothing of espresso machines (if applicable)
  - Brew strength
  - Sediment
  - Brew time
- **Safety:**
  - Recommended that products adhere to the safety requirements of UL 1087 (see section 0)

This 2005 version of the measurement standard does not require the measurement of energy use and hence does not make any recommendations or performance requirements in terms of energy efficiency. Many of the measurements are required to be taken at multiple times throughout the brewing process. This measurement standard gives a rough guide for recommended values of some of the results such as typical brewing temperatures.

- **Switzerland**

- **Fournisseurs d'appareils électrodomestiques (FEA) with Conseil européen de la construction électrodomestique (CECED) - Measurement method for the determination of the energy consumption of Espresso machines**

Prepared by: FEA / CECED

Date of implementation: 2009

Description: The development of a new *étiquette énergie* in Switzerland necessitated the development of a standardised and acceptable measurement method for espresso machines. This programme is supervised by the Swiss Federal Energy Agency. The label and measurement method are voluntary but legally enforced.

The measurement method can be used for all manual and automatic espresso and multi-purpose hot beverage machines characterised by high pressure and a cup-by-cup system. Hence, it does not cover the entire scope of this study. In addition, the method does not consider the quality and taste of the product as a key parameter, but measures the temperature of the beverage.

Energy consumption is estimated considering a typical day by day usage of the machine in four main EU countries. Four modes of operation are defined and tested to determine the overall, yearly energy consumption of the coffee machines. Performance per function is weighted based on the relative energy consumption of the function. A summary of the calculation parameters used to estimate each coffee machine's energy consumption is shown in Figure 1-19, which shows the main summary of the calculation tool and the benchmark values for each parameter as of 11 May 2009.

Criteria assessment tool energy label Espresso machines Version: 11 May 2009

Declaration for energy use of Coffee Machines

Machine brand: | Date:

Type number: | Prepared by:

Results reflect energy consumption in Wh over 24 hr use. | Signature:

Ref	Task	Procedure	Weight based on use frequency	Benchmark for function [Wh]	Calculated std consumption [Wh]	Function available? (yes=1; no=0)	Benchmark result based on calibration	Measured result for function	Calculated real consumption [Wh]	Relative performance per item
4.1	Heating up from "off"	One time heating up	1	20	20		20		0	0%
4.2	Brewing coffee	Sum of 1xsingle and 1x doubles of 40g and same for 120g.	1	55,8	55,8		55,8		0	0%
4.3	Steaming	Avrg of 3 measurements	1	15	15	1	15		0	0%
4.4	Ready to use time	60 min measurement	5	15	75		75		0	0%
4.5	Standby time	According to IEC 62301	11	2	22		22		0	0%
4.6	Heating up after standby	One time heating up	2	16	32		32		0	0%
4.7	"off" mode time	According to IEC 62301	8	1	8		8		0	0%
	Corrections									
	(Automatic) rinsing	Measured as part of heating up	1	3	3	1	3		0	
	Grinding	Minor impact, no measurement	1	2	2	1	2		0	
		Total consumption					233		0	0%

Calibration inputs:

Tcoffee =	76	°C
Avrg Cup=	80	g
Twater,brew	23	°C
DeltaTsteam	40	K

Tolerances shall not exceed limits as given in the implementing directive 2005/32/EC on standby energy

Tolerances shall not exceed 10% in case not covered by this directive.

Tolerances include testlab inaccuracy and production tolerances

Figure 1-19: Main calculation summary of FEA / CECED measurement method for Swiss Federal Energy Agency's voluntary energy label

This standard defines serving sizes, heating up periods, stand-by time and off time for espresso machines and makes the comparison based on these assumptions. They are based on real-life practices by users and factory settings of espresso machines. This method defines a procedure to classify coffee machines according to their energy consumption and efficiency, and also consider the quality of the product as a key parameter. The method includes a negative factor that impacts the final value of the energy performance if the product quality is different from the calibration inputs (initial water temperature, ambient temperature, etc).

The method also includes a guideline on how to standardise the measurement conditions. This includes a measurement of 'ready to use' mode which is fixed over one hour and requires manual reactivation if the machine automatically switches to 'standby' (after more than 10 minutes). If the machine switches to 'standby' before 10 minutes it is argued that no 'ready-mode' exists and standby is taken as 'ready' and reheating energy must be included in the subsequent brewing measurements. This can be considered an over-simplification of a key energy saving potential area for these machines. There is no definition in this method of an 'energy saving mode'.

The FEA/CECED method penalises coffee machines that have a switch-off delay time between 10 and 60 minutes (factory setting). Some coffee machines execute a rinsing process before powering down, which causes extra electricity consumption. To avoid this consumption being measured in the frame of the 60 minutes ready mode of the FEA/CECED method, manufacturers have lengthened the power-down delay to

two hours. This will of course raise the typical energy consumption – not really the intention of an energy label measuring method.

The appliance has to be reactivated (when powering down between 10 and 59 minutes) immediately, so as to artificially maintain the ready-mode for 60 minutes, although the appliance would not do so in reality. As there are a number of espresso machine models with power-down delays in that range (and more may come onto the market), these would be penalised without any physical or practical reason.

The FEA/CECED method and the voluntary Swiss energy label were developed in parallel to the already existing (since 2005) and successfully applied Euro-Topten Measuring Method (described in the next section). The FEA/CECED method was not adopted by the Blue Angel (for RAL-UZ 136), which favoured the Euro-Topten measuring method instead.

- **Measuring Method and Calculation Formula for the Electricity Consumption of Coffee Machines for Household Use** - Euro-Topten

Prepared by: Euro-Topten and S.A.F.E.

Date of implementation: 2005, latest update May 2009

Description: Euro-Topten and S.A.F.E. developed the measuring method 17 in 2005 subsequent to the report ”Standby consumption of household appliances” by Jürg Nipkow and Eric Bush (2003), a study on behalf of the Swiss Federal Office of Energy SFOE.

The Euro-Topten measuring method was developed and first applied in Switzerland. It was presented at EEDAL 2006 and EEDAL 2009 (Energy label for coffee machines. Jürg Nipkow and Eric Bush (Swiss Agency for Efficient Energy Use S.A.F.E.), EEDAL-Conference, London 2006; Strategies to Enhance Energy Efficiency of Coffee Machines. Eric Bush, Jürg Nipkow, Barbara Josephy, Susanne Heutling and Rainer Griesshammer (Topten International Group TIG, Swiss Agency for Efficient Energy Use S.A.F.E., German Federal Environment Agency, Oeko-Institute). EEDAL-Conference, Berlin 2009).

The Euro-Topten measuring method was discussed publicly with stakeholders and has been adopted by The Blue Angel (see section 1.2.2. and 1.3.2). The measuring method is applied by Topten in various European countries (e.g. www.topten.ch, www.topprodukte.at, etc.) and at European level (www.topten.info) for the best products of Europe and is supported by environmental organisations (e.g. WWF, ECOS).

The Euro-Topten measuring method is applicable for:

- Bean-to-cup coffee and espresso machines (all automation grades and with piston lever)
- Pad and capsule coffee and espresso machines (not regarding pump pressure)
- Coffee machines without regular ready mode (e.g. with flow-type heater)

The Euro-Topten measuring method covers the following operating modes:

- On or ready (water is kept at temperature for an immediate cup of coffee), including eco-modes if activated in the factory settings
- Standby (water is not kept at temperature)
- Energy saving modes that are not activated in the factory settings, but can be activated, can be included in an additional measurement. If a machine has accessory heating elements that can be switched off (e.g. cup warmer, steamer), additional programmable modes can be measured next to the factory setting. The electrical consumption can be measured for coffee machines both with and without auto-power-down function.

The aim of the Euro-Topten measuring method is to identify the total energy consumption (TEC) for the typical use of the machine during one year (standard use). This includes keeping the coffee machine warm for a certain time (ready mode consumption) as well as the standby mode. The production of coffee is generally not measured, but is accounted for with a standard value, as it requires relatively little energy and the difference from one machine to another is minimal.

Standard Values for Use to calculate the yearly energy consumption (Figure 1-20) are based on:

- 2 coffee periods per day, 365 days per year, i.e. 730 coffee periods.
- A coffee period comprises: heating up from cold, after 30 minutes switching off and on, the same after another 30 minutes, then waiting for auto-power-down.
- 2 190 cups per year using 20 kWh/year for standard coffee production.
- Machines without ready-mode need to be measured producing coffee, i.e. 3 cups (to be normalised on an average of 3*80g), instead of the standard 20 kWh.

Standard Values for Use

Length of the period of use	1 hour + switch-off delay
Periods of use: 2 per day, ca. 52 weeks (@ 7 days)	730/year

If the machine is never switched off completely, total standby time therefore equals

$$t_{stb} = 8760 - 730 * (t_{off} - t_{act}) \quad hrs$$

Example:	
Including 1 hr switch-off delay the coffee period ($t_{off} - t_{act}$) equals	2 hrs
Total standby time (8760 – 730 * 2) =	7300 hrs/year
Energy per cup of coffee (average in daily use, espresso/normal)	9.13 Wh
Number of cups per year	2190
Thus Energy consumption for 2190 cups of coffee	20 kWh/year

The resulting standard energy consumption for one year is therefore equal to:

730 * energy in ready mode during coffee period

+ duration standby * standby power

+ standardized energy consumption for 2190 cups (20 kWh)

$$E_{tot} = (730 * E_{ready} + t_{stb} * P_{stb})/ 1000 + 20 \quad in\ kWh$$

Figure 1-20: Standard values for use and calculation of energy consumption for one year by Euro-Topten[14]

The Euro-Topten measuring method includes the following topics:

- Scope
- Measuring Instruments
- Definitions
- Notes on the measuring instructions
- Tolerances and control methods
- Measuring Instructions
- Measurement Report Form
- Standard use and Calculation of Power Consumption
- Appendix with Chart, Glossary of Formulas, References, Detail Measurement Report Form

[14] Euro-Topten and S.A.F.E. (2009) *Measuring Method and Calculation Formula for the Electricity Consumption of Coffee Machines for Household Use*. Available at: www.topten.eu/uploads/images/upload/Measuring%20Method%20Coffeemachines-090509.pdf.

- **Russia**

- **GOST 20888-81 Standard, 2001 –** Methods for measuring the performance of electric household coffee makers

Prepared by: Federal Agency on Technical Regulating and Metrology, GOST (Gosudarstvennyy Standart – State standards)

Date of implementation: June 1981, Amended in December 1984, December 1986, July 1988, re-issued on January 2001

Description: This standard sets the limit on electricity consumption per unit of brewed coffee by a coffee making machine. It separates coffee machines into four categories, which are defined by how they draw water through the infusion process to produce the coffee. The four categories are:

  - Compression
  - Filtration
  - Percolating
  - Vacuum

This document restricts electricity consumption (kWh), water consumption (kg), and maximum time (minutes) to produce a specified volume of coffee (L) and is therefore applicable as MEPS. Examples of the MEPS are included in section 1.3.3. It incorporates the requirements of IEC 60335 -2-15 and is therefore also applicable as a safety standard included in Section 0

1.2.4. STANDARDS AT INTERNATIONAL LEVEL

International standards exist for all major appliances, typically originating from industry standards, government agencies, or professional societies, and are eventually adopted by a national or international standardisation body.

- **International Electro-Technical Commission (IEC)**

- **IEC 60661 -** Methods for measuring the performance of electric household coffee makers

Prepared by: IEC Sub Committee (SC) 59G: Small kitchen appliances, of IEC Technical Committee (TC) 59: Performance of household electrical appliances.

Date of implementation: Feb 21 2006

Description: The IEC 60661 standard entitled "Methods for measuring the performance of electric household coffee makers" (publication date: 2006-02-21) applies to electric coffee makers for household use, but not commercial or industrial use. It does not define methods for the measurement of energy efficiency, but defines the main performance characteristics which are of interest to the user and describes the standard methods for measuring these characteristics.

- **IEC 62301 -** Household electrical appliances - Measurement of standby power

Prepared by: IEC Technical Committee (TC) 59: Performance of household electrical appliances.

Date of implementation: June 2005

Description: This international standard specifies methods of measurement of electrical power consumption in standby mode. It is applicable to powered electrical household appliances and to the powered parts of appliances that use other fuels such as gas or oil. This standard does not specify safety requirements. It does not specify minimum performance requirements nor does it set maximum limits on power or energy consumption.

International Standardisation Organisation

Prepared by: ISO Technical Committee TC 34 / SC 15

Date of implementation: June 2005

Description: The International Standardisation Organisation (ISO) has 23 standards currently published directly related to coffee and coffee products under the TC 34, SC 15. This sub-committee is dedicated to coffee and coffee related products. The topics covered by the TC 34/SC 15 include:

- Terminology
- Nomenclature
- Sampling and sample preparation
- Methods of test and analysis
- Product specifications
- Packaging Storage Transportation

While the standards published by the sub-committee are related to the coffee industry, many are relevant for farming, international trade and coffee bean quality standards. As such, they are not directly relevant to energy use of coffee machines and hence have not been described here in detail. A list of these standards for reference has been included in Table 1-4.

Table 1-4: ISO Standards concerning coffee

Standard	Title
ISO 1446:2001	Green coffee - Determination of water content - Basic reference method
ISO 3509:2005	Coffee and coffee products - Vocabulary
ISO 3726:1983	Instant coffee - Determination of loss in mass at 70°Cunder reduced pressure
ISO 4052:1983	Coffee - Determination of caffeine content

Standard	Title
ISO 4072:1982	Green coffee in bags - Sampling
ISO 4149:2005	Green coffee - Olfactory and visual examination and determination of foreign matter and defects
ISO 4150:1991	Green coffee - Size analysis -- Manual sieving
ISO 6666:1983	Coffee triers
ISO 6667:1985	Green coffee - Determination of proportion of insect-damaged beans
ISO 6668:2008	Green coffee - Preparation of samples for use in sensory analysis
ISO 6669:1995	Green and roasted coffee - Determination of free-flow bulk density of whole beans
ISO 6670:2002	Instant coffee - Sampling method for bulk units with liners
ISO 6673:2003	Green coffee - Determination of loss in mass at 105°C
ISO 8455:1986	Green coffee in bags - Guidance on storage and transport
ISO 8460:1987	Instant coffee - Determination of free-flow and compacted bulk densities
ISO 9116:2004	Green coffee - Guidelines on methods of specification
ISO 10095:1992	Coffee - Determination of caffeine content - Method using high-performance liquid chromatography
ISO 10470:2004	Green coffee - Defect reference chart
ISO 11292:1995	Instant coffee - Determination of free and total carbohydrate contents - Method using high-performance anion-exchange chromatography
ISO 11294:1994	Roasted ground coffee - Determination of moisture content - Method by determination of loss in mass at 103°C
ISO 11817:1994	Roasted ground coffee - Determination of moisture content - Karl Fischer method
ISO 20481:2008	Coffee and coffee products - Determination of the caffeine content using high performance liquid chromatography (HPLC) - Reference method
ISO 20938:2008	Instant coffee - Determination of moisture content - Karl Fischer method

1.2.5. COMPARISON OF THE TEST STANDARDS

- **Summary of main test standards relevant for coffee machines**

Table 1-5: Main test standards relevant for coffee machines

Reference	Title
EN 13248:2002	"Cookware - Coffee makers for domestic use with an independent heat source - Definitions, requirements and test methods" *Contents: Scope, Normative references, Terms and definitions, Requirements, Tests, Marking and labelling, Instructions for use and maintenance*
EN 60661:2005 (IEC 60661)	"Methods for measuring the performance of electric household coffee makers" *Defines the main performance characteristics which are of interest to the user and describes the standard methods for measuring these characteristics.*
ANSI/AHAM CM-1-2007	"Method for Measuring Performance of Household Coffee Makers" *Establishes a uniform, repeatable procedure for measuring specified product characteristics of household electric coffee makers.*
CECED / FEA	"Measurement method for the determination of the energy consumption of Espresso machines" *Applicable to all manual and automatic espresso and multipurpose hot beverage machines characterised by the fact that they are based on high pressure (> 5 bar maximum working pressure) espresso technology and on a cup by cup system.*
Euro-Topten / S.A.F.E (2005, latest update May 2009)	"Measuring Method and Calculation Formula for the Electricity Consumption of Coffee Machines for Household Use." *Describes a measuring method for most types of household coffee machine and a calculation scheme for the yearly energy consumption. Adopted by The Blue Angel and approved for several years for the evaluation of appliances presented e.g. on www.Topten.ch and www.Topten.info.*

It is important to note that there is a current discussion within CENELEC TC59X/WG15 comprising representatives of industry and consumers organisations (e.g. Topten). Indeed, as presented above, two main voluntary methods are currently used: FEA/CECED and Euro-Topten/S.A.F.E. After several discussions between these organisations, it was agreed that both methods have benefits and drawbacks, and that it would be useful to have only one revised approach, validated by CENELEC. It is expected that a draft standard will be available by mid-2011.

Regarding drip filter coffee machines, Topten is drafting a method to calculate the annual electricity consumption of this type of appliance and should then be used by CENELEC. These developments should allow the revision of the standard EN 60661, which would include one part on pressure machines and one part on filter coffee machines.

1.2.6. TEST STANDARDS ON SAFETY

Standards on safety are indirectly linked to the study as they could introduce some requirements that affect the design of the product. The main standards, referenced under the Directive 2006/95/EC on low voltage, are presented below:

- **EN 60335-1** Household and similar electrical appliances — Safety — Part 1: General requirements

Prepared by: CENELEC Technical Committee CPL/61, Safety of household and similar electrical appliances

Date of implementation: Originally approved 2 July 2002, several amendments, current version published November 2008

Description: It is a safety standard for domestic appliance to show conformity with the Low Voltage Directive. Scope is appliances intended for household use and appliances used by laymen in shops, light industry, etc.

- **EN/IEC 60335-2-15:2008** - Safety of household and similar electrical appliances **Part** 2-15 - Particular requirements for appliances for heating liquids

Prepared by: IEC technical committee 61: Safety of household and similar electrical appliances

Date of implementation: Originally approved 2002, several amendments, current version published September 2008

Description: This standard deals with the safety of electrical appliances for household and similar purposes, the rated voltage of which is not more than 250 V for single-phase appliances and 480 V for other appliances.

This standard is applicable to other common kitchen appliances used for heating water, such as coffee machines.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account persons whose physical, sensory or mental capabilities, or lack of experience and knowledge prevent them from using the appliance safely without supervision or instruction, or children playing with the appliance.

- **EN/IEC 60335-2-14:2008 -** Safety of household and similar electrical appliances Part 2-14 **-** Particular requirements for kitchen machines

Prepared by: IEC technical committee 61: Safety of household and similar electrical appliances

Date of implementation: Originally approved 2002, several amendments, current version published September 2008

Description: This standard deals with the same measurement of parameters as described above. However it relates to the safety of electric kitchen machines, the rated voltage of which is not more than 250 V, for household and similar purposes.

This standard is applicable to, among other common kitchen appliances, coffee mills. Coffee machines including a separate functionality of coffee grinding would be submitted to the standard.

- **EN/IEC 60730-1:2007** - Automatic electrical controls for household and similar use – Part 1:General requirements

Prepared by: IEC technical committee 72: Automatic controls for household use

Date of implementation: Originally approved 2000, several amendments, current version published 2008

Description: This standard applies to automatic electrical controls for household or similar use (i.e. offices), including controls for, among other types of appliances, coffee machines. The equipment may use among other forms of energy, electricity.

This standard applies to the inherent safety of the appliance. It is specifically concerned with operating values, operating times, and operating sequences which are associated with equipment safety, and to the testing of automatic electrical control devices used. This standard is applicable to domestic heating appliances and appliances which fall under the scope of IEC 60335, including coffee machines.

Third country safety standards

Safety standards related to coffee machines used in third countries are presented below:

- **USA - UL 1082** Underwriters Laboratories Inc. Standard for Safety Household Electric Coffee Makers and Brewing-Type Appliances

Prepared by: Underwriters Laboratories

Date of implementation: NA

Description: The scope of this safety standard covers portable electric coffee machines, percolators, coffee urns, and other brewing-type appliances rated 120 V or less, for use in ordinary locations in accordance with the National Electrical Code, NFPA 70 (USA).

In addition to coffee machines, this standard covers tea pots, kettles, pots, soup warmers, and other similar appliances in which liquid is heated to greater than 115°F (46°C), and are lifted and tilted to dispense the liquid in normal service.

This standard does not set requirements to cover coffee-making-type appliances with capacities of more than 250 ounces (7.4 l), appliances intended for outdoor use, or appliances that are covered in individual requirements that are separate from this Standard.

This standard sets requirements for products and test procedures for products, materials, components, assemblies, tools and equipment, chiefly dealing with product safety. Consideration is given to typical risks encountered or likely to be encountered during normal use of the product in the intended environment.

- **Canada - CAN/CSA-E335-1/2E-94 (R2004)** Safety of Household and Similar Electrical Appliances - Part 1: General Requirements

Prepared by: Canadian Standards Association

Date of implementation: Original: 1994, reaffirmed: 2004

Description: This standard applies to electric heating appliances and electric motor-operated or magnetically-driven appliances for household and similar purposes.

This standard applies to the safety of such equipment designed to be installed and used in accordance with the rules of the Canadian Electrical Code (CEC), Part I. This standard sets safety requirements which apply to electric heating appliances and electric motor-operated or magnetically-driven appliances for household and similar purposes. It is largely based on the safety standard IEC 60335 with Canadian deviations.

- **Canada - CAN/CSA C22.2 NO. 64-M91 (R2008) -** Household Cooking and Liquid-Heating Appliances

Prepared by: Canadian Standards Association

Date of implementation: Original: Sep 1, 1991, reaffirmed: 2008

Description: This standard applies to cord-connected and permanently connected cooking and liquid-heating appliances rated for use on nominal single-phase system voltages of 240 V and less, designed to be used in household and similar applications in accordance with the Rules of the Canadian Electrical Code, Part I.

The standard applies to kitchen-type cooking and liquid heating appliances such as, among other appliances, domestic coffee machines. It covers definitions, construction requirements, marking, and tests of a general nature that are applicable to appliances which fall under the scope.

- **Russia - GOST 20888-81** Standard, Methods for measuring the performance of electric household coffee makers

Prepared by: Federal Agency on Technical Regulating and Metrology, GOST (Gosudarstvennyy Standart – State standards)

Date of implementation: June 1981, Amended in December 1984, December 1986, July 1988, re-issued on January 2001

Description: This standard is described previously in the test standards section for countries outside the EU, however also incorporates IEC 60335 and is therefore also applicable as a safety standard.

1.3. EXISTING LEGISLATION

The aim of this subtask is to give an overview of existing legislation and voluntary programmes for coffee machines included in Lot 25. Further, this subtask includes a comparative analysis of such legislation in the context of possible future Ecodesign implementing measures.

1.3.1. LEGISLATION AND AGREEMENTS AT EUROPEAN COMMUNITY LEVEL

There is no specific legislation for coffee machines in Europe. However, as electrical products, coffee machines are under scope of many European Directives, mostly in environmental and safety categories. The most relevant legislation is presented in Table 1-6.

Table 1-6: Relevant European legislation identified

Scope	Legislation
Environmental legislation	
Entire product	Waste Electrical and Electronic Equipment Directive 2002/96/EC (category 2. Small household appliances)
	Restriction of the use of certain Hazardous Substances in electric and electronic equipment Directive 2002/95/EC (category 2. Small household appliances)
	REACH Regulation No 1907/2006
Energy legislation	
Standby and off-mode power consumption	Commission Regulation (EC) No 1275/2008 of 17 December 2008
Legislation related to safety	
Entire product	General Product Safety Directive 2001/95/EC
	Low Voltage Equipment Directive 73/23/EEC
	Materials and articles intended to come into contact with foodstuffs – Directive 89/109/EEC
	Electromagnetic Compatibility (EMC) Directive 89/336/EEC

At first glance, it seems that the EU has not developed a specific voluntary programme.

There is currently no European Directive specific to coffee machines, and thus there is no legislation on energy efficiency or consumption of coffee machines. To tackle this lack of legislation, the most relevant obligatory environmental policy measures at the European level are the Directive on Waste Electrical and Electronic Equipment (WEEE Directive) and the Directive on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS Directive). Among the generic European Directives that apply to electrical and electronic equipment, the low voltage

and electromagnetic compatibility Directives, as well as the Regulation on standby and off mode power consumption, are the most relevant to coffee machines.

- **WEEE Directive 2002/96/EC[15]**

Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on Waste Electrical and Electronic Equipment (WEEE)

The Directive applies to electrical and electronic equipment categories which are dependent on electric currents or electromagnetic fields, and aims to test the equipment for the generation, transfer and measurement of these currents and fields. Equipments relevant for this Directive should be designed for use with a voltage rating not exceeding 1 000 Volt for alternating current and 1 500 Volt for direct current. Hence, electric coffee machines fall within the scope of this regulation, in Category 2 namely "small household appliances".

The Directive was effective on 13 August 2005, and requires from this time on the separate collection of electrical and electronic waste. Directive 2008/34/EC, amending Directive 2002/96/EC, does not add relevant changes for non-tertiary coffee machines.

- **RoHS Directive 2002/95/EC[16]**

Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

The Directive applies to the same electrical and electronic equipment categories which are covered by WEEE Directive, with the exception of medical devices and monitoring and control instruments. Although coffee machines are not explicitly mentioned in the indicative list of product categories, they can be considered as falling into category 2 (Small household appliances). Therefore they must be designed respecting the prescriptions of the RoHS Directive.

The Directive requires the substitution of various heavy metals (lead, mercury, cadmium and hexavalent chromium) and brominated flame retardants (polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)) in new electrical and electronic equipment put on the market from 1st July 2006 on. Amendments 2005/618/EC, 2005/717/EC, 2005/747/EC, 2006/122/EC, 2008/385/EC, 2009/428/EC, 2009/443/EC, bring new exemptions for applications of lead, cadmium and mercury.

[15] Official Journal L 37, 13/02/2003, p. 24-39
[16] Official Journal L 37, 13/02/2003, p. 19-23

- **REACH Regulation 1907/2006/EC**

Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

REACH is a new European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. The new law entered into force on 1 June 2007.

The aim of REACH is to improve the protection of human health and the environment through a better and earlier identification of the intrinsic properties of chemical substances. At the same time, innovative capability and competitiveness of the EU chemicals industry should be enhanced. The benefits of the REACH system will come gradually, as more and more substances are phased into REACH.

The REACH Regulation gives greater responsibility to industry to manage the risks from chemicals and to provide safety information on the substances. Manufacturers and importers will be required to gather information on the properties of their chemical substances, which will allow their safe handling, and to register the information in a central database run by the European Chemicals Agency (ECHA) in Helsinki. The Agency will act as the central point in the REACH system: it will manage the databases necessary to operate the system, co-ordinate the in-depth evaluation of suspicious chemicals and run a public database in which consumers and professionals can find hazard information.

The Regulation also calls for the progressive substitution of the most dangerous chemicals when suitable alternatives have been identified.

REACH provisions is being phased in over 11 years. Companies can find explanations of REACH on the ECHA website, in particular in the guidance documents, and can contact national helpdesks.

- **Standby and off mode power consumption Regulation 1275/2008**

Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment

Directive 2005/32/EC sets Ecodesign requirements by the Commission for energy-using products representing significant volumes of sales and trade, having a significant environmental impact and presenting significant potential for improvement in terms of environmental impact without entailing excessive costs.

This Regulation is based on a previous preparatory study in the context of the Ecodesign Directive, and establishes Ecodesign requirements related to electric power consumption in no-load condition and average active efficiency of external power supplies. It sets a few specifications for the maximum Power Output for different

power output categories, as well as specifications the measurements, as shown in Table 1-7.

Table 1-7: Ecodesign requirements for standby and off mode electricity consumption

		January 2010	January 2013
Standby mode		1.00 W	0.50 W
	Reactivation function and status display	2.00 W	1.00 W
Off mode		1.00 W	0.50 W

- **Low Voltage Directive (LVD) 2006/95/EC**

Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to Electrical Equipment designed for use within certain voltage limits.

The Directive applies to all electrical equipment designed for use with a voltage rating[17] 50-1 000 V AC and 75-1 500 V DC. It requires products to have protection against hazards that could arise from within the product itself or from external influences. All risks arising from the use of electrical equipment, including mechanical, chemical, and all other risks. Noise and vibration, and ergonomic aspects, which could cause hazards, are also within the scope of the Directive.

- **Materials and articles intended to come into contact with foodstuffs – Directive 89/109/EEC**

Directive 89/109/EEC of 21 December 1988 on the approximation of the laws of the Member States relating to materials and articles intended to come into contact with foodstuffs

This Directive shall apply to materials and articles which, in their finished state, are intended to be brought into contact with foodstuffs or which are brought into contact with foodstuffs and are intended for that purpose.

Covering or coating substances, such as the substances covering cheese rinds, prepared meat products or fruits, which form part of foodstuffs and may be consumed together with those foodstuffs, shall not be subject to this Directive.

- **Electromagnetic Compatibility (EMC) Directive 2004/108/EC**

Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC

The Directive lays down requirements in order to ensure that an apparatus is compatible with its electromagnetic environment (covering frequency band 0 to

[17] Voltage ratings refer to the voltage of the electrical input or output, not to voltages that may appear inside the equipment.

400 GHz), i.e. that it functions as intended without disturbing other equipment, and without being disturbed by other equipment. Equipment must be designed to minimise any potential electromagnetic interference with other equipment and also must itself be immune to specific levels of interference.

1.3.2. LEGISLATION AND AGREEMENTS AT MEMBER STATE LEVEL

- **France - NF Environnement**

The NF Environnement mark is a voluntary certification mark issued by AFNOR Certification by the Central Laboratory of Electrical Industry (LCIE) in France. The NF Environnement logo was created in 1991 and is the official French ecological certification logo. It is awarded to products that have a reduced effect on the environment while offering an equivalent performance.

To be issued the NF Environnement mark, the product must comply with ecological and quality criteria. These criteria determined by manufacturers, consumers, environmental protection groups, distributor associations and public authorities.

Figure 1-21: The NF Environnement Eco-Label[18]

There are two certification categories relevant to the Lot 25 study, NF 397 "Electric Filter Coffee Machines for Domestic Use" and NF 265 "Coffee Filters" and are described below:

- NF 397 – Electric Filter Coffee Machines for Domestic Use

The French ecolabel NF Environnement "NF397" is applicable to electric filter coffee machines. Certified characteristics comprise energy consumption in standby mode, off mode, as well as for coffee preparation, with threshold levels for each mode. NF397 also requires a hard on/off switch. These energy consumption requirements are evaluated according to test standards described within the document. There are 16 criteria categories required in this product category, the main energy consumption criteria are:

- Auto-off and energy efficiency – the machine must have a means to turn itself off after 15 minutes of completion of coffee preparation. Energy efficiency must be greater than 60%;

[18] Référentiel de certification "Cafetières électriques à filtre pour usage domestique" AFAQ AFNOR Certification, www.marque-nf.com, France

- Off mode – the machine must have the means to interrupt the power supply and consume 0 watts of power. Stand-by mode must not consumer more than 2 watts.

Other example criteria include:

- Replacement parts – the replacement parts of the coffee machine are to be guaranteed available for 5 years after the purchase of the product
- Water level indicator – the coffee machine must indicate the level of water which is available to make coffee (in cups and litres)
- Scaling – the device must have a scaling warning system accounting for the hardness of water used
- Guarantee – the product must have a 2 year guarantee

- NF 265 – Coffee Filters

The French ecolabel NF Environnement "NF 265" is applicable to paper coffee filters. While not directly applicable to coffee machines, coffee filters are part of the life cycle of coffee machines and hence this label has been included for reference.

The labelling scheme is similar to that as described for NF 397. There are 8 main criteria for coffee filters, the main example criteria are:

- Use of recycled fibre in the package -The fibrous mass of the package must consist of at least 80% recycled fibre.
- Limited mass packaging - for packaging in boxes of 40 filters, mass packaging <24 grams, for packaging in boxes of 80 or more filters, mass packaging <36 grams.
- Types of fibres used for filters - The fibres used should be natural and unbleached.
- Consumer information - The product packaging must describe the possibility of composting the filter after use or the opportunity

Germany - Blue Angel[8]

The Blue Angel is one of the most well-known eco-labels worldwide. It was established in 1978 and sets standards for eco-friendly products and services. The awarding of the ecolabels is done by an independent jury in line with defined criteria. The Blue Angel is awarded to companies also as a reward for their commitment to environmental protection.

The awards are divided into four 'protection' areas, Health, Climate, Water and Resources. The "Espresso Machines /Coffee machines with high pressure" category for the Blue Angel label falls under the Climate protection area and the "RAL-UZ 136 criteria" (Testing method described in section 1.2.2. and 1.2.3. for these products defines how a product can be awarded the label.

Figure 1-22: German Blue Angel Logo for Climate[8]

The types of machines covered by the Blue Angel are espresso/coffee machines using a pump pressure of at least 8 bars (brew an "Italian-style" coffee) for private household use:

- Fully automatic coffee machines,
- Single-serve coffee machines for pads (automatic pad coffee machines),
- Portafilter espresso/coffee machines.

Overall, the goal for establishing the label is to encourage applicable coffee machines to:

- Feature a low power consumption
- Be durable goods
- Avoid the use of environmentally damaging substances

The criteria for the label are divided into four sections:

- **Power consumption** – the product should have an auto-off function with factory default of less than 1 hour for automatic coffee machines (consuming less than 35 Wh) and 30 minutes for pad types (consuming less than 30 Wh),[19] stand-by power consumption shall not exceed 1.0 W, off mode power consumption shall not exceed 0.3 W;
- **Longevity** – all repair and service parts shall be produced for 10 years after the purchase of the product;
- **Material requirements** – no carcinogenic, reprotoxic, mutagenic, persistent, bio-accumulative, or toxic materials shall be used in the construction of the product. Parts in contact with water or milk shall be in accordance with the German Food code, and shall avoid the release or leeching of toxic materials (maximum 2 mg Pb / litre H_20 and 50 mg Ni / litre H_20 brewed);
- **Consumer information** – A comprehensible and detailed Operating Instructions and Product Information Manual in a printed form shall be enclosed with the product complying with DIN EN 62079;

[19] These Wh values refer to ready-to-use mode during the coffee period, including the energy for heating up. Note that the length of the coffee period varies according to the factory settings of the auto-power down.

- **Coffee filters** – There are also criteria for coffee filters within the Blue Angel, in RAL UZ 65 – Unbleached Filter Papers for Use with Hot or Boiling Water. They are that wood fibres come from sustainably managed forests, that no bleaching agents are used and that in-house purification equipment must meet high standards.[20]

The testing standards for this label are described in section 1.2.2. (Germany: RAL-UZ 136) and 1.2.3. (Euro-Topten Measuring Method).

- **Finland, Norway and Sweden - Nordic Swan scheme**[21]

The Nordic environmental label is an independent label which guarantees a certain environmental standard. Only products that satisfy strict environmental requirements on the basis of objective assessments will be allowed to display the environmental label. The label is intended to provide consumers with guidance in choosing products least hazardous to the environment, to stimulate manufacturers to develop products and processes that are better for the environment, and to use market forces as a complement to environmental legislation. The green swan symbol now has high consumer recognition and respect, covering over 60 product groups. The label is usually valid for three years, after which the criteria is revised and the company must reapply.

Criteria for Swan labelling of paper products encompass a wide range of requirements, most of which relate to pulp and paper production. The Basic Module (Swan labelling of paper products – Basic Module) contains requirements regarding forest management, emissions, energy and waste in pulp and paper manufacturing. The Chemical Module (Swan labelling of paper products – Chemical Module) covers requirements of chemicals used in the production of pulp and paper. Coffee filters fall under these criteria and hence these requirements are applicable to Lot 25 and the life cycle of coffee machines.

Requirements imposed are based on a life-cycle assessment of the product and concern production, use and waste. In the case of coffee filters this is achieved by using certified raw materials, by limiting the use of environmentally harmful chemicals, by producing low emissions to air and water and by reducing energy consumption. The requirements for a Nordic Swan label include requirements for:

- Recycling systems
- Environmental and quality assurance
- Production techniques
- Filter properties
- Packaging, including labelling and packaging recycling

[20] Source: www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=124.
[21] The Nordic Ecolabel: www.svanen.nu/eng.

- Chemical use limitations
- National and European wide food regulation compliance
- Production waste

While the Nordic Swan Label is not directly concerned with non-tertiary coffee machines, the use of the filters is normally part of the life cycle of coffee machines and is therefore pertinent to the Lot 25 study. It has been included here for reference purposes.

1.3.3. THIRD COUNTRY LEGISLATION AND INITIATIVES

- **Australia's Standby Power Strategy 2002-2012**

Australia implemented a National Standby Strategy, which aims to meet a power of 1 Watt in 2012 for numerous appliances, including espresso coffee machines[22]. The National Appliance and Equipment Energy Efficiency Committee found out that off mode was consuming 1.8W on average in 2003, and 0.4W in 2004, and advised the Ministerial Council of Energy to target off mode of 1W by 2007, and 0.5W with 1 hour power down by 2012. This would result in the decreasing curve of cumulative annual greenhouse emissions for espresso machines below (Figure 1-23).

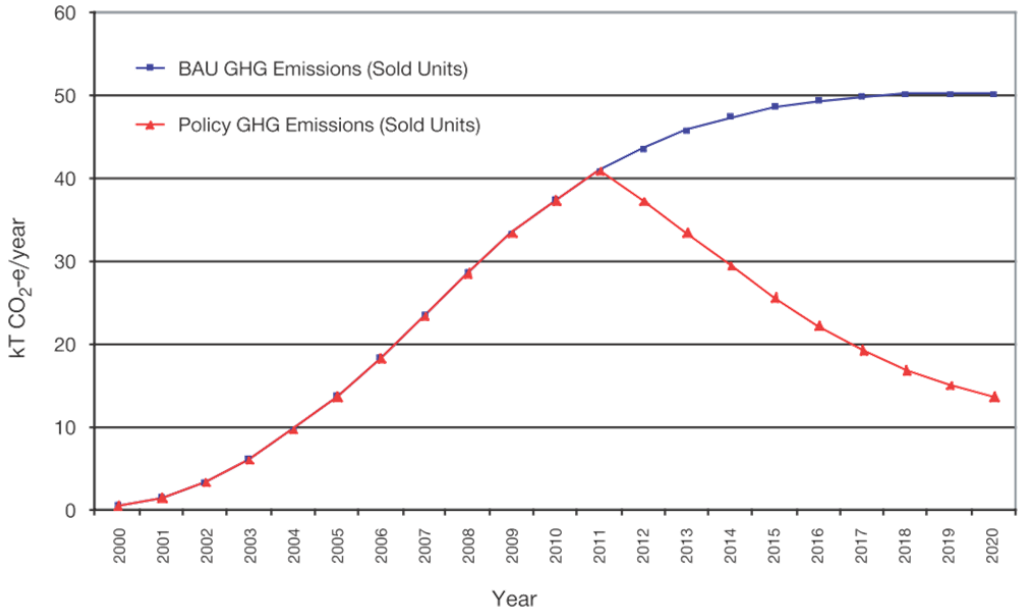


Figure 1-23: BAU vs. Policy target – cumulative annual greenhouse emissions for espresso machines[23]

[22] Standby product profile – Espresso coffee machines, Australia's standby power strategy 2002 – 2012, www.energyrating.gov.au/library/pubs/sb200408-espresso.pdf (download 31-08-2009)

[23] Taken from Standby product profile – Espresso coffee machines, Australia's standby power strategy 2002 – 2012, www.energyrating.gov.au/library/pubs/sb200408-espresso.pdf (download 31-08-2009)

- **Switzerland – L'EtiquetteEnergie (voluntary energy label)**

The new voluntary EtiquetteEnergie (energy label) for non-tertiary espresso machines has been designed for consumers to spot energy efficient machines in stores easier. The voluntary energy Label for coffee machines can show at a glance if a machine is among the models saving electricity (efficiency class A: green arrow) or not (efficiency class G: red arrow). The current annual consumption of the machine is also shown on the label.

The voluntary energy label for coffee was developed under the guidance of the Swiss Association of Manufacturers and suppliers of electrical appliances (FEA) and in close collaboration with the Swiss manufacturer of coffee machines and the European Council of Equipment Manufacturers (CECED). It was created for use in Switzerland voluntarily since September 2009, and is foreseen to become mandatory in the future.

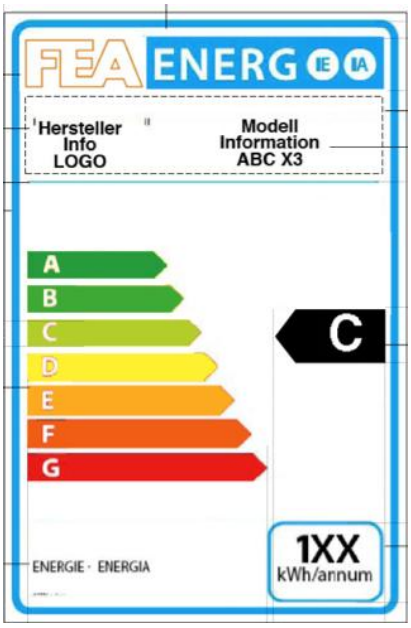


Figure 1-24: L'EtiquetteEnergie

- **Switzerland – S.A.F.E. and Euro-Topten**

2003, S.A.F.E. (Swiss Agency for Efficient Energy Use) suggested the introduction of an energy label for coffee machines in the framework of the report "Standby consumption of household appliances" by Jürg Nipkow and Eric Bush (S.A.F.E.) on behalf of the SFOE Swiss Federal Office of Energy. A very first draft of an energy label was presented at EEDAL 2006 (Energy label for coffee machines. Jürg Nipkow and Eric Bush (Swiss Agency for Efficient Energy Use S.A.F.E.), EEDAL-Conference, London 2006). The labelling scheme has been optimised (see Figure 1-25) and is supported by Euro-Topten (www.Topten.info).

Figure 1-25 indicates annual electricity consumption of coffee machines computed through a Topten measuring campaign (August 2008) and suggests a labelling scheme related to this annual consumption.[24]

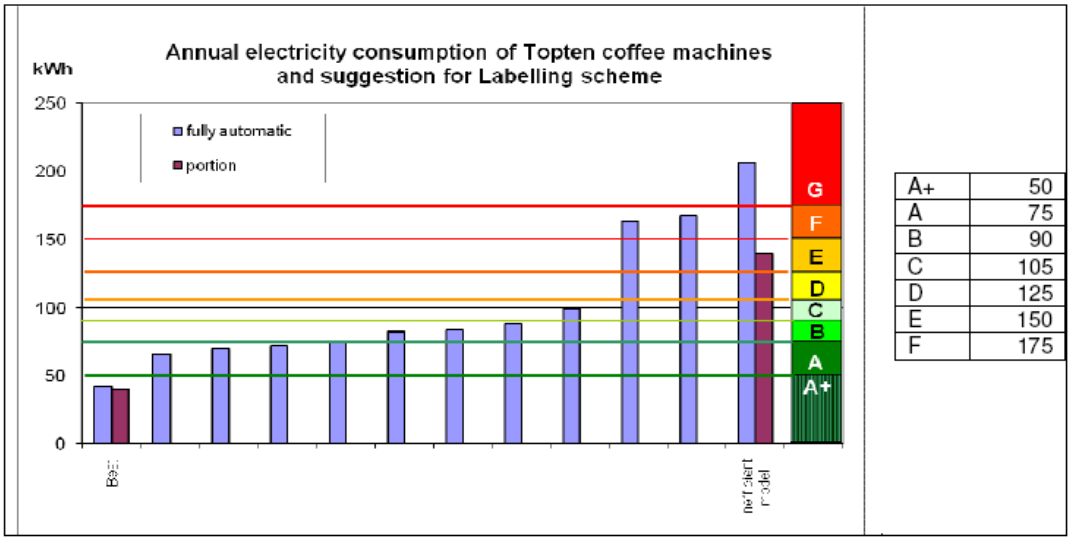


Figure 1-25: Suggestion for a labelling scheme based on annual electricity consumption of coffee machines

The Euro-Topten measuring method and testing criteria are described in this document in section 1.2.3.

- **Korea - The "e-Standby Program"**

The "e-Standby Program" has been implemented since April 1, 1999 for the purpose of enhancing the spread of energy-saving products that enable reduced electric power consumption during standby mode. This is a voluntary labelling scheme supported by the Ministry of Commerce, Industry and Energy (MOCIE) and the Korea Energy Management Corporation (KEMCO). Microwave ovens are one of the 18 product groups covered by this programme. The e-Standby Program is managed according to the long-term road map, "Standby Korea 2010," which details the three stages of the "1W initiative," that is designed to reduce standby power usage to below 1W by 2010. The first stage was the "Voluntary 1W Policy", implemented from 2005 to 2007, under which manufacturers were encouraged to adopt the standard under their own volition. The second stage is the "Preparation for Transition to a Mandatory 1W Policy" from 2008 to 2009, during which manufacturers will be prepared to adopt the standard as compulsory. From 2010, the "Mandatory 1W Policy" - the ultimate goal of the road map - will be implemented as the final stage.

The program encourages the adoption of energy saving modes while the appliances are idle and the minimisation of standby power. An Energy Boy label is attached to those products that meet the standards for standby power. It is the core programme to reduce standby power below 1W by 2010.

[24] "Coffee machines: recommendations for policy design", August 7th 2008, Jürg Nipkow and Eric Bush, Topten International Group TIG, Paris, www.Topten.info

Currently, it is a voluntary program. However, from 2010 onwards, when the amendment of the Rational Energy Utilization Act is completed, the amended Act will include provisions that make standby power reporting mandatory as well as the mandatory indication of warning labels on appliances that fall below the standby power standards.

Figure 1-26: Korean Energy-Saving Label – "Energy Boy"

- **Korea - Eco-Label**[25]

The Korean Eco-labelling programme is a voluntary certification programme which helps consumers to choose eco-products that reduce consumption of energy and resources and minimise the generation of pollution throughout the production process. Established in 1992, the programme has over 136 product categories defined and several more under development.

Figure 1-27: Korean Eco-Label logo[25]

The programme is applicable to electric kettles and electric coffee machines generally used for house, with rated voltage 2.0kW or less. The main criteria for electric coffee machines include:

- The energy efficiency of the appliance will be at least 72% according to the following equation:

$$efficiency\ [\%] = \frac{Water\ [mL] \times (T_2 - T_1)}{Measured\ energy\ consumption\ [Wh]} \times \frac{1[Wh]}{860cal} \times 100$$

[25] "Electric Kettles and Electric Coffee Makers EL408" Korea Eco-Products Institute www.koeco.or.kr

Where T_2 = 82˚C ±2˚C, the coffee extraction temperature and T_1 = initial water temperature

- A maximum of 45Wh of energy consumption for heating 1.0 l of water for 60 minutes.
- Lead, cadmium, mercury and hexavalent chromium shall not be used in the product except for circuit boards. For circuit boards, limits are provided for the aforementioned heavy metals.
- Chlorinated plastics such as PVCs shall be avoided
- Recyclability of plastics shall meet specific criteria
- Quality assurance shall be compliant with Korean Safety and Control Act for Electric Appliances
- Information for consumers shall be provided

Russia - GOST 20888-81 Standard

The Russian standard GOST 20888-81: 2001 – "Methods for measuring the performance of electric household coffee makers" was previously described as a test standard and safety standard. As this document includes MEPS, it is also relevant under the legislative standard section.

Limits on electricity consumption per unit of cooked coffee by a coffee making machine as required by GOST 20888-81, are presented below in Table 1-8.

Table 1-8: Limits on electricity consumption per unit of cooked coffee as per the GOST 20888-81 standard

Type of coffee machine	Specific volume of cooked coffee, litres	Specific electricity consumption, Wh/litre	Specific mass, kg-h/ litres-yr., no more than	Time of coffee cooking, min, no more than
Compression	0.2 0.5	200 150	0.160 0.090	9.6
Percolating	0.8 1.0 1.2	120 - 100	0.037	
Filtration	0.5 0.8	160	0.09	
Vacuum	0.2 0.5 0.8	150 120 110	0.040 0.045 0.050	11

1.4. CONCLUSIONS TASK 1

The scope is defined in Subtask 1.1 in order to determine which appliances are covered by Lot 25. The preliminary scope boundary for the Lot 25 study is restricted to non-tertiary coffee machines, i.e. not involving commercial use. The scope of products investigated in this study will be further refined on the basis of Tasks 2 and 3 and will be finalised in consultation with the Commission and the stakeholders.

Most test standards related to coffee machines deal with safety and methods for measuring energy performance. The EN test standard 60661 for electric household coffee machines is currently being revised by CENELEC TC59X/WG15. This updated standard will contain two sections: one on pressure machines and one on filter coffee machines. All further task reports of this study will refer to this standard.

Various pieces of legislation exist throughout the world but a direct comparison between these legislations is difficult as the scope and test standards are different.

ANNEX 1: FEA/CECED - MEASUREMENT METHOD FOR THE DETERMINATION OF THE ENERGY CONSUMPTION OF ESPRESSO MACHINES - MEASUREMENT FORM

Measuring form for espresso machines energy label

Machine brand			
Type			
Name of test engineer			
Date of testing			
Rated voltage		V	
T ambient		°C	
T machine		°C	
Twater in reservoir		°C	
Input voltage		V	
Default settings of switches:			
Shut off time	time	s	Enter n.a. in case no power management system available
Cup heater	on/off		
....			
....			
....			

Measurement equipment used:

Measurement 4.1 heat up from cold

Energy used		Wh - include first 60 seconds after ready to use!
Rinsing? (yes/no)		

Measurement 4.2 brewing

Coffee type used		
Grinding function? (yes/no)		
Energy used first **40** g brew		Wh - Include first 60 seconds after ready to use*)
Temp in cup		°C
Weight total		g
Weight of cup		g
Weight of coffee	0	g

*) in case the system after 60 s has not yet recuperated and is still heating up in its first heating cycle since the brewing, add the energy used in the heating cycle in progress. This also holds for the other brew cycles.

Coffee type used		
Energy used first **120g** brew		Wh - Include first 60 seconds after ready to use
Temp in cup		°C
Weight total		g
Weight of cup		g
Weight of coffee	0	g

…….Wait 60 minutes to let the system return to steady state ready to use temperatures……
In case the shut off time of the PMS is shorter than 10 minutes, let it cool down for 60 minutes and in that case include in the next brew cycles the re-heating energy in the brew cycle measurements.

Measurement 4.2 continued

Energy used **double 40 g** brew			Wh - Include first 60 seconds after ready to use	
Temp in cup			°C	
Weight total			g	
Weight of cup			g	
Weight of coffee	0	0	g	Sum: 0 g

In case the shut off time of the PMS is shorter than 10 minutes, let it cool down again for 60 minutes

Measurement 4.2 continued

Energy used **dble 120 g** brew			Wh - Include first 60 seconds after ready to use	
Temp in cup			°C	
Weight total			g	
Weight of cup			g	
Weight of coffee	0	0	g	Sum: 0 g

Summary brew function 4.2

	Single 40	Single120	Double40	Double120	Average	
Temperature of servings	0	0			0	°C
Weight of servings	0	0	0	0	0	g
Energy used	0	0	0	0	0	Wh

Measurement 4.3 Steaming function First time

Weight of water (target=100g)		g
T water in beaker		°C
Weight after steaming		g
T water after steaming		°C
Energy used		Wh
Presteaming time used		s

…….Brew a coffee in between……

Measurement 4.3 Steaming function Second time

Weight of water (target=100g)		g
T water in beaker		°C
Weight after steaming		g
T water after steaming		°C
Energy used		Wh
Presteaming time used		s

…….Brew a coffee in between……

Measurement 4.3 Steaming function Third time

Weight of water (target=100g)		g
T water in beaker		°C
Weight after steaming		g
T water after steaming		°C
Energy used		Wh
Presteaming time used		s

Summary steam function

	Msrmt 1	Msrmt 2	Msrmt 3	Average	
Weight of water (target=100g)	0	0	0	0	
T water in beaker	0	0	0	0	
Weight after steaming	0	0	0	0	Delta T steam
T water after steaming	0	0	0	0	0
Energy used	0	0	0	0	

Measurement 4.4 Ready to use energy

Energy use 60 minutes: 5 Wh — In case shut off time < 10 minutes, use standby value.

Measurement 4.5 Standby energy

Energy use 60 minutes: 1 Wh

Power management system? 1 (1=Yes/0=No) — If "No" than standby energy is: 0 Wh

Explanation:A power management system switches the machine automatically to standby or off mode.

…….Wait 120 minutes to let the system cool down sufficiently……

Measurement 4.6	**Heating up from standby**		
Energy use		Wh	Skip in case no power management system exists. In case "standby" equals "off" start from "off" include first 60 seconds after ready to use!
Measurement 4.7	**Off energy use**		
Energy use 60 minutes		Wh	Take standby value in case no "off" mode exists

All measurements done in compliance with CECED measuring procedure version 7.2 dated 20090511:
Measurement method for the determination of the energy consumption of Espresso machines

Signature test engineer:

ANNEX 2: EURO-TOPTEN - MEASURING METHOD AND CALCULATION FORMULA FOR THE ELECTRICITY CONSUMPTION OF COFFEE MACHINES FOR HOUSEHOLD USE; MEASUREMENT REPORT FORM (XLS)

General measurement Report, Coffee machine:			
All W, Wh and °C readings shall be recorded with 1 decimal place. **For machines without regular ready mode fill in item 1 - 4 as far as meaningful. Item 2b - e shall be replaced by 5b - d.**			
	Place		
	Date		
	Name of person measuring the machine		
	Measuring instrument used (make, model)		
1b	Make, model, code, category of machine (pad/capsule, fully automatic, with piston), poss. year of manufacture		
	Power according to nameplate (possibly under the machine or in a maintenance compartment)		kW
1 a, c	Ambient temperature halfway up the machine with a clearance to the machine of 0.5m (permissible values 22 - 24°C)		°C
	Temperature of the water in the tank (permissible values 22 - 24°C)		°C
	Pump pressure according to producer's manual:		bar
	Is piston installed (for hand-operated machines)? (y/n)		
1d	**Auto power down, auto-off, energy-saving mode:** Informations as per instruction manual - programmable values from / to (h or min) - Interim values (h or min) - Can it be deactivated? (y/n) - Factory setting as per instruction manual - Factory settings effective when the programme is first started		
1e	- Can the machine be **switched to standby** manually? (y/n), if yes, how? (short description) - Is standby mode displayed? (y/n); if yes, how? (e.g. display, illuminated button)		
	How can the machine **be activated**? (short description) How can you tell that the machine is **ready**? (short description)		
1f	**Brewing temperature**, information as per instruction manual: - programmable? (y/n), - Settings (e.g. low, medium, high) - Factory setting (to be used!) - Factory settings effective when the programme is first started		
	Rinse function, information as per instruction manual: - Does the machine rinse automatically? (y/n) - Does the rinse function have to be confirmed manually? (y/n) - If yes: How? (short description) - Can the rinse function be switched off? (y/n) - Factory setting (to be used!) - Factory settings effective when the programme is first started		
1g	**Cup warming plate** Does the machine have a cup warming plate? (y/n) If yes: Information as per instruction manual: - Is the warming programmable? (y/n) Please note: if it can be switched off, further measurements at other setting may be necessary. - Factory setting as per instruction manual (on/off) is to be used for this test - Factory setting effective when the programme is first consulted		

Detailed measurement Report, Coffee machine:			
All W, Wh and °C readings shall be recorded with 1 decimal place.		Date:	
2a	Switch to standby:		
	- Ambient temperature		°C
	- Time		hh:mm:ss
	- Energy reading (set to zero if possible)		Wh
2b	Activate after at least 6 hrs:		
	- Ambient temperature		°C
	- Time (when same day)		hh:mm:ss
	- Time (when overnight, next day)		
	- Energy reading		Wh
2c	Ready (poss. after confirming automatic rinse):		
	- Time		hh:mm:ss
	- Energy reading		Wh
2d	After 30 min: energy reading (set to standby afterwards, reactivate after 5 sec.)		Wh
	After 60 min: energy reading (set to standby afterwards, reactivate after 5 sec.)		Wh
2e	Immediately after auto-off:		
	- Time		hh:mm:ss
	- Energy reading		Wh
	- Ambient temperature		°C
4	Does the machine have a hard-off (switch)? (y/n)		
	(Power input has to be zero!)		
	Does it have a (soft-off) on/off switch? (y/n)		
	Power input in soft-off:		
	- Energy reading when switching off		Wh
	- Energy reading after 1h		Wh

Results

Duration of coffee period	00:00:00	hh:mm:ss
Energy consumption in Ready mode (coffee period)	0,00	Wh
Duration of standby mode (per year)	8760	h
Standby power consumption	#DIV/0!	W
Standby energy consumption (per year)	#DIV/0!	kWh
Energy consumption for coffee preparations, standard	20	kWh
Total energy consumption (per year)	#DIV/0!	kWh

$E_{tot} = (730 * E_{ready} + t_{stb} * P_{stb})/ 1000 + 20$ in kWh

Measurement Report (flow-type), Coffee machine:			
All W, Wh and °C readings shall be recorded with 1 decimal place.		Date:	
5	**Machines without ready mode** (note pos. 1 in "General")		
5a	Switch to standby:		
	- Ambient temperature		°C
	- Time		hh:mm:ss
	- Energy reading (set to zero if possible)		Wh
5b	Activate / start coffee production, after at least 6 hrs (resp. at least 2 hrs if machine was not heated up), values **before** activating:		
	- Ambient temperature		°C
	- Time (when same day)		hh:mm:ss
	- Time (when overnight, next day)		
	- Energy reading		Wh
5c	When coffee production is completed (incl. rinsing if relevant; no more noise, no power consumption):		
	- Time		hh:mm:ss
	- Energy reading		Wh
	- Amount of coffee in cup (net weight)		g
5d	30 minutes after first activating prepare another portion. Values **before** activating:		
	- Ambient temperature		°C
	- Time		hh:mm:ss
	- Energy reading		Wh
	When coffee production is completed (incl. rinsing if relevant; no more noise, no power consumption):		
	- Time		hh:mm:ss
	- Energy reading		Wh
	- Amount of coffee in cup (net weight)		g
	60 minutes after first activating prepare a third portion. Values when production is completed and the machine passed into the lowest standby state:		
	- Time		hh:mm:ss
	- Energy reading		Wh
	- Amount of coffee in cup (net weight)		g
6	Does the machine have a hard-off (switch)? (y/n)		
	(Power input has to be zero!)		
	Does it have a (soft-off) on/off switch? (y/n)		
	Power input in soft-off:		
	- Energy reading when switching off		Wh
	- Energy reading after 1h		Wh

Results

Duration of coffee period	00:00:00	hh:mm:ss
Duration of standby mode (per year)	8760	h
Standby power consumption	#DIV/0!	W
Standby energy consumption (per year)	#DIV/0!	kWh
Energy consumption coffee period incl. 3 preparations, measured value	0,00	Wh
Energy consumption for coffee period (3 cups), standardised by amount of coffee	#DIV/0!	Wh
Total energy consumption (per year)	#DIV/0!	kWh

$E_{coff\text{-}p} = 15 + (E_{coff\text{-}p\text{-}3C} - 15)*(240 / M_{3C})$

$E_{tot} = (730 * E_{coff\text{-}p} + t_{stb} * P_{stb})/ 1000$ in kWh

Detailed measurement Report, Coffee machine:			
All W, Wh and °C readings shall be recorded with 1 decimal place.		Date:	
2a	Switch to standby:		
	- Ambient temperature	22,2	°C
	- Time	08:00:00	hh:mm:ss
	- Energy reading (set to zero if possible)	0	Wh
2b	Activate after at least 6 hrs:		
	- Ambient temperature	23,0	°C
	- Time (when same day)	15:00:00	hh:mm:ss
	- Time (when overnight, next day)		
	- Energy reading	11,3	Wh
2c	Ready (poss. after confirming automatic rinse):		
	- Time	15:01:30	hh:mm:ss
	- Energy reading	27,6	Wh
2d	After 30 min: energy reading (set to standby afterwards, reactivate after 5 sec.)	38,7	Wh
	After 60 min: energy reading (set to standby afterwards, reactivate after 5 sec.)	47,9	Wh
2e	Immediately after auto-off:		
	- Time	16:31:30	hh:mm:ss
	- Energy reading	55,2	Wh
	- Ambient temperature	22,9	°C
4	Does the machine have a hard-off (switch)? (y/n)	n	
	(Power input has to be zero!)		
	Does it have a (soft-off) on/off switch? (y/n)	j	
	Power input in soft-off:		
	- Energy reading when switching off	55,2	Wh
	- Energy reading after 1h	55,2	Wh

Results

Duration of coffee period	01:31:30	hh:mm:ss
Energy consumption in Ready mode (coffee period)	43,90	Wh
Duration of standby mode (per year)	7647	h
Standby power consumption	1,61	W
Standby energy consumption (per year)	12,34	kWh
Energy consumption for coffee preparations, standard	20	kWh
Total energy consumption (per year)	64,39	kWh

$E_{tot} = (730 * E_{ready} + t_{stb} * P_{stb})/ 1000 + 20$ in kWh