Energy efficiency labels for residential and commercial coffee makers

Nadja Gross
Topten GmbH
Schaffhauserstrasse 34
CH-8006 Zürich, Switzerland
nadja.gross@topten.ch
www.topten.ch

Eric Bush
Topten GmbH
Schaffhauserstrasse 34
CH-8006 Zürich, Switzerland
eric.bush@topten.ch
www.topten.ch

Keywords

domestic appliances, commercial programmes, market transformation, energy standards, domestic energy efficiency, testing, measurement and evaluation

Abstract

Since 2015, Switzerland has a mandatory energy label for residential coffee makers. It is based on the measurement standard EN60661:2014 and also takes into account Regulation (EC) No 1275/2008 on standby. While the adoption of auto-power-off and low standby was mainly driven by the EC standby regulation, it can be said that the Swiss label led to the adoption of more efficient technologies such as better insulation of boilers and the promotion of the very effective flow through-type heaters. The annual consumption of coffee makers dropped from an average of 180 kWh (2006) to below 50 kWh for efficient models (2018). This success story could be transposed to the European Union, regulating a much bigger market and saving much more energy in the process. The stock of residential coffee makers in the EU is estimated 100 Mio units, consuming 17 TWh per year. Estimates of annual sales are roughly 30 Mio units by 2025.

A recent Swiss study (Gross, 2021) looks into energy efficiency of commercial coffee makers and ways to boost innovation. While some differences exist for residential and commercial coffee makers, there are also many similarities. The higher complexity of commercial coffee makers poses a challenge for developing a comprehensive testing standard (measuring the production of several different kinds of beverages with high accuracy). CENELEC is currently working on such a testing standard (CLC/TC 59X/WG 21). Other approaches focus only on energy losses as one of the key drivers of efficiency taking into account that the main energy for production of coffee is heating up water. Pragmatic and broadly applicable solutions that focus on key drivers such as energy losses and how to prevent them, are necessary. The stock of commercial coffee makers in the EU is estimated at 5.9 Mio units, consuming 13.6 TWh per year. Estimates of annual sales are roughly 700,000 by 2025 according to BIO (2014).

This paper discusses the success of the Swiss energy label for residential coffee makers and its possible application to the European market as well as for commercial coffee makers. The trade-off between a pragmatic measurement method and the complexity of commercial coffee makers is discussed.

Introduction

This paper first looks at the success story of the Swiss energy label for residential coffee makers. The development that led to the successful introduction of the energy label was a complex process from studies showing the impact of coffee makers as well as proving the feasibility of test standards. The exchange and group effort together with manufacturers and regulators eventually led to the improved, yet simple testing standard that is widely accepted as a basis for defining energy efficiency classes for the label. The at first voluntary label from 2009 was adapted to the new standard and made mandatory for Switzerland in 2015. Because many manufacturers already measure their models for the Swiss market, an introduction of the same label for the European Union is easily feasible and the only logical conclusion.

For commercial coffee makers this paper is evaluating the differences, but also similarities in comparison to residential

coffee makers, which could lead to the adaptation of the existing energy label also for the commercial use. Topten Switzerland is already presenting a list of energy-efficient models on www.topten.ch/gewerbliche-kaffeemaschinen. The existing test standards EN60661:2014 (testing norm for the residential coffee makers) and DIN 18773-2:2016 (testing norm for commercial coffee makers, focussing on energy losses alone) are evaluated, their strengths and weaknesses highlighted. The next steps that could eventually lead to the introduction of the energy label for commercial coffee makers are clear: more data is needed for the existing testing standards to prove the feasibility on a broader spectrum.

Residential coffee makers

THE HISTORY OF THE SWISS ENERGY LABEL FOR RESIDENTIAL COFFEE MAKERS

Switzerland has established a mandatory label for residential coffee makers. In 2006, Topten and S.A.F.E. proposed the introduction of an energy label for coffee makers in a contribution at EEDAL conference (Nipkow 2006). In 2009, the voluntary energy label for residential coffee makers, very similar in nature to the energy label already common for other residential products, was approved (FEA 2009). However, it did not work as anticipated, as only coffee makers in the efficiency classes A and B were labelled. Less efficient coffee makers were not declared with the energy label. Thus, the goal of providing consumers with better information on energy-efficiency was not sufficiently achieved.

Shortly after the introduction of the label, in 2010, Topten could provide input for the CECED (now Applia, European Association of home appliance manufacturers)-Working Group TC59X-WG15 with new insights on their testing method. It became obvious that the norm discussed was not yet the optimal testing standard for the energy label. The work on a new measuring standard began, which eventually concluded with the integration in EN60661:2014.

In accordance with SFOE (Swiss Federal Office of Energy), FEA (Swiss Association of Manufacturers of Electric Appliances for residential and commercial use) began working on further developing the existing energy label for residential coffee maker in 2012. After many meetings, phone conferences and written correspondence, a consensus was found where all members of CECED agreed on the subsequent procedure, which was presented to SFOE mid 2014. CECED agreed to conduct round robin tests, which FEA then was able to present, concluding in a Letter of Intent. In there were also the main points described for the adaptation of the energy label for residential coffee makers, such as the scaling from A+++ to D. The work was concluded mid 2015, just in time for the revision of the EnV (Swiss Energy Directive).

At the same time, Electrosuisse (Swiss Association for Electrical Technology, Energy and Information Technology) conducted a comparison of the two measuring methods, the existing one used for the voluntary energy label and the new method, developed by FEA (Schweizer 2014). As a consequence, in 2015, the energy label for residential coffee makers became mandatory, using the newly developed FEA measuring method.

In 2016, Topten conducted a study with comparing measurements using the FEA-measuring norm and EN60661 (Bush et al. 2016). This was the basis on which the energy label for residential coffee makers was revised as of August 1st, 2016, resulting in a new look, a new classification as well as based on the international measuring standard EN60661:2014 (EnEV 2016). In addition, also the ErP (Comission Regulation (EU) No 1275/2008 and Comission Regulation (EU) No 801/2013) was adopted, meaning all coffee makers have to have an auto-shut-off of 30 min as factory setting (Commission Regulation (EU) No 801/2013) that cannot be changed by the user to a longer period.

Commercial Coffee Makers

While the path to higher energy-efficiency for residential coffee makers seems very clear, commercial coffee makers only recently came into focus.

EUROPEAN POLICY

Preliminary study for Ecodesign Working Plan (WP) 3 (2014)

BIO (2014) presented rather low energy saving potential for commercial coffee makers. The lack of data made it very difficult to estimate realistic savings for the various machine types.

Dropped from Ecodesign WP3 (2016)

In 2016, the European Commission dropped tertiary hot beverage equipment from the Ecodesign Working Plan 3 (2015–2017).

Preliminary study for Ecodesign WP4 (2021)

In February 2021, the draft version of the new preparatory study for the next Working Plan 4 (2020–2024) was released (Viegand et al. 2021). After reviewing work from Topten (Rothwell (2017), Gross (forthcoming 2021)), the saving potential was revised and is now more than double compared to what was presented in the previous preparatory study from 2014 (see above).

New testing standard CLC/TC 59X/WG 21 by CENELEC (pending)

CENELEC is currently working on a new standard CLC/TC 59X/WG 21 "Professional and commercial coffee machines". It is similar to the EN60661, combining various use phases (heating up, ready, standby, cleaning) as well as the actual production of beverages, incl. the steam function. The standard can be used for all machine types by simply only measuring what is present in the particular model. It is currently being put to the test by several laboratories and manufacturers for a last round of feedback before it is finalized.

VARIOUS TYPES OF COMMERCIAL COFFEE MAKERS

What is considered to be a commercial coffee maker? The scope includes commercial coffee machines of the types *fully automatic* and *semi-automatic*, as well as manually operated machines such as *portioning* machines and *portafilter* espresso machines. There are machines with and without the internal use of fresh milk. Machines which use fresh milk have a higher energy consumption because for one, the milk needs to be kept cold. In addition, in order to heat up the milk and create steam, additional technology (steam-boiler, milk pump) is required. Machines without usage of fresh milk sometimes offer a man-

Table 1. Typologies of Commercial Coffee Makers (adapted from Gross 2021).

Fully automatic: Free standing	Fully automatic: tabletop	Semi-automatic: tabletop	Porta filter espresso machine
			
Coffeetek NEO	Franke FCS4026	Egro Zero + Pure Coffee	La Marzocco Linea Classic

Portioning machine	Filter: Batch brewer	Filter: Satellite Coffee Brewer	Filter: Urn
			
Nespresso Aguila Range	Bloomfield Koffee King 3	Bloomfield Pourover Airpot	West Bend Coffee Urn

Table 2. EU-27 Stock estimates (adapted from Viegand et al. 2021).

Type of coffee maker	2017 stock	2030 stock	2030 sales
Free standing vending	1,177,904		
Table-top vending	1,160,482		
Table-top, non-vending	1,160,482		
Total Vending and table-top	3,498,867	3,052,570	316,055
Portafilter espresso	1,278,460	1,584,327	131,704
Batch and Bulk brewer	714,434	821,450	217,311
Total	**4,321,327**	**5,458,347**	**665,070**

ual steaming option (semi-automatic), they may use powdered milk for mixed coffee beverages, or they only offer pure coffee beverages without any milk. In terms of coffee type, machines are available for instant, ground and bean coffee which means that some have built-in grinders.

A distinction is made between *free-standing* or *tabletop* fully automatic machines, tabletop semi-automatic machines and tabletop portafilter machines. The last two types of machines differ from fully automatic machines in that they require trained personnel to operate them (manually steaming milk for semi-automatic, or operation of the entire machine for portafilter), whereas fully automatic machines can be operated independently by the user. Professional portioning machines are also included as a further subgroup. These can also be considered fully- or semi-automatic except for the insertion of the capsule/pad and are therefore not treated separately.

Free-standing hot beverage machines are designated for busy places and include a vending function. In the table-top category there are vending and non-vending machines available. Table-top hot beverage machines are designated for offices and gastronomy; they have an average throughput of 5 to 50 litres/day.

There are also various types of filter machines, but these are hardly used in Switzerland and were therefore not considered in the study conducted by Topten. However, for other countries, they still matter and are therefore included in the preparatory study (Viegand et al 2021) with their respective saving potentials. Batch and bulk commercial coffee brewers which seem to be more popular in the United States, are not considered. Batch commercial coffee brewers have a brew volume capacity of 24–384 oz. which is about 0.7–11.5 litres. Bulk commercial coffee brewers have a brew volume capacity larger than 11.5 litres.

MARKET OVERVIEW

The stock of commercial coffee makers for 2025 in the EU was estimated at 5.9 Mio units, consuming 13.6 TWh per year. Estimates of annual sales are roughly 700,000 by 2025 (BIO 2014). However, these numbers were recently revised and updated in the draft of the new preparatory study for Working Plan 2020–2024.

DIFFERENCES BETWEEN COMMERCIAL AND RESIDENTIAL COFFEE MAKERS

What makes a commercial coffee maker so different from its residential counterpart that the same testing norms and energy label could not simply be apply as well? Eventually it still produces coffee, can be argued. If you take a closer look, commer-

Table 3. EU-27 Estimated Energy consumption and GHG emissions 2030 for the use phase (adapted from Viegand et al. 2021).

Type of coffee maker	Stock	TWh/a Electricity	PJ/a Primary Energy	1,000 t/a GHG
Total Vending and table-top	3,052,570	8.6	64.8	2,915
Portafilter espresso	1,584,327	1.6	12.3	555
Batch and Bulk brewer	821,450	2.4	17.8	801
Total	**5,458,347**	**12.3**	**95.0**	**4,271**

cial coffee makers do differ in some ways, but are very similar in general.

- Higher capacity, speed of production: in most cases, commercial coffee makers need to deliver promptly, there is no time for tedious preheating the machine, while you might be patient enough for it at home. At work, you just push a button and expect your coffee to be filled into the cup immediately after. Similar in a restaurant: the table of eight guests all want their coffee served together, without the first one already being cold because you have to wait for the machine to finish making the other six cups. This is why commercial coffee makers are built to deliver: their capacity to deliver a certain number of cups per hour is often much higher. Many of the high-capacity models are also built to produce several beverages at once (e.g., you can fill two coffee cups while steaming milk and fill a cup with hot water for tea, all simultaneously). In order to do so, more technology is built in, which consumes more energy than a simpler model.
- Higher automation in places with no regular personnel: While your machine at home often greets you with the "empty coffee grounds" or "empty tank", commercial coffee makers are much more automated. The available beverage types, when to start the cleaning cycles, the auto-off function and much more can all be programmed for many models. With automatic residue removal, freshwater supply and large coffee bean hoppers, these machines can be left alone for a long time before it needs to be restocked and maintained.
- Trained personnel: most machines require trained personnel at some point. Two cases can be distinguished:
  - Maintenance and restocking: be it merely for refilling (coffee, milk, powders) or regular, deeper cleaning cycles than the automatic ones. This is usually done by initial training by the manufacturer or reseller. For offices, this could be a designated employee responsible for the coffee maker, cleaning staff or cantina personnel. Similar for coffee take-away in places like self-serving restaurants, shops, gas-stations, etc., it is usually an employee taking care of the coffee maker.
  - Some machine types like portafilter espresso machines can only be operated by highly trained personnel (barista) even for producing the beverages, not only maintenance and restocking. For these type of coffee makers, the art of making coffee is celebrated. Often these machines are also a design showstopper in a bar, café or restaurant, where the customer can clearly notice and appreciate the effort and work that goes into their beverage.
- High variety of products: Fully-automatic models often offer various types of coffee beans (decaf, organic, light roast, dark roast), milk-types (normal, lactose free, skim, vegan), flavoured syrups to be added in the beverage, even cold versions of the classics to choose from.
- Although this is trending as well for residential coffee makers, a big difference is the usage of fresh milk, which is kept cold directly in or nearby the machine, ready to be heated and frothed. In comparison: most residential coffee machines that use fresh milk do not have a cooling unit, the milk needs to be placed back in the fridge for cooling. However, the external milk cooling of commercial coffee makers uses additional energy in combination with the readiness to produce any beverage right away (mentioned above), additional technology (steam boiler) has to be kept ready to operate immediately. In case of the steam boiler, this means having the pressure and temperature ready to heat and froth the milk. In Figure 1, the differences in energy loss are shown for the models listed on the Topten website. These models are measured according to DIN-18873-2 the energy for cooling the milk itself is not included here, but measured separately, because the machines usually can be combined with various milk refrigerators. This means the actual energy loss associated with a coffee-milk-beverage such as cappuccino is even higher.

SAVING POTENTIAL OF COMMERCIAL COFFEE MAKERS

In 2016, the European Commission has abandoned tertiary hot beverage equipment from the Ecodesign Working Plan 3 (2015–2017), as the estimated energy saving potential of 1.2 TWh per year was considered as too low (in 2030 in the EU). Topten conducted a brief plausibility check of the underlying preparatory study and came to the conclusion, that this estimated saving potential seemed far too low. According to Rothwell (2017) the actual saving potential for the EU in 2030 lies more around 4 TWh per year, taking into consideration standby and higher saving potential for different types of commercial coffee makers.

As presented in the draft version of the preparatory study for the Working Plan 2020–2024 (Viegand et al. 2021), the saving potential has been revised and is now more than double the amount from the previous study with 2.6 TWh per year by 2030. However, it is still lower than what Topten has proposed due to comparison with an average model instead of the best available.

In particular, Topten has been estimating the potential savings for portafilter machines to be even higher than presented in Viegand et al. 2021. These machines very often run 24/7 and are never shut down completely. Thus. we deem the saving potential to be higher.

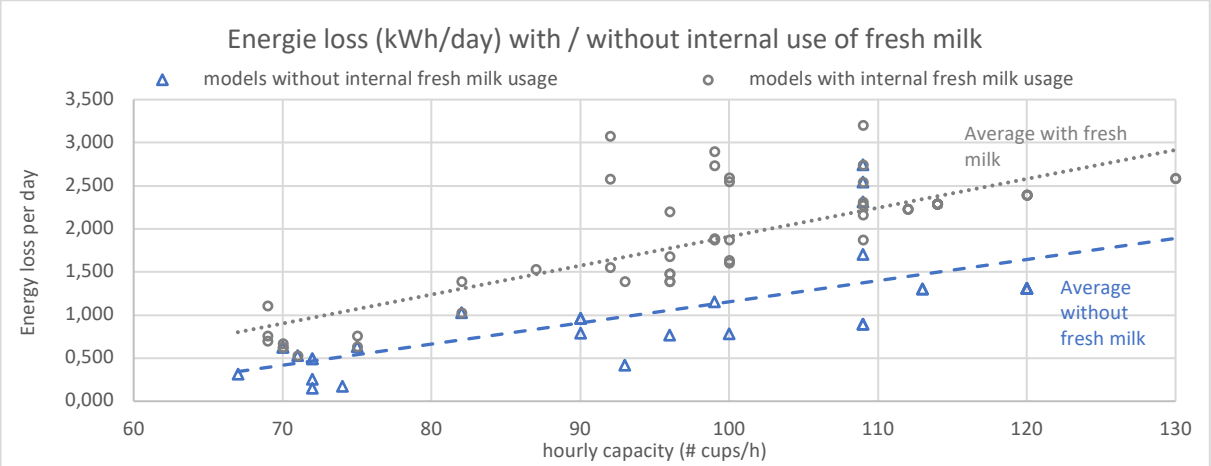

Figure 1. Overview on models showing their energy loss, rated by the hourly coffee capacity and grouped by using fresh milk or no fresh milk.

Table 4. EU-27 Saving potential for Energy consumption and GHG emissions 2030 for the use phase (adapted from (Viegand et al. 2021, Rothwell 2017).

Type of coffee maker	TWh/a Electricity (Viegand et al. 2021)	PJ/a Primary Energy (Viegand et al. 2021)	1,000 t/a GHG (Viegand et al. 2021	Electricity (TWh/a) Topten (Rothwell 2017)
Free standing	0.6	4.3	188	0.7
Tabletop	0.4	3.1	135	0.7
• Portafilter espresso	1.5	11.0	538	2.6
• Batch and Bulk brewer	0.0	0.2	8	n/a
Total	**2.4**	**869**	**4,271**	**4.0**

Fully-automatic commercial coffee makers

As of 2020, Topten Switzerland has listed energy-efficient fully automatic and semi-automatic tabletop commercial coffee makers, which is giving an up-to-date market overview of the most energy-efficient models today. They can be found together with the selection criteria on www.topten.ch/gewerbliche-kaffeemaschinen for Switzerland and on www.topten.eu/commercial-coffee-makers for the European market. The list is based on the energy loss per day (as measured following DIN 18873-2:2016) which is available in the HKI-database for over 100 models[1]. After analyzing the data to check for clusters (e.g., do all machines using fresh milk have a higher energy loss?), a threshold was defined depending on the hourly capacity for coffee (cups), taking into consideration that machines with a higher capacity are more likely to use more energy (and consequentially have a higher energy loss). For the definition of the threshold, it was considered to differentiate models using fresh-milk due to the additional energy used for cooling and additional energy used for creating steam, pumping milk, etc. (compare with Figure 1). However, the differences were not substantial enough and thus the general threshold was used for all models. There were several models fulfilling the criteria (e.g., automatic shut off or the possibility to set a schedule) and could be listed on Topten. With the presented threshold, models of various capacity, with and without the use of fresh milk, are represented. Further details can be found in the report (Gross 2021).

1. https://grosskuechen.cert.hki-online.de/de

In order to give an incentive for consumers to buy energy-efficient commercial coffee makers, Topten was able to integrate commercial coffee makers in the Swiss federal rebate program ProKilowatt in 2020. The program is already well known for its other categories, mainly in the commercial cooling appliances. Even though the Topten list for commercial coffee makers is a first approach to put energy-efficiency for this product category on the table, adding it to the ProKilowatt program gives it even more visibility for many stakeholders active in the same field (e.g. retailers buying commercial refrigerators for their stores, which also have a coffee take-away, will see the presentation of commercial coffee makers on Topten and look into it themselves or tell their colleague responsible for that section to do so). Topten is looking to further promote their product list to large buyers by individually contacting them, publishing articles in specialized journals and reaching out to professional associations in order to communicate with their members about the new rebates.

Portafilter espresso machines

As for portafilter machines, there is currently no data available, thus they are not yet listed on Topten. However, the testing standard DIN 18873-2 is applicable for all types of machines, incl. portafilter. There is no reason why these machines could not be measured accordingly.

Topten is striving to conduct a test series in order to get more insights of the actual energy consumption on portafilter machines as so far, they are "flying under the radar" in terms of their energy consumption. Discussions with manufacturers to obtain data were not yet successful, even though the interest in energy-efficiency improvements is there.

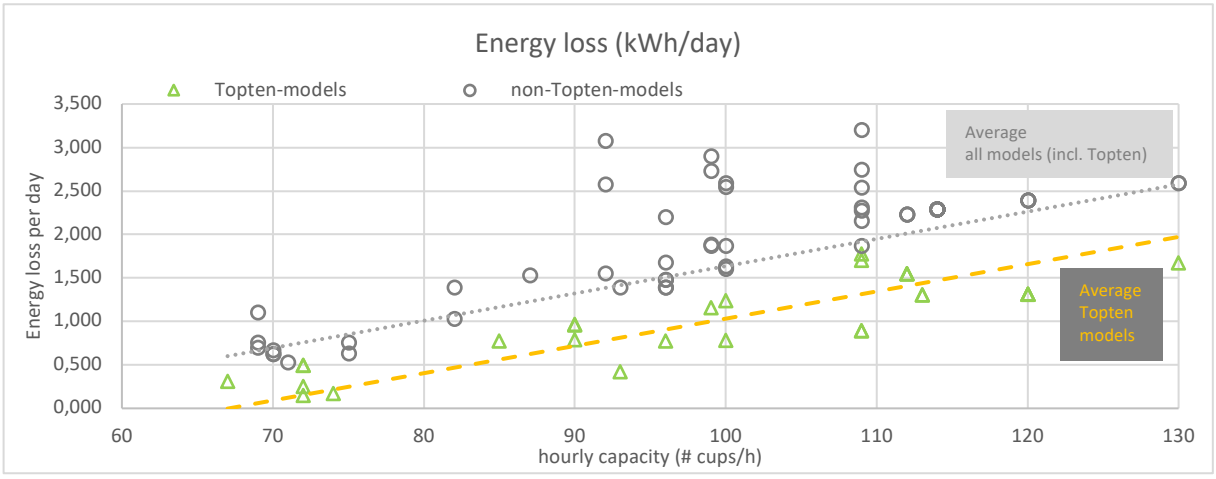

Figure 2. Overview on models showing their energy loss, rated by the hourly coffee capacity, grouped by Topten and non-Topten-models.

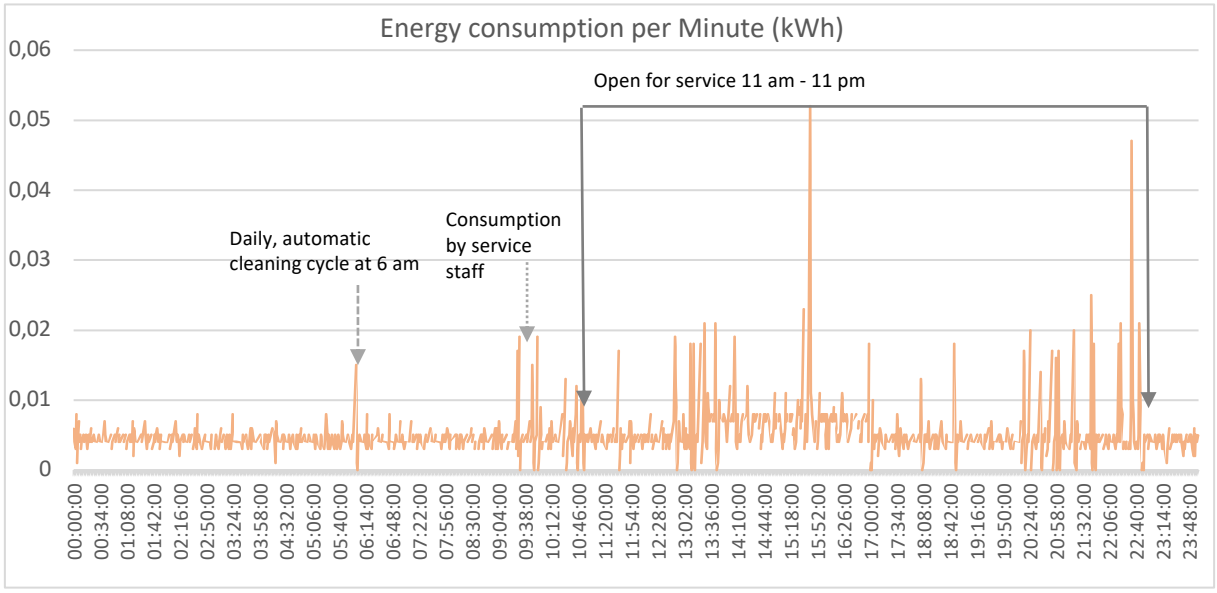

Figure 3. Power curve of a practice measurement of a portafilter espresso machine in a restaurant (kWh/minute) for a full day.

For a start, Topten was able to receive data of one portafilter espresso machine, which was measured for two weeks in practice. This model is located in a restaurant (open seven days a week), open for lunch as well as dinner service. Data was analysed using the opening hours (11 am to 11 pm = "open") as well as the duration of workdays (6am – midnight = "closed", staff is present, gets the machine ready, staff consumes a few beverages during the service preparation time, etc.). In Figure 4, the data is aggregated as the daily average over the two weeks of data, taking into account that weekends are busier. When looking at the individual power curves (one example for a Monday is shown in Figure 3), it is easy to spot that the energy consumption is to the most part (>90 %) caused by keeping the machine ready (idle mode), not the actual production of a beverage ("purchase"). It is due to this fact that Topten has proposed to focus on the energy losses occurring at all times. If the energy losses are minimized, this has the highest impact on the majority of energy consumption. Note: optimizing user behaviour is an additional topic, e.g., why is the machine not completely shut off during the night.

MEASURING STANDARDS FOR COMMERCIAL COFFEE MAKERS

Rothwell (2017) presented the available measuring standards that could be applied for commercial coffee makers.

- EVA EMP 3.1b «Test Protocol for the measurement of energy consumption in vending & dispensing machines, part 2: Hot and Hot & Cold drinks machines».
- DIN 18873-2:2016 «Methods For Measuring Of The Energy Use From Equipment For Commercial Kitchens – Part 2: Commercial Coffee Makers».
- ENERGY STAR: Energy Star 1.0 Commercial Coffee Brewers.
- ENAK: «Testdefinition zum Kaffeemaschinen-Datenblatt».
- EN60661:2014 «Methods for measuring the performance of electric household coffee makers».

Rothwell (2017) proposed to further evaluate EVA EMP 3.1b or DIN 18873-2, as well as to analyse the standard used for residential coffee makers, EN60661 for its possible adaptation

for the commercial sector. Gross (2021) based their work on this study and concluded due to the simplicity of the testing method and available data for a large number of commercial coffee makers to go forward with DIN 18873-2.

DIN 18873-2:2016

The German Institute for Standardisation (DIN) provides the measurement standard DIN 18873-2 "Methods For Measuring Of The Energy Use From Equipment For Commercial Kitchens – Part 2: Commercial Coffee Machines". It targets fully automatic table-top machines and professional espresso machines (porta filter). The norm measures the energy losses per day (kWh) which includes the energy for cleaning and rinsing. It separately measures the energy loss (idle mode) of the refrigerator systems for milk. The productive energy for producing the drink (e.g., coffee) is not considered. The DIN standard does not have an energy efficiency scale nor is it used for any energy labelling.

The DIN 18873-2 is mainly used by the German Industrial Association of House, Heating and Kitchen Technology (HKI). HKI lists the energy consumption data for over 100 professional table-top coffee makers on their website. Values for professional espresso machines are currently not yet measured, although the testing norm would allow for it.

EN60661:2014

The Swiss energy label for residential coffee makers is based on the norm EN60661 "The methods for measuring the performance of electric household coffee makers". The label indicates the energy class which is calculated on the yearly total energy consumption. The measurement standard is separately defined for pressure coffee makers (incl. capsule/pad machines) and filter coffee makers. A test procedure for pressure coffee makers includes not only the coffee period but also the steam function, standby mode, off mode, rinsing and grinding. The procedure for filter coffee makers includes also the consumption in standby and off mode, besides the energy consumption for the coffee producing period.

CLC/TC 59X/WG 21 (pending)

CENELEC is currently working on a new standard CLC/TC 59X/WG 21 "Professional and commercial coffee machines". At the moment it is not yet possible to rely on this work, as the results are still confidential, methods have not yet been finalised and therefore no measured values are available. The COVID-19 pandemic has delayed the work and the standard has not yet been finalised. Currently, the standard is in the test phase, in which various laboratories are testing according to the draft standard and providing feedback. These test measurements could not yet be carried out due to the pandemic. It is planned to be able to conclude this feedback round in 2021, make any necessary adjustments and then submit the standard.

In the CLC/TC 59X/WG 21 standard, the goal is to be able to measure all types of machines. For this purpose, the various processes are defined individually and measured according to the machine. If individual functions, such as foaming milk, are not available, these measurement steps are omitted. The energy consumption is shown separately for each of the individual processes.

As soon as the new standard is available and measurement data is available, Topten will base its product list on these new values. However, the measurement procedure is rather complex, and it is questionable whether all manufacturers will test their models accordingly.

Comparison of methods

DIN 18873-2:2016 has the advantage that as of 2016, its measurement standard includes also professional espresso machines (porta filter), therefore it would cover all machine types. Nevertheless, measurement figures for professional espresso machines and free-standing machines are not yet found. Furthermore, the test procedure seems less demanding since the actual preparing (and vending) functions don't need to be tested. Testing only the energy loss is especially easier for professional espresso machines, where replacing the porta filter 60 times in a row and testing additional features (touch displays, vending

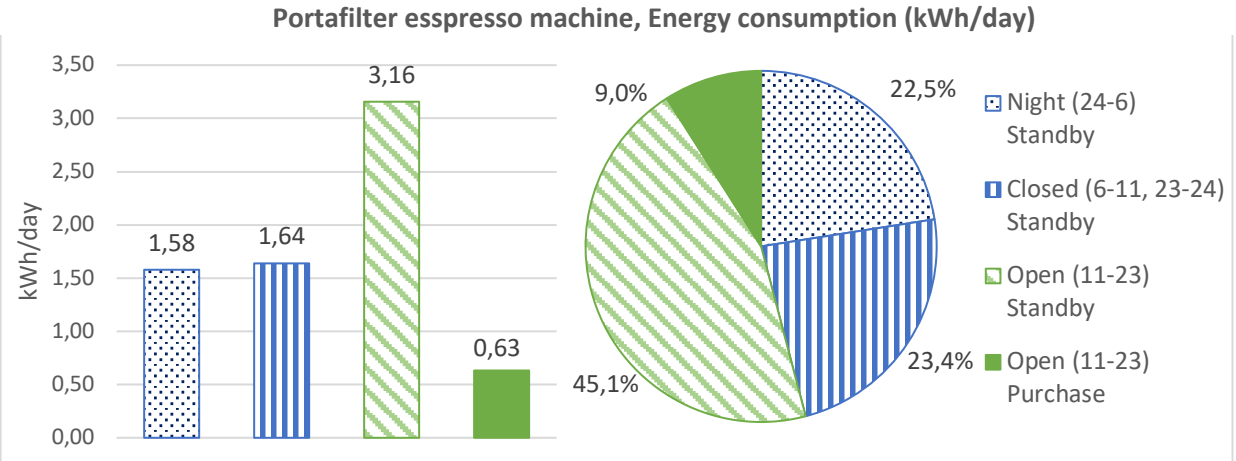

Figure 4. Practice measurement of a portafilter espresso machine in a restaurant (kWh/day) grouped for the different use phases, average per day.

options, built-in grinders etc.) are complicated. It is debatable if the productive energy should be considered at all for a measuring norm or if it is enough to focus on the energy loss as the relevant size. We propose to go forward with the DIN 18873-2:2016 as measuring standard and re-evaluate once the new measuring norm currently developed from CENELEC is in place.

Discussion and Conclusion

INTRODUCTION OF THE ENERGY LABEL FOR RESIDENTIAL COFFEE MAKERS IN THE EU

An energy label is a very effective measure to help consumers recognize the most efficient coffee makers on the market. A label in the top class is an incentive for industry and trade to develop and offer energy-efficient coffee makers. These are more likely to be placed in retail stores. It further would be a useful tool for rebate programmes.

Topten recommends the introduction of an EU energy label for all types of residential coffee makers such as fully automatic machines, portioned machines (high and low pressure), machines with porta filter as well as drip-filter machines. The measurements of the energy consumption shall follow the revised EN60661:2014.

ECODESIGN AND MEPS FOR COMMERCIAL COFFEE MAKERS

Ecodesign and MEPS are powerful tools to shift appliances towards higher energy-efficiency. Due to the diverse nature of the models, it is currently difficult to name specific best or worst technologies that have the highest influence on energy consumption, further research is required on this matter.

As shown in the practice measurement conducted for a portafilter espresso machine in a restaurant (Figure 3), the majority of energy is used in ready or standby mode, not for actual production of coffees. More data is needed to show the variety of energy consumption between different types and models and applications (restaurants, offices, take-away stores, etc.), but the conclusion from just this one measurement is clear: energy losses need to be minimized, both in ready mode and standby mode.

Measures to achieve this could be

- The adoption of Comission Regulation (EU) No 1275/2008 and Comission Regulation (EU) No 801/2013 on standby regulation for electrical appliances for household and office equipment.
- Mandatory timetables for the setting of on/off times to prevent machines from running 24/7. Especially for portafilter espresso machines, this is still common practice and often even recommended by manufacturers and dealers. This could also be solved with an automatic shut-off after the cleaning cycle was initiated as well as a schedule to automatically start the machine in the morning to give enough time to preheat.
- Promotion of eco-modes (reduced keep-warm-temperature) after 15 min of inactivity during on-time. Some manufacturers already feature this for their machines (all types).

APPLYING THE ENERGY LABEL FROM RESIDENTIAL COFFEE MAKERS TO COMMERCIAL COFFEE MAKERS

With some adaptation, the Swiss energy label for residential coffee makers could also be used to label commercial coffee makers. As in EN60661:2014 all phases are already described that are present also for commercial coffee makers. It could be argued that the number of beverages produced is much higher for commercial coffee makers, however this does not prevent the label to be effective. It might not exactly represent the actual energy consumption of a commercial coffee maker, especially for very busy places such as take-away cafés in a train station with lots of beverages produced daily but would still allow consumers to compare the different models based on the consumption presented. Some manufacturers already have the household energy label featured on their smaller models.

A simple adaptation would be to increase the number of beverages measured. The new measuring norm from CENELEC is heading towards this approach and can be used as the basis for a new energy label for commercial coffee machines.

INTRODUCTION OF A NEW ENERGY LABEL SPECIFICALLY DESIGNED FOR COMMERCIAL COFFEE MAKERS

Currently, energy consumption of commercial coffee makers is not at the top of the minds for consumers. Most of them are not aware how much energy their machines are using over the lifetime. In many cases, the user is not the same person who pays the electricity bill or buys the new machine (in e.g., restaurants and bars, hotels, stores). Therefore, avoiding energy losses by shutting off the machine has no priority. An energy label can make the differences visible between manufacturers and their models and make the energy consumption a factor in the buying decision. Of course, many other factors play a role in the purchase of a commercial coffee maker:

- How reliable and durable is it?
- How large is the product range?
- How well is the service provided after the purchase for maintenance?
- How important is the prize, the design and the brand?

Energy efficiency should be one of those factors. And a label can provide the necessary information and comparability.

NEXT STEPS

In order to get better insights, more practice measurements are needed to reveal the actual energy consumption of various types of coffee makers, models of the same type. It would also be interesting to see the differences for various applications (HORECA (HOtel, REstaurant, Catering/Café), OCS (Office Coffee Service)) and user behaviours (aware or unaware of energy consumption with resulting behaviour).

In order to test the applicability of the EN60661 for commercial coffee makers, a test series should be conducted in an independent laboratory (e.g., VDE in Germany, which is measuring many household coffee makers and some commercial coffee makers as well).

In order to test the applicability of the DIN 18773-2:2016 for other types of commercial coffee makers currently not available in the HKI Database (free-standing, portafilter, portioning

machines), a test series should be conducted in an independent laboratory (e.g., VDE in Germany).

In the meantime, Topten will work on the promotion of its product list to bring awareness to the topic of energy-efficiency of commercial coffee makers. Topten is looking to further promote their product list to large buyers by individually contacting them, publishing articles in specialized journals and reaching out to professional associations in order to communicate with their members about the new rebates.

Glossary

CECED	former name of now APPLiA, the Association of home appliance manufacturers in Europe, Brussels.
EnV	Energieverordnung (Swiss Energy Directive).
Electrosuisse	Verband für Elektro-, Energie und Informationstechnik (Association for Electrical Technology, Energy and Information Technology).
ErP	Regulation on Energy-related Products: Regulation on Standby and Off-Mode (Commission Regulation (EU) No 1275/2008) and its amendment (Comission Regulation (EU) No 801/2013).
FEA	Fachverband Elektroapparate für Haushalt und Gewerbe Schweiz (Swiss Association of Manufacturers of Electric Appliances for residential and commercial use).
HKI	Industrieverband Haus-, Heiz- und Küchentechnik (German industry association for home-, heating- and kitchen appliances).
HORECA	HOtel, REstaurant, Catering/Café.
MEPS	Minimum Energy Performance Standard.
OCS	Office Coffee Service.
SFOE	Swiss Federal Office of Energy.
S.A.F.E.	Swiss Agency for Energy efficiency.
VDE Testing and Certification Institute	Testing Institute from the Association of German Electrotechnology.

References

BIO by Deloitte (BIO), Oeko-Institut and ERA Technology, 2014, "Preparatory Study to establish the Ecodesign Working Plan 2015–2017 implementing Directive 2009/125/EC Task 3 Draft Final Report".

Bush, E., Josephy, B., Michel, A., S.A.F.E., 2016, «Testproject Coffee makers».

EN60661:2014, "Methods for measuring the performance of electric household coffee makers," CENELEC. Test protocol available at https://www.bfe.admin.ch/bfe/de/home/effizienz/energieetiketten-und-effizienzanforderungen/die-energieetikette-fuer-haushaltsgeraete/die-energieetikette-fuer-kaffeemaschinen.exturl.html.

EnEV, 2016, Swiss Energy regulation, Appendix 3.2, AS 2017 6951, available online https://www.fedlex.admin.ch/eli/cc/2017/765/de#lvl_d1594e275.

European Commission, 2016, "Ecodesign Working Plan 2016–2019". [Online]. http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52016DC0773&from=EN

European Commission, 2008, "COMMISSION REGULATION (EC) No 1275/2008," *Official Journal of the European Union*. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32008R1275

European Commission, 2013, "COMMISSION REGULATION (EU) No 801/2013," *Official Journal of the European Union*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0801

FEA, SFOE 2009, "Voluntary agreement on the application of energy labels on coffee machines (espresso machines)".

Gross, N., Bush, E., forthcoming 2021, Swiss Federal Office of Energy SFOE. "5x Basics: efficient commercial equipment. Part: Commercial coffee makers".

HKI (Industrieverband Haus-, Heiz- und Küchentechnik e.V.), "Database for the verification of energy consumption of commercial catering equipment," [Online]. Available: https://grosskuechen.cert.hki-online.de/de and http://grosskuechen.cert.hki-online.de/pdf/basic_principles_for_the_data_base_hki_cert_09-2014.pdf.

Josephy, B., Nipkow, J., Pilone, A., Bush, E., 2009, "Super-Efficient Coffee Machines – Best Available Technology (BAT) and Market Transformation," in EEDAL-Conference Berlin.

Nipkow, J. and Bush, E., 2006, "Energy label for coffee machines," in EEDAL-Conference London.

Rothwell, I., Bush, E., 2017, Swiss Federal Office of Energy SFOE, "Preliminary Study on Tertiary Hot Beverage Equipment". https://pubdb.bfe.admin.ch/en/publication/download/8833

Schweizer, B., Electrosuisse, 2014, Swiss Feder Office of Energy SFOE, "Assessment of energy efficiency measurement methods for coffee machines according to: FEA / EN60661".

Viegand Maagøe, Oeko-Institut and Van Holsteijn en Kemna, 2021, "Preparatory study for the Ecodesign and Energy Labelling Working Plan 2020–2024, Task 3 Preliminary analysis of product groups and horizontal initiatives: Tertiary hot beverage equipment: Draft".