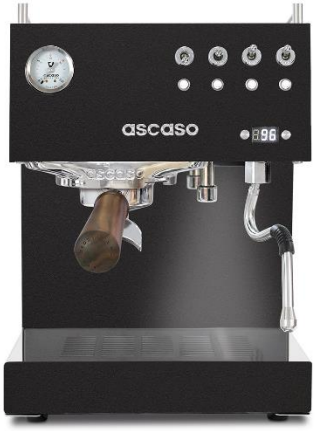
ascaso
BARCELONA
1962

ENERGY CONSUMPTION TEST



From	Ascaso Factory Tech.Dept.	**For**	
Conducted by	Raül Mansilla	**Revision**	#1
Date	May 2nd 2022	**Revision date**	May 2nd 2022

Summary

1 Previous considerations

The objective of this test is to determine the energy consumption (always expressed in kWh) of a domestic coffee machine considering the standard EN60661 (Methods for measuring the performance of electric household coffee makers). The result gives as an idea about the energy efficiency of the machine in terms of energy use per day, considering the main functions of the coffee machines and a standard pattern of use.

1.1 Equipment identification

In order to control and compare results between different tests, environmental conditions must be registered as follows:

i. Environment temperature.
ii. Water temperature.

Main factors causing energy request are groups/boilers, and those 2 parameters may cause come variations on results.

As well as the environmental conditions, the following data about the machine being tested must be registered:

i. Manufacturer, model, serial number.
ii. Electrical features (voltage, frequency, and power).
iii. Setting temperatures for coffee and steam or setting pressure if there is no PID control.
iv. Power restrictions applied to the configuration being tested, as well as energy saving modes if applicable.
v. Any other device connected to the machine which may cause energy consumption, such cup warmers for example.

2 Preparation of the test

Before starting the test the machine must be disconnected and cooled down for a minimum period of time of 12h, so we make sure that when starting the measurement process, initial conditions are correct, which means that water inside the group/boiler is at environment temperature, and that brewing units are not heated up.

The setpoint for coffee and steam must be adjusted to the working parameters we want for the test before the cooling period. It is important that machine is completely closed, including all covers, side panels and lids, before starting the test. This will allow us to make sure working conditions are the most similar to the real ones.

3 Test process

3.1 Test pattern

Test pattern is based on EN60661 (Methods for measuring the performance of electric household coffee makers) and considers a standard usage patter of the appliance.

Measuring steps are as follows:

a. STEP A - First part of the test consists of the working mode itself. It needs to switch ON the machine, wait for it to complete the heating up process until it reaches working conditions, and the preparation of 4 shots of coffee: 1 single (40gr), 1 double (2x40gr) and 1 large (120gr). In order to have a correct energy measurement under same conditions for all machines being tested, the measuring time to be completed is 40 minutes. This way we're simulating what could be considered as a standard use of the machine, which may include all operations for heating up and brewing coffee.

b. STEP B - Next step is having the machine ready to be used, for another 60 minutes more after first test is finished. This way we have the information of the energy consumption of the machine just being connected and ready to be used, without any energy efficiency or stand-by mode being activated.

c. STEP C - Then it is measured the energy request simulating milk frothing, steaming 100g of water to a temperature around 65-70ºC for 3 consecutive times.

d. STEP D - It is also measured the energy consumption of the machine when the energy efficiency or stand-by mode gets activated. This is similar to the second part of the test, but this way we can have the complete information completed covering all working possibilities. If machine is not including any system to reduce energy request, then we will be considering measurement of step B. Measuring time is 60 minutes.

e. STEP E – In the last step of the process it is measured the energy request of the machines when being OFF. Measuring time is 60 minutes.

3.2 Interpretation of results

Last step before having results is to structure a normal usage patter which will allow us to use each one of previous measures in the correct way. The pattern being considered is as follows:

i. Machine heated up and used for brewing according to STEPS A+B for 3 times a day. This simulates 3 operations per day, for example in the morning, noon and afternoon. Total 5 hours of use.
ii. Milk frothing for 3 times a day according to STEP C (this doesn't imply using time, just energy consumption). This would simulate milk preparation on each brewing of STEP A.
iii. Machine on stand-by mode for 11 hours according to STEP D, considering machine is ON all day since first use in the morning.
iv. Off mode for 8h a day according to STEP E, completing 24 hours of use.

So final energy consumption measurement would be as follows:

$$\text{DAILY ENERGY CONSUMPTION} = 3 \cdot E_{\text{STEP A+B}} + 1 \cdot E_{\text{STEP C}} + 11 \cdot E_{\text{STEP D}} + 8 \cdot E_{\text{STEP E}}$$

$$\text{ANNUAL ENERGY CONSUMPTION} = 365 \cdot \text{DAILY ENERGY CONSUMPTION}$$

Final value is to be considered the estimation of the annual energy consumption of the machine.

Observation: Considering the different measuring steps it is possible to set many different usage patterns as well as the official one. For example, just not consider steaming operations, or consider that machine is switched OFF after the first coffees are made. What it's important is to keep the same pattern when comparing between different models. In that sense, the official pattern is the most complete according to what could be considered a standard pattern of use.

4 Test results comparison: DUO PID / BABY T / HX SYSTEM

In order to benchmark our machines models DUO PID and BABY T we proceeded with this test with the following machines: HX PID single boiler model and HX PID double boiler model.

All machines were tested with the same setpoint for coffee and steam as well, and of course under same environmental conditions.

Summary of results is below.

	ASCASO DUO PID	ASCASO BABY T PLUS	SINGLE BOILER HX PID (no energy saving mode)	SINGLE BOILER HX PID	DOUBLE BOILER HX PID
POWER	2.000 W	2.200 W	1.500 W	1.500 W	1.550 W
COFFEE GRUP	TB	TB	1,5 L Cu BOILER	1,5 L Cu BOILER	0,8 L SS BOILER
STEAM BOILER	TB	2,3 L SS BOILER			1,5 L SS BOILER

STEP A	0,15 kWh	0,25 kWh	0,26 kWh	0,26 kWh	0,41 kWh
STEP B	0,12 kWh	0,11 kWh	0,15 kWh	0,15 kWh	0,14 kWh
STEP C	0,03 kWh	0,03 kWh	0,03 kWh	0,03 kWh	0,03 kWh
STEP D	0,01 kWh	0,01 kWh	0,15 kWh	0,02 kWh	0,02 kWh
STEP E	0,00 kWh	0,00 kWh	0,00 kWh	0,00 kWh	0,00 kWh

DAILY REQUEST	0,95 kWh	1,22 kWh	2,91 kWh	1,48 kWh	1,90 kWh
ANNUAL REQUEST	346,75 kWh	445,30 kWh	1062,15 kWh	540,20 kWh	693,50 kWh

ASCASO DUO PID	-	-22%	-67%	-36%	-50%
ASCASO BABY T PLUS	28%	-	-58%	-18%	-36%

Energy consumption comparison between models considering EN60661.

ANNUAL ENERGY COST	85,79 €	110,17 €	262,78 €	133,65 €	171,57 €

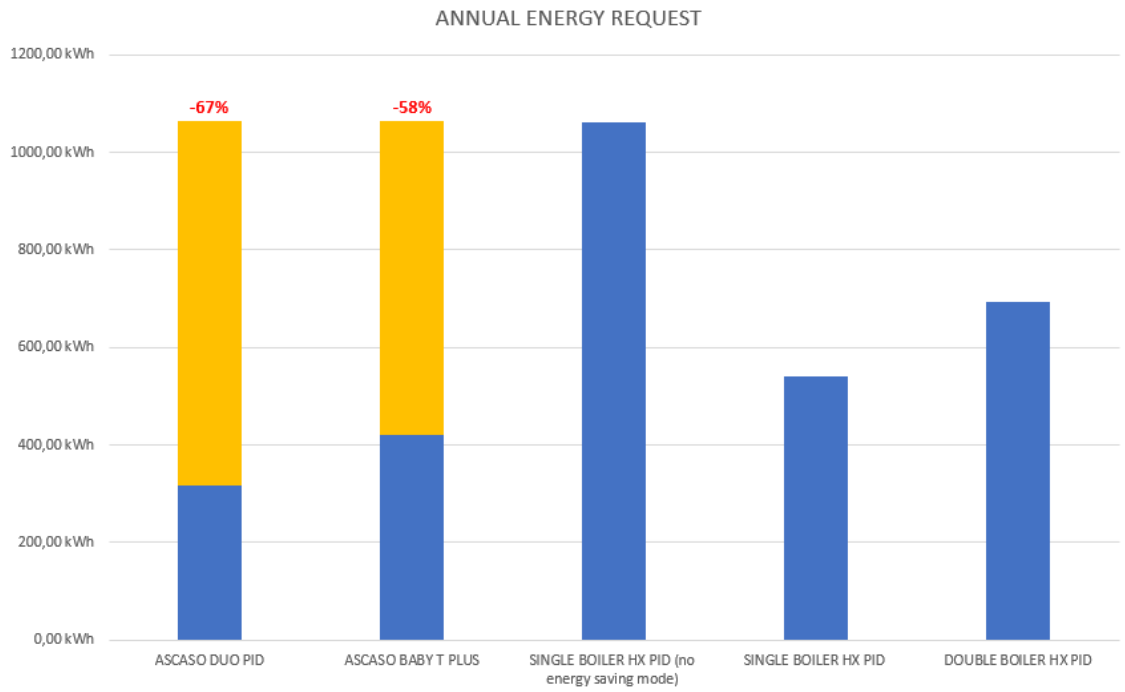
ASCASO DUO PID	-	-24,38 €	-176,99 €	-47,86 €	-85,79 €
ASCASO BABY T PLUS	24,38 €	-	-152,61 €	-23,48 €	-61,40 €

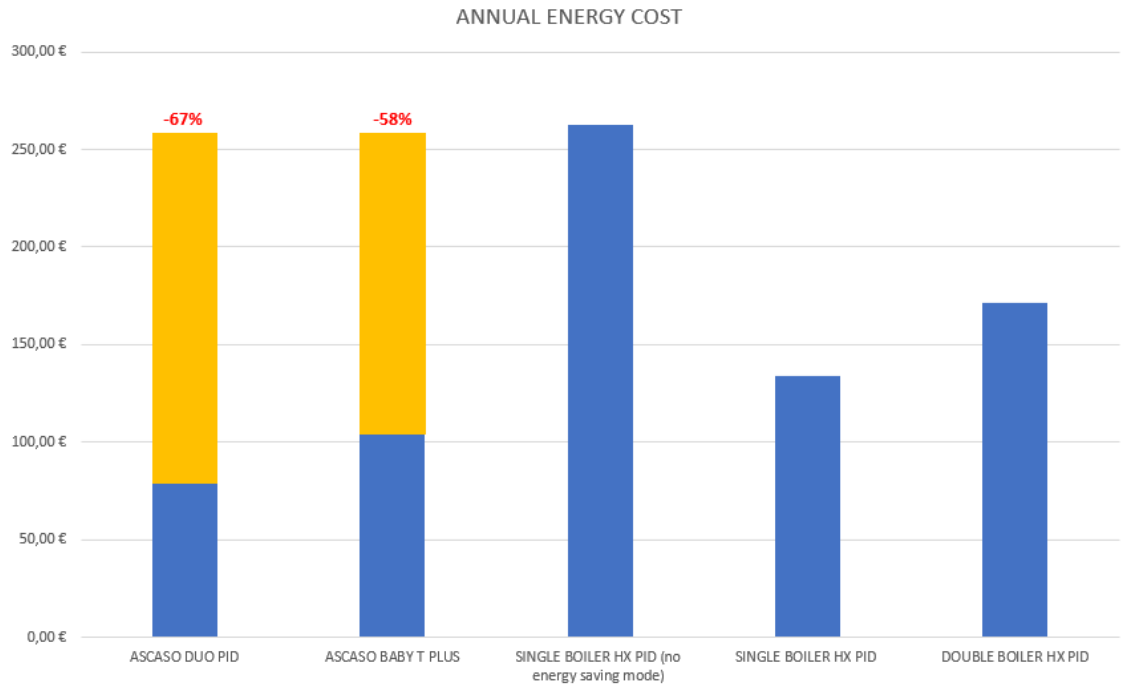
Energy consumption comparison between models considering EN60661. EA area kWh cost average 0,2474€.

KWh cost depending on country available at:

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics

https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a


ANNUAL ENERGY REQUEST
1200,00 kWh
1000,00 kWh
800,00 kWh
600,00 kWh
400,00 kWh
200,00 kWh
0,00 kWh
-67%
-58%
ASCASO DUO PID
ASCASO BABY T PLUS
SINGLE BOILER HX PID (no energy saving mode)
SINGLE BOILER HX PID
DOUBLE BOILER HX PID


ANNUAL ENERGY COST
300,00 €
250,00 €
200,00 €
150,00 €
100,00 €
50,00 €
0,00 €
-67%
-58%
ASCASO DUO PID
ASCASO BABY T PLUS
SINGLE BOILER HX PID (no energy saving mode)
SINGLE BOILER HX PID
DOUBLE BOILER HX PID

5 Conclusions

After checking and comparing all results, conclusions are as follows:

a. DUO PID model is so far the most efficient model of the range. Not only because it is the one with a lower annual energy consumption (-67% compared with HX single boiler and -50% compared with HX double boiler), but also considering it is more powerful than any of the HX models (2.000 W vs 1.500/1.550 W). So we have more power and less energy request.
   In terms of money, it means between 85€ and 175€ less per year comparing with single and double boiler HX models.

b. If we compare DUO PID with BABY T (using a boiler for steaming purpose) we see the high importance of the thermoblock. Just for the regular working mode (steps A+B) we have a difference of 0,27 kWh per day, which means 98,55 kWh per year, and 24,38€ per year. That's directly the cost of the boiler.

c. Considering BABY T, even we see is not as efficient as DUO PID basically because of boiler, it is still showing better efficiency results than any of the other 2 models being compared, and also regardless the fact it's also more powerful.
   If we compare with HX models results show that it needs -58% less energy per year than a HX PID single boiler model, and a -36% than a double boiler one. In terms of money this difference means -152€ and -61€ per year respectively.

d. Finally, considering these results, we reinforce the idea of using thermoblocks instead of boilers in our machines, offering customers a high energy efficiency and lower energy consumptions with its consequent savings. And of course with high thermal performance (stability and repeatability) and offering fresh and clean water coffee after coffee.

e. Just to give some comments about the results of the HX units, we see we have 2 measurements for the single boiler and 1 for the DUAL boiler.
   The reason is that single boiler HX unit being tested didn't include energy saving mode, while double boiler one did. In order to have a complete test we simulated energy saving mode on single boiler unit, even this is not the most common configuration on the market, but this way we have a complete analysis if both systems.

6 Curious data

We can translate the energy request of those models into CO_2 generation due to the energy being used to. Considering each 1.000 kWh being used generate 458 kg of CO_2, or which is equivalent, to cut 19 trees.

Translating data to those 2 parameters shows us results as follows:

	ASCASO DUO PID	**ASCASO BABY T PLUS**	**SINGLE BOILER HX PID (no energy saving mode)**	**SINGLE BOILER HX PID**	**DOUBLE BOILER HX PID**
ANNUAL ENERGY REQUEST	346,75 kWh	445,30 kWh	1062,15 kWh	540,20 kWh	693,50 kWh
GENERATION OF CO_2	158,81 kg	203,95 kg	486,46 kg	247,41 kg	317,62 kg
CUTTED TREES	6,59 Trees	8,46 Trees	20,18 Trees	10,26 Trees	13,18 Trees

Also considering energy request differences between models and DUO PID, can also try to translate these differences into something common for all of us, for example the energy request of a fridge. Considering the annual energy request of a fridge is around 175 kWh, the differences between DUO Pid and the other models would allow user to completely cover the energy request of this appliance, as follows:

	ASCASO DUO PID	**ASCASO BABY T PLUS**	**SINGLE BOILER HX PID (no energy saving mode)**	**SINGLE BOILER HX PID**	**DOUBLE BOILER HX PID**
ENERGY REQUEST DIF.	-	98,55 kWh	715,40 kWh	193,45 kWh	346,75 kWh
FREE FRIDGES PER YEAR	-	0,56	4,09	1,11	1,98