EUROPEAN COMMISSION

Brussels, 1.10.2019
SWD(2019) 349 final

PART 2/2

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

COMMISSION REGULATION (EU) .../... laying down ecodesign requirements for household washing machines and household washer-dryers pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008

and repealing Commission Regulation (EU) No 1015/2010

and

COMMISSION DELEGATED REGULATION (EU) .../... supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of household washing machines and household washer-dryers

and repealing Commission Delegated Regulation (EU) No 1061/2010 and Commission Directive 96/60/EC

{C(2019) 1804 final} - {C(2019) 2124 final} - {SEC(2019) 337 final} - {SWD(2019) 351 final}

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Annex 1: Procedural information

1.1. Lead DG, D*e*cide Planning/CWP references

DG ENER and DG GROW are Co-Chefs of the File for Ecodesign and Energy label. DG ENV, Unit B.1 is the lead DG for this product group. DG ENER is Chef of the File for Energy Label.

Household washing machine and household washer-dryers appliances were mentioned as one of the priority products in the first Ecodesign Directive from 2005. On this basis, the commission drafted the Ecodesign regulation currently in place (Commission Regulation (EC) No 1015/2010), which was discussed and voted on by Member States in the Regulatory Committee. Following scrutiny by the European Parliament and Council, the Commission adopted the measure with a publication in the Official Journal of the European Union in 2010. The legal basis for the implementing measure is Article 114 TFEU. As soon as the overall Energy Label regulation 2010/30/EU was adopted, the household washing machine and household washer-dryers Energy Label Commission Delegated Regulation (EU) No 1061/2010 was prepared and entered into force.

1.2. Organisation and timing

As mentioned in section 1 of the main report Article 7 of both regulation requires the Commission to review the regulations and present the results to no later than 4 years after its entry into force. The Commission fulfilled this legal obligation through it 2014 "Omnibus" review, on the basis of which the Commission Ecodesign Consultation Forum decided in May 2004 that a more extensive preparatory review study, was in order. This review study took place in the period March 2015- September 2017. On the basis of the Review study 2017, the commission drafted the policy options presented in this impact assessment. The last Ecodesign Working Plan, adopted in November 2016 for the period 2016-2019, confirms that household washing machine and household washer-dryers continue to be a priority product group. Furthermore, the recent Energy Label Regulation (EU) 2017/1369 stipulated that household washing machine and household washer-dryers are one of the five priority subjects for which the Commission should adopt a new Energy Label regulation in accordance with the said overall regulation by 2 November 2018.

Article 19 of the Ecodesign Directive foresees a regulatory procedure with scrutiny for the adoption of implementing measures. Subject to qualified majority support in the Regulatory Committee and after scrutiny of the European Parliament and of the Council, the adoption of the measure by the Commission is planned for the end of 2018.

All relevant Commission services (ENER, SG, GROW, ENV, CNECT, JUST, ECFIN, REGIO, RTD, CLIMA, COMP, TAXUD, EMPL, MOVE, TRADE, and the JRC) were consulted on the draft Impact Assessment on 4th May 2018.

1.3. Consultation of the RSB

This present impact assessment report was submitted to the RSB on 16/05/2018 and discussed by the board on 13 June 2018. The Board issued a positive opinion with reservations. The main considerations given by the board, and incorporated in the final version of the Impact Assessment, are the following:

RSB Opinion 18.06.2018	Where and how the comments have been taken into account
Main considerations	
1) The report is not sufficiently transparent on the relatively minor importance of the initiative in terms of its contribution to the EU 2030 energy and climate targets.	The modest contribution to the EU 2030 targets is acknowledged in the new Section 1.5 and the corresponding figures are given in Section 8.
2) The report does not integrate circular economy aspects comprehensively and in a way which is consistent across ecodesign products. It does not impact assess them either.	The integration of circular economy aspects is now explained in Section 5.5.3 and the approach followed for their assessment is explained in Section 6.1.
3) In this context, the choice of the preferred option is not sufficiently justified. It is unclear how the report strikes a balance between energy efficiency, circular economy and consumer preferences.	The choice of the preferred option has been further elaborated in Section 8. The balance between policy objectives and possible trade-offs have also been further elaborated in Section 6 on the assessment of policy options.
4) The report is not sufficiently transparent about the elements that have already been agreed upon and the choices that are left open for political decision.	This is now presented in a new Section 5.1.
Further considerations and adjustment requirements	
1) Conclusions of past evaluations or review studies should directly contribute to defining the problem. They should also present information on possible discrepancies between original expectations and real-life efficiency gains, in particular in the context of the identified consumer behavioural bias not to choose the test programmes very often.	The conclusions of the evaluation undertaken during the review study are now summarised in the new Section 2.1 and more details are given in Annex 4.
2) In view of this, the report should adjust its narrative to strengthen the rationale for continuing to regulate washing machines and washer-dryers. It should demonstrate that in view of consumers avoiding the most energy efficient programs, further energy savings can still be achieved. The report should stress measures aimed at correcting the perverse impacts of the current policy (e.g. ever bigger machines used mostly with half-loads) and nudging consumers to use the energy efficient programmes more often.	The need to act is now the object of a new Section 1.5. The link between the problems identified, including in relation to consumers' choices, and the options proposed, is recalled in introduction to Section 5 and further elaborated in Annex 6.
3) The report should clarify how the circular economy requirements have been established and explain why they have not been fully impact assessed. For instance it does not show how the new requirements would change current practice. It should also explain the rationale for setting any parameters other than energy input	The elaboration of circular economy requirements, including relation with current practice, is now explained in Section 5.5.3 and the approach followed for their assessment is explained in Section 6.1.

	coefficients, test programme duration and temperature, which have been agreed with stakeholders. The report should also clearly present what information will be displayed on the label and how it aligns with the preferences of consumers.	The changes to the label (considered as ‘de minimis’ changes) are now summarised in a new section in Annex 9.
4)	The report needs to better justify the choice of the preferred option, making all the criteria behind this choice transparent. Given that stakeholders have not been consulted on the preferred solution, the report should also discuss whether it would be acceptable to them, in particular that consumers expressed their clear preference for washing programmes of shorter duration (3 hours).	The choice of the preferred option has been further elaborated in Section 8 and views of stakeholders discussed also in this context. Consumers preferences regarding programme duration are integrated in the modelling of energy and water consumptions, as explained in Annex 6, and therefore they are indirectly reflected in the results of the impact assessment.
5)	The report does not sufficiently qualify the results of the modelling, given the shortcomings of the methodology.	The assumptions and limitations of the modelling are introduced in the new Section 6.1 and further elaborated in Annex 6.
6)	This report should be streamlined as far as possible with the impact assessments accompanying the other proposals in this package of proposals for implementing legislation regarding ecodesign and energy labelling.	The impact assessment reports have been aligned to the extent possible considering the specificities of each product.

Annex 2: Stakeholder Consultation

This Annex gives a brief summary of the consultation process. Details are given of how and which stakeholders were consulted. In addition, it explains how it was ensured that all stakeholder's opinions on the key elements relevant for the IA were gathered.

There has been extensive consultation of stakeholders during the review studies, and before and after the Consultation Forum meeting. Further external expertise was collected and analysed during this process. The results of the stakeholder consultation are further described in this section.

2.1. Review study and stakeholder consultations

In the context of the review of regulations (EC) No 1015/2010 and (EU) No 1061/2010 an inclusive and articulated stakeholder consultation took place, with the aim to gather feedback from a very wide audience. The Review Study started in 2015 and was completed in 2017. It followed the structure Methodology for Ecodesign of Energy related Products (MEErP)[1].

The review study covered household washing machines and household washer-dryers in the current scope of those regulations. A technical, environmental and economic analysis was performed. This assessed the need of updating the requirements for these products and to assess policy options. This was done as per the review clause of the regulations, and within the framework of the Ecodesign Directive and Energy Labelling Regulation.

The review study was developed in an open process, taking into account input from relevant stakeholders including manufacturers and their associations, environmental NGOs, consumer organisations and MS representatives. The study provided a dedicated website and a platform for information interchange (BATIS) where interim results and further relevant materials were published regularly for timely stakeholder consultation and input. The study website is still open for download of the study documents and stakeholder comments (status May 2018). During the study, two face-to-face meetings were held on the 24th June 2015 in Seville and 18th November 2015 in Brussels and the webinar was held on the 7th October 2016. The minutes of these meetings are available at: http://susproc.jrc.ec.europa.eu/Washing machines and household washer dryers/index.html

2.2. Working documents and Consultation Forum

The Commission services prepared two Working Documents with ecodesign and energy labelling requirements based on the results of the Review Study. The Working Documents were circulated to the members of the Ecodesign Consultation Forum and for information to the secretariat of the ENVI and ITRE Committees of the European Parliament. The Ecodesign Consultation Forum consists of a balanced representation of MS representatives, industry associations and NGOs in line with Article 18 of the Ecodesign Directive. On 18 December 2017, they were discussed in the Ecodesign Consultation Forum meeting.

1 Kemna, R.B.J., Methodology for the Ecodesign of Energy-related Products (MEErP) – Part 2, VHK for the European Commission, 2011 (MEErP)

The Working Documents were circulated before the meeting to the members of the Ecodesign Consultation Forum. [The working documents were included in the Commission's CIRCA system alongside the stakeholder comments received in writing before and after the Commission Forum meeting.] More than 20 papers were received and analysed by the Commission Services before and after the Consultation Forum.

2.3 RESULTS OF STAKEHOLDER CONSULTATION DURING AND AFTER THE CONSULTATION FORUM

The comments of the main stakeholders on key features of the Working Document received during and after the Consultation Forum can be summarised as follows:

Change of testing programme: stakeholders were split on the introduction of a requirement on the minimum temperature in laundry core for the testing programme (cotton 40) and for the cotton 60 programme; several Member States were not in favour of this requirement and would prefer a requirement on the maximum duration of testing programmes (time cap) instead; industry stakeholders were against a requirement on the temperature of the cotton 60 programme and against a time cap but the programme duration could be given as indication; consumer organisations and environmental NGOs preferred to have both requirements and, for consumers, that the minimum temperature equals the nominal temperature of programmes.

On the specific case of the **cotton 60 programme**, opinions were also split if this programme was to be considered a hygienisation programme, whether 45°C was a sufficient temperature and whether there should be such hygienisation programme at all.

Possible addition of rinsing performance: several Member States requested the introduction of a new requirement on a minimum rinsing performance, based on the recent development of a new measurement method; industry and standardisation experts are undertaking a series of tests to provide the basis for a scale or for minimum performance; some Member States were considering the possibility of relaxing the requirement on maximum water consumption to enable the achievement of good rinsing performance.

Regarding **water consumption**, it should also be noted that environmental NGOs commented that the proposed revised measure for water consumption was already lax in comparison with the current one, because of the change of testing programme and the calculation formula with inclusion of partial loads.

On the different loadings to be considered in tests and calculation of the Energy Efficiency Index: stakeholders were generally welcoming the introduction of small loadings in the index, some Member States preferring a fixed load (for example 2 kg) to the proposed quarter of full load; most Member States and consumer and environmental associations were considering that the weighting factors affecting loadings in the EEI calculation should be revised, the proposed ones continuing or even reinforcing the current bias towards large capacity machines; some Member States propose to use an exponential factor instead, as proposed by the Commission for tumble dryers.

On resource efficiency requirements: Stakeholders were generally in agreement with the requirements proposed on the marking of refrigerating gases and dismantling of electric and electronic equipment, with nuances on the wording, and were split on Commission's proposals for requirements on spare parts and on access to information. Some Member States consider that these requirements will be difficult to enforce by

Market Surveillance Authorities and that access to repair and maintenance information should be restricted to authorised repairers only. Industry (especially manufacturers) concurred on the last point, and was more open on spare parts requirements, if they were instead replaced by declarations. Environmental NGOs and other Member States supported the proposals and/or suggested more ambitious ones.

On the energy label for washer-dryers: stakeholders were generally against the proposal of two labels for washer-dryers (one for the washing cycle, one for the combined washing and drying cycle) and in favour of one label – for some stakeholders with two energy scales, for others with only one.

The full Minutes of the Consultation Forum meeting can be found in Annex 3.

2.4. OPEN PUBLIC CONSULTATION

An *online public consultation (OPC)*[2] took place from 12th February to 7th May 2018, with the aim to collect stakeholders' views on issues such as the expected effect of potential legislative measures on business and on energy consumption trends.

The OPC contained a common part on Ecodesign and Energy labelling, followed by product specific questions on (i) refrigerators, (ii) dishwashers, (iii) washing machines and washer-dryers, (iii) televisions, (iv) electronic displays and (v) lighting.

1230 responses were received of which 67% were consumers and 19% businesses (of which three quarters were SMEs and one-quarter large companies). NGOs made up 6% of respondents, and 7% were "other" categories. National or local governments were under 1% of respondents, and 0.25% came from national Market Surveillance Authorities.

The countries of residence of the participants were predominantly the UK (41%) and Germany (26%), with a second group of Austria, Belgium, France, the Netherlands and Spain comprising together some 17%. Nine other Member States comprised another 9.5% of replies, but residents in 12 EU Member States gave either zero or a negligible number of responses. Non-EU respondents comprised around 5% of replies.

It should be noted that of the 1230 respondents, 719 (58%) replied only to lighting related questions as part of a coordinated campaign related to lighting in theatres. This was considered to significantly distort the replies, and for some questions the "lighting respondents" were removed from the calculation. Furthermore, as respondents did not have to reply to all questions, a high rate of "no answer" was observed (from 5% - up to 90%), in addition to those who replied "don't know" or "no opinion". To reflect better the actual answers, the number of "no answers" was deducted and the remaining answers treated as 100%.

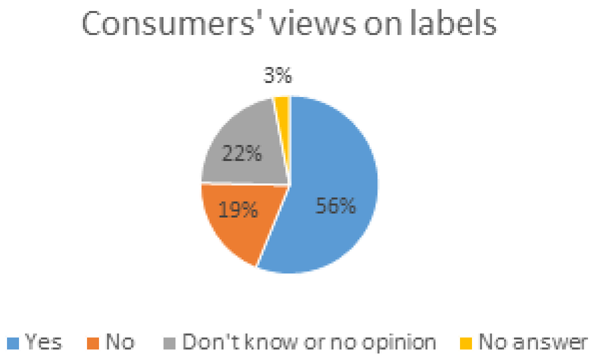
2.4.1 Overall results

The first part of the questionnaire asked general questions aimed at EU citizens and stakeholders with no particular specialised knowledge of ecodesign and energy labelling regulations.

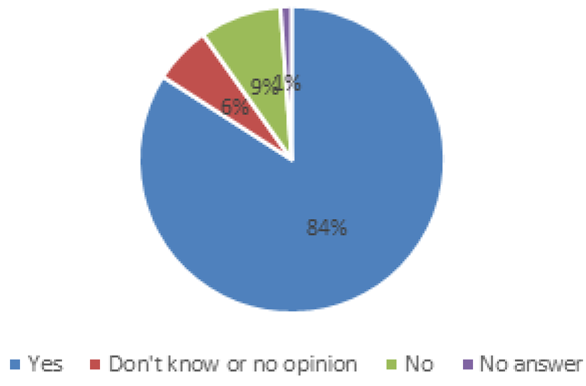
[2] https://ec.europa.eu/info/consultations/public-consultation-ecodesign-and-energy-labelling-refrigerators-dishwashers-washing-machines-televisions-computers-and-lamps_en

When asked regarding whether their professional activities related to products subject to Ecodesign or Energy Labelling, two-thirds (67%) of business respondents replied in the positive, and one-third (33%) in the negative, with no "no answer" replies. Almost the same percentages for "yes" (63%) and "no" (37%) were given when the business entities were asked whether they or their members knew of the Ecodesign requirements for one or more of the product groups concerned by the questionnaire, although this was reduced to 50% "yes" and 50% "no" when asked about Energy Labelling.

In reply to the question: "In your opinion, does the EU energy label help you (or your members) when deciding which product to buy?" 56% of the total respondents to the OPC gave a positive answer. Of the remainder, around 22% cited "don't know or no opinion", 3% did not reply and 19% responded negatively.



However, looking only at the ‘lighting respondents’ (526 of the total 1230), 73% of them replied ‘No’, ‘Don't know or no opinion’, or ‘no answer’. Given that the ‘lighting respondents’ mainly focused their comments on a narrow issue related to the current exemption for theatre lighting under ecodesign, the replies of these respondents to the earlier questions cannot necessarily be considered representative. Therefore, the calculation was also done with “lighting respondents” removed. Then, 84% of the respondents to the OPC agree that the EU Energy Label helps when deciding which product to buy. Of the remainder, around 7% cited "don't know or no opinion" or did not reply and 9% responded negatively.



When asked where they would look to find additional technical information about a product, respondents listed the following (more than one response permitted), ranked by the options provided: manufacturer's website (82%), the booklet of instructions (50%), [the Ecodesign] product information sheet (47%), internet user fora (39%), the retailer's website (18%), and consumer organisations (10%).

Some 63% of the participants were in favour of including Ecodesign requirements on reparability and durability, and 65% of respondents considered that this information should be on Energy Labels.

Regarding the reparability of products, participants valued mostly as "very important" to "important" (in the range 62%-68%)[3] each of the following: a warranty, the availability of spare parts, and a complete manual for repair and maintenance. The delivery time of spare parts was rated as 56% "very important" to "important".

2.4.2 Small and Medium Enterprises (SME)[4] Consultation

One of the aims of the OPC was to gather specific information on SMEs' roles and importance on the market, and to acquire more knowledge on how the aspects related to the environmental impacts of these six product groups were considered by SMEs.

The quali-quantitative evaluation of the effect on SMEs of potential regulatory measures for the environmental impact of all six product categories gave the following results. Approximately 10.5% or replies were from SMEs. These SMEs were involved in the following activities (most popular cited first): (i) product installation, (ii) rent/ leasing of appliances, (iii) repair, (iv) retail of appliances or spare parts, (v) final product manufacture/ assembly, (vi) sale of second-hand appliances, (vii) "other" activities, and (viii) manufacture of specific components.

In the OPC responses, SMEs reported that they were aware of the Ecodesign and EU Energy Label requirements applicable to the products they were involved in. Nevertheless, SMEs mostly declined to respond (90%) or replied in "don’t know/ no opinion" (6%) when asked about the potential impact on their businesses per se, or potential impacts on SMEs compared to larger enterprises, of the introduction of resource efficiency requirements in the revised Ecodesign and Energy Labelling regulations. Of those SMEs who gave an opinion, some 3-4% considered that the impacts could be negative, and around 1% thought that the effects would be positive.

2.4.3 Responses relating specifically to Household Washing Machines and Household Washer-dryers

Regarding technical questions on household washing machines and household washer dryers, consumers overall had some awareness (c. 30%) that longer washing programmes tended to promote energy savings. However, the caveat is that c. 20% were not aware of this relationship, and c.50% overall either gave a "don't know/ no opinion" answer (c.13%) or no answer (c.38%).

It is important to note that c.45% considered that the relation between time duration and energy use should both be shown on the Energy Label, and also made more clearly visible on the appliance per se.

Regarding the performance of the washing machines and the most relevant issues to select the testing programmes, consumers ranked as important or very important (a combined 45%) the selection of the most frequently-used programmes. Regarding

[3] Scale ranging from not important, somewhat important, important, very important, don’t know or no opinion and no answer

[4] SMEs < 250 employees

programme duration, low power modes and programme duration, consumers ranked them consistently as c.33% either "important" or "very important", with an additional 10% ranking them as "somewhat important" (i.e., overall c.43% for "somewhat important" to "very important"). Consumers also considered that the energy consumption, energy efficiency and water consumption were the most relevant parameters to be communicated on the EU Energy Label. A second grouping of quite highly ranked elements that respondents wanted to have on the EU Energy Label included capacity, noise, washing performance and spin-cycle efficiency.

Regarding material efficiency elements, respondents gave the following answers for "important" and "very important" rankings: warranty (45%), a list of certified repairers (35%), quick repair time (45%), spare parts and instructions to enable self-repair (35%). If the "somewhat important" ranking is included for each of the above elements, this captures in each case an additional 5%-10% of respondents.

The two most numerous responses for the expectation of how long spare parts were expected to remain available for washing machines were: more than 10 years (c.35% of respondents), and between 5-10 years (c.16%). Fewer than 2.5% of respondents cited a period of 5 years or less. (8% "don't know/ no opinion" responses were recorded, and c.38% gave no reply).

2.5. IMPACT ASSESSMENT

An Impact Assessment is required when the expected economic, environmental and social impacts of EU action are likely to be significant. The Impact Assessment for the review of regulations (EC) No 1015/2010 and (EU) No 1061/2010 was carried out between January and April 2018.

The data collected in the review study served as a basis for the impact assessment. Additional data and information was collected and discussed by the Impact Assessment study team with industry and experts representing other stakeholders and Member States. During this process, several meetings were held with industry and Member States experts. The additional data and information collection focused on:

- additional market data, especially the differences between number of models and volume of sales of the energy efficiency classes for the period 2005-2015 for household washing machines and 2012-2015 for household washer dryers
- fine tuning of the metrics (revised standard)

An Inception Impact Assessment (IIA) "Regulatory measures on the review of Ecodesign requirements for household washing machines and household washer dryers"[5] and the Inception Impact Assessment "Regulatory measure on the reviews of Energy Labelling for household washing machines and household washer dryers (EU) No 1061/2010" were published before the CF. Feedback on both the above IIAs were received (with 11 and 9 comments, respectively) on a number of aspects. In general, the feedback supported the Ecodesign and Energy Label requirements for household washing machines and household washer dryers as they help mitigate climate change, help EU citizens save

[5] Initiative ARES (2015) 476416 and initiative ARES (2018) 476380

their bills, and better integrate domestic appliances on a Circular Economy through the proposed reparability and recyclability requirements.

The submitted feedback commented on the strictness of the Ecodesign requirements regarding energy minimum requirements, the testing programmes, and the low power modes as well as several aspects of the information to be included on the energy label. The feedback also focused on the resource efficiency aspects that are in general strongly supported and some additional proposal were made in order to ensure their proper implementation.

2.6 CONSUMER SURVEY ON THE ENERGY LABEL

The aim of the consumer study[6] was to inform the Commission on the impact of possible different icons and layouts of the revised energy labels for household washing machines, and washer-dryers on consumer understanding and choices. The survey was finalised in July 2018 (after the impact assessment was presented to the Regulatory Scrutiny Board). The results of the study can be summarised as follows.

2.6.1 Methodology

To gain insight into consumer understanding of draft energy labels for washing machines and washer-dryers, an online survey was administered in GfK's online panels in seven European countries. The fieldwork was conducted in July 2018. Approximately 1350 consumers per country completed the survey (9863 respondents in total), which consisted of five parts

Part 1: Interpretation of the tested programme

Part 2: Product identification and choice tasks

Part 3: Comprehension test (isolated icons)

Part 4: Comprehension test (full label)

A new label layout with several icons representing specific product features was tested:

- Most of the proposed features are also represented on the current energy labels, namely the energy consumption, water consumption, rated capacity (maximum load for washing machines and washer-dryers, and noise level. However, in this new label the energy and water consumption are indicated per cycle, and are accompanied by an indication of the tested programme.
- Furthermore, the new proposal includes the addition of a new icon representing the duration of the (tested) programme and its name, "Eco 40-60" is now indicated on the label

[6] Roxanne van Giesen, Millie Elsen, Thijn van der Linden, Bram Bruisten, Tim Meeusen, Femke Maes, "Study on consumer understanding of draft energy labels for household washing machines, household washer-dryers and household dishwashers", CentERdata., July 2018 commissioned by the EC under No. FWC ENER/C3/2015-631/04

- Finally, some icons that are displayed on the current energy labels are no longer part of the new tested label, namely the icons indicating spinning efficiency of washing machines.

This study aimed to test consumer responses to:

- consumer understanding of specific icons designed to represent the proposed product features;
- consumer understanding of the full label (e.g. how different elements relate to each other);
- the perceived relevance of the product features proposed to be represented on the proposed new label;
- the extent to which consumers miss information provided in current labels that is not included in the proposed new labels;
- the impact of the labels (relative to other product information) on consumer choice behaviour.

For water consumption, the maximum load, programme duration, and noise level, three icon alternatives were developed and tested for for washing machines and respectively washer-dryers. The icons were combined into the energy labels (see Table 2.1a and b). Furthermore, the labels include an indication of the tested programme. The position of this information varies across the label alternatives.

Table 2.1a Label alternatives: washing machines

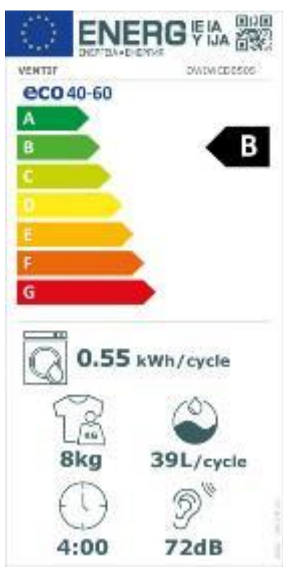
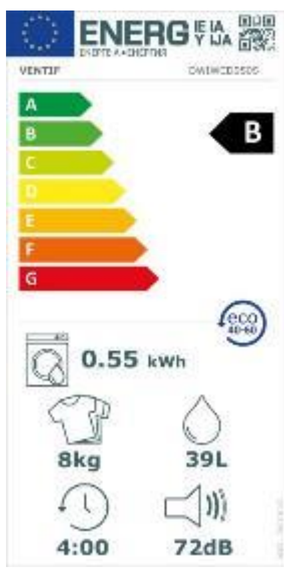
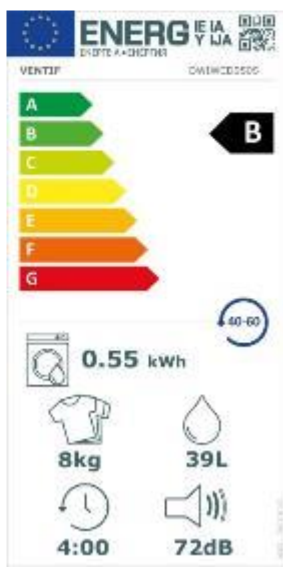
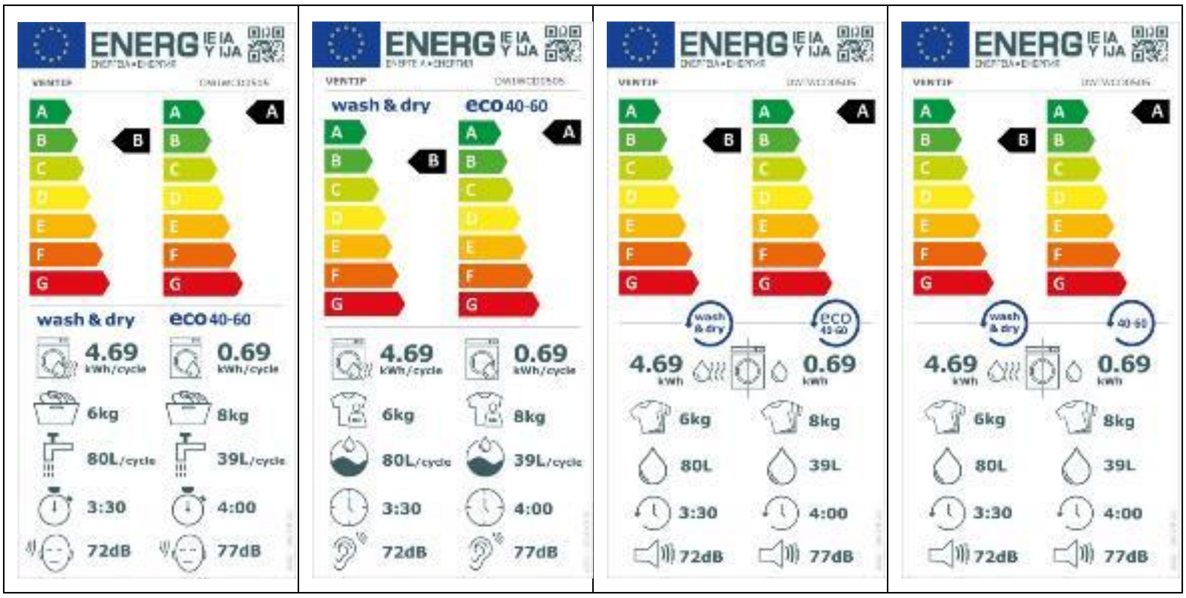
Label alternative 1	Label alternative 2	Label alternative 3A	Label alternative 3B
			

Table 2.1.b Label alternatives: washer-dryers

Label alternative 1	Label alternative 2	Label alternative 3A	Label alternative 3B



The survey was administered in seven countries – Bulgaria, Denmark, Germany, Italy, The Netherlands, Portugal and Romania – which together cover 39.7% of the EU28-population with adequate geographical spread.

In each country, approximately 1350 respondents completed the survey. Respondent samples consist of members of the general public, aged 18-70, nationally representative of each country's population with quotas on age and gender.

Respondents were incentivised as part of their membership of the GfK online panel, where they receive 'points', which can then be converted into shopping vouchers, as reward for taking part in surveys.

2.6.2 Results

Perceived relevance of the features

For each of the features of interest in this study (i.e. water consumption, load capacity, programme duration and noise level), Table 2.2 provides an overview of the percentage of respondents who found it (very or extremely) important that the information is displayed on the energy label. For all features the majority of respondents considered it important that the energy label displays this information. For washing machines and washer-dryers, water consumption (69.0% and 71.0%, respectively) as well as load capacity (69.9% and 69.5%, respectively) were perceived as most important to include on the label.

	% of respondents who find it important that the feature is displayed on the energy label	
	Washing machines	Washer-dryers
Water consumption	69.0%	71.0%
Load capacity	69.9%	69.5%

Programme duration	52.8%	56.5%
Noise level	60.4%	61.4%

Table 2.2. Perceived importance

Comprehension of the icons

Table 2.3a provides an overview of the comprehension results. A distinction is made between subjective comprehension (i.e. does the consumer *think* s/he understands the meaning of the icon, does s/he perceive the icon as being clear?) and objective comprehension (i.e. does the consumer *actually* understand the meaning of the icon?). Objective comprehension was assessed for icons presented in isolation (multiple choice quiz question) as well as for icons embedded in full labels in the context of a (small) product assortment (product identification task).

For the icons representing water consumption and noise level, the results revealed a clear gap between subjective and objective comprehension. While a large majority of respondents indicated that they understood, or thought they understood, the meaning of the icons (typically in the range of 75% to 90%), at most about two-third of the respondents correctly identified the appliance(s) that they were supposed to find in the product identification tasks. It seems that many respondents had difficulty actually searching for and comparing the right information. However, this gap was particularly large for the washer-dryers, which may be explained by the fact that this label displays double information. Respondents may have looked at the wrong part of the label in the product identification task, explaining their relatively poor performance.

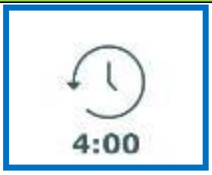
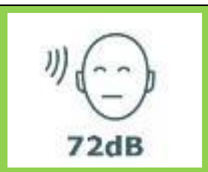
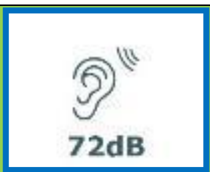
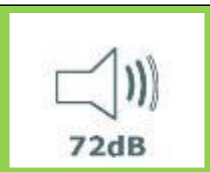
Icons	Icon alternative 1	Icon alternative 2	Icon alternative 3
Water consumption			
Maximum load (washing machines and washer-dryers)			
Programme duration			
Noise level			

Table 2.3. Best (green) vs. worst (red) performing icons

Table 2.4 and Table 2.5 has the summary of the subjective comprehension results for washing machines and respectively for washer driers. Subjective comprehension was measured by asking whether respondents thought the icon was clear or unclear (immediate understanding). Subsequently, the meaning of the icon was explained to respondents, after which the perceived clarity of the icon was assessed once more ("Now you know its meaning, do you think the icon is clear or unclear?"). Icon alternatives that were immediately clear – i.e. at least 80% of respondents reported to find the alternative clear or very clear – are shaded yellow in Table 2.4. Icon alternatives that reached this 80% benchmark after the explanation was provided are shaded green.

Furthermore, the blue border around an icon indicates that the specific icon alternative is perceived as most clear relative to the other icon alternatives representing the feature. If multiple icon alternatives have a blue border (row-wise), there were no differences in the perceived clarity of these alternatives.

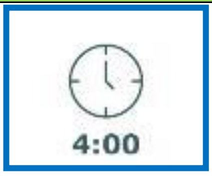
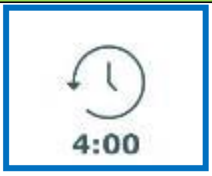
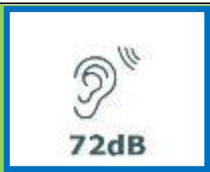
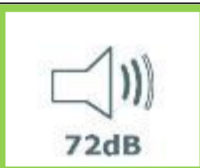
Table 2.4. Washing machines: subjective comprehension

Icons	Icon alternative 1	Icon alternative 2	Icon alternative 3
Water consumption	 39L	 39L	 39L
Maximum load	 8kg	 8kg	 8kg
Programme duration	 4:00	 4:00	 4:00
Noise level	 72dB	 72dB	 72dB

Note – Icon alternatives shaded yellow are immediately understood (self-declared) by at least 80% of the respondents. Icon alternatives shaded green are perceived as clear by at least 80% of the respondent after explanation of the icon. Icon alternatives with a blue border outperform other alternatives for the same feature.

Table 2.5. Washer-dryers: subjective comprehension

Icons	Icon alternative 1	Icon alternative 2	Icon alternative 3

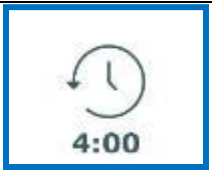
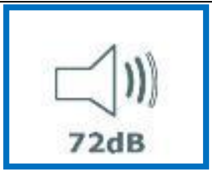
Water consumption			
Maximum load			
Programme duration			
Noise level			

Note – Icon alternatives shaded yellow are immediately understood (self-declared) by at least 80% of the respondents. Icon alternatives shaded green are perceived as clear by at least 80% of the respondent after explanation of the icon. Icon alternatives with a blue border outperform other alternatives for the same feature.

Table 2.6 and Table 2.7 is the summary of the results on objective comprehension for washing machines and respectively washer driers, which was assessed for icons presented in isolation (multiple choice quiz question) as well as for icons embedded in full labels in the context of a small assortment of eight dishwashers (product identification task). The blue border around an icon alternative indicates that the alternative outperforms other alternatives that represent the same feature. If multiple icon alternatives have a blue border (row-wise), there were no differences in the actual understanding of these alternatives.

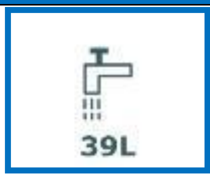
Table 2.6 Washing machines: objective comprehension

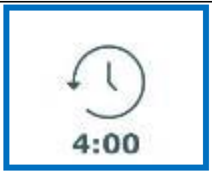
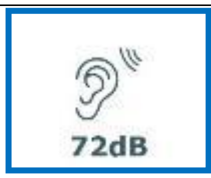
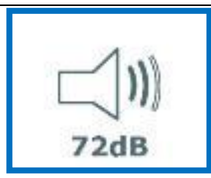
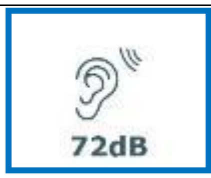
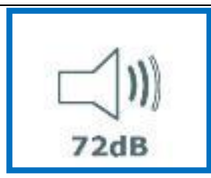
Icons		Icon alternative 1	Icon alternative 2	Icon alternative 3
Water consumption	Isolated icon			

	Icon in product context	 39L	 39L	 39L
Maximum load	Isolated icon	 8kg	 8kg	 8kg
	Icon in product context	 8kg	 8kg	 8kg
Programme duration	Isolated icon	 4:00	 4:00	 4:00
	Icon in product context	 4:00	 4:00	 4:00
Noise level	Isolated icon	 72dB	 72dB	 72dB
	Icon in product context	 72dB	 72dB	 72dB

Note – Icon alternatives with a blue border outperform other alternatives for the same feature.

Table 2.7. Washer-dryers: objective comprehension

Icons		Icon alternative 1	Icon alternative 2	Icon alternative 3
Water consumption	Isolated icon	 39L	 39L	 39L

	Icon in product context			
Maximum load	Isolated icon			
	Icon in product context			
Programme duration	Isolated icon			
	Icon in product context			
Noise level	Isolated icon			
	Icon in product context			

Note – Icon alternatives with a blue border outperform other alternatives for the same feature.

Comprehension of other label information

In order to test whether respondents also understood other information on the label, such as the indication of the tested programme and the information per cycle (rather than per year), respondents were exposed to one of the full labels (see Table 2.8 and 2.9) and responded to a number of true/false statements. Understanding of those aspects is quite low, in general, with the percentage of respondents who responded correctly to *all* statements related to a specific label aspect (e.g. understanding that the information is provided per cycle) ranged between 8.8% and 47.9%.

Table 2.8. Label alternatives: washing machines

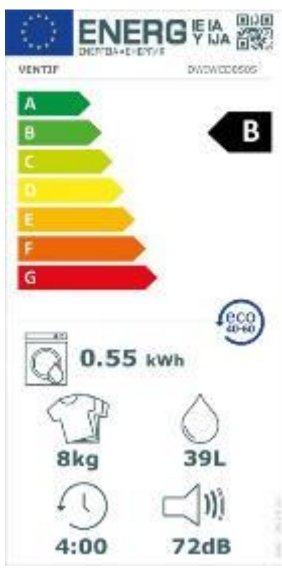
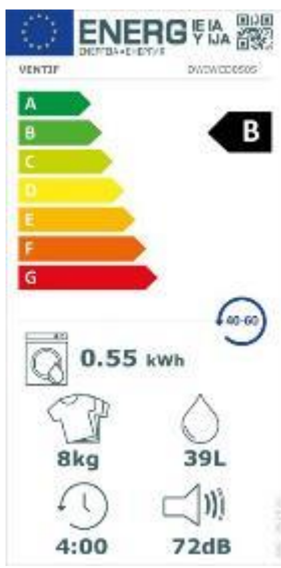
Label alternative 1	Label alternative 2	Label alternative 3A	Label alternative 3B
			

Table 2.9. Label alternatives: washer-dryers

Label alternative 1	Label alternative 2	Label alternative 3A	Label alternative 3B
			

Some label aspects contributed to (somewhat) higher levels of understanding:

- Label alternative 2 with the tested programme indicated at the top of the label (above the energy efficiency scale) seemed to communicate more clearly that all information on the label pertains to the tested programme, as compared to other label alternatives.
- Label alternative 1 and 2 – where 'cycle' was indicated in words – seemed to communicate more clearly that the energy and water consumption are displayed per cycle compared to label variant 3 – where 'cycle' was represented graphically.

The washer-dryer label was more complex than the labels for the other two product groups as it contained information on both the complete wash and dry cycle as well as the wash cycle only. The results of the product identification task, seem to confirm that the washer-dryer label is more complex. Accurate identification of the product with the highest (or lowest) energy consumption was lower among respondents who saw washer-dryers (30.2%) than among respondents who saw washing machines (50.3%). It thus seems that a substantial group of respondents looked at the wrong part of the washer-dryer label. Nonetheless, a vast majority of respondents (76.6%) reported to prefer having both info on the complete wash and dry cycle and the washy only cycle displayed on the same label.

In this study, we examined which representation of the washer-dryer functions facilitated understanding of the ‘wash and dry’ and ‘wash-only’ parts of the label: separate icons (see label alternatives 1 and 2 in Table 2.9) or an integrated icon (see alternatives 3A and 3B in Table 2.9). A higher proportion of respondents accurately indicated that the left part of the label pertained to a wash and dry cycle rather than a drying-only cycle when the separate icons were shown (in alternatives 1 and 2) as compared to the integrated icon (alternatives 3A and 3B). However, respondents who were exposed to alternative 3A and 3B in turn seemed to better understand that the information on the right side of the label pertains to a washing-only cycle. Overall, understanding was slightly higher for alternative 3B than for all other alternatives.

Annex 3: Draft minutes: Meeting of the Consultation Forum on Ecodesign

THE COMMISSION REGULATION (EU) NO 1015/2010 ON ECODESIGN REQUIREMENTS FOR HOUSEHOLD WASHING MACHINES;
THE COMMISSION REGULATION (EU) NO 1061/2010 ON ENERGY LABELLING REQUIREMENTS FOR HOUSEHOLD WASHING MACHINES; AND
THE COMMISSION DIRECTIVE 96/60/EC ON ENERGY LABELLING REQUIREMENTS FOR HOUSEHOLD WASHER-DRYERS

BRUSSELS, 18 DECEMBER 2017 (10.00 – 17.00)

Participants: See "Attendance List" in Annex.

3.1 Welcome and introduction

The Chair welcomed the participants and explained the purpose of the meeting i.e. to discuss the results of the review study regarding Regulation (EU) No 1015/2010, Regulation (EU) No 1061/2010 and Directive 96/60/EC, and the proposed draft working documents.

3.2 Adoption of the agenda and approval of the minutes of previous meetings

The agenda was adopted without amendments.

The Commission gave information about the overall estimated schedule for adoption steps of planned Ecodesign and Energy Labelling regulations during 2018, as well as a summary of CFs that took place in the last few months.

The Commission presented the context of the review foreseen in both Articles 7 of the existing Regulations EU 1015/2010 and 1061/2010.

3.3 Information concerning the Combined Ecodesign and Energy labelling Consultation Forum

The **Commission** informed stakeholders that the 2017 Energy Labelling framework Regulation (EU) 2017/1369 formally establishes a specifically dedicated Consultation Forum (CF) for Energy Label measures, which shall be combined with the Ecodesign Consultation Forum. In the coming weeks, there will the opportunity to respond to an expression of interest to become a formal member of this CF, pending the fulfilment of certain requirements. Member States (MS) will automatically be registered for this new CF; however, for Commission administrative reasons it would be better if each MS could nominate one representative.

3.4 Presentation of the main findings of the review study

The Commission services presented the main findings of the review study:

- Current testing programmes do not reflect user behaviour in terms of temperature and loading;
- Consumers rarely use long programmes;

- Because of the above, the Energy Label does not represent accurately the energy efficiency of machines as effectively used;

- Further energy and water savings are possible with available technology;

- Repair requirements present an opportunity to increase product lifetime.

Some clarifications were requested:

BE enquired if the assessment of the energy classes and their evolution estimates were based on the current test programmes or on the proposed new ones. The **Commission** replied that the assessment used existing data (from current test programmes) but re-processed so as to simulate the effect of the new proposed test programmes. For the actual proposal, new data need to be gathered, after which recalculations will be carried out.

UK commented that changes in consumer behaviour could lead to substantial energy savings and asked whether this assumption was taken into account. The **Commission** answered that data on user behaviour comes from the user survey and this is reflected in the baseline scenario (Business as Usual or BAU). Only a small proportion of consumers use the programmes regulated as testing programmes, so it is not possible to reach the maximum savings potential provided by regulated programmes.

3.5 Presentation of the working documents

The Commission services presented the working documents in view of revised Commission Regulations on the Ecodesign (ED) and on the Energy Labelling (EL) of washing machines (WMs) and washer-dryers (WDs), via means of summary slides, highlighting proposed changes in comparison with existing legislation.

Clarifications were asked on how and when to send written comments. The JRC's BATIS tool does not allow contributing stakeholders to see the comments already submitted by other stakeholders during the commenting period, i.e., prior to the deadline for comment submission. Stakeholders asked the possibility to submit comments via emails or the CIRCABC platform.

3.6 Discussion of the working documents

3.6.1 Ecodesign

Article 1 – Subject matter and scope

On point 2, **NL** found the reference to non-household WMs and WDs to be inappropriate. Since the definition of household products is clear, point 2 is not needed. **IT** agreed with **NL**, but noted that if point 2 is kept, it should be modified (e.g. those "households only operated by battery" should be excluded).

UK enquired about the state of progress on ED and EL for professional WMs and WDs and the creation of standards. The **Commission** replied that other product categories have been prioritised for the time being, but that it will follow up with **CEN/CENELEC** on the standards and assess whether there is enough evidence to restart the work on ED and/or EL.

Article 2 - Definitions

BE asked if the reference to the Low-Voltage directive (LVD) is sufficient to define household WMs, in which case if a product does not comply with the LVD, it does not fall under the scope of the regulation. **BE** also enquired about the mention of "as stated by the manufacturer in their declaration of conformity" used in Definitions 1 and 2 and whether it is the same as "declared" in Definition 8, as well as the meaning of "rated capacity". **BE** asked that the mention of "generic and specific requirements" in the definition of "equivalent washing machines" and "equivalent washer-dryer" be changed in line with the framework Directive. The Commission responded that household appliances must comply with the LVD, which is why it is used as a criterion in the definition, and that the use of "stated" or "declared" will be harmonised. **BE** remarked also that there is no definition of tolerances and no requirement for standby mode.

IT supported **BE**'s comments. Additionally, **IT** would like to see Definitions 1 and 6 merged. **IT** also requested that in Definition 5, the expression "use in an environment other than an individual household", be reworded, otherwise it would mean that a machine used by two households would, by definition, be a non-household WM/WD. **IT** would also like Definition 24 on standby modes to be modified or deleted, since WMs and WDs have no standby but a left-on mode as per definition 27. **IT** highlighted however several discrepancies between the "left-on mode" in definition 27 and in the requirements and asked that they be aligned. There should also be a 'pre-starting mode' covering both the delay start and the network standby. **IT** would also prefer Definition 34 to be split into two definitions, one for "spare part" and one for "necessary spare part". The **Commission** responded that in the working document, "spare parts" is used for "necessary spare parts" as only those parts that are necessary for the use of the machines are the object of proposed requirements.

NL asked that definitions common to ED and EL be aligned. **NL** also found the definition on "household" to be too generic and would prefer for the word "units", in Definition 6, to be replaced by "casings". **NL** did not see a need to define partial loads, half load and quarter load. Instead, it is enough to indicate in the annex, as currently done, that the half (quarter) load is half (quarter) of the rated capacity. **NL** also found definition 10 of drying cycle to contradict the definition in the EL proposal. Concerning the second part of Definition 10, **NL** would prefer to define the drying capacity as the capacity that can be dried in one single process, while the current text would lead to different drying capacities, depending whether the continuous cycle or the interrupted cycle is considered. With regard the other modes, **NL** noted that the word 'mode' is superfluous when referring to network standby. **NL** also suggested that the delay start be treated as a condition and that a pre-cycle mode be defined that could be used for covering delay start and network standby, as this would facilitate the verification process.

CENELEC recommended that symbols not be used in the document (this could cause problems for translation) and offered to provide common symbols already in use. **CENELEC** indicated that the notion of network standby is not used anymore in standards. Regarding low-power mode symbols, the **Commission** indicated that the definitions are explained in the table of Annex III.

Similarly to **IT**, **CEDED** found inconsistencies between the standby requirements in the vertical and horizontal regulation. **CECED** would prefer to have the requirements on low power modes in vertical regulations where they can be adapted to each product. Consequently, WMs, WDs, and DWs should be excluded from the horizontal regulation on standby modes. Regarding Annex 6 dealing with this point, **CECED** suggested that "other appliances for cooking…and maintenance of clothes" be removed and that the revised wording in Regulation 1275/2008 clearly states that washing machines are not covered by the horizontal regulation. The **Commission** responded that its intention is indeed to include all standby requirements in the vertical regulations and remove the products concerned from the horizontal regulation.

ECOS does not agree with WMs, WDs, and DWs to be excluded from the horizontal Standby regulation unless the corresponding requirements in the vertical regulation are made more stringent.

ANEC/BEUC requested that, if the Commission includes all low-power modes in the vertical regulation, information requirements be also included.

In a second round of comments **IT** suggested, as an alternative to having two definitions for spare parts, to have only one but for necessary spare parts. In response to **BE** regarding the manufacturer's declaration on the rated capacity, **IT** stated that the rated capacity is verified during the verification tests. More generally, there are requirements embedded in the measurement method, which, once the standard is harmonised, could be used for the verification. **NL** added that, for consistency with the standard, it would be fine to leave definitions for "rated capacity".

Coming back to Definitions 1 and 2, **BE** suggested replacing "complying" by "should comply with LVD" to avoid linking the scope of ecodesign to the compliance with another regulation that may change.

PT agreed with **BE**'s comment on the risk of referring to the LVD. **PT** would prefer to have no reference to LVD at all because these products are covered by the CE marking and have to comply with other directives such as electromagnetic compatibility, RoHs, REACH, and WEEE. **NL** noted that the word "complying" may be confusing but the reference to LVD, or the use of the same definition used in LVD, is useful to clearly distinguish household appliances from others.

CENELEC remarked that the definition of "left-on mode" refers to the 'lowest consumption mode, which cannot be measured, and asked the **Commission** to either provide precise definitions on low-power modes or submit a standardisation request.

Article 3 – Ecodesign requirements

NL noted that in points 1 and 3 the washing process is not defined and that the washing cycle should be referred instead. **BE** requested that "measured" be replaced by "assessed" in point 4, as it is more general and not everything will be measured.

Article 4 – Conformity assessment

NL noted that the wording referring to equivalent washing machines and washer dryers in point 2 should be modified since it contradicts the definition of "equivalent" in the EL regulation. Additionally, the last sentence should state that the technical documentation shall include the list of all equivalent household WM/WD models. **BE** also pointed to the same paragraph and proposed that, similar to the regulation on servers, the concept of "product family" be introduced. The **Commission** responded to **NL's** comment that the text is the same as the current one, in particular for "equivalent" WMs, but that it will look again into it.

Article 5 - Circumvention

NL noted that "power" should be changed to "energy". **DE** asked that the wording be aligned with the label framework regulation and that it be indicated that minimum requirements should still be met after software updates. **ECOS** enquired why article 5 is included in ED but not EL regulation and why it is limited to the question of power consumption.

The **Commission** indicated that the article on circumvention has been introduced for all products. It should not be a problem to extend it to all requirements, but this will need to be confirmed with the legal services. Regarding the text of the energy label regulation, it does not need to be reproduced since it is already covered in the EL framework.

ANEC/BEUC stated that the 'end user' should be better defined, as well as the conditions under which the explicit consent of the end user is required, to avoid a loophole wherein an end user is deemed to accept an increase in energy consumption.

IT remarked that, concerning the second sentence on "consumer consent", when the class changes because of a software update, the consumer cannot be asked to consent as the change doesn't comply with legal requirements. The concept of the sentence is that when there is a software modification or update, all parameters cannot be lower than those declared by the manufacturer.

NL makes a distinction between ED and EL regarding user's consent: under ED, it is not acceptable for a product not to comply with the minimum requirements and if the product uses more energy but still complies with ED requirements, user consent is not necessary. In the context of the EL, people buy products with a certain label (no minimum requirement), but energy classes change over time and the product uses more energy. **NL** asked that, to ensure compliance, this be aligned in EL. **NL** also pointed out that the definition of "equivalent" is based on the initial regulation and is no longer correct.

Article 6 – Verification procedure for market surveillance purposes

PT remarked that the tolerances of the proposed regulation are not the same in omnibus regulation and suggested that that omnibus be amended to the make the verification tolerances more explicit. The **Commission** replied that there is no legal need to amend the omnibus regulation. The omnibus regulation only amended the current WM regulation, not the proposed one. The **Commission** would like the text, to the extent possible, to remain the same, bearing in mind that it cuts across product groups.

Article 6 – Benchmarks

CEN/CENELEC would like to stress that the benchmarks correspond to the current testing programmes, not to the proposed ones, and shared doubts that these machines fulfil the requirements of minimum temperature in the laundry, since the reported energy consumption for the benchmark would not permit the water to be heated to 40°.

DE enquired if the benchmark is class A. **ANEC/BEUC** asked if the benchmarks are for entire products and whether benchmarks for acoustic emissions are the best option. The **Commission** responded that the benchmarks were calculated based on available data and that they will be recalculated based on the new testing. Therefore, for the moment they are indicative and are ranked according to the energy efficiency class - the rest of the characteristics follow. This may be why noise is not the best benchmark. Based on the current portfolio these products fall in A+++ for WMs and A for WDs.

NL requested that it be made clear that the new EL will not allow products in class A.

Article 7 - Revision

DE would like consumer behaviour changes to be included, **IT** remarked that rinsing performance wasn't considered, **DK** would like to include the new rinsing performance as in the new standard, and **UK** requested rinsing and heat-pump to be included. **ANEC/BEUC** wanted consumer behaviour and rinsing performance to be included.

No comments were made on **Article 8.**

Article 9 – Amendment to Regulation (EC) No 1275/2008

NL raised concern on the different amendments on the same annex of the Standby Regulation by different product regulations: the final result may depend on the order of adoption of the product regulations.

Article 10 – Entry into force and application

DE enquired what is meant by 10 December 2020 and why it is not possible to start with tier 1 when it enters into force.

UK asked that the entry into force and application be placed in article 3 or the annexes, and that this made more consistent across regulation.

DK agreed with both **DE** and **UK** and suggested that tier 1 be enforced earlier.

CECED asked that the date of entry into force be amended to at least 12 months, or sufficient time from the date of publication, both in the ED and EL documents and shared its concerns about not knowing when the regulation is published. It explained that companies need to be sure that the requirement will enter into force.

IT asked that the entry into force of ED and EL be aligned to the extent possible. **IT** also raised the concern about the new testing portfolios and timing for manufacturers and suggested 12 months between entry into force and becoming mandatory.

The **Commission** responded that the current schedule provides almost two years.

CEN/CENELEC requested that a standardization request be made if the regulation enters into force that quickly. It needs around three years to update the standards. The **Commission** replied that standardisation requests will be sent out soon, but that the text must be more or less stabilised before this can happen. Transition methods are also available.

CEN/CENELEC shared that it has been proactive on WMs and that transition methods have to be published, otherwise the testing houses are not able to do the measurements. Measurements are needed for the transitional method. Therefore, it is a question of, first, how to measure and then, second, to do the measurements. The test houses committed to provide new data soon.

Annex I – Ecodesign requirements

On Section 1 (generic requirements for washing machines and the washing process of washer-dryers) **IT** raised the issue of rinsing performance, which if included, would mean that minimum requirements for water would need to change. **IT** also raised the point that water and energy consumption might increase to reach decent rinsing performance and would like for water consumption and rinsing performance to be rescaled from A to G. The **Commission** responded that this requirement was not included in the past because the data were insufficient, which is still the case.

NL shared **IT** views and remarked that programmes are too long. **NL** would like to set a maximum time for programmes, including rinsing cycles so that rinsing is not shortened to fulfil the time. A possible solution would be to include water requirements as well; **NL** was not in favour of minimum temperatures as they appear in the proposal. **IT** agreed with **NL** proposal and will provide a proposal on decent rinsing performance to the Commission by early spring.

DE mostly agreed with **NL** and **IT** and did not want an icon on rising performance on the label, because it would contradict the EL. **DE** agreed on having a minimum requirement, but asked that it be kept inside the programme.

DK agreed, but was concerned that the methods were not correct.

SE thanked **IT** for its proposal, but felt that the problem is related to the robustness of the standards. **SE** suggested providing information on the label combined with low requirements as a starting point. **SE** would also like for there to be some flexibility for regions that face water shortages, or in humid places where a high rinsing performance is needed. **ANEC/BEUC** underscored the importance of this last issue for customers.

ECOS asked for more evidence before water consumption requirements are relaxed and considered that the water consumption levels have been relaxed already in working documents.

CECED asked what "reasonable rinsing performance" means and whether the new standard will measure the alkalinity or trace elements of the detergents, which have not been studied so far.

CECED had not yet discussed this topic with its members because no proposal had been made, but they would like to discuss with others (MS, NGOS, etc.) and to assess whether it is feasible to set the rinsing performance and associated water needs. **CECED** did not feel that a time cap is needed because it will decrease nevertheless due to competition.

The **Commission** responded that the intention is to keep the same level of requirement on water consumption as the current one, which is not related to rinsing. Rather, it has to do with the fact that, until now, energy and water efficiency have been improved, but there is no guarantee that the correlation will continue in the medium term. Water cannot be continuously reduced since there is a limit linked to functionality. Setting a rinsing performance requirement is a good idea but sufficient data is needed to support it. New standards are arriving that will make it possible to collect this data, with the support of industry and MS. The Commission will work with stakeholders to come to a conclusion within a reasonable timeframe.

DE raised its concern that all possible incentives to reduce energy consumption are not used in this regulation. In particular, consumer behaviour is insufficiently covered by looking at just one programme since just 15 percent of consumer behaviour is covered by cotton 40°. **DE** would like for a second programme to be added, at least. For the program duration, **DE** would like to have a clear time limit for the programme and more flexibility to increase energy efficiency by changing the temperature. The combination of programs, e.g. 40-60°, can impact energy reduction and **DE** has consumer surveys that show that users are in favour of this. **DE** is against the idea of getting rid of the Eco-programme and suggested that all manufacturers offer an eco-programme that is more efficient than the regulated programmes.

NL underscored that the choice of programmes and indication on how consumers select a certain programme are essential for steering consumer behaviour. **NL** did not find the requirement for a 60° programme to be useful and supported **DE** on reintroducing the eco-programme that consumes less energy than the proposed 40° cotton. In addition, **NL** felt that requirements under 3 and 4 are unnecessary and possibly confusing since this information can be provided at the point of sale.

DK supported the proposal of having one additional, more efficient, washing and eco-programme.

BE supported **NL** on the 60° programme. **BE** asked that the eco-programme be included as the most efficient programme in the requirement. The testing programme should be selected by default; if it is 40° it could increase energy consumption. **BE** also found parts of the text to be long and confusing and, in support of **NL**, **BE** asked that the section on local conditions be left out.

IT also asked that the text be rewritten and that if two programmes have to be measured, that the eco-programme be measured according to cotton 40. **IT** supported **NL** and **BE** on removing the 60° requirement. The requirements on the availability of some cycles should be mandatory for all drums in the washing machines were the rated capacity is equal or larger than two kilograms. Regarding the booklet of instructions, some requirements are not coherent. **IT** also asked that measured and indicative values not be included in the same table. **IT** opposed including the requirements on spare parts and access to independent repairers in this proposal, but would rather see them in a horizontal regulation that defines these terms for all products.

In response to **IT**, **DE** remarked that it did not see the need for a measurement for an eco–programme, as it is just an option for consumers.

IT suggested that the Commission ask the manufacturer to have an eco-programme, but if it has to be more efficient than the regulated programme and this must be verifiable.

ECOS supported the intention to address the issue of machines having multiple, similar programmes, but asked for more information. Regarding the 60° programme, it is used less frequently than the 40°, but since it consumes 30% more energy it has an important impact on annual consumption.

ANEC/BEUC suggested the eco-programme as a second programme, which would encourage manufacturers to improve their machines. In terms of hygiene, there needs to be caution regarding potential unintended consequences linked to temperature reduction. **ANEC/BEUC** also enquired if the Commission is inviting manufacturers to not reach the temperatures and highlighted that not reaching the indicated temperature may be problematic for communicating with consumers and journalists.

CEN/CENELEC pointed out that, for the booklet of instructions, indicative information would not require measurement and asked whether provided values for the main washing programmes should be measured according to a standard.

IT argued that indicative values do not require verification; measurements are made but the values are not required to be put into the technical information.

NL remarked that the verification of indicative values depends on the law systems of MS and, therefore, may differ.

IT would like indicative values to be provided for all unregulated programmes.

NL agreed and suggested an alternative, where "main" could be defined in the annex. Another alternative would be to indicate that all programmes shall provide indicative values, apart from programmes are used for the label and minimum requirements.

CECED was not convinced by the indicative values and shared that it would create an extra burden for manufacturers. **CECED** shared its willingness to work on agreeing on the "main" programme based on a common denominator and supported **BE** on the definition of the cotton 40 cycle, in which it found the last sentence "better performance" unclear. **CECED** also asked that there be a transition for phasing out the label with the arrow for cotton 40.

SE was not comfortable with including the indicative values in the booklet of instructions. **SE** tested cotton programmes and found that they used much more energy and water than indicated, and had lower cleaning performance. Regarding the testing temperature, **SE** enquired if a standard exists on testing the temperature in the drum. **SE** was concerned that the 60° programmes don't reach more than 45° and requested an indication for that. **SE** supported 60° if evidence shows that it achieves hygienic conditions, otherwise **SE** would support going to 45°; this would need to be understandable to the consumer.

ECOS shared its concern that a horizontal regulation on spare parts is a delay strategy and supported including elements on spare parts at this stage. **ECOS** highlighted that the topic is coherent with the CEAP and remarked that starting with a limited number of products is a good way to gain experience and work towards increasing repair and recycling.

CEN/CENELEC informed that they have been working on temperature measurement for a while and that it is not simple to measure the temperatures in WMs. A total of nine evaluation methods are under way. **CEN/CENELEC** needs to know what the requirements will be – if they are the minimum or maximum for not damaging laundry or the minimum temperature of each single item of the laundry. Therefore, the core of the laundry has to be more precisely defined.

NL felt that the issue of temperature requirements cannot be solved within the current time frame. If hygiene is an important topic of concern, then a requirement should be made.

SE asked for more information on hygiene, in particular if there are hygiene-related issues and if 60 or 45° would provide any benefit at all.

BE suggested adding cotton 40° as the automatic programme, removing the 60° requirement, and adding an eco-programme.

The **Commission** responded that the intention of the 60° is to propose a "hygiene" temperature for consumers. As a first step, 45° already ensures a minimum temperature to kill common germs, but this can be improved. Cotton 40 does not exclude having an eco-programme. The requirement on information for main programmes provides flexibility to manufacturers on how to define them, but the three regulated programmes must still be included. The 20° is a very good eco-programme and is required. The Commission could also work with a minimum list, and the three programmes could be a step in that direction. Indicative information does not have the same weight as mandated information, but at least the information is there for the consumer.

IT requested a table with at least the main programmes.

On Section 2 (Generic requirements for washer-dryers), **CECED** found the name of the "cupboard dry cycle" to be unclear and suggested a requirement that sets the cupboard dry cycle as a default when the wash and dry cycle is used.

ANEC/BEUC asked that the information in the booklet be made available to consumers before purchase via the product fiche.

CEN/CENELEC asked that the Commission clarify the issue of information on the maximum temperature reached in the core of the laundry and the drying process where temperatures are much higher than washing.

Regarding Section 3 (additional requirements on repair and end of life), **NL** found the section to be too vague and general – it should be clarified.

DE raised its concern that the spare part availability and the delivery time requirements are not feasible when the product is put on the market.

FEARDS remarked that documenting the sequence of dismantling as it is required might not be sufficient for certain products. **FEARDS** suggested a maximum time for dismantling, especially for removing harmful components, as well as mentioning the WEEE directive annex, e.g. heat pumps are not mentioned in this annex. **FEARDS** also raised concerns that printed circuit boards are too close to the surface and difficult to take out without any damage and that the LCD display size (100 cm2) is unreasonably large, which means that many displays would not be impacted by this requirement.

IFIXIT shared that making circuit diagrams for important white goods repairable on a component level is important economically, since some components have a cost 10 EUR while replacing the whole board costs 300 EUR. The identification of the components in the way they fit into the circuit board has to be known, therefore **IFIXIT** requested that circuit board diagrams be added to this list.

ANEC/BEUC welcomed the resource efficiency requirements and prefers dealing with spare parts on a vertical level; also encouraged a shorter deadline, since having spare parts available in three weeks does not mean the product will work within that timeframe.

Regarding point two on dismantling, **IT** raised its concern that this may pose a problem for manufacturers if they have to disclose how their circuit boards are made, since competitors could use this information. **IT** proposed that, as soon as the product is placed on the market, the requirement should be tied to the legal warranty, wherein manufacturers would give this information at the expiration of the legal warranty. On "extraction of components must be possible without proprietary rules" **IT** asked that the ED Directive be followed (proprietary tools should "in principle" be avoided). **IT** also asked that "commonly available tools" be removed as the concept is vague and the tools for dismantling will already be displayed in the information. Regarding maximum delivery time, **IT** agreed with the target, but not with the tools for achieving the target. **IT** inquired about spare parts that are phased out through additional ED requirements and products with hydrocarbons.

CECED shared that the requirements on refrigerant gas is already usual practice, but it should be marked on the appliance and not necessarily on the back. On dismantling, manufacturers shall ensure that WMs and WDs components in annex 2 are removable. Regarding spare parts, **CECED** agreed with **DE** and **IT** and enquired on the time of seven years and three weeks. As suggested by **IT**, the spare part delivery time is not always under the control of the manufacture, therefore there is the issue of when the time starts and whether the spare part is functional or cosmetic. **CECED** also raised three concerns on repair: intellectual property, safety, liability of manufacturer.

BE supported **IT** proposal on legal warranty, but remarked that it could be attached to any free warranty. **BE** raised that concern that a point may be missing on the recycler asking for the sequence of dismantling in addition to market surveillance authorities and requested that delivery time be a verification criterion.

SE enquired why there are no specifications on the spare parts covered by the requirement and raised the concern that this may lead to a loss of resources if all parts have to be produced and saved.

ECOS welcomed the requirements and their ability to tackle the availability and price of spare parts, as well as availability of information and tools to repair. **ECOS** would like to see a minimum of seven years, but would be okay with ten year since 7-12.5 years is the average lifetime for a WM. **ECOS** highlighted that the availability software and firmware updates were missing from spare parts and asked that durability requirements be on a number of components for a certain number of cycles. Also the accessibility to the drum bearings should be ensured. On dismantling, **ECOS** supported the minimum dismantling time and **FEARDS** remark on the size of the displays and requested a paragraph on plastics design be included.

REUSE asked that access to information be available from the beginning and supported the proposal that independent repairers be able to repair appliances even if they are broken before the end of the warranty. It also supported **ECOS** remarks on longer accessibility of spare parts and **SE** comments on specifications for spare parts.

In response to **IT** and **SE** on spare parts and proprietary rules, **IFIXIT** remarked that "in principle" could work. Regarding parts, ERPs are defined as parts also put into the market, so it remains to be seen whether spare parts shall be included. **IFIXIT** viewed issues on intellectual property to be overstated and argued that linking it to the warranty could lead to replacement and not repair; there might be times where it would be beneficial to have a machine repaired by an independent repairer. Regarding safety, **IFIXIT** also saw the risk as overstating. **IFIXIT** found **SE** remark to be important on prioritization of spare parts and has done work with **ECOS** on a preliminary list that may prove useful for this product group.

IT asked that the reference to fees be eliminated. **IT** would like to see manufacturers be highly discriminatory in order to have the best authorised repairers and to, therefore, provide "restricted access" to authorized repairers. **IT** raised the concern that if a repair is done incorrectly by an unauthorised repairer, then the manufacturer or retailer may still be held responsible.

On the price of spare parts and access to information, **REUSE** shared that resource efficiency requirements need to be financially accessible for repairs to occur.

IFIXIT supported **IT** proposal to have the information available for free. Concerning manufacturer discrimination under warranty, **IFIXIT** would be willing to discuss if and how the warranty is voided if a spare part is not installed correctly. However, warranties should not be an argument against disclosure of information. **IFIXIT** also raised that concern that requiring repairers to undergo training may be burdensome because they would have to be constantly trained in order to keep up with the products available on the market.

The **Commission** responded that the possibility to fix requirements on the availability of spare parts is mentioned in the annex of the general ED Directive; nothing is outside of the scope of ED. The Commission finds 7 years to be a reasonable minimum, as it is half the expected lifetime of WMs. Three weeks is based on the consumer survey and is the maximum time consumers are willing to wait. The text is not intended to cover all spare parts; only those spare parts necessary for the use of the WM. Manufacturers will need to define this for each machine. The access to information provision is not intended for the general public, only for professional repairers legally registered in their MS and legally responsible for their work. The safety and liability of repair shouldn't be an issue in this case.

Concerning intellectual property of the machine, the secrets behind a new technology are quickly known by the competitors after a few years, so the information on repair won't change much. It could also be made more explicit that repairers are also bound to respect intellectual property rights.

CECED highlighted that certain organisations make information available to the public without paying any fees.

Concerning Section 4 (specific requirements for washing machines and the washing process of washer-dryers), **NL** was not in favour of the first point on minimum requirements on load temperature and asked that manufacturers have some flexibility to achieve the temperatures for hygiene requirements. **NL** was in favour of having a maximum time for cotton 40 used for testing and expressed that there might be some flexibility if rinsing is discussed.

CEN/CENELEC requested clarification on whether each individual cycle should fulfil the washing performance or what is called "treatment" that is usually run several times.

ECOS asked for clarification regarding the intention of the tier of minimum requirements and whether Tier 1 is actually a new tier. **ECOS** raised its concern that there may be a high risk of backsliding with Tier 1 and, therefore, suggested that Tier 1 be dropped and Tier 2 be the starting point, as it is closer to the LLCC.

SE raised that same question as **CEN/CENELEC** on washing efficiency and remarked that it may be difficult to assess the stringency of the requirements. **SE** supported **ECOS** comment that Tier 1 will not lead to any improvements between 2013 and 2024. **SE** also raised its concern that the new formula with A, B, C weighting factors will not prevent large machines to achieve good ratings more easily than smaller ones and, therefore, **SE** suggested using logarithmical factors instead. **SE** supported the introduction of quarter load, but inquired whether it would be better to have a 60° cycle and suggested a compromise wherein one a 40° cycle is removed and on 60° is included.

TOPTEN shared the same concern on backsliding – valid for countries where machines are already very efficient – and supported **SE** comment that the formula incentivises larger machines and suggested inserting a fix load as a solution.

IT asked to clarify the washing performance for each cycle required (whether is cotton 40, 60 , ecoprogram, etc) then the temperature and the time result from it. **IT** raised the concern that by limiting the requirement to appliances with a rated capacity higher than 2Kg, there may be a risk of a loophole and highlighted that water performance would be modified if rinsing performance was included. Low power modes aligned with the standby regulation, not the values but which modes. For the time being, **IT** agreed with **NL** on having only network standby and delay start modes.

DK understood the concern about backsliding, but did not think it would happen because the label will drive development and bad products off the market. **DK** also shared its view that minimum requirements are not very ambitious and should be strengthened and that the current formula still promotes larger machines receiving better labels. **DK** supported investigating the fixed load idea suggested by **TOPTEN**.

FR supported the overall proposal, but also raised two concerns: Tier 1 may be less ambitious than in existing legislation and, concerning the promotion of larger appliances, something needs to be done with the formula (not unique to WMs).

ANEC/BEUC pointed out that the weighing factors will give a greater advantage to larger machines at low loads that consume less energy, which still promotes larger machines. **ANEC/BEUC** also shared that categories for small, medium and large machines do not reflect consumer opinion; suggested that 6 kilo should be included for small machines and large machines should begin before 11 kilos.

CECED shared its concern that it is difficult to assess because there isn't enough data, therefore caution must be used when basing a label on insufficient data. Regarding weighting factors, after evaluation, **CECED** sees room for improvement, but does not support a fixed load for all appliances. This would be difficult in terms of testing, market surveillance, and manufacturing. Concerning low-power modes, **CECED** did not see the need for further requirements for the first twenty minutes, since it is sufficient to turn it off after twenty minutes, and found "any mode" to be vague.

BE supported **ECOS** regarding the level of ambition related to low-power modes and would like to see a clear forecast on this issue before taking a decision. **BE** also supported **NL** on leaving out temperature-level requirements and asked that each individual cycle calculation be revised.

DE asked that the parameters in formula c in annex 2 be reviewed. **DE** also remarked that the formula encourages larger machines. Regarding the size of categories, **DE** asked that small should be 6 or less, medium 6-8, larger greater than 8.

UK expressed that the time between tiers is too long, since the review would take place before the second tier comes into force. Regarding the low-power modes, **UK** advised to be careful on whether they should be placed in vertical or horizontal regulation.

CEN/CENELEC raised the point that it is not possible to confirm that the formula provides an incentive for larger machines and that the formulas are not incorrect, rather manufacturers have put larger and more energy efficient machines on the market.

ECOS raised its concern that the trend towards larger machines counteracts achievements in energy savings and asked for more robust answers than those presented in the new proposal. **ECOS** also enquired whether a drop of differentiated weighting factors could be a solution and suggested that, instead of a linear equation, something similar to the one used in tumble dryers could be looked at (e.g. curving the line at larger capacities).

NL raised its concern that there was too much discussion on the level of ambition and other targets of the regulation. Seeing the saving just 1 TWh, **NL** suggested focusing more on much greater savings in other product categories. **NL** suggested that rinsing performance might need some attention, avoiding the use of different tiers, and simplifying weighing capacities.

Annex II – Measurements

CEN/CENELEC would like to see a clear difference between the number of cycles to be tested and the weighting factors and for this to be made in the text whether it is for WMs or WDs. **NL** remarked that the number of test runs or cycles needed for a good value of energy and water consumption could be set by standardisation bodies. In addition, **NL** asked that a remark on rounding be placed in the beginning of the annex. **CEN/CENELEC** agreed with **NL**, and would like for it to be based on the standard and made consistent throughout the proposal. **BE** asked that the rounding be made clear and, concerning point a, suggested taking out any reference to 60° programmes. On point b, **BE** asked that the same term for the cotton 40 programme be used (i.e. with or without apostrophes).

Annex III – Product compliance verification by market surveillance authorities

NL pointed out that Table 1 should be made consistent with the other tables. **IT** asked the Commission to verify that all of the parameters are in the table on tolerances. **IT** also would like to see low-power modes rewritten according to the CF on standby and requested that water consumption and the washing efficiency index need to be amended.

Annex IV – Indicative benchmarks

DK would like to see a measurement on tolerance if the maximum and minimum temperatures are to be included.

Annex V – Multi-drum washing machines

IT would like to see this annex added to the measurement methods and shared the view that all drums should be equal or larger than 2 kilos.

Annex V – List of energy-using products covered by Annex I, point 1 to Regulation (EC) No 1275/2008

CECED requested that, if the DWs are excluded, then it should also be deleted from this table. Concerning cycle and programme duration, **BE** commented that the requirement for a maximum duration of the 40° programme would require tolerances and benchmarks to be complete.

3.6.2 Energy Labelling

The **Commission** shared that comments will be cross referenced with comments on ED and highlighted that a consumer survey for these appliances is about to be launched.

No comments were made on **Article 1 and 2**.

Article 3 – Obligations of suppliers

NL asked that the circumvention clause be aligned with framework regulation. In addition, **NL** would not find it ideal to have two arrows for products sold online and would prefer one label only for washing and drying.

BE, DE, IT, PT, UK, ECOS and **ANEC/BEUC** agreed on one label with one scale. **AT** and **SE** supported one label with two scales. **Eurocommerce, CECED, DK** and

Independent Retail Europe all supported one label, but were not sure on one or two scales.

IT asked that the product information be sent. **PT** found point g to be redundant – either all obligations are included or none are. **BE** agreed with **PT**.

SE wanted to see spinning performance included on the label.

No comments were made on **Article 5 and 6**.

Article 7 - Revision

ANEC/BEUC asked that consumer behaviour be included in the revision clause.

No comments were made on **Article 8.**

Article 9 – Entry into force and application

CECED reiterated comments it made in the morning on 12 months minimum time between the publication and the entry into force.

Annex I – Definitions

NL asked that the interrupted operation cycle be refined, EL be aligned and that definitions be put in one place. **NL** also remarked that definition 13 equivalent "washing machine" is not needed because it is already in the framework regulation.

Annex II – Energy efficiency classes

BE enquired why airborne noise emission clauses explicitly state that they should be aligned with state of the art standards, while other elements don't. **NL** suggested that the "EEI" be called "specific energy consumption", otherwise the numbers should be multiplied by 100. **The Commission** will consult the relevant standards stakeholders on the state of the art.

IT suggested adding noise emissions to the label and adopting an A to G scale. **IT** would like to have a discussion on about relative versus absolute scales for each product. **IT** would prefer an absolute scale, otherwise a declaration of noise should be included and the revision should specify that noise will be classified based on an absolute scale. This would be to ensure that there is coherence among different products.

Regarding the size of the scale, **ECOS** would prefer a more even class distribution. **SE** did not agree with **ECOS** on the even distribution of the classes, as smaller scales/bandwidths are needed to promote innovation.

DE favours an icon on noise emissions in the label. Based on Table 4, **DE** would like for the number to be lowered and suggested changing light, medium and loud to A, B, and C.

BE also favours an indication of sound on the label and asked whether all WMs would be considered loud.

UK cautioned that if an absolute scale is adopted, it should only be for household products.

DE would prefer a relative scale on noise emissions.

ANEC/BEUC requested that noise emissions be on the label since they are important to consumers, but they should be consulted so that the icon design is understandable.

CECED shared that there is an ongoing activity in standards for measuring noise emissions.

No comment was made on **Annex III.**

Annex IV – Label

CECED asked whether the C class is green. The **Commission** replied that it is light green.

DE asked that absolute energy consumption cycle be changed to per year and that the 40° cotton be deleted because it is not neutral in the language. **DE** does not favour the timing icon because consumers may not understand the information and will end up purchasing more energy consuming products; would prefer an icon on spinning instead.

NL was in favour of the proposal on energy consumption per cycle, but agreed with **DE** that cotton 40° is not language neutral and, therefore, is not appropriate. **NL** would like for time to be on the label, however, not the weighted, but longest maximum time. On spinning versus noise, **NL** remarked that spinning may be more important than noise. Once an energy smart definition is in place, it would be useful to place it there.

IT asked that the voltage symbol not be used, for the capacity logo to be placed close to energy consumption, and did not agree with the prominent position of the QR code.

CECED requested a link to a product database and agreed with NL suggestion on the smart icon. **CECED** also supported information per cycle, agreed with having the time indication in hour and minutes and asked that the information on the label be consistent with the text.

PT would like for spinning and noise to be on the label, for the QR code to be made smaller, and asked that there be a further assessment on time after the survey.

SE asked that energy not be in green so that it is neutral.

ANEC/BEUC enquired if a different label for WDs would be part of the consumer survey and whether the results of the survey will be shared with, and whether comments can be made, by CF members. The Commission confirmed that the survey will cover WDs. Three alternatives will be tested starting from this proposal and the Commission will give CF members the opportunity to comment on it.

Annex V – Product information sheet

Concerning point 1c, **IT** found the rated washing capacity in kg for the 40° programme to be contrary to the definition of rated capacity or maximum capacity of the machine. On point g, **IT** asked for clarification of the definition and whether all programmes should be tested in order to determine which consumes the most energy. For point h, **IT** would like to see delay start and network standby added. **IT** would also like for 'weighted power' consumption to be changed to "weighted energy".

NL found the first sentence of point 1 to be confusing and would like for it, along with point 3, to be deleted. **UK** reiterated a point it made on information requirements for refrigerators to ensure that the entire burden isn't placed on manufacturers. Concerning point g and h, **CECED** shared that checking which programmes consume the most energy can be complex, suggested taking out point h, and asked that noise requirements for WDs to be simplified.

Annex VI – Technical documentation

IT found point g to be inconsistent with Annex 3. **NL** wanted to see the technical documents, product information sheet, and energy label connected with each other.

Annex VII – Information to be provided in the case of distance selling, except distance selling on the Internet

DE repeated its proposals for washing appliances and refrigerators and asked those in favour of two scales to keep in mind that it may be confusing.

No stakeholder comments were made on **Annex VIII**.

Annex IX – Product compliance verification by MSAs

NL raised the same comment it raised on ED.

Concerning airborne noise emissions, **SE** asked why there are no tolerances, especially in light of the fact that they exist for air conditioning products. **CEN/CENELEC** responded by stating that declarations are usually different from measurements and that tolerances are usually taken into the measure value. Tolerances are not needed, but for time's sake it was not possible to go into more detail. The Commission will look into this issue further.

No comment was made on **Annex X**.

3.6.3 Additional comments

BE had a question on market coverage for CF on voluntary agreements.

The **Commission** responded that there has not been any follow up on the very low market coverage with the sector. The Commission will get back to stakeholders in early 2018.

3.7 Conclusions

The **Commission** thanked the participants for their contributions and explained that the next steps would include the drafting of an amending regulation, the usual steps of inter-service consultation and WTO notification and that it would be working to submit its Impact Assessment to the Regulatory Scrutiny Board in May 2018, with a view to having the amending regulation included for discussion at a Regulatory Committee and Expert Group meeting in October 2018, and in the overall Ecodesign/Energy Labelling "package" for adoption by the College by the end of 2018.

ANNEX – Attendance List

Commission Services	
DG ENER	C.3
DG GROW	C.1
DG ENV	B.1
DG JRC	B.5

Member States	
AT	Austrian Energy Agency
BE	FPS Economy, SME, Self-employed and Energy
	FPS Health, Food chain Safety and Environment
BG	Ministry of Economy
CH	Swiss Federal Office of Energy
CZ	Ministry of Industry and Trade
DE	Federal Institute for Materials Research and Testing
	Federal Ministry for Economic Affairs and Energy
	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
	Baden Württemberg Ministry for the Environment, Climate Protection and the Energy Sector
DK	Danish Energy Agency
ES	Ministry of Economy, Industry and Competitiveness
FI	Energy Authority
FR	Ministère de l'énergie et du développement durable
IE	Enterprise Ireland
IT	ENEA
LT	Ministry of Economy
NL	Netherlands Enterprise Agency
PT	Directorate General for Energy and Geology
SE	Swedish Energy Agency
UK	Department for Business, Energy & Industrial Strategy
	Department of Energy and Climate Change
	Department for Environment, Food & Rural affairs

Organisations
ANEC/ BEUC
CECED
CLC/TC 59X
ECOS
EuRIC
EuroCommerce
FEICA
IFixit
Independent Retail Europe

ORGALIME
RREUSE
TOPTEN
VHK

Annex 4: Evaluation of the Ecodesign and Energy Labelling Regulations for household washing machines and of the Energy Labelling Directive for household washer dryers

In the context of the Better Regulation policy[7], the Commission is committed to evaluate all EU activities intended to have an impact on society or the economy in a proportionate way.

A joint evaluation of the Ecodesign and Energy Labelling Directives[8] was carried out by the Commission in 2015. Main findings and conclusions were presented in a Report to the European Parliament and the Council[9]. Among others it was pointed out that the ecodesign and energy labelling measures in place are effective and bring tangible and substantial energy and cost savings. The implementation of the two Directives is estimated to save 175 Mtoe primary energy per year by 2020, which corresponds to 19% savings with respect to business-as-usual energy use for those products. These policies will deliver almost half of the 20% energy efficiency target by 2020. Dependency on imports of energy would be reduced by 23% and 37% for natural gas and coal, respectively. In total, the ecodesign and energy labelling measures in place to date are estimated to save end-users of products 100 billion euro per year in 2020 through lower utility bills (translated into roughly 500 euros yearly savings in each household).

This annex presents the relevant findings of the evaluation of the Ecodesign and Energy Labelling legislation and complements them with findings from the Review study 2017.

4.1. Effectiveness

This section focuses on two key objectives of the current Regulations, i.e. ensuring a transition towards more energy-efficient household washing machines and washer dryers, and achieving significant energy savings. Other impacts are quantified but are not analysed in depth.

4.1.1 Conclusions of the review study

A review study was carried out in close cooperation with the stakeholders. This review study revealed that the way the washing machines and washer dryers are used by the consumers widely differs from the way manufacturers optimize the performance of these machines, being triggered by Ecodesign and energy labelling requirements in place. This review shows that there are also discrepancies between the original expectations and real-life efficiency gains, in particular in the context of the identified consumer behavioural bias not to choose the test programmes very often. More detail, the discrepancies steams from:

- Energy label classes: Most washing machines already exceed the highest current energy efficiency class, A+++. This is especially true for appliances with higher rated capacities and heat pump-equipped washing machines, or washing machines with very advanced technologies. A re-scaling of the energy labelling classes

[7] https://ec.europa.eu/info/law/law-making-process/better-regulation-why-and-how_en

[8] SWD(2015) 143 final, Commission Staff Working Document - Evaluation of the Energy Labelling and Ecodesign Directives

[9] COM(2015) 345 final, Report from the Commission to the European Parliament and the Council - Review of Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication of labelling and standard product information of the consumption of energy and other resources by energy-related products

should therefore simplify comparisons for consumers and provide an incentive to manufacturers to continue improving their appliances.

- Range of programmes: Washing machines are characterised by a broad range of programmes, besides the standard cotton 40°C/60°C programmes that provide the basis for measuring the energy consumption of the appliance and the EU Energy Label classification. Usually, non-standard programmes are not, however, optimised regarding energy efficiency to the same extent as the standard programmes. This contrasts with the findings of a user survey undertaken in 2015, which indicated that 90% of respondents expect or understand the label to represent the performance of the washing machine in all programmes, not only in some of them.

- Use of standard programmes: Especially for washing machines, the standard cotton 40°C/60°C programmes are actually used only to a minor extent (17% altogether, or 5% if considering only the programmes lasting more than 3 hours). There are other programmes for the same purpose (i.e. the 'normal' cotton 40°C/60°C programmes) which are used more often (26% altogether) which consume more energy and water than the standard programmes. In some appliances, consumers can also change the characteristics of the standard cotton 40°C/60°C programmes by adding options such as ‘short’ or different temperatures. Such alterations tend to increase the energy and/or water consumption of the standard programmes.

- Programme duration: The standard cotton 40°C/60°C programme, whose combined energy consumption is displayed on the EU Energy Label, and thus influences the purchase decisions of consumers, were designed to improve energy efficiency. However, this reduction in energy use is often achieved via - in parallel - reducing the washing temperature, and prolonging the programme duration, as trade-offs to maintain the washing performance. However, these characteristics are not so convenient to consumers, and contradict their usual preferences. The above-referenced 2015 user survey indicated that most consumers accept a maximum of 2-3 hours'programme duration, and there is a clear reluctance to use programmes lasting over 3 hours.

- Loading of machines: In general, consumer research shows that the average amount of load in actual conditions of use is around 3.4 kg per cycle for the cotton programmes. This load is much lower than full load, and is substantially lower even than the average 5 kg load used for measurement under standard conditions for a 7kg capacity machine. In parallel, the market seems to be moving towards an increase of the rated load capacities of machines. The current calculation of the Energy Efficiency Index (EEI) makes it relatively easier for large machines to reach a good EU Energy Label rating. However, the lower consumption values per kg of laundry are only obtained if machines are fully loaded, which is generally not the case in real-use conditions. Corrective actions should aim at improving the loading of the machines, as it is one key aspect to increase their energy efficiency. According to the review study, even relatively small increases of load (e.g. 4%-8%) would be beneficial for the overall performance of the machines.

- Technical innovation: the results from the review show that further energy savings for washing machines could be achieved by technical improvement in the following features: adoption of permanent magnet motors, improved drenching, improved load detection and partial load adaptation, automatic detergent dosage and consumer feedback on loading. These options have minimal impacts on life cycle costs. The use of a heat pump, or very advanced technology features, leads to energy savings, but these savings do not make up for the initial investment cost over the lifetime of the appliance. For washer-dryers, further improvement in the technical design includes options such as the use of permanent magnet motors, improved load detection and adaptation, improved drenching, automatic detergent dosage, consumer feedback on loading and improvement of the drying phase via air condensing or design of the combined wash&dry programme. These options barely influence the life cycle cost. The use of a heat pump for improving the drying process represents a significant investment cost but it also leads to significant energy savings; therefore, it can be considered a suitable technology option for washer-dryer appliances.

- Durability: Statistics point to an increased proportion of household washing machines that have to be replaced earlier than the expected average lifetime, especially within the first 5 years, due to a defect. Early device defects may be due in part to consumer behaviour.

The main results of the review study regarding the other aspects required to be revised by Article 7 of Regulation 1015/2010 are the following:

- Rinsing performance: standard EN60456:2011 describes a procedure for measuring rinsing efficiency by measuring alkalinity. This method was not considered sufficiently reproducible, resulting in difficulties to compare rinsing efficiencies or to set minimum requirements. An alternative measurement method for rinsing performance has been developed during these years and it is ready to be in place. Thanks to the rinsing performance standard, a minimum ecodesing requirement can be set up, however, sufficient data to assess its level of ambition are still missing.
- Spin-drying efficiency: The spin-drying efficiency influences the residual moisture content of the laundry, which ultimately decreases the energy demand of the subsequent drying process, but also the energy demand of the subsequent ironing process. Given the different programmes and user needs in terms of drying and spinning, the complexity of assessing possible trade-offs with line-drying and ironing, and the market transformation observed (most of the appliances on the market achieve a dry-spinning efficiency class between C and A), it is proposed to keep the current overall framework but to adapt the scale to the newly proposed testing portfolio and to only communicate this information via the QR code (accessing to the information product sheet) on the Energy Label. Ecodesign minimum requirements on spin-drying will not be set. In addition, it was observed that most of the appliances on the market achieve a dry-spinning efficiency class between C and A already (plus, many machines offer the possibility for customers to change this performance level).
- Hot water inlet: the use of hot water inlets could lead to additional energy savings if the optimal conditions are met (e.g. short and well-insulated pipelines, high efficiency water boilers providing the alternative source of hot water, provision of renewable energy sources to heat the water, etc). However, given the variety of installations and boilers used in houses and the complexity of assessing possible trade-offs, it does not seem advisable to set stronger requirements at this stage. On the other hand, information requirements are considered to be suitable to promote the use of this machines wherever and whenever they can bring environmental benefits. The market share of appliances that are compatible with hot water inlets is currently very low, although some increase is expected in the

near future in relation to the installations of renewable energy technologies in the residential sector, as supported by Art 13(4) of Directive 2009/28/EC.

- Verification tolerances: the current tolerances should be completely revised once the new test method would be in place. Due to the changes in the testing portfolio, a recalibration of the verification tolerances by means of round robin tests done among different laboratories will be needed. .

The review study made other recommendations to address market failures, and thus to improve overall environmental performance during the life cycle by :

- having requirements which facilitate repair (e.g. provisions and design for easy repair)
- stipulating requirements which facilitate recycling and depollution actions at the end-of-life of the appliance (e.g. design for dismantling for depollution purpose and recovery and recycling)

4.1.2. Market transformation and innovation for washing machines

Table A4.1 gives the real energy use up to 2016 and the energy use projected in the Impact Assessment 2009[10] in comparison to the BAU scenario and the preferred option of this impact assessment 2015. It seems that the estimated energy consumption in the Impact Assessment 2009 is much higher than the estimated energy consumption in this impact assessment even for the historical data. The differences can be due to different parameters (average energy consumption of the washing machines, number of cycles per year, user correction factors or even estimations of the sales and stock) considered in the studies as shown in table A4.1

<table>
<tr><th>Parameter</th><th>IA 2009</th><th>IA 2015</th></tr>
<tr><td>Number of cycles per year</td><td>234 cycles/year</td><td>220 cycles/year</td></tr>
<tr><td>User correction factors</td><td>1.01 (from declared to real)
1.00 by 1980
0.69 (2005 and beyond) for real life consumption correction (lower washing temperatures)</td><td>Ranging from 0.77 to 1.20 depending on the rated capacity and scenarios</td></tr>
<tr><td>Low power consumption</td><td>From 0 in 1990 to 12 kWh/a in 2005 and beyond</td><td>0 kWh/a (considered part of the declared values or excluded from the measures)</td></tr>
<tr><td>Sales and stock</td><td><table><tr><th>Year</th><th>Sales*</th><th>Stock*</th></tr><tr><td>2005</td><td>14</td><td>167</td></tr><tr><td>2010</td><td>13</td><td>186</td></tr><tr><td>2015</td><td>13.5</td><td>197</td></tr><tr><td>2020</td><td>14</td><td>201</td></tr><tr><td>2025</td><td>13.5</td><td>203</td></tr></table></td><td><table><tr><th>Year</th><th>Sales**</th><th>Stock **</th></tr><tr><td>2005</td><td>16</td><td></td></tr><tr><td>2010</td><td>16.4</td><td></td></tr><tr><td>2015</td><td>16.7</td><td></td></tr><tr><td>2020</td><td>15.4</td><td></td></tr><tr><td>2025</td><td>15.7</td><td></td></tr></table></td></tr>
<tr><td>Average energy consumption per cycle</td><td><table><tr><th>Year</th><th>kWh/cycle</th></tr><tr><td>2005</td><td>1.00</td></tr><tr><td>2010</td><td>0.96</td></tr><tr><td>2015</td><td>0.94</td></tr><tr><td>2020</td><td>0.93</td></tr><tr><td>2025</td><td>0.91</td></tr></table></td><td><table><tr><th>Year</th><th>kWh/cycle</th></tr><tr><td>2005</td><td>0.65</td></tr><tr><td>2010</td><td>0.74</td></tr><tr><td>2015</td><td>0.81</td></tr><tr><td>2020</td><td>0.79</td></tr><tr><td>2025</td><td>0.73</td></tr></table></td></tr>
</table>

[10] EC, impact assessment, SEC(2010)

Average purchase price	Base price EUR 443.20 1.04 price increase in euro per kWh annual electricity consumption decrease (real life consumption)	Base price EUR 378 in year 2005 decreasing depending on the cumulative sales and the maturity of the technology
Electricity price	EUR 0.17 /kWh electric 4% escalation rate	EUR 0.21 /kWh electric in 2015 and PRIMES estimations
Water price	EUR 3.7 /m3 in 2005	

Table A4.1 Comparison table between the assumptions of IA2009 and IA 2015

**(million of units, rounded to the nearest 500000) ** million of units*

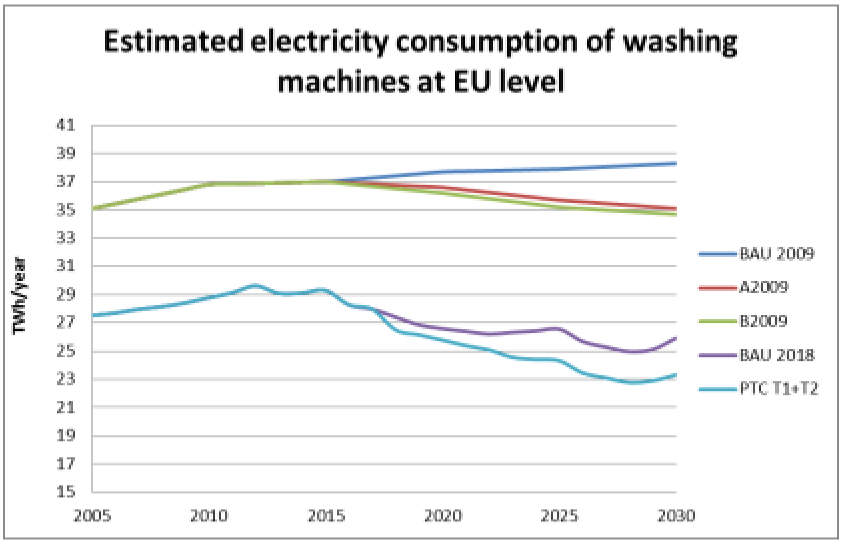


Figure A4.1. Electricity consumption of household washing machines 2005-2025. According to BAU and A and B scenarios assessed in 2009 versus BAU 2018

It shows that depending on the assumptions, the energy consumption estimated can be different. Both lines show an increase up to 2010 when a decrease in the overall energy consumption is started. This date is also the entry into force of the current regulations showing that the regulations have been effective.

4.2. Efficiency

This section describes to what extent the current Regulations have contributed to delivering the above mentioned benefits for the specific products considered in this Impact Assessment.

4.2.1 Efficiency for household washing machines

Table A4.2 gives an overview of the different average prices per appliance in a scenario where no measures where proposed BAU 2009 and in scenario where the current regulations were proposed and implemented (current scenario BAU2015), calculated according to the Impact Assessment 2009, this Impact Assessment 2018 and in Reality. In the Impact Assessment 2009, the average price per appliance was expressed in fixed 2005 euros. In this Impact Assessment, average price per appliance is expressed in fixed 2015 euros. Given the inflation rate over the 2005-2015 period the price in fixed 2015 is be 2.2% lower than the price in fixed 2005 euros

Year	2009	BAU 2015	2015- current
Impact assessment 2009 (fixed 2005 prices) EUR	443	397	487

Current impact assessment (fixed 2015) EUR		379	465
Reality (EUR)			467

Table A4.2 average prices per appliance according to the impact assessment 2009 and this impact assessment

The real price is approximately the calculated price in this Impact Assessment.

Currently, when purchasing a household washing machine, the consumer pays 86 euro extra compared to the BAU scenario. This amount is distributed among the different actors as follows:

- VAT (20%) = EUR 14.4

- Retail sector = EUR 28.17

- Industry = EUR 43.43

At almost 15 million units sales per year this means an extra revenue of EUR 216 million for the tax office, EUR 422.55 million for retail and EUR 651.45 million for industry.

In table A4.3, the life cycle cost of the average washing machine in a BAU and the policy option POWM 4 (T1+T2) are calculated. The energy prices are increased according to PRIMES 2016

Figure 2: Life cycle cost calculation in a BAU and POWD 4 (T1&T2) in fixed EUR_{2015}.

	BAU	POWM 4
Average price per appliance (EUR)	378.68	459.83
Average electricity consumption (kWh/a)	179.38	179.38
Average water consumption (m^3/a)	11.87	9.50
Electricity tariff (EUR/kWh)	0.21	0.21
Water tariff (EUR/m3)	4.62	4.62
Energy cost over the product life (12.5 years) (EUR)	470.86	470.86
Water cost over the product life (12.5 years) (EUR)	685.49	548.39
Total life cycle cost (EUR)	1535.03	1479.09

In total consumers will pay EUR 56 less per unit that at 15 million unit sales per year this means a savings of around EUR 840 million for consumers. The administrative burden of the current legislations was calculated at EUR 0.5 million annually, divided over the various stakeholders.

4.3. Relevance

The Review study 2017 and this Impact Assessment show that the regulations support a transition towards more energy-efficient household washing machines effectively but that the efforts done by the manufacturers are not fully realized due to the mismatches between the testing programmes and the user behaviour. This forms the basis of the proposal for an updated regulation. It is made possible and necessary also due to the technical progress and the development of more efficient appliances

However, higher savings could be achieved by revising the requirements (see Section 2). This forms the basis of the proposal for an updated regulation. Moreover, the current regulations only regulate the energy efficiency of the appliances. The Review study 2017 revealed that household washing machines can contribute substantially to the Commission's Circular Economy Initiative.

Annex 5: Description of the policy scenarios

5.1 Market analysis for household washing machines and washer dryers

5.1.1 Market data and trends regarding the rated capacity

Household washing machines are widely present in European households, with an average household ownership rate of about 92%. In 2015, the EU-28 stock of household washing machines (WM) amounted to 201.4 million units. Thus, the 17.2 million new household washing machines sold on the market each year (2015 in the EU28), are mainly replacement products for old and/ or broken, since the market is nearly saturated. machines.

Household washer-dryers (WD) have a much lower presence in European households. In 2015, the EU28 stock reached 8.76 million units, bringing the household ownership rate to around 4%, but it is increasing. In 2015, yearly sales amounted to 0.88 million units in the EU-28.

The load capacity of washing machines and washer-dryers has changed gradually over the past few years (see. Figure A5.1 on WM and Figure A5.2 on WD). For household washing machines, the prevailing trend shows an increase in the market share of washing machines with higher average rated capacities[11] (4.8 kg in 1998, increasing to over 7 kg in 2013). In 2013, the most common load capacity was 7 kg (31%). For household washer-dryers, the trend is similar. The average washing rated capacity was 4.9 kg in 1998, growing to 7.40 kg in 2013. Similarly, the average drying rated capacity has increased from 2.47 kg in 1998 up to 4.91 kg in 2013.

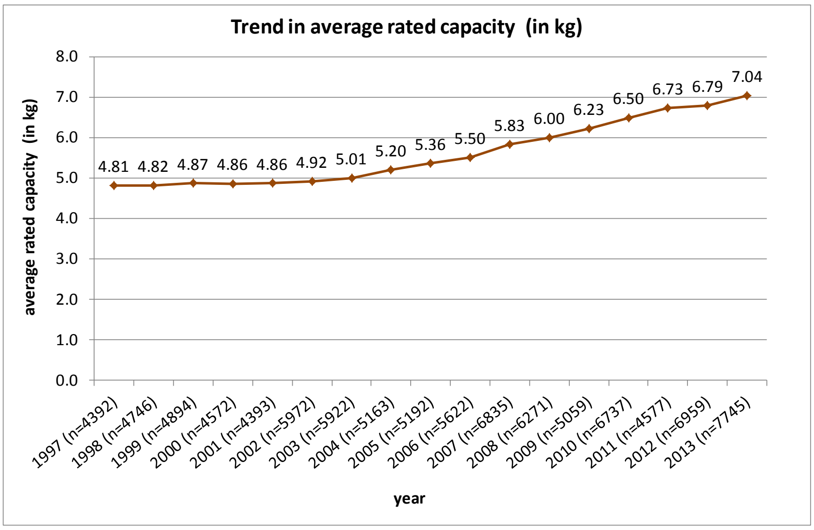


Figure A5.1: Average rated capacity (kg cotton) of washing machine models

[11] i.e., the washing loadforload for which the washing machine or washer dryer is designed. It depends on each specific washing programme. The value reported in this study refer to cotton laundry

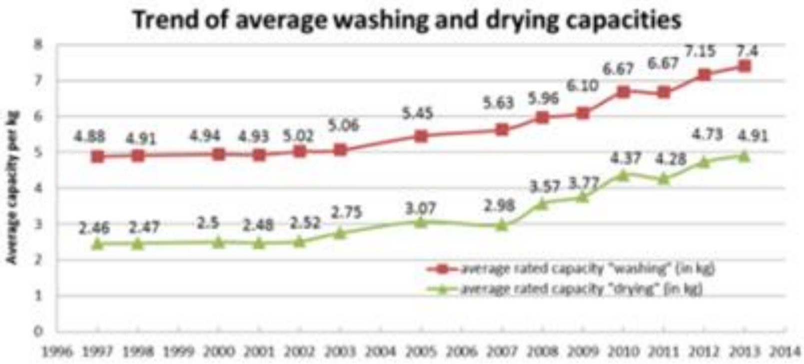


Figure A5.2: Trend of average washing and drying capacities of washer-dryer models

5.1.2 Performance of household washing machines and household washer-dryers

In 2015, the total electricity and water consumption related to household washing machines in Europe was estimated to be 31.3 TWh and 2343 million m^3, respectively. For washer-dryers, in 2015, the respective figures were 4.0 TWh and 152.5 million m^3.

5.1.2.1 Energy efficiency classes and energy consumption

Energy efficiency in washing machines is measured using a fixed combination of the two "standard programmes", at 40°C and 60°C for cotton textiles and at two different loadings: full load and half load. These programmes were selected as the reference for the testing because they were considered as those programmes that better represent the most frequently used programmes by consumers.

The EU Energy Label efficiency class of a machine is determined by comparing the energy consumption of a machine's standard programmes with the average reference energy consumption of a machine of the same capacity (called standard annual energy consumption (SAE_c)).

Table A5.1 shows that, since December 2013, only three energy efficiency label classes (A+, A++ and A+++) have been allowed on the European market for washing machines with rated capacity ≥ 4 kg. In theory, label class A is only allowed for washing machines < 4 kg. However, according to the CECED database, all 36 models of 4 kg WM and 4.5 kg WM on the European market are labelled A+.

EU Energy Label Class	EEI	Ecodesign Tier I: Dec 2011	Ecodesign Tier II: Dec 2013
A+++	EEI < 46		
A++	46 ≤ EEI < 52		
A+	52 ≤ EEI < 59		
A	59 ≤ EEI < 68		Banned for all machines ≥ 4 kg
B	68 ≤ EEI < 77	Banned for all machines	
C	77 ≤ EEI < 87		
D	EEI ≥ 87		

Table A5.1: Overview of the current Ecodesign requirements for household washing machines and which EU Energy Label classes have been phased out

The energy efficiency classes of washing machine models available on the EU market have evolved constantly over the past two decades (see Figure A5.3). The average declared energy consumption of standard programmes was reduced by half from 0.245 kWh per kg and cycle in 1997, to 0.120 kWh per kg and cycle in 2013. In 2013, 50% of the washing machine models available on the market had already achieved EU Energy Label class A+++ (CECED 2014).

Note that Figure A5.3 shows the number of models on the market - this does not necessarily reflect sales figures.

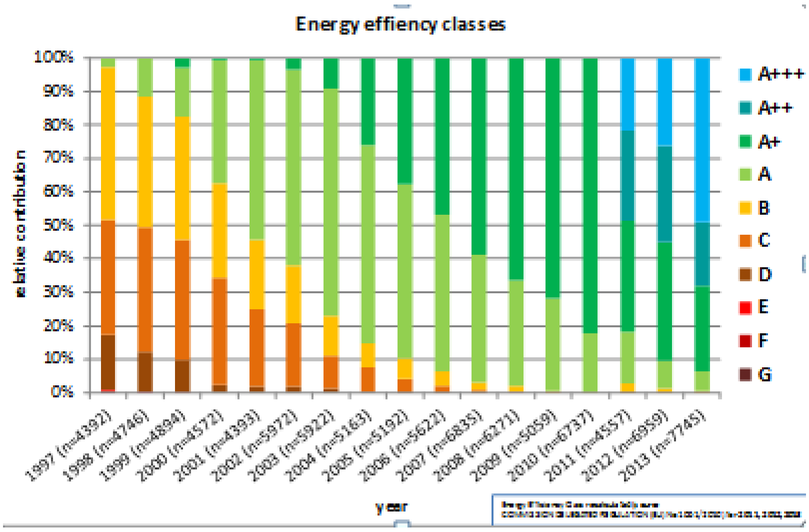


Figure A5.3: Distribution of energy efficiency classes for washing machines in 1997-2013 (CECED 2014)

To illustrate the development of washing machine energy efficiency compared to the current ecodesign and energy label requirements, Figure A5.4 shows a sample of washing machines models ≥ 5 kg sold in the EU market in 2014 (from the CECED database). The figure shows that a large share of washing machines far exceed the best Energy Efficiency Class, A+++. This is especially true for appliances with larger rated capacities. On the other hand, only a few of the smaller machines (<5 kg) achieve Energy Efficiency Classes better than A+++.

However, it should be noted that Figure A5.4 shows yearly energy consumption under the testing and declaration regime of the existing standard programmes. Under real-life use conditions, the distribution of energy efficiency may be different.

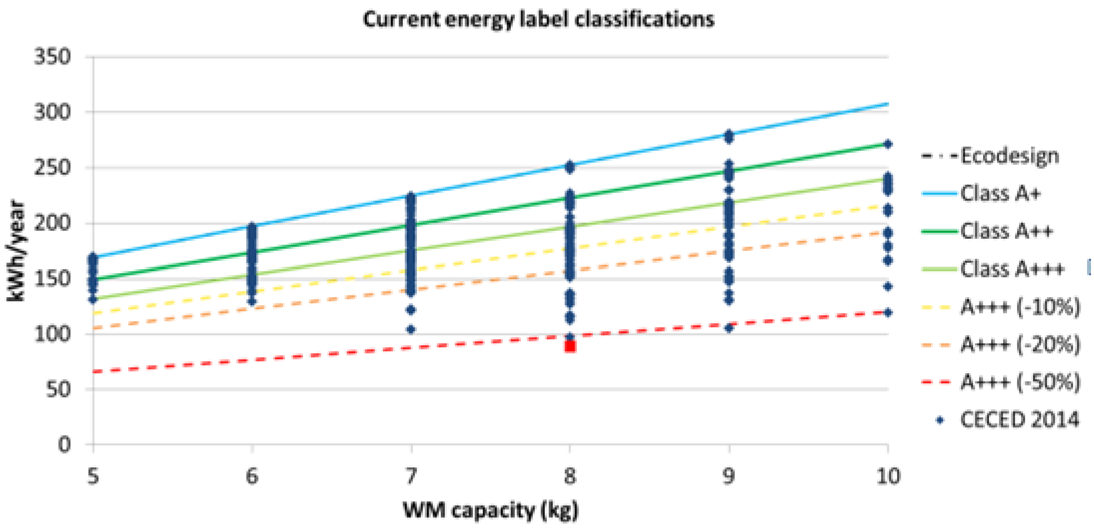


Figure A5.4: Yearly energy consumption of washing machine models (5kg-10kg capacity range) on the market in 2014 as a function of their rated capacity, and current EU Energy Labelling classes and Ecodesign requirements (overlapping with Class A+).

In the EU, the washing machine market has been strongly influenced by the Ecodesign and Energy Label regulations. The above information clearly illustrates that, for the past few years, most machines have been labelled A++ or A+++. Therefore this has now resulted in the policy being a "victim of its own success", as there is presently little market differentiation of WM based on the EU Energy Label.

At first glance, it may seem necessary to update the scale and set more stringent minimum energy performance standards (MEPS). However, some additional considerations are key to understanding the current market situation and label claims. Firstly, it is important to note that for a large number of machines on the market, the products' rating in the better energy classes has been achieved by means of extending the duration of standard programmes (> 4 h). However, although this seems to represent progress, in reality consumers have tended not to use these programmes under actual use conditions. In addition, the top energy classes are, in some cases, only reached under full loading of very large drums (> 9 kg), which consumers seldom need, or in fact use.

Washer-dryers placed on the market between 1997 and 2013 have also substantially improved in terms of energy efficiency (see Figure A5.5). Washer-dryers classified with energy efficiency class A entered the EU market in 2007 and reached over 50% of the EU market share by 2013 (CECED 2014).

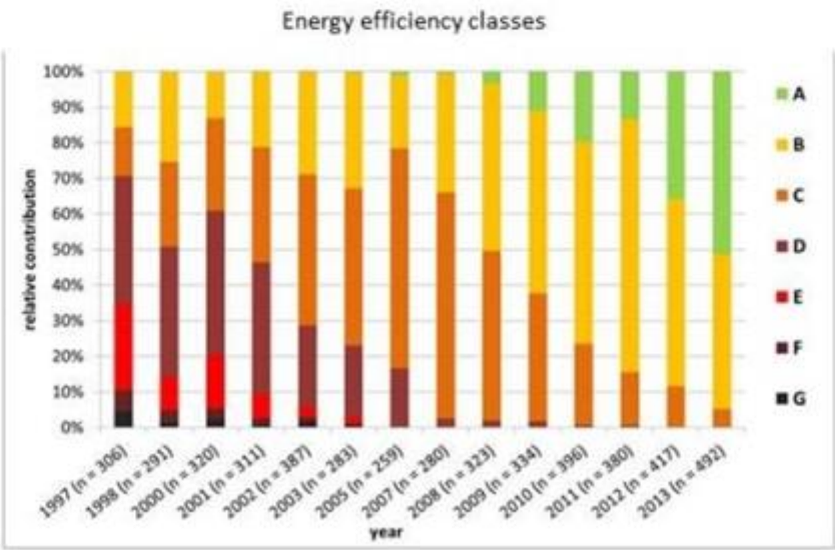
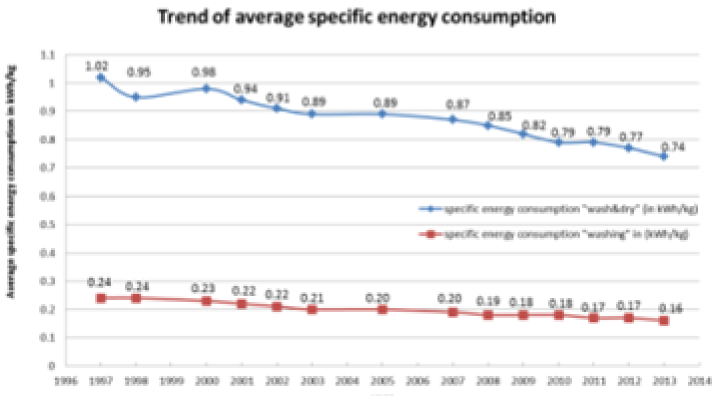


Figure A5.5: **Progressive distribution of Energy Efficiency classes of washer-dryer models 1997-2013 (CECED 2014)**

Recent user surveys indicate that manufacturers have designed the washing conditions of "standard cotton programmes" with energy use optimisation in mind, in order that machines are able to receive the best possible EU Energy Label, at the moment of purchase. However, these design strategies have often led to longer washing programmes that, in reality, consumers use less frequently. It has been shown that for convenience, consumers often choose less energy-efficient (e.g. shorter) programmes, and frequently run their WM only partially loaded. (These consumer behaviour patterns may, understandably, also be related to historical, greater familiarity with shorter washing programmes from past experience). As a consequence, the actual energy and water consumption under real-life conditions of household washing machines is, on average, 30% higher than the value of those figures displayed on the EU Energy Label declaration. This value is based, therefore, for the time being, on water and energy optimised programmes that are only partially used.

Household washer-dryers have higher average energy consumption values than washing machines, since they also dry the textile load. Considering the "wash & dry" cycle (washing and drying of the whole load), absolute energy consumption increased by 0.5 kWh per cycle from 1997 to 2013 (4.95 to 5.44 kWh/cycle). This is due to the increased capacity of the machines on offer, over time. However, the specific energy consumption (per kg of laundry) has shown steadily declining values, from 1.02 kWh/kg in 1997 down to 0.74 kWh/kg in 2013 (see Figure A5.6).



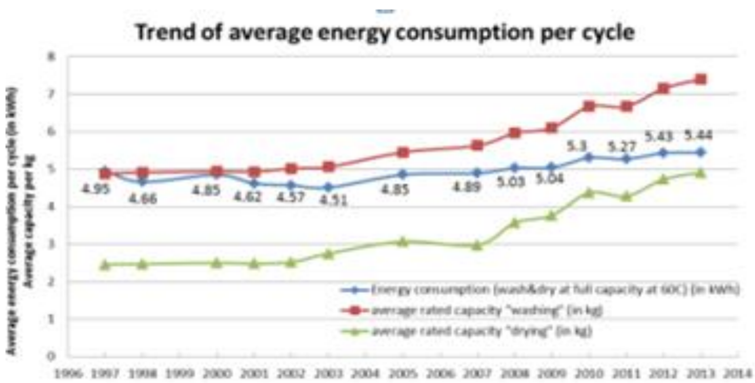


Figure A5.6: **Development 1997-2013 of the average energy consumption of "wash&dry" cycle per kg (above) and the overall energy consumption of the "wash&dry" cycle (below). Source:(CECED 2014)**

5.1.2.2 Water consumption

Washing machines average water consumption *per cycle* has significantly declined between 1997 and 2005, but has since then stabilised (Figure A5.7). By contrast, water consumption *per kg* of rated capacity has steadily decreased, from 13.9 litres/kg in 1997 to 6.5 l/kg in 2013. The difference in the results expressed per cycle and per kg is due to the increased average rated capacity (in kg load) of washing machines.

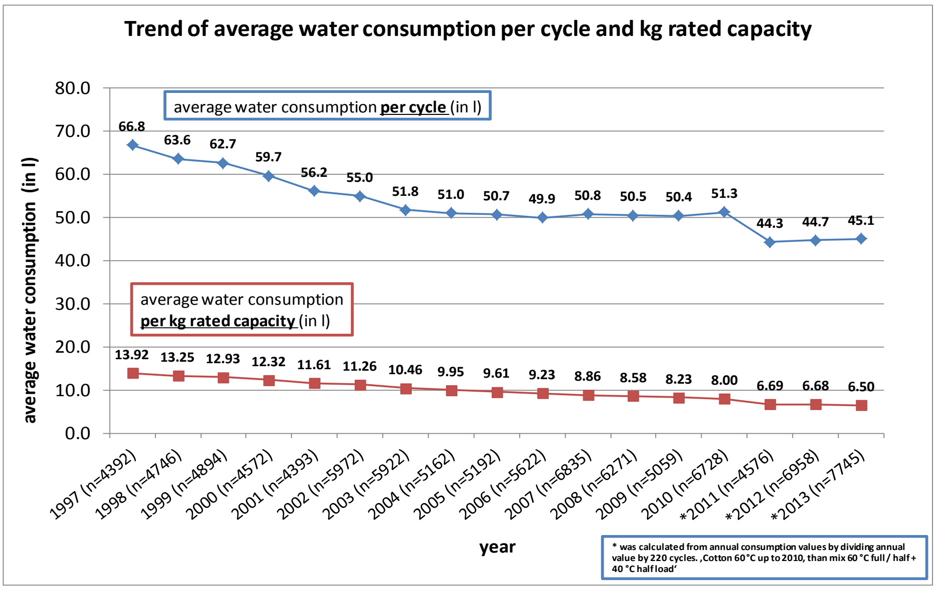


Figure A5.7: **Development of average water consumption per cycle and per kg (CECED 2014)**

For household washer-dryers, the average water consumption of the "wash & dry" cycle declined from 129.7 litres/cycle in 1997 to 98.1 litres/cycle in 2013 (see Figure A5.8). This represents an improvement of 24%. Nevertheless, most washer-dryers on the market still consume around twice as much water as a washing machines of the same capacity. Perhaps counter-intuitively, this is due to the need for additional water to cool down the air in the drying process (only washer-dryers equipped with air/air condensing or heat-pump drying do not use water during this stage). The average specific water consumption rate per model capacity has been reduced by half from 26.8 litres/kg in 1997 down to 13.4litres/kg in 2013 (see Figure 9). This is again due to a combination of lower absolute values, but increased capacities, over time.

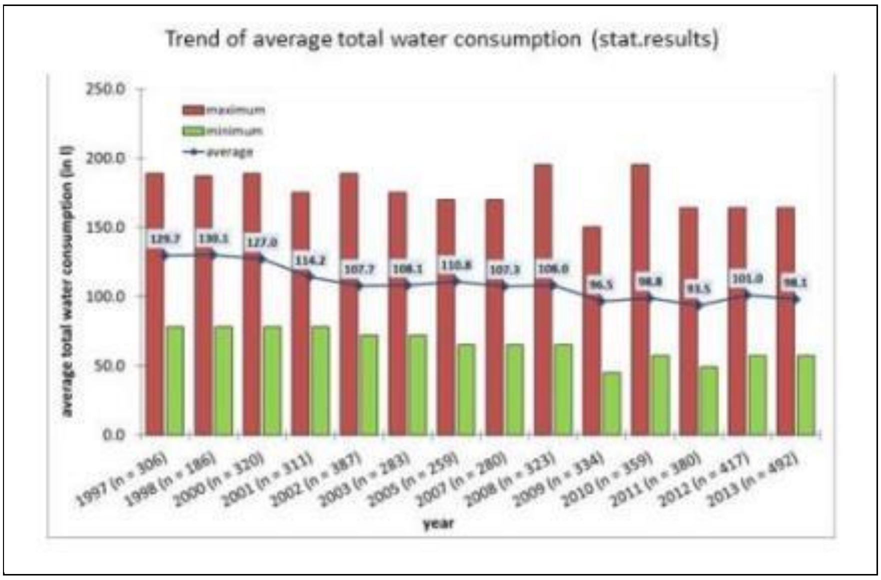


Figure A5.8: **Average total water consumption of washer-dryer models (statistical results based on CECED 2014))**

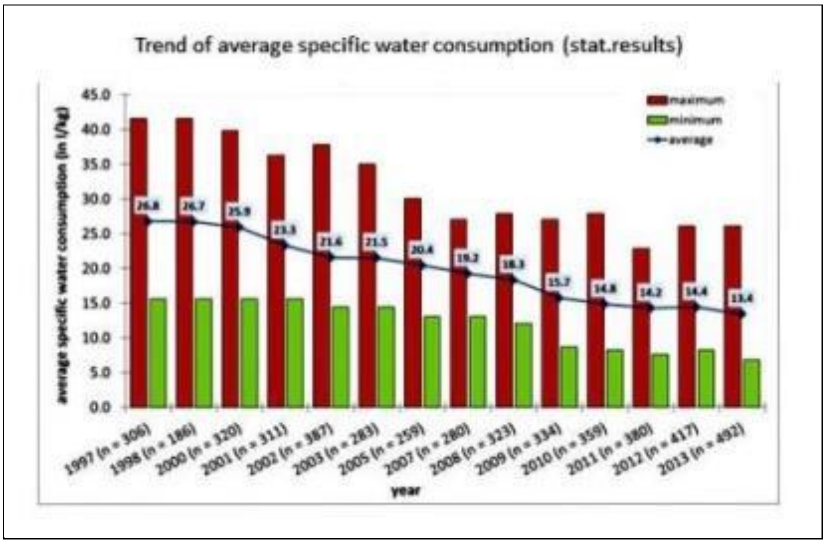


Figure A5.9: **Average specific water consumption of washer-dryer models (statistical results based on CECED 2014))**

5.1.2.3 Spin drying performance and spin speeds

Washing Machines

According to the EU Ecodesign Regulation (EU) No 1015/2010, its subsequent revision over time had to assess, inter alia, the opportunity for setting requirements on spin-drying efficiency. Spin-drying performance ("efficiency" in the current wording) is part of the information displayed on the label. The spinning performance is expressed via an A-G scale, with A being the best performing class. Currently, there are no ecodesign requirements on spin-drying performance.

Spin-drying is an energy-consuming function. However, spin-drying is more efficient than tumble drying in terms of energy consumption. Thus, if consumers use both a washing machine and a tumble dryer or they dry the laundry in a heated room, improving the performance of the spinning prior to placing the wash load in the tumble dryer or in the heated room can bring about overall energy savings. However, higher spinning speeds can produce more creasing (wrinkle formation), which is not ideal when line-drying, and may subsequently require more use of relatively higher energy-intensity ironing, to "iron out" the creases..

According to the CECED (2014) database, in 2013 around 56% of washing machine models fell into spin drying class B, 18.5% in class A and 20% in class C. Products in the other spin drying performance classes account for the remaining 5% product distribution (see Figure A5.10).

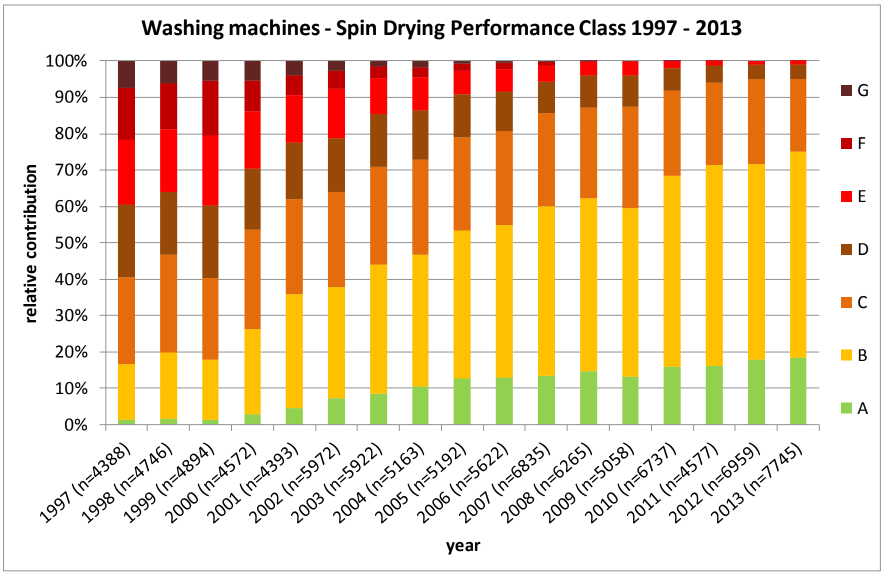


Figure A5.10 **Distribution of spin drying performance classes for washing machines from 1997-2013 (CECED 2014)**

Spin speed is a main driver for the drying efficiency value. The more the laundry is spun, the less energy is subsequently needed to dry it. Figure A5.11 shows a clear trend of substituting low spin speed machines (at 900 rpm or lower) with higher spinning machines. These results illustrate a steady increase in the average spinning speed from just over 800 rpm in 1997 to slightly more than 1200 rpm in 2010.

According to the available data, the maximum spin speed of machines is 1000-1600 rpm. The proportion of machines with spin speeds of less than 1000 rpm has decreased over the last decade, and the market share is negligible for maximum spin speeds in excess of 1600 rpm. Machines with 1800-2000 rpm appeared on the market at the end of 1990s, but they disappeared because higher spin speeds barely reduce the remaining moisture but do significantly increase product costs. Additionally, safety requirements impose limits on the maximum spin speed[12].

Given users' different needs in terms of drying and spinning, together with geographical (e.g., availability of sun for natural line-drying) and possibly socio-cultural (time, tradition) effects, assessing possible trade-offs is complex, with high uncertainty and variability. Taking line-drying and ironing (together with changes in the materials used commonly for clothes) into account, as well as the market transformation observed with the use of the energy label, it is suggested that the current information on spin-drying efficiency classes should be removed from the Energy Label and kept in the product information sheet. One progressive change is that the spin-drying efficiency information should be accessible through a QR code on the energy label. It is suggested to refrain from putting in place Ecodesign requirements on spin-drying.

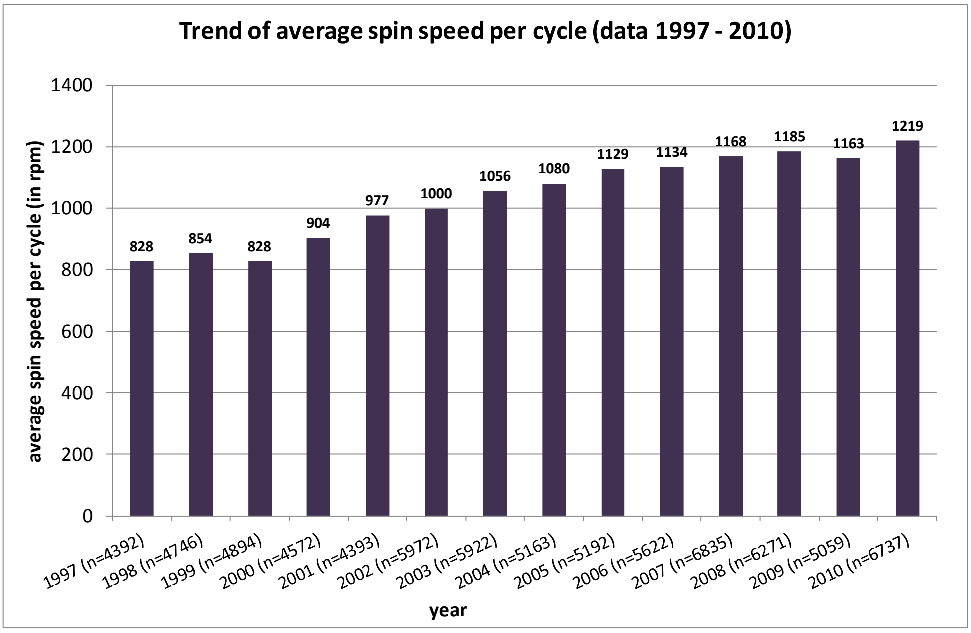


Figure A5.11: **Development of average spin speed per cycle (CECED 2014)**

Household washer-dryers

For household washer-dryers, the picture is slightly different, as the use of so-called "wash & dry" programmes benefit from higher spin speeds. Figure A5.12 shows a continuous increase in the average maximum spin speed from circa 1102 rpm in 1997 to circa 1400 rpm in 2013.

In 2013, over 60% of the machines had a spin speed of around 1400 rpm, just over 15% of the machines had spin speed declarations of 1200 rpm and 1600 rpm. Note that less than 5% had declared spin speeds of higher than 1600 rpm.

[12] Danger comes from the fact that centrifugal force does not increase in direct proportion to an increase in speed, but instead it increases as the square of that speed increase. When rotational speed doubles, centrifugal force quadruples. This effect means that relatively small changes in speed can produce significant increases in force

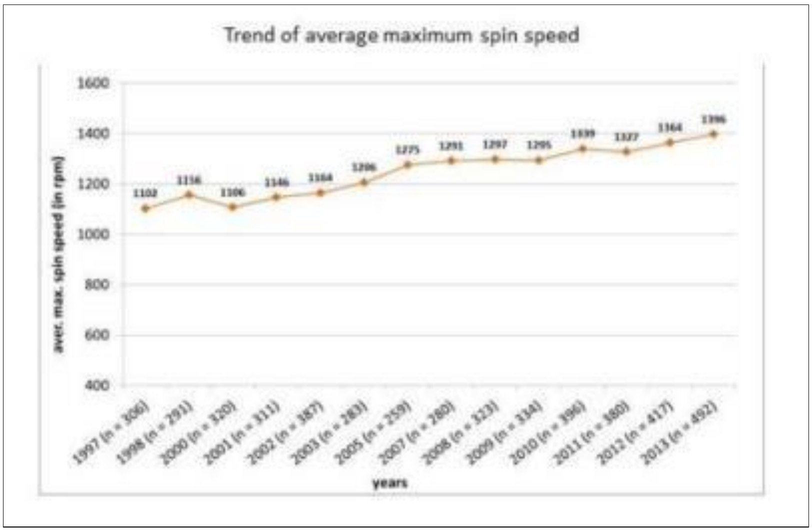


Figure A5.12: **Trend of average maximum spin speed of washer-dryer models (CECED 2014)**

5.2 Policy scenarios for washing machines

This option considers the setting of Ecodesign requirements in combination with Energy Labelling as combined market "*push and pull*" effect. The simultaneous revision of both measures (Ecodesign and Energy Label) will ensure that the introduction of Ecodesign measures will have the effect that the least efficient models are removed from the market. The simultaneous revision of the labelling scheme ensures that he revised scheme is adapted to the impacts of proposed Ecodesign measures on the market and should ensure that the label is able to function as a market tool to drive household washing machine's efficiency. Additionally, the simultaneous revision of both regulations ensures the synergic effect of the pushing effect of the Ecodesign specific requirements and the pulling effect of the new labelling energy efficiency scales as well as the harmonization of both measures.

In order to analyse the impact of the different alternatives, the performance of the washing machines under the respective conditions of each scenario has been modelled. The model provides the energy and water consumption values of three average washing machines that represent models equipped with the best not yet available technology (BNAT), best available technology (BAT) and worse available technology (WAT) for rated capacities between 5kg and 15kg. Thanks to this model, for each of the scenarios proposed the BNAT values will represent machines in class A while WAT values will be considered representative of the class G.

5.2.1 BAU

The total sales of household washing machines in the EU-28 were close to 202 million units in 2016 which leads to an average penetration rate across Europe of 92%. The results of the estimations show that the EU28 total sales remains stable in the coming years around 15 million units, being the purpose of most of the units to replace old machines in the stock.

Of the approximately 15 million units sold in EU 28 in 2016, one quarter were washing machines with a rated capacity equal or lower than 6kg, 31% had 7kg rated capacity, one quarter had 8kg rated capacity and the rest were larger than 8kg rated capacity. This increase in the rated capacity in the last years has been partially due to the EEI as washing machines with higher rated capacities are likely to get a better Energy Label classification. Even due to the limitations in volume of the household washing machines to fix in the kitchens (60cm x 60cm x 90cm) this trend does not seem to have reached its end. The relation between larger capacities and higher energy classes is given in Table A5.2.

	≤6 kg			**7 kg**			**8kg**			**≥9kg**		
Year	**A3+**	**A2+**	**A+**	**A3+**	**A2+**	**A+**	**A3+**	**A2+**	**A+**	**A3+**	**A2+**	**A+**
2012	8%	23%	83%	28%	45%	23%	93%	5%	2%	93%	5%	1%
2013	28%	26%	50%	54%	29%	17%	78%	14%	8%	86%	10%	3%
2014	18%	42%	33%	37%	41%	11%	71%	22%	6%	71%	17%	8%
2015	28%	27%	42%	70%	19%	15%	90%	7%	4%	90%	9%	1%
2016	41%	31%	28%	77%	15%	8%	93%	5%	2%	93%	5%	1%

Table A5.2. Energy efficiency class and distribution depending rated capacity of the household washing machines

For the business-as-usual (BAU) scenario, the sales are assumed to remain approximately constant as it is considered a saturated market and that the penetration rate will be constant in the coming years (close to 92%). The current electricity consumption of the household washing machines is 29.3 TWh in 2015, up from the 27.7TWh in 2006 and under the assumptions of the BAU scenario it would decrease to 25.9 TWh/year in 2030 due to a slow technological progress.

The current water consumption of household washing machines is 2272 million m^3 in 2015, down from 2362 million m^3 in 2006 and projected that under the BAU scenario would decrease to 1633 million m^3 in 2030.

With all products in only three Energy Label classes and the current Ecodesign limit, it is questionable that any further energy saving will be achieved. In fact, the BAU scenario it is assumed that the Energy Label will lose its effectiveness in differentiating the products decreasing the demand for more energy efficiency appliances.

Base cases

The base cases with major market share should be included in the baseline scenario to establish the energy consumption most representative of the sector. In this subsection, sensible base cases have been established in close consultation with the industry. It should be noted that base cases identified for the impact assessment are different from the review study regarding the rated capacity but are the same regarding other aspects such as the energy efficiency class, water consumption or purchase price (in the review study only a 7kg washing machine was considered).

The main common characteristics of the washing machines base cases are included in Table A5.3.

	≤6 kg	**7 kg**	**8kg**	**≥9kg**
Nominal rated capacity (kg)	6	7	8	9
Number of cycles per year	220			
Average loading (kg)	3.33			
Observed retail Price (EUR)	413			
Manufacturing cost (EUR)	148			
Maintenance and repair costs for the consumer (in €/lifetime)	45			
Energy consumption wash (kWh/y)	130.69	164.98	202.97	245.08

Water consumption (m3/year)	11.87	11.87	11.87	11.87
Detergent consumption (g/cycle)	75			
Washing performance class	A			
Spin drying performance class	B			
Lifetime (years)	12.5			

Table A5.3. Base cases of washing machines

5.2.2. Scenario A: Minimum temperature to be reached in all treatments

Scenario A analyses the impacts of implementing a minimum temperature to be reached by all the treatments. This measure will allow to set a well-defined requirement however, at the time of implementing, this measures of the temperature inside the load can be challenging for each manufacturer as s/he has no direct control of this measurement. The only control that the manufacturer has is the heating temperature of the water outside the drum and the duration of this heating operation. The temperature inside the load is then governed by the soaking process of the load. The repeatability and the reproducibility of this process and, thus, the temperature measurement inside the laundry core is currently unknown but the standardization group is working on this point with positive impressions.

Two options have been considered under this scenario A, while keeping in both cases a washing performance of 1.03 with cotton 60C as reference programme:

- *scenario A1*: *a minimum temperature of 30C in all the treatments*.
- *scenario A2*: *a minimum temperature of 35C in all the treatments*.

The minimum temperature in the laundry core is one of the most important parameters in the EEI calculated and thus on the declaration and fulfilment of the Ecodesign requirements of the washing machines. Additionally, this is one of the parameters that mostly influence the duration of the cycles (the higher the temperature the shorter the programme duration) and consequently the acceptance of the testing programmes by the consumers (the shorter the testing programme the higher the likelihood to be used by the consumers).

5.2.3. Scenario B: Minimum temperature to be reached in all treatments

Scenario B analyses the impacts of implementing a time cap for all treatments. Regarding the consumers survey results, the duration of the cycle is one of the main parameters for being used. This survey confirmed that for the same level of washing performance, consumers' acceptance increases provided programme duration decreases. Indeed, for the same level of washing performance consumer acceptance reached 42% when the programme duration was 2h but dropped to 13% when the programme duration increased up to 5h.

For the same level of the washing performance, the programme duration depends mainly on two variables: the temperature reached in the laundry core and the loading. As commented in the scenario A, the programme duration is inversely correlated to the temperature reached in the laundry core. On the other hand, the programme duration is directly correlated to the loading of the cycle. The higher the loading the longer the cycle takes.

Setting a time cap aims at increasing the acceptance of the testing programmes by the consumers. Using the testing programmes the potential energy and water savings would be realized to a further extend. Several options have been considered on how to set a sensible time cap:

- *scenario B1*: *a time cap of 3h for all the treatments*. This scenario considers a unique time cap to be applied to all the treatments. This measure will allow to set a well-defined requirement but a programme duration of 3h will have an expected acceptance of approximately 23% of the consumers
- *scenario B2*: *a time cap for each of the loadings (3.5h for full load, 2.5 for half load and 2h for quarter load).* This measure aims at imposing the same level of strictness to each of the treatments that are part of the testing portfolio, allowing longer cycles for full loads. Additionally, this measure aims at increasing the acceptance of the testing programmes by the consumers as the time cap for the half load and quarter load are shorter.
- *Scenario B3*: *a time cap for half and quarter loadings and information of the full time programme duration on the Energy Label.* This measure focuses on doing more attractive the half and quarter loadings for the consumers as they are the loadings mainly used according to the consumer survey (average loading is around 3.3kg/cycle) and leave unregulated the duration of the full load treatment. Under this scenario, two possible reactions of the manufacturers have been simulated:
  - *Scenario B3.1* assumes that manufacturers will focus on optimising the energy efficiency of the full load treatment by decreasing the temperature in the laundry core and increasing its duration. Following this strategy washing machines will get a better energy efficiency classification but will show durations close to the current standard programme durations (e.g. 5-6h)
  - *Scenario B3.2* assumes that manufacturers will focus on optimising the duration of the full load treatment by increasing the temperature of the laundry core close to 40C. This strategy will display duration on the Energy Label shorter than the previous one but will increase the energy consumption of the washing machine and being awarded with lower energy efficiency class than in the previous alternative.

  The likelihood of this last alternative is considered to be quite low according to Brazil and Caulfield (2017). The authors pointed out that consumers easily remembered information such as alphabetical grades or colours when assessing, and not to other figures located in the lower part of the label. Therefore this alternative is discarded in the modelling of the option impacts.

- *Scenario B4*: time cap proportional to the rated capacity. This measures aims at setting a time cap that can be considered as challenging for all washing machines regardless their rated capacity. As commented before, the duration of the programmes depends not only on the temperature on the laundry core but also on the loading or capacity. This means that larger machines will need more time to deliver the same results that smaller machines, what is logic considering that the amount of laundry washed by larger machines is much more than by smaller machines. Two options are considered in this study
  - *Scenario B4*.1: a time cap of this option includes 140 min for all the loadings and additional 20min per kg of laundry for all the treatments. This alternative tries to optimize the heating system install in the machine as the energy consumed to heating up the water is a large contribution of the overall energy consumption of the cycle. The time cap will be ruled by

$$t_{cap} = 2.33 + \frac{loading}{3}$$

- *Scenario B4.2*: a time cap as suggested before for full and half loadings and the time cap for the quarter loading will equal the half loading time cap. This alternative gives incentives to the manufacturers to not only optimize the energy consumed used by the heating system but also to optimize the energy consumed by the motor. This optimization of the motor performance will be beneficial for any other programme in the machine.

5.2.3. Scenarios for further analysis

From the above scenarios and according to the results of a preliminary analysis, three scenarios were selected for a further analysis: scenario A2 re-called as "Minimum temperature 35C" (POWM 2), scenario B3 recalled as "Time cap of 3h for half and quarter loadings and information of the duration of the full load on the energy label" (POWM 3) and scenario B4.2 recalled as "proportional time cap" (POWM 4). Each of the scenarios has a different rescaling and a different SEc as shown in the following Table.

POWM 2		**POWM 3**		**POWM 4**	
	T1&T2		**T1&T2**		**T1&T2**
A ≤ 70 70 < B ≤ 76 76 < C ≤ 82 82 < D ≤ 89 89 < E ≤ 96 96 < F ≤ 104 104 < G	Tier 1: 112 in April 2020 Tier 2: 96 in April 2024	A ≤ 60 60 < B ≤ 66 66 < C ≤ 73 73 < D ≤ 80 80 < E ≤ 88 88 < F ≤ 97 97 < G	Tier 1: 107 in April 2020 Tier 2: 88 in April 2024	A ≤ 65 65 < B ≤ 71 71 < C ≤ 77 77 < D ≤ 84 84 < E ≤ 92 62 < F ≤ 100 100 < G	Tier 1: 109 in April 2020 Tier 2: 92 in April 2024

Policy options	**SEc**
POWM 2	$SE_C = -0.0022\ c^2 + 0.0671\ c + 0.5352$
POWM 3	$SE_C = -0.0025\ c^2 + 0.0737\ c + 0.3677$
POWM 4	$SE_C = -0.0025\ c^2 + 0.0846\ c + 0.3920$

Table A5.4 Energy efficiency limits for each of the scenarios further analysed

Additionally, the energy consumption of the washing machine is a weighted average between of the three loadings at which the testing programme should be run. The weighting factors applied to each of the treatments (loadings) depend on the rated capacity of the washing machine according to the following equations.

$$A_{full\ load} = -0.0391\ x\ c + 0.6918$$

$$B_{half\ load} = -0.0109x\ c + 0.3582$$

$$C_{quarter\ load} = 1 - (A_{full\ load} + B_{half\ load})$$

Where c is the rated capacity of the washing machines or the washing rated capacity of the washer dryers.

After conclusion of this assessment, new information based on the updated database of APPLiA showed that the EEI values of the 'Best Available Technology' and, to a much smaller extent, of the 'Worst Available Technology', were over-estimated. As the error affects all policy options in a similar way, this did not put in question the overall conclusion but it led to re-calculate the energy category scale and minimum requirements as follows:

Energy Label bandwidth	Ecodesign requirements (Tiers)
A ≤ 52 52 < B ≤ 60 60 < C ≤ 69 69 < D ≤ 80 80 < E ≤ 91 91 < F ≤ 105 105 < G	Tier 1: 105 in April 2021 Tier 2: 91 in April 2024

5.3 Policy scenarios for household washer dryers

5.3.1. BAU

All other inputs needed for the model were estimated in the same way as in the case of the washing machines. The purchase price of the washer dryers was considered as 826 euro$_{2015}$ with a rated washing capacity of 7 kg, energy consumption in the continuous wash&dry cycle of 0.823kWh/kg and a water consumption of 16.1l/kg.

In 63% of the wash cycles, washed clothes are then dried in the WD, either in continuous (32.6% of the washes) or interrupted (30.4% of the washes). In the rest of the cases (37% of the cycles) other methods for drying were used, e.g. a clothes line.

5.3.2. POWD 2 (ED+EL (T1))

POWD 2 analyses the impacts of implementing a proportional time cap depending on the capacity as proposed in POWM 4 for all the treatments and a cupboard dry in a wash&dry cycle. This measure combines the requirements of the washing process that are considered the same as for washing machines and includes the drying process in the most characteristic programme of this appliance.

This scenario assumes a Tier that will enter into force in 2020 and that remains at a similar level that the currently worst available machines on the market. It means, it is not expected to remove a significant number of models from the market

5.3.3. POWD 3 (ED+EL T1&T2)

POWD 3 analyses the impacts of implementing a proportional time cap depending on the capacity as proposed in POWM 4 for all the treatments and a cupboard dry in a wash&dry cycle. This measure combines the requirements of the washing process that are considered the same as for washing machines and includes the drying process in the most characteristic programme of this appliance.

This scenario assumes two Tiers that will enter into force at two different points in time 2020 and 2024 respectively. Tier 1 remains at a similar level that the currently worst available machines on the market, but Tier 2 set a minimum energy requirement that is approximately 80% more ambitious than the Tier 1. It means, just before entering Tier 2 into force some models will be removed from the market

Both scenarios have the same rescaling and SEc as shown in the following Table.

Energy Label bandwidth	Ecodesign requirements (TIERS)
A ≤ 60 60 < B ≤ 66 66 < C ≤ 73 73 < D ≤ 80 80 < E ≤ 88 88 < F ≤ 97 97 < G	Tier 1: 107 in April 2020 Tier 2: 88 in April 2024

Table A5.5 Energy efficiency limits for each of the scenarios further analysed

Where: $SEc = 0.0088 * c^2 - 0.2494 * c + 2.296$

After conclusion of this assessment, stakeholders reported that the formula for SEc was not suitable to represent the lowest performing technologies. Furthermore, new updated information was released in the product database of APPLiA that allowed to re-calculate the values of the energy efficiency for the 'Best Available Technology' and the 'Worst Available Technology' and, on this basis, of the SEc formula. As the change affects all policy options in a similar way, this does not put in question the overall conclusion but it led to re-calculate the energy category scale and minimum requirements as follows:

Energy Label bandwidth	Ecodesign requirements (Tiers)
A ≤ 37 37 < B ≤ 48 48 < C ≤ 63 63 < D ≤ 76 76 < E ≤ 88 88 < F ≤ 100 100 < G	Tier 1: 105 in April 2021 Tier 2: 88 in April 2024

Where:

$$SE_C = -0,0502 * c^2 + 1,1742 * c - 0,644$$

Annex 6: Analytical model

6.1 Testing programmes for household washing machines

The differences between the actual use conditions of the household washing machines and the current eco-design and energy label regulations triggered a revision of the testing programmes. Information gathered in the review study indicates the significant improvement potential for the energy efficiency of household washing machines could be realized if consumers were willing to use more often the most energy efficient programmes and to increase the loading conditions. Additional energy savings would result from the implementation of technical innovation, which would be effective if loading conditions increased.

Due to the lack of data regarding the performance of the washing machines under the conditions of the new testing programmes and the conditions set by the different scenarios an analytical model was created.

The model estimates that the energy consumption of a washing machine can be split in five factors:

- the amount of water which needs to be heated to a certain temperature
- the energy of the motor to rotate the drum during washing and during spinning
- the auxiliary energy (such as for electronic parts and pumps)
- the energy needed to heat up the structure of the machines (drum, tub, concrete. etc.)
- the energy needed to heat up the loading.

Additionally, it was considered that there are three types of machines:

- Best Not Available Technology
- Best Available Technology
- Worse Available Technology

The main differences between the three types of technology rely on the amount of water to be heated up, the efficiency of the motor and auxiliaries and the isolation of the machines and possible heat losses.

The amount of water to be heated is commonly considered to be made up to separate parts: one which describes the aster soaked up by the laundry (bound water) and the other which is between the drum and the tub and not bound (free water). This free water has the task of taking up the heating energy and transporting it, together with the detergent, into the laundry and exchanging it with the bound water. Thus there is an active continuous water transportation process. Regarding the BAT it is assumed that the bound water is around 200% of the load weight, as defined in the EN 60456. The free water for a 5kg rated capacity machine is assumed to be 3 litre increasing by 0.5 litre per kg. Machines using the drenching system manage to wash the load at an un-saturated level of water uptake, at about 140% bound water. These machines also use alternative ways of heating up the load by utilising the condensation energy of the steam produced. Thus they have the advantage of having to heat up less water to the target temperature. However, they have more heat losses due to the steam production. Moreover, those systems which apply the drenching system do this only for small loads, they cannot wash a full load under these energy saving conditions. Therefore, this is assumed to represent the BNAT level.

Motor and auxiliaries (sensors, actors and electronics) need energy to be driven. The motor and auxiliary energy use is assumed to be at 90W for BAT and 80W for BNAT for 5kg washing machine, and to increase proportional to the rated capacity. The motor and auxiliary energy use for WAT is assumed to be at 120W for a 5kg washing machine and to increase proportionally when operated with a full load. Additionally, it is assumed that the motor and auxiliary energy use is approximately the same for full and half load and 10% lower for quarter load.

The energy use in heating up the structure was estimated based on the weight of the washing machine and the specific heat capacity. It is assumed that a 5kg washing machine weighs 70kg and the structural parts are heated up by 50% of the temperature difference between the room temperature (23C) and the temperature of the laundry. The weight of the washing machines is supposed to increase 2% proportional to the rated capacity. No difference is assumed for smaller load sizes and no differences for BAT, BNAT or WAT.

Finally the energy used to heat up the load is calculated considering a specific heat capacity of 1150kJ/kg K for cotton. No differences between BAT, BNAT or WAT were considered.

Other parameters such as noise or remain moisture content (RMC) are assumed not to be affected by the technology used in the washing machine. The noise level is assumed to stay the same if measured at full load and the RMC is assumed not to change between the full load and the half load. The quarter load can be worse that those values but it has not been estimated.

Using the conditions described above it is possible to calculate the total energy consumption for washing machines fulfilling the requirements of a certain minimum temperature in the core of the load or a minimum time cap depending on the load size, the rated capacity and the BAT, BNAT or WAT scenario.

6.2 Energy efficiency index (EEI) for household washing machines

The method for calculating the Energy Efficiency Index (EEI) is essential to be revised. The current method includes:

- The annual energy consumption (AE_c) of the household washing machine calculated in accordance with the technical specifications set in the standard EN 60456/2011, on the basis of 60C cotton programme at full and half load, 40C cotton programme at half load and the left-on mode and off-mode.

- The standard annual energy consumption (SAE_c) that was calculated reflecting the market situation before the introduction of the EU regulations 1015/2010 and 1061/2010 and that equals $SAE_c = 47.0 \times c + 50.7$ where c is the rated capacity of the household washing machine for the standard 60C cotton programme at full load or the standard 40C cotton programme at full load, whichever is the lower.

A revision of the regulations shall specify a new testing method which represents current loading conditions (3.3 kg/cycle on average) and the test the capacity of appliances to adapt to the load, e.g. by testing different loading conditions (partial, e.g. ¼ and 1/2 and full loads). Additionally, along these years an increase in the average rated capacity of the washing machines have been observed. This increase is suspected to incentivise by the current EEI formula that makes easier to achieve better energy efficiency classes to larger machines.

In this revision, the information regarding the energy and water consumption provided to the consumers to allow them to compare among the different models in the market is proposed to be communicated per cycle. Up to now the information has been communicated on an annual basis but stakeholders considered that it is more transparent to be communicated on a cycle basis even if the comparison of decimal number could be more challenging. In the annual basis option, 220 cycles/year were assumed as basis for the calculation. This assumption does not reflect each specific consumer situation. This change in the basis affects the calculations of the energy consumption of the machine as well as of the standard energy consumption.

Thus, the energy consumption of the household washing machine is proposed to be calculated on a cycle basis including the energy consumed for washing, rinsing and spinning the laundry. The energy consumption of the low power modes will be regulated separately as indicated in section 5.4. The energy consumption per cycle includes the energy consumption of the cotton 40C programme at three loadings: full, half and quarter each of them multiplied by a weighting loading factors that depend on the rated capacity of the machine.

The loading factors aim at weighting the contribution of the full, half and quarter loads to the energy consumption of the washing machine in accordance with the likelihood of being loaded in that load range. To estimate the value of the weighting factors for each rated capacity the data reported by Kruschwitz (2014)[13] were considered. According to Kruschwitz (2014) consumers' average laundry loads amount to 3.4 kg ± 1.2 kg, even if the average rated capacity of the machines has been increasing in the last years and reached and average value of 7.2kg ± 1.2 kg. It was assumed that the consumer loading behaviour is normally distributed (Gaussian distribution) then the factors can be calculated by the following equations:

$$A_{full\ load} = -0.0391\ x\ c + 0.6918$$

$$B_{half\ load} = -0.0109 x\ c + 0.3582$$

$$C_{quarter\ load} = 1 - (A_{full\ load} + B_{half\ load})$$

Where *c* is the rated capacity of the washing machine.

The loading factors as reconsidered in this impact assessment provide compensation for the large washing machines regarding the actual consumer loading. This is done by given more weight to the quarter and half loads

The factors defined in the working documents presented in the consultation forum as well as the SEC used were not accepted because, even with the introduction of the weighting factors, the EEI reduces with increasing rated capacity. Thus machines with a higher rated capacity would be significantly preferred. In order to correct the tendency of

[13] Kruschwitz, A., Karle A., Schmitz, A., and Stamminger R., (2014) Consumer laundry practices in Germany, Int. J. of consumer studies, 38(3), pp 265-277

the weighting factors presented in the working documents those presented in this section can be applied.

Second, the SEC should be defined in an alternative way as presented in the working documents at the consultation forum. It is proposed in this impact assessment to take the average energy consumption of the WAT as SEC. Applying the algorithm to the energy consumption values calculated for BNAT, BAT and WAT reveals an almost constant classification of the EEI for all rated capacities.

6.3 Acceptance of the testing programmes (Use correction factors) for household washing machines

Taking into account the acceptance of the consumers of different programme durations, a redistribution of the use percentages for the programmes that disappear with the new regulation has been done and plotted in Table A6.1. E.g. in the scenario of the minimum temperature 30C, the users of the new normal 40-60 cotton would be ca. 33%, this is calculated as follows:

- all those that were using standard. 40 cotton and all those using st. 60 cotton [17%=10%+7%]
- 21% of those using normal cotton 40 and 60 would accept the longer duration of 4h [5.46%=0.21*(15+11)]
- Form the remaining ca. 80% of users, we assume that half will be smart enough to understand that they are only using half load, so that the new cotton 40-60 will be fine [10.4=0.4*(15+11)]

Table A6.1. Programme duration acceptance by consumers (preparatory study for washing machines and washer dryers)

Programme duration	Acceptance by consumers
2h	43%
3h	23%
4h	21%
5h	13%

Table A6.2. Share of use percentage distribution for the different Ecodesign scenarios

Share of use Scenarios Ecodesign		$3.5h_F$-$2.5h_H$	$4h_F$-$2.5h_H$	$5h_F$-$3h_H$	$3.8h_F$-$2h_H$	$3.8h_F$-$2.3h_H$	$3.5h_F$-$2.5h_H$	$3.8h_F$-$2.3h_H$	3h	$4h_F$-$2.5h_H$	$3.8h_F$-$2h_H$
	BAU	time cap 35h/2.5h/2h	temp min 30C	time cap 3h half & opt EL	min temp 35C	min temp 35C & time	prop time cap	time cap & time comp	time cap 3h	prop time cap Stammering er	prop time cap stricter
standard 40° cotton programmes	10%										
standard 60° cotton programmes	7%										
normal 40°cotton	15%										
normal 60° cotton	11%										
40-60 cotton		40%	33%	31%	42%	38%	40%	38%	39%	33%	42%
- superquick (20-30 min)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
- normalquick (45-70 min)	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Synthetic/easy care	11%	13%	14%	15%	11%	14%	13%	14%	13%	14%	13%
Cotton 30°C	10%	11%	13%	13%	11%	11%	11%	11%	12%	13%	11%
Mix	9%	9%	9%	9%	9%	9%	9%	9%	9%	10%	9%
Cotton 90°C	5%	6%	9%	9%	6%	6%	6%	6%	6%	9%	6%
Cotton 20°C	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Eco light	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Others	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%

6.4 Testing programmes for household washer dryers

The differences between the actual use conditions of the washer dryers and the current energy label regulation triggered a revision of the testing programmes. Information gathered in the review study 2017 indicates the significant improvement potential for the energy efficiency of household washer dryers if the testing programmes optimized by the manufacturers are used by the consumers.

6.5 Energy efficiency index (C) for household washer dryers

The household washer dryers currently do not have an EEI index. Howerver, they are classified regarding their energy performance based on their energy consumption, so-called "C". "C" is calculated in kWh per kg complete operating (washing, spinning and drying) cycle using standard 60C cotton cycle and "dry cotton" drying cycle, determined in accordance with the test procedures of the harmonized standards. The household washer dryers are tested at the washing rated capacity, meaning that several drying process are needed to dry the whole laundry.

This index is not in line with the index used for the household washing machines and other appliances where an EEI index is defined. In this sense, in this Impact assessment an EEI index for washer dryers is proposed, as follows:

$$EEI_{washer-dryers} = \frac{Energy\ consumption\ per\ wash\&dry\ cycle}{SEc}$$

Where SEc is the standard energy consumption. SEc is correlated with the wash&dry rated capacity according to the following equation

$$SEc = 0.0088 * c^2 - 0.2494 * c + 2.296$$

After conclusion of this assessment, stakeholders reported that the formula for SEc was not suitable to represent the lowest performing technologies. Furthermore, new updated information was released in the product database of APPLiA that allowed to re-calculate the values of the energy efficiency for the ‘Worst Available Technology’ and, on this basis, of the SEc formula.. The new formula for SEc was recalculated as follows:

$$SE_C = –0,0502 * c^2 + 1,1742 * c – 0,644$$

6.6 Model structure for household washing machines and household washer dryers

6.6.1 Sales and Stock

General data availability for the scenario analyses of household washing machine and household washer-dryers appliance is good. For sales, stock and prices of the washing machines and household washer dryers stakeholders provided information and for energy efficiency there are time series of APPLiA database.

The review study used APPLiA- data up to 2014, for the impact assessment the databases for 2015 and 2016 were added. The reliability of most data could be checked by various sources and ultimately the data were confirmed by stakeholder consensus in various stakeholder meetings, bilateral and plenary.

For the market estimation, the so-called "*stock model*" was used as basis for estimating the EU stock of household washing machines and household washer dryers from the penetration ratio (number of households that own a household washing machines and household washer dryers) and the forecast of households in Europe. The stock model was modified by assuming a Weibull distribution for the lifetime of the appliances with its characteristic parameters α=1.64 and β=13.72 for the BAU scenario according to Prakash et al (2016)[14] having an average lifetime on the market close to 12.3 years.

The real lifetime calculated in this way is the lifetime that is assumed for 2015 in the stock and sales model. The literature reports that he real and technical lifetime of the appliances have not been kept constant along the years. A reduction of the lifetime of the machines has been observed by several authors and modelled by changing the characteristic parameters of the Weibull distribution align the years. For the years 1981-2014 the values considered are in accordance with Balde et al (2015)[15]. For years before 1981, the same parameters are assumed as in 1981. For years after 2014 the parameters are set according to the assumptions which can be found in the review study. A constant distribution between the full-size household washing machines and household washer dryers and the slim-line household washing machines and household washer dryers has been kept (86% and 14% respectively).

Annual growth rates are mainly obtained through forecast of the penetration rate of the household washing machines and household washer dryers in the coming years. These estimations were coming from VHK 2014[16] study and POTENCIA[17].

There is a lack of data for some input parameters such as Weibull factors (for statistic life expectancy estimation), the historical stock, the product lifetime, or other parameters related to the reparability of the appliances, in those cases the same values as for the washing machines were used.

Finally, the penetration rate of the washer-dryers is supposed to keep constant in the future. This is derived from the information the approximately 4% of the washing machines are washer-dryers and the lack of better forecast for the coming years.

[14] Prakash, S.; Dehoust, G.; Gsell, M.; Schleicher, T. & Stamminger, R. in cooperation with Antony, F., Gensch, C.-O., Graulich, Hilbert, I., & Köhler, A. R. (2016). Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung: Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen „Obsoleszenz“: Final report [Influence of the service life of products in terms of their environmental impact: Establishing an information base and developing policies against "obsolescence"].

[15] Balde CP, Wang F, Kuehr R and Huisman J (2015), The global e-waste monitor – 2014. United Nations University IAS – SCYCLE. Available at: https://i.unu.edu/media/unu.edu/news/52624/UNU-1stGlobal-E-Waste-Monitor-2014-small.pdf

[16] Review study on cold appliances, washing machines, dishwashers, washer-dryers, lighting, set-top boxes and pumps. Available at: http://susproc.jrc.ec.europa.eu/Washing_machines_and_washer_dryers/docs/omnibus_studyf_2014-03.pdf

[17] https://ec.europa.eu/jrc/en/potencia

Stakeholders commented that an increased in the penetration rate was expected but they did not provide more accurate data.

6.6.2 Annual emissions

For primary energy conversion, rates for electricity generation and distribution the projections included in PRIMES 2016 were considered. For GHG emissions, the emission rate (in kg CO_2 eq/kWh) does vary over the projection period in line with the overall EU projections as indicated in MEErP and published in PRIMEs 2016.

6.6.3 Consumer expenditure

The impacts of possible policy measures on the consumer expenditure have been analysed. These impacts include a change in the operating expenses (which are usually decreased because of more energy efficient machines) and a change in the purchase price (which is usually increased). The consumer expenditure is calculated as the life cycle costs (LCC) i.e including purchase costs and operating costs (energy, water costs, auxiliary costs (detergents) and repair and maintenance costs.

6.6.4 Purchase price

The purchase price is estimated based on the information included in section 7.4 of the Review study 2017 regarding manufacturing costs, mark-ups for the manufacturers and retailers and the VAT. The manufacturing costs include, when appropriate, the additional manufacturing costs of the improvement options which are added to the base case to achieve better energy performance. The real cost of a product usually decreases over time because the manufacturer's experience in producing that product. In the case of washing machines and washer dryers, a part of the downward trend in purchase price might also be attributed to a change in sales channels, i.e. from specialised electronics retailers to big supermarket chains and internet sales.

An experience curve corrects the real costs of the production with the manufacturer's cumulative production and could be described as a mathematical correlation between the initial purchase price (205 euro in 2015) and the cumulative sales to the power of a positive constant known as the experience rate parameter. The parameters of this mathematical function depend on the maturity of the technology under consideration.

6.6.5 Operating costs

The operating costs consist of the electricity and water costs, maintenance and repair costs, and auxiliaries' costs. The auxiliaries consist of detergent, regeneration and salt and rinsing agent.

The energy consumption of the overall stock at EU 28 per year is calculated multiplied the number of units surviving in a specific year which have entered the market in any year before that date and the average energy consumption of a new machine in that year which the product was purchased as a new unit. The average energy consumption of a new machine is calculated from the distribution of the sales over the label classes when it is purchased.

The energy consumption of each washing machines and washer dryers in a certain label class is calculated at the maximum value of EEI of that energy class. For example, the current A++ class the energy consumption of the machine is taken at EEI=56 even though the class is spread from EEI=56 and EEI=50. This stems from observing the APPLiA database where most of the models in a certain class are declared at the maximum EEI of that class.

The water consumption of each washing machine is calculated based on the simulations to estimate the energy consumption of the BNAT machine and the WAT machine. The value of the water to be heated up has been multiplied by a factor of 3.3. This factor was calculated from several stakeholders' data that varied between 4 and 2.7. Therefore, it is estimated that the water consumption has an uncertainty of approximately 20%. The value of the BNAT free water multiplied by 3.3 is attributed to class A and the value of the WAT free water multiplied by 3.3 is attributed to class G. Values in between follow a linear interpolation.

As regards the various monetary rates, the impact assessment forecast data that are reported in $euro_{2015}$ simplifying future projections of discount rate and inflation rate. Whenever needed, the impact assessment conforms to the MEErP[18]. Historical energy prices were assessed from Eurostat and future energy prices projections rely on PRIMES 2016[19]. Future water prices were estimated by an escalation factor of 2.5%.

The repair and maintenance costs include costs associated with repairing or replacing components that have failed and costs associated with maintaining the operation of the washing machines and household washer dryers. According to the review study, it was assumed that small incremental changes in product energy efficiency produce no changes in repair and maintenance costs over the base case costs. However, washing machines and household washer dryers having significantly higher energy efficiencies (such as those equipped with heat pumps) are more likely to incur higher repair and maintenance costs, because their increased complexity and higher part count typically increases the cumulative probability of failure.

For the auxiliaries' costs, the cost per year per machine is multiplied by the stock on the EU 28 market in that year. The annual average price is assumed constant, the same as for the repair and maintenance costs.

6.6.7 Business impacts and employment impacts

Household washing machines and household washer dryers sold in Europe are big corporations. None of the manufacturers meet the definition of SMEs. So the proposed regulations would not have a significant economic impact on a substantial number of small business entities.

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[18] Kemna, R. B. J., Methodology for the Ecodesign of Energy-related Products (MEErP) – Part 2, VHK for the European Commission, 2011

[19] EU Reference Scenario 2016 Energy, transport and GHG emissions Trends to 2050, available at https://ec.europa.eu/energy/sites/ener/files/documents/20160713%20draft_publication_REF2016_v13.pdf

The model estimates the creation of jobs in the manufacturer and retailer sectors in the BAU and the sub-options under study from 2015 to 2030. The model uses specific ratios to estimate the number of jobs based on the revenues of each sector as shown in Table A6.3.

Table A6.3. Ratios used for the estimation of job creation in the household washing machines and household washer dryers

Sector	Turnover/employee	% jobs in EU	% revenue of the sector
Manufacturer	EUR 180 000 /employee	50%	49%
Retailer	EUR 60 000 /employee	80%	32%

6.7 *Material efficiency requirements*

For the Review Study 2017 and during this impact assessment, numerous resources have been consulted in order to assess the impacts that material efficiency requirements might have on this product group. The aim has been to assess the impacts on the extension of product in-service lifetime, either by measures on extending product durability, or on facilitating repair, thus dissuading any premature irreparable product breakdown, which would trigger unnecessary dismantling or disposal (at an earlier than optimal end of life stage). Cost implications of the requirements were investigated, via feedback after the Consultation Forum, the Review study 2017 and other relevant studies which are ongoing (see Annex 3) or have been recently conducted for the European Commission (e.g. Deloitte 2017, 2018).

While insufficient data is available to calculate the exact impact and consequently the expected environmental savings of the proposed measures on product lifetimes, it is safe to assume that the requirements on availability of repair information and spare parts will lead to significantly more products being repaired instead of replaced, due to higher availability of repair options at lower costs than in the BAU scenario. According to Deloitte 2016[20], technical and cost barriers to repair household washing machines and washer dryers are related to disassembly activities for repair or dismantling operations at the end of life, e.g. difficulties to access some internal components or the need of destroying some components to access to other components. (See Annex 3) It is precisely these barriers that the measures proposed aim to take away.

Estimates of the lifetime of a washing machines or washer dryer range from 10 – 17 years, but most studies find an average of 12,5 years (see annex 3). The proposed measure to make spare parts available for at least 7 years after last marketing of a model would ensure that repairs are possible well into the second half of the lifetime of the washing machines. After that, the added value of repair in terms of additional expected product lifetime begins to diminish, and the demand of consumers for repairs can be expected to follow.

[20] See Footnote 37

6.8 Outputs from the performance model

6.8.1. Estimation of the energy and water consumption for WAT, BAT and BNAT machines under the conditions of POMW 2

The tablesshow the data and assumptions considered to estimate the energy and water consumption of machines considered as WAT, BAT and BNAT under the conditions of POWM 2.

WORST AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	10	12	14	16	18	20	22	24	26	28	30	L
free water (between drum and tub) in L	4.5	5.1	5.7	6.3	6.9	7.5	8.1	8.7	9.3	9.9	10.5	L
total amount of water which needs to be heated	14.5	17.1	19.7	22.3	24.9	27.5	30.1	32.7	35.3	37.9	40.5	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	290	342	394	446	498	550	602	654	706	758	810	kcal
energy needed to heat up the water	0.337	0.398	0.458	0.519	0.579	0.640	0.700	0.760	0.821	0.881	0.942	kWh
programme duration	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	h
motor power	120.0	125.0	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	W
motor and auxiliary energy	0.516	0.538	0.559	0.581	0.602	0.624	0.645	0.667	0.688	0.710	0.731	kWh
load heating-up energy	0.019	0.023	0.027	0.031	0.035	0.038	0.042	0.046	0.050	0.054	0.058	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.991	1.079	1.167	1.255	1.343	1.432	1.520	1.609	1.697	1.786	1.874	kWh
total energy specific per kg load	0.198	0.180	0.167	0.157	0.149	0.143	0.138	0.134	0.131	0.128	0.125	kWh/kg
total energy specific per kg rated capacity	0.198	0.180	0.167	0.157	0.149	0.143	0.138	0.134	0.131	0.128	0.125	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	10	12	14	16	18	20	22	24	26	28	30	L
free water (between drum and tub) in L	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	L
total amount of water which needs to be heated	13	15.5	18	20.5	23	25.5	28	30.5	33	35.5	38	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	260	310	360	410	460	510	560	610	660	710	760	kcal
energy needed to heat up the water	0.302	0.360	0.419	0.477	0.535	0.593	0.651	0.709	0.767	0.826	0.884	kWh
programme duration	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	h
motor power	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0	135.0	140.0	W
motor and auxiliary energy	0.383	0.404	0.425	0.446	0.468	0.489	0.510	0.531	0.553	0.574	0.595	kWh
load heating-up energy	0.019	0.023	0.027	0.031	0.035	0.038	0.042	0.046	0.050	0.054	0.058	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.822	0.908	0.993	1.079	1.165	1.251	1.336	1.422	1.508	1.594	1.680	kWh
total energy specific per kg load	0.164	0.151	0.142	0.135	0.129	0.125	0.121	0.119	0.116	0.114	0.112	kWh/kg
total energy specific per kg rated capacity	0.164	0.151	0.142	0.135	0.129	0.125	0.121	0.119	0.116	0.114	0.112	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	

soaked up water which is heated (in L)	7	8.4	9.8	11.2	12.6	14	15.4	16.8	18.2	19.6	21	L
free water (between drum and tub) in L	2	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5	L
total amount of water which needs to be heated	9	10.7	12.4	14.1	15.8	17.5	19.2	20.9	22.6	24.3	26	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	180	214	248	282	316	350	384	418	452	486	520	kcal
energy needed to heat up the water	0.209	0.249	0.288	0.328	0.367	0.407	0.447	0.486	0.526	0.565	0.605	kWh
programme duration	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	h
motor power	80.0	83.0	86.0	89.0	92.0	95.0	98.0	101.0	104.0	107.0	110.0	W
motor and auxiliary energy	0.344	0.357	0.370	0.383	0.396	0.409	0.421	0.434	0.447	0.460	0.473	kWh
load heating-up energy	0.019	0.023	0.027	0.031	0.035	0.038	0.042	0.046	0.050	0.054	0.058	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.691	0.749	0.808	0.867	0.925	0.984	1.043	1.102	1.161	1.220	1.279	kWh
total energy specific per kg load	0.138	0.125	0.115	0.108	0.103	0.098	0.095	0.092	0.089	0.087	0.085	kWh/kg
total energy specific per kg rated capacity	0.138	0.125	0.115	0.108	0.103	0.098	0.095	0.092	0.089	0.087	0.085	kWh/kg

WORST AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	5	6	7	8	9	10	11	12	13	14	15	L
free water (between drum and tub) in L	5.5	5.90	6.30	6.70	7.10	7.50	7.90	8.30	8.70	9.10	9.50	L
total amount of water which needs to be heated	10.5	11.9	13.3	14.7	16.1	17.5	18.9	20.3	21.7	23.1	24.5	L
delta temperature (target temp. - 15 °C cold water temperature)	25	25	25	25	25	25	25	25	25	25	25	K
energy needed to heat up the water in Kcal	262.5	297.5	332.5	367.5	402.5	437.5	472.5	507.5	542.5	577.5	612.5	kcal
energy needed to heat up the water	0.305	0.346	0.387	0.427	0.468	0.509	0.549	0.590	0.631	0.672	0.712	kWh

programme duration	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	h
motor power	120.0	125.0	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	W
motor and auxiliary energy	0.300	0.313	0.325	0.338	0.350	0.363	0.375	0.388	0.400	0.413	0.425	kWh
load heating-up energy	0.010	0.012	0.013	0.015	0.017	0.019	0.021	0.023	0.025	0.027	0.029	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.733	0.790	0.848	0.906	0.963	1.021	1.079	1.136	1.194	1.252	1.310	kWh
total energy specific per kg load	0.293	0.263	0.242	0.226	0.214	0.204	0.196	0.189	0.184	0.179	0.175	kWh/kg
total energy specific per kg rated capacity	0.147	0.132	0.121	0.113	0.107	0.102	0.098	0.095	0.092	0.089	0.087	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	5	6	7	8	9	10	11	12	13	14	15	L
free water (between drum and tub) in L	5	5.25	5.50	5.75	6.00	6.25	6.50	6.75	7.00	7.25	7.50	L
total amount of water which needs to be heated	10	11.25	12.5	13.75	15	16.25	17.5	18.75	20	21.25	22.5	L
delta temperature (target temp. - 15 °C cold water temperature)	25	25	25	25	25	25	25	25	25	25	25	K
energy needed to heat up the water in Kcal	250	281.25	312.5	343.75	375	406.25	437.5	468.75	500	531.25	562.5	kcal
energy needed to heat up the water	0.291	0.327	0.363	0.400	0.436	0.472	0.509	0.545	0.581	0.618	0.654	kWh
programme duration	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	h
motor power	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0	135.0	140.0	W
motor and auxiliary energy	0.216	0.228	0.240	0.252	0.264	0.276	0.288	0.300	0.312	0.324	0.336	kWh
load heating-up energy	0.010	0.012	0.013	0.015	0.017	0.019	0.021	0.023	0.025	0.027	0.029	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.634	0.687	0.740	0.792	0.845	0.898	0.951	1.004	1.057	1.110	1.163	kWh

total energy specific per kg load	0.254	0.229	0.211	0.198	0.188	0.180	0.173	0.167	0.163	0.159	0.155	kWh/kg
total energy specific per kg rated capacity	0.127	0.115	0.106	0.099	0.094	0.090	0.086	0.084	0.081	0.079	0.078	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	3.5	4.2	4.9	5.6	6.3	7	7.7	8.4	9.1	9.8	10.5	L
free water (between drum and tub) in L	2	2.30	2.60	2.90	3.20	3.50	3.80	4.10	4.40	4.70	5.00	L
total amount of water which needs to be heated	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	L
delta temperature (target temp. - 15 °C cold water temperature)	25	25	25	25	25	25	25	25	25	25	25	K
energy needed to heat up the water in Kcal	137.5	162.5	187.5	212.5	237.5	262.5	287.5	312.5	337.5	362.5	387.5	kcal
energy needed to heat up the water	0.160	0.189	0.218	0.247	0.276	0.305	0.334	0.363	0.392	0.422	0.451	kWh
programme duration	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	h
motor power	80.0	83.0	86.0	89.0	92.0	95.0	98.0	101.0	104.0	107.0	110.0	W
motor and auxiliary energy	0.200	0.208	0.215	0.223	0.230	0.238	0.245	0.253	0.260	0.268	0.275	kWh
load heating-up energy	0.010	0.012	0.013	0.015	0.017	0.019	0.021	0.023	0.025	0.027	0.029	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.488	0.529	0.569	0.610	0.651	0.692	0.733	0.775	0.816	0.857	0.898	kWh
total energy specific per kg load	0.195	0.176	0.163	0.153	0.145	0.138	0.133	0.129	0.126	0.122	0.120	kWh/kg
total energy specific per kg rated capacity	0.098	0.088	0.081	0.076	0.072	0.069	0.067	0.065	0.063	0.061	0.060	kWh/kg

WORST AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	L
free water (between drum and tub) in L	6.5	6.8	7.1	7.4	7.7	8	8.3	8.6	8.9	9.2	9.5	L
total amount of water which needs to be heated	9	9.8	10.6	11.4	12.2	13	13.8	14.6	15.4	16.2	17	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	180	196	212	228	244	260	276	292	308	324	340	kcal
energy needed to heat up the water	0.209	0.228	0.247	0.265	0.284	0.302	0.321	0.340	0.358	0.377	0.395	kWh
programme duration	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	h
motor power	108.0	112.5	117.0	121.5	126.0	130.5	135.0	139.5	144.0	148.5	153.0	W
motor and auxiliary energy	0.216	0.225	0.234	0.243	0.252	0.261	0.270	0.279	0.288	0.297	0.306	kWh
load heating-up energy	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.012	0.013	0.014	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.548	0.579	0.610	0.641	0.672	0.703	0.735	0.766	0.797	0.828	0.860	kWh
total energy specific per kg load	0.439	0.386	0.349	0.321	0.299	0.281	0.267	0.255	0.245	0.237	0.229	kWh/kg
total energy specific per kg rated capacity	0.110	0.097	0.087	0.080	0.075	0.070	0.067	0.064	0.061	0.059	0.057	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	

soaked up water which is heated (in L)	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	L
free water (between drum and tub) in L	7	7.2	7.4	7.6	7.8	8	8.2	8.4	8.6	8.8	9	L
total amount of water which needs to be heated	9.5	10.2	10.9	11.6	12.3	13	13.7	14.4	15.1	15.8	16.5	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	190	204	218	232	246	260	274	288	302	316	330	kcal
energy needed to heat up the water	0.221	0.237	0.253	0.270	0.286	0.302	0.319	0.335	0.351	0.367	0.384	kWh
programme duration	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	h
motor power	81.0	85.5	90.0	94.5	99.0	103.5	108.0	112.5	117.0	121.5	126.0	W
motor and auxiliary energy	0.162	0.171	0.180	0.189	0.198	0.207	0.216	0.225	0.234	0.243	0.252	kWh
load heating-up energy	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.012	0.013	0.014	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.506	0.535	0.563	0.592	0.621	0.649	0.678	0.707	0.736	0.765	0.794	kWh
total energy specific per kg load	0.405	0.356	0.322	0.296	0.276	0.260	0.247	0.236	0.226	0.219	0.212	kWh/kg
total energy specific per kg rated capacity	0.101	0.089	0.080	0.074	0.069	0.065	0.062	0.059	0.057	0.055	0.053	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	35	35	35	35	35	35	35	35	35	35	35	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	1.75	2.1	2.45	2.8	3.15	3.5	3.85	4.2	4.55	4.9	5.25	L
free water (between drum and tub) in L	2	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5	L
total amount of water which needs to be heated	3.75	4.4	5.05	5.7	6.35	7	7.65	8.3	8.95	9.6	10.25	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	75	88	101	114	127	140	153	166	179	192	205	kcal
energy needed to heat up the water	0.087	0.102	0.117	0.133	0.148	0.163	0.178	0.193	0.208	0.223	0.238	kWh

programme duration	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	h
motor power	72.0	74.7	77.4	80.1	82.8	85.5	88.2	90.9	93.6	96.3	99.0	W
motor and auxiliary energy	0.144	0.149	0.155	0.160	0.166	0.171	0.176	0.182	0.187	0.193	0.198	kWh
load heating-up energy	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.012	0.013	0.014	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.354	0.378	0.402	0.426	0.450	0.474	0.498	0.522	0.546	0.571	0.595	kWh
total energy specific per kg load	0.283	0.252	0.230	0.213	0.200	0.190	0.181	0.174	0.168	0.163	0.159	kWh/kg
total energy specific per kg rated capacity	0.071	0.063	0.057	0.053	0.050	0.047	0.045	0.044	0.042	0.041	0.040	kWh/kg

6.8.2. Estimation of the energy and water consumption for WAT, BAT and BNAT machines under the conditions of POMW 3

The tables show the data and assumptions considered to estimate the energy and water consumption of machines considered as WAT, BAT and BNAT under the conditions of POWM 3.

WORST AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	10	12	14	16	18	20	22	24	26	28	30	L
free water (between drum and tub) in L	4.5	5.1	5.7	6.3	6.9	7.5	8.1	8.7	9.3	9.9	10.5	L
total amount of water which needs to be heated	14.5	17.1	19.7	22.3	24.9	27.5	30.1	32.7	35.3	37.9	40.5	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	145	171	197	223	249	275	301	327	353	379	405	kcal
energy needed to heat up the water	0.169	0.199	0.229	0.259	0.290	0.320	0.350	0.380	0.410	0.441	0.471	kWh
programme duration	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.1	6.2	6.3	6.4	h
motor power	120.0	125.0	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	W

motor and auxiliary energy	0.576	0.625	0.676	0.729	0.784	0.841	0.900	0.946	0.992	1.040	1.088	kWh
load heating-up energy	0.003	0.004	0.004	0.005	0.006	0.006	0.007	0.008	0.008	0.009	0.010	kWh
structure heating-up energy	0.020	0.020	0.020	0.021	0.021	0.022	0.022	0.023	0.023	0.024	0.024	kWh
total energy per wash	0.767	0.848	0.930	1.014	1.101	1.189	1.279	1.356	1.434	1.513	1.593	kWh
total energy specific per kg load	0.153	0.141	0.133	0.127	0.122	0.119	0.116	0.113	0.110	0.108	0.106	kWh/kg
total energy specific per kg rated capacity	0.153	0.141	0.133	0.127	0.122	0.119	0.116	0.113	0.110	0.108	0.106	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	10	12	14	16	18	20	22	24	26	28	30	L
free water (between drum and tub) in L	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	L
total amount of water which needs to be heated	13	15.5	18	20.5	23	25.5	28	30.5	33	35.5	38	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	130	155	180	205	230	255	280	305	330	355	380	kcal
energy needed to heat up the water	0.151	0.180	0.209	0.238	0.267	0.297	0.326	0.355	0.384	0.413	0.442	kWh
programme duration	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.1	6.2	6.3	6.4	h
motor power	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0	135.0	140.0	W
motor and auxiliary energy	0.432	0.475	0.520	0.567	0.616	0.667	0.720	0.763	0.806	0.851	0.896	kWh
load heating-up energy	0.003	0.004	0.004	0.005	0.006	0.006	0.007	0.008	0.008	0.009	0.010	kWh
structure heating-up energy	0.020	0.020	0.020	0.021	0.021	0.022	0.022	0.023	0.023	0.024	0.024	kWh
total energy per wash	0.606	0.679	0.754	0.831	0.911	0.992	1.075	1.147	1.221	1.296	1.371	kWh
total energy specific per kg load	0.121	0.113	0.108	0.104	0.101	0.099	0.098	0.096	0.094	0.093	0.091	kWh/kg
total energy specific per kg rated capacity	0.121	0.113	0.108	0.104	0.101	0.099	0.098	0.096	0.094	0.093	0.091	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	7	8.4	9.8	11.2	12.6	14	15.4	16.8	18.2	19.6	21	L
free water (between drum and tub) in L	2	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5	L
total amount of water which needs to be heated	9	10.7	12.4	14.1	15.8	17.5	19.2	20.9	22.6	24.3	26	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	90	107	124	141	158	175	192	209	226	243	260	kcal
energy needed to heat up the water	0.105	0.124	0.144	0.164	0.184	0.203	0.223	0.243	0.263	0.283	0.302	kWh
programme duration	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.1	6.2	6.3	6.4	h
motor power	80.0	83.0	86.0	89.0	92.0	95.0	98.0	101.0	104.0	107.0	110.0	W
motor and auxiliary energy	0.384	0.415	0.447	0.481	0.515	0.551	0.588	0.616	0.645	0.674	0.704	kWh
load heating-up energy	0.003	0.004	0.004	0.005	0.006	0.006	0.007	0.008	0.008	0.009	0.010	kWh
structure heating-up energy	0.020	0.020	0.020	0.021	0.021	0.022	0.022	0.023	0.023	0.024	0.024	kWh
total energy per wash	0.512	0.563	0.616	0.671	0.726	0.783	0.840	0.889	0.939	0.989	1.040	kWh
total energy specific per kg load	0.102	0.094	0.088	0.084	0.081	0.078	0.076	0.074	0.072	0.071	0.069	kWh/kg
total energy specific per kg rated capacity	0.102	0.094	0.088	0.084	0.081	0.078	0.076	0.074	0.072	0.071	0.069	kWh/kg

WORST AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	

soaked up water which is heated (in L)	5	6	7	8	9	10	11	12	13	14	15	L
free water (between drum and tub) in L	5.5	5.90	6.30	6.70	7.10	7.50	7.90	8.30	8.70	9.10	9.50	L
total amount of water which needs to be heated	10.5	11.9	13.3	14.7	16.1	17.5	18.9	20.3	21.7	23.1	24.5	L
delta temperature (target temp. - 15 °C cold water temperature)	15	15	15	15	15	15	15	15	15	15	15	K
energy needed to heat up the water in Kcal	157.5	178.5	199.5	220.5	241.5	262.5	283.5	304.5	325.5	346.5	367.5	kcal
energy needed to heat up the water	0.183	0.208	0.232	0.256	0.281	0.305	0.330	0.354	0.378	0.403	0.427	kWh
programme duration	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	h
motor power	120.0	131.3	136.5	141.8	147.0	152.3	157.5	162.8	168.0	173.3	178.5	W
motor and auxiliary energy	0.360	0.394	0.410	0.425	0.441	0.457	0.473	0.488	0.504	0.520	0.536	kWh
load heating-up energy	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.015	0.016	0.017	kWh
structure heating-up energy	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	kWh
total energy per wash	0.618	0.677	0.718	0.760	0.801	0.842	0.883	0.925	0.966	1.007	1.049	kWh
total energy specific per kg load	0.247	0.226	0.205	0.190	0.178	0.168	0.161	0.154	0.149	0.144	0.140	kWh/kg
total energy specific per kg rated capacity	0.124	0.113	0.103	0.095	0.089	0.084	0.080	0.077	0.074	0.072	0.070	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	5	6	7	8	9	10	11	12	13	14	15	L
free water (between drum and tub) in L	5	5.25	5.50	5.75	6.00	6.25	6.50	6.75	7.00	7.25	7.50	L
total amount of water which needs to be heated	10	11.25	12.5	13.75	15	16.25	17.5	18.75	20	21.25	22.5	L
delta temperature (target temp. - 15 °C cold water temperature)	15	15	15	15	15	15	15	15	15	15	15	K
energy needed to heat up the water in Kcal	150	168.75	187.5	206.25	225	243.75	262.5	281.25	300	318.75	337.5	kcal
energy needed to heat up the water	0.174	0.196	0.218	0.240	0.262	0.283	0.305	0.327	0.349	0.371	0.392	kWh

programme duration	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	h
motor power	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0	135.0	140.0	W
motor and auxiliary energy	0.270	0.285	0.300	0.315	0.330	0.345	0.360	0.375	0.390	0.405	0.420	kWh
load heating-up energy	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.015	0.016	0.017	kWh
structure heating-up energy	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	kWh
total energy per wash	0.519	0.557	0.595	0.633	0.671	0.709	0.746	0.784	0.822	0.860	0.898	kWh
total energy specific per kg load	0.208	0.186	0.170	0.158	0.149	0.142	0.136	0.131	0.127	0.123	0.120	kWh/kg
total energy specific per kg rated capacity	0.104	0.093	0.085	0.079	0.075	0.071	0.068	0.065	0.063	0.061	0.060	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	3.5	4.2	4.9	5.6	6.3	7	7.7	8.4	9.1	9.8	10.5	L
free water (between drum and tub) in L	2	2.30	2.60	2.90	3.20	3.50	3.80	4.10	4.40	4.70	5.00	L
total amount of water which needs to be heated	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	L
delta temperature (target temp. - 15 °C cold water temperature)	15	15	15	15	15	15	15	15	15	15	15	K
energy needed to heat up the water in Kcal	82.5	97.5	112.5	127.5	142.5	157.5	172.5	187.5	202.5	217.5	232.5	kcal
energy needed to heat up the water	0.096	0.113	0.131	0.148	0.166	0.183	0.201	0.218	0.235	0.253	0.270	kWh
programme duration	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	h
motor power	80.0	83.0	86.0	89.0	92.0	95.0	98.0	101.0	104.0	107.0	110.0	W
motor and auxiliary energy	0.240	0.249	0.258	0.267	0.276	0.285	0.294	0.303	0.312	0.321	0.330	kWh
load heating-up energy	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.015	0.016	0.017	kWh
structure heating-up energy	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	kWh
total energy per wash	0.410	0.438	0.466	0.493	0.521	0.548	0.576	0.603	0.631	0.659	0.686	kWh

total energy specific per kg load	0.164	0.146	0.133	0.123	0.116	0.110	0.105	0.101	0.097	0.094	0.091	kWh/kg
total energy specific per kg rated capacity	0.082	0.073	0.067	0.062	0.058	0.055	0.052	0.050	0.049	0.047	0.046	kWh/kg

WORST AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	L
free water (between drum and tub) in L	6.5	6.8	7.1	7.4	7.7	8	8.3	8.6	8.9	9.2	9.5	L
total amount of water which needs to be heated	9	9.8	10.6	11.4	12.2	13	13.8	14.6	15.4	16.2	17	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	90	98	106	114	122	130	138	146	154	162	170	kcal
energy needed to heat up the water	0.105	0.114	0.123	0.133	0.142	0.151	0.160	0.170	0.179	0.188	0.198	kWh
programme duration	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	h
motor power	132.0	137.5	143.0	148.5	154.0	159.5	165.0	170.5	176.0	181.5	187.0	W
motor and auxiliary energy	0.396	0.413	0.429	0.446	0.462	0.479	0.495	0.512	0.528	0.545	0.561	kWh
load heating-up energy	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	kWh
structure heating-up energy	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	kWh
total energy per wash	0.521	0.547	0.573	0.599	0.625	0.651	0.677	0.703	0.729	0.755	0.781	kWh
total energy specific per kg load	0.417	0.365	0.327	0.300	0.278	0.260	0.246	0.234	0.224	0.216	0.208	kWh/kg
total energy specific per kg rated capacity	0.104	0.091	0.082	0.075	0.069	0.065	0.062	0.059	0.056	0.054	0.052	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg

Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	L
free water (between drum and tub) in L	7	7.2	7.4	7.6	7.8	8	8.2	8.4	8.6	8.8	9	L
total amount of water which needs to be heated	9.5	10.2	10.9	11.6	12.3	13	13.7	14.4	15.1	15.8	16.5	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	95	102	109	116	123	130	137	144	151	158	165	kcal
energy needed to heat up the water	0.110	0.119	0.127	0.135	0.143	0.151	0.159	0.167	0.176	0.184	0.192	kWh
programme duration	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	h
motor power	81.0	85.5	90.0	94.5	99.0	103.5	108.0	112.5	117.0	121.5	126.0	W
motor and auxiliary energy	0.243	0.257	0.270	0.284	0.297	0.311	0.324	0.338	0.351	0.365	0.378	kWh
load heating-up energy	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	kWh
structure heating-up energy	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	kWh
total energy per wash	0.374	0.396	0.418	0.439	0.461	0.483	0.505	0.527	0.548	0.570	0.592	kWh
total energy specific per kg load	0.299	0.264	0.239	0.220	0.205	0.193	0.184	0.176	0.169	0.163	0.158	kWh/kg
total energy specific per kg rated capacity	0.075	0.066	0.060	0.055	0.051	0.048	0.046	0.044	0.042	0.041	0.039	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	25	25	25	25	25	25	25	25	25	25	25	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	1.75	2.1	2.45	2.8	3.15	3.5	3.85	4.2	4.55	4.9	5.25	L
free water (between drum and tub) in L	2	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5	L
total amount of water which needs to be heated	3.75	4.4	5.05	5.7	6.35	7	7.65	8.3	8.95	9.6	10.25	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K

energy needed to heat up the water in Kcal	37.5	44	50.5	57	63.5	70	76.5	83	89.5	96	102.5	kcal
energy needed to heat up the water	0.044	0.051	0.059	0.066	0.074	0.081	0.089	0.097	0.104	0.112	0.119	kWh
programme duration	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	h
motor power	72.0	74.7	77.4	80.1	82.8	85.5	88.2	90.9	93.6	96.3	99.0	W
motor and auxiliary energy	0.216	0.224	0.232	0.240	0.248	0.257	0.265	0.273	0.281	0.289	0.297	kWh
load heating-up energy	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	kWh
structure heating-up energy	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	kWh
total energy per wash	0.280	0.296	0.312	0.328	0.343	0.359	0.375	0.391	0.407	0.422	0.438	kWh
total energy specific per kg load	0.224	0.197	0.178	0.164	0.153	0.144	0.136	0.130	0.125	0.121	0.117	kWh/kg
total energy specific per kg rated capacity	0.056	0.049	0.045	0.041	0.038	0.036	0.034	0.033	0.031	0.030	0.029	kWh/kg

6.8.3. Estimation of the energy and water consumption for WAT, BAT and BNAT machines under the conditions of POMW 4

The tables show the data and assumptions considered to estimate the energy and water consumption of machines considered as WAT, BAT and BNAT under the conditions of POWM 4.

WORST AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	10	12	14	16	18	20	22	24	26	28	30	L
free water (between drum and tub) in L	4.5	5.1	5.7	6.3	6.9	7.5	8.1	8.7	9.3	9.9	10.5	L
total amount of water which needs to be heated	14.5	17.1	19.7	22.3	24.9	27.5	30.1	32.7	35.3	37.9	40.5	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	290	342	394	446	498	550	602	654	706	758	810	kcal
energy needed to heat up the water	0.337	0.398	0.458	0.519	0.579	0.640	0.700	0.760	0.821	0.881	0.942	kWh

programme duration	3.2	3.3	3.5	3.7	3.8	4.0	4.2	4.3	4.5	4.7	4.8	h
motor power	120.0	125.0	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	W
motor and auxiliary energy	0.380	0.417	0.455	0.495	0.537	0.580	0.625	0.672	0.720	0.770	0.822	kWh
load heating-up energy	0.019	0.023	0.027	0.031	0.035	0.038	0.042	0.046	0.050	0.054	0.058	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.855	0.958	1.063	1.170	1.278	1.388	1.500	1.614	1.729	1.846	1.965	kWh
total energy specific per kg load	0.171	0.160	0.152	0.146	0.142	0.139	0.136	0.134	0.133	0.132	0.131	kWh/kg
total energy specific per kg rated capacity	0.171	0.160	0.152	0.146	0.142	0.139	0.136	0.134	0.133	0.132	0.131	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	10	12	14	16	18	20	22	24	26	28	30	L
free water (between drum and tub) in L	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	L
total amount of water which needs to be heated	13	15.5	18	20.5	23	25.5	28	30.5	33	35.5	38	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	260	310	360	410	460	510	560	610	660	710	760	kcal
energy needed to heat up the water	0.302	0.360	0.419	0.477	0.535	0.593	0.651	0.709	0.767	0.826	0.884	kWh
programme duration	3.2	3.3	3.5	3.7	3.8	4.0	4.2	4.3	4.5	4.7	4.8	h
motor power	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0	135.0	140.0	W
motor and auxiliary energy	0.285	0.317	0.350	0.385	0.422	0.460	0.500	0.542	0.585	0.630	0.677	kWh
load heating-up energy	0.019	0.023	0.027	0.031	0.035	0.038	0.042	0.046	0.050	0.054	0.058	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.725	0.821	0.918	1.018	1.119	1.222	1.326	1.433	1.541	1.650	1.762	kWh

total energy specific per kg load	0.145	0.137	0.131	0.127	0.124	0.122	0.121	0.119	0.119	0.118	0.117	kWh/kg
total energy specific per kg rated capacity	0.145	0.137	0.131	0.127	0.124	0.122	0.121	0.119	0.119	0.118	0.117	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR FULL LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	7	8.4	9.8	11.2	12.6	14	15.4	16.8	18.2	19.6	21	L
free water (between drum and tub) in L	2	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5	L
total amount of water which needs to be heated	9	10.7	12.4	14.1	15.8	17.5	19.2	20.9	22.6	24.3	26	L
delta temperature (target temp. - 15 °C cold water temperature)	20	20	20	20	20	20	20	20	20	20	20	K
energy needed to heat up the water in Kcal	180	214	248	282	316	350	384	418	452	486	520	kcal
energy needed to heat up the water	0.209	0.249	0.288	0.328	0.367	0.407	0.447	0.486	0.526	0.565	0.605	kWh
programme duration	3.2	3.3	3.5	3.7	3.8	4.0	4.2	4.3	4.5	4.7	4.8	h
motor power	80.0	83.0	86.0	89.0	92.0	95.0	98.0	101.0	104.0	107.0	110.0	W
motor and auxiliary energy	0.253	0.277	0.301	0.326	0.353	0.380	0.408	0.438	0.468	0.499	0.532	kWh
load heating-up energy	0.019	0.023	0.027	0.031	0.035	0.038	0.042	0.046	0.050	0.054	0.058	kWh
structure heating-up energy	0.118	0.121	0.123	0.125	0.128	0.130	0.133	0.136	0.138	0.141	0.144	kWh
total energy per wash	0.600	0.669	0.739	0.810	0.883	0.956	1.030	1.105	1.182	1.259	1.338	kWh
total energy specific per kg load	0.120	0.112	0.106	0.101	0.098	0.096	0.094	0.092	0.091	0.090	0.089	kWh/kg
total energy specific per kg rated capacity	0.120	0.112	0.106	0.101	0.098	0.096	0.094	0.092	0.091	0.090	0.089	kWh/kg

WORST AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg

Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	5	6	7	8	9	10	11	12	13	14	15	L
free water (between drum and tub) in L	5.5	5.90	6.30	6.70	7.10	7.50	7.90	8.30	8.70	9.10	9.50	L
total amount of water which needs to be heated	10.5	11.9	13.3	14.7	16.1	17.5	18.9	20.3	21.7	23.1	24.5	L
delta temperature (target temp. - 15 °C cold water temperature)	15	15	15	15	15	15	15	15	15	15	15	K
energy needed to heat up the water in Kcal	157.5	178.5	199.5	220.5	241.5	262.5	283.5	304.5	325.5	346.5	367.5	kcal
energy needed to heat up the water	0.183	0.208	0.232	0.256	0.281	0.305	0.330	0.354	0.378	0.403	0.427	kWh
programme duration	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	h
motor power	120.0	131.3	136.5	141.8	147.0	152.3	157.5	162.8	168.0	173.3	178.5	W
motor and auxiliary energy	0.330	0.372	0.398	0.425	0.453	0.482	0.512	0.542	0.574	0.606	0.640	kWh
load heating-up energy	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.015	0.016	0.017	kWh
structure heating-up energy	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	kWh
total energy per wash	0.588	0.655	0.707	0.759	0.813	0.867	0.923	0.979	1.036	1.094	1.153	kWh
total energy specific per kg load	0.235	0.218	0.202	0.190	0.181	0.173	0.168	0.163	0.159	0.156	0.154	kWh/kg
total energy specific per kg rated capacity	0.118	0.109	0.101	0.095	0.090	0.087	0.084	0.082	0.080	0.078	0.077	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	5	6	7	8	9	10	11	12	13	14	15	L
free water (between drum and tub) in L	5	5.25	5.50	5.75	6.00	6.25	6.50	6.75	7.00	7.25	7.50	L
total amount of water which needs to be heated	10	11.25	12.5	13.75	15	16.25	17.5	18.75	20	21.25	22.5	L
delta temperature (target temp. - 15 °C cold water temperature)	15	15	15	15	15	15	15	15	15	15	15	K

energy needed to heat up the water in Kcal	150	168.75	187.5	206.25	225	243.75	262.5	281.25	300	318.75	337.5	kcal
energy needed to heat up the water	0.174	0.196	0.218	0.240	0.262	0.283	0.305	0.327	0.349	0.371	0.392	kWh
programme duration	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	h
motor power	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0	135.0	140.0	W
motor and auxiliary energy	0.247	0.269	0.292	0.315	0.339	0.364	0.390	0.417	0.444	0.472	0.502	kWh
load heating-up energy	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.015	0.016	0.017	kWh
structure heating-up energy	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	kWh
total energy per wash	0.496	0.541	0.586	0.633	0.680	0.728	0.776	0.826	0.876	0.928	0.980	kWh
total energy specific per kg load	0.199	0.180	0.168	0.158	0.151	0.146	0.141	0.138	0.135	0.133	0.131	kWh/kg
total energy specific per kg rated capacity	0.099	0.090	0.084	0.079	0.076	0.073	0.071	0.069	0.067	0.066	0.065	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR HALF LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	3.5	4.2	4.9	5.6	6.3	7	7.7	8.4	9.1	9.8	10.5	L
free water (between drum and tub) in L	2	2.30	2.60	2.90	3.20	3.50	3.80	4.10	4.40	4.70	5.00	L
total amount of water which needs to be heated	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	L
delta temperature (target temp. - 15 °C cold water temperature)	15	15	15	15	15	15	15	15	15	15	15	K
energy needed to heat up the water in Kcal	82.5	97.5	112.5	127.5	142.5	157.5	172.5	187.5	202.5	217.5	232.5	kcal
energy needed to heat up the water	0.096	0.113	0.131	0.148	0.166	0.183	0.201	0.218	0.235	0.253	0.270	kWh
programme duration	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	h
motor power	80.0	83.0	86.0	89.0	92.0	95.0	98.0	101.0	104.0	107.0	110.0	W
motor and auxiliary energy	0.220	0.235	0.251	0.267	0.284	0.301	0.318	0.337	0.355	0.374	0.394	kWh
load heating-up energy	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.015	0.016	0.017	kWh

structure heating-up energy	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	kWh
total energy per wash	0.390	0.424	0.458	0.493	0.528	0.564	0.600	0.637	0.674	0.712	0.750	kWh
total energy specific per kg load	0.156	0.141	0.131	0.123	0.117	0.113	0.109	0.106	0.104	0.102	0.100	kWh/kg
total energy specific per kg rated capacity	0.078	0.071	0.065	0.062	0.059	0.056	0.055	0.053	0.052	0.051	0.050	kWh/kg

WORST AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	L
free water (between drum and tub) in L	6.5	6.8	7.1	7.4	7.7	8	8.3	8.6	8.9	9.2	9.5	L
total amount of water which needs to be heated	9	9.8	10.6	11.4	12.2	13	13.8	14.6	15.4	16.2	17	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	90	98	106	114	122	130	138	146	154	162	170	kcal
energy needed to heat up the water	0.105	0.114	0.123	0.133	0.142	0.151	0.160	0.170	0.179	0.188	0.198	kWh
programme duration	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	h
motor power	132.0	137.5	143.0	148.5	154.0	159.5	165.0	170.5	176.0	181.5	187.0	W
motor and auxiliary energy	0.363	0.390	0.417	0.445	0.475	0.505	0.536	0.568	0.601	0.635	0.670	kWh
load heating-up energy	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	kWh
structure heating-up energy	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	kWh
total energy per wash	0.489	0.525	0.562	0.600	0.639	0.679	0.720	0.762	0.804	0.848	0.892	kWh
total energy specific per kg load	0.391	0.350	0.321	0.300	0.284	0.272	0.262	0.254	0.247	0.242	0.238	kWh/kg
total energy specific per kg rated capacity	0.098	0.088	0.080	0.075	0.071	0.068	0.065	0.063	0.062	0.061	0.059	kWh/kg

BEST AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	
soaked up water which is heated (in L)	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	L
free water (between drum and tub) in L	7	7.2	7.4	7.6	7.8	8	8.2	8.4	8.6	8.8	9	L
total amount of water which needs to be heated	9.5	10.2	10.9	11.6	12.3	13	13.7	14.4	15.1	15.8	16.5	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	95	102	109	116	123	130	137	144	151	158	165	kcal
energy needed to heat up the water	0.110	0.119	0.127	0.135	0.143	0.151	0.159	0.167	0.176	0.184	0.192	kWh
programme duration	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	h
motor power	81.0	85.5	90.0	94.5	99.0	103.5	108.0	112.5	117.0	121.5	126.0	W
motor and auxiliary energy	0.223	0.242	0.262	0.283	0.305	0.328	0.351	0.375	0.400	0.425	0.451	kWh
load heating-up energy	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	kWh
structure heating-up energy	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	kWh
total energy per wash	0.354	0.382	0.411	0.441	0.471	0.502	0.533	0.566	0.599	0.633	0.668	kWh
total energy specific per kg load	0.284	0.255	0.235	0.220	0.209	0.201	0.194	0.189	0.184	0.181	0.178	kWh/kg
total energy specific per kg rated capacity	0.071	0.064	0.059	0.055	0.052	0.050	0.048	0.047	0.046	0.045	0.045	kWh/kg

BEST NOT AVAILABLE TECHNOLOGY MACHINES FOR QUARTER LOAD												
Rated capacity	5	6	7	8	9	10	11	12	13	14	15	kg
Target temperature in the core of the load	30	30	30	30	30	30	30	30	30	30	30	°C
soaked up water which is heated (in % of textile load)	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	140%	
soaked up water which is heated (in L)	1.75	2.1	2.45	2.8	3.15	3.5	3.85	4.2	4.55	4.9	5.25	L
free water (between drum and tub) in L	2	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5	L

total amount of water which needs to be heated	3.75	4.4	5.05	5.7	6.35	7	7.65	8.3	8.95	9.6	10.25	L
delta temperature (target temp. - 15 °C cold water temperature)	10	10	10	10	10	10	10	10	10	10	10	K
energy needed to heat up the water in Kcal	37.5	44	50.5	57	63.5	70	76.5	83	89.5	96	102.5	kcal
energy needed to heat up the water	0.044	0.051	0.059	0.066	0.074	0.081	0.089	0.097	0.104	0.112	0.119	kWh
programme duration	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	h
motor power	72.0	74.7	77.4	80.1	82.8	85.5	88.2	90.9	93.6	96.3	99.0	W
motor and auxiliary energy	0.198	0.212	0.226	0.240	0.255	0.271	0.287	0.303	0.320	0.337	0.355	kWh
load heating-up energy	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	kWh
structure heating-up energy	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	kWh
total energy per wash	0.263	0.284	0.306	0.329	0.352	0.375	0.399	0.423	0.448	0.473	0.498	kWh
total energy specific per kg load	0.210	0.190	0.175	0.164	0.156	0.150	0.145	0.141	0.138	0.135	0.133	kWh/kg
total energy specific per kg rated capacity	0.053	0.047	0.044	0.041	0.039	0.038	0.036	0.035	0.034	0.034	0.033	kWh/kg

6.9 Outputs from the impact modelling

6.9.1 Estimation of the energy consumption under actual conditions for an average washing machine in 2016

Scenarios A and B were simulated for considering considering the market shares regarding the rated capacity of the washing machines in 2016. Table A6.4**.** compares the expected energy consumption of an average washing machine on the EU market under the newly proposed testing programme conditions and the specific ecodesing and energy requirements for scenario A and B and all their options. The assumptions are described in Annex 6.1.2 and Annex 6.1.3 in more detail.

Table A6.4. Average energy consumption (kWh/cycle) under the actual use conditions and the market state in 2016 regarding the rated capacity of the washing machines

Scenario	Alternative	Estimated energy consumption (kWh/cycle) under actual use conditions
BAU	BAU	0.734
A	A 1: 30C minimum temp	0.667
	A 2: 35C minimum temp	0.651
B	B 1: Duration limit of 3h	0.648
	B 2: Duration limit of 3.5h/2.5h/2h	0.624
	B 3.1: Duration limit of 3h half & optimized EL	0.668
	B 3.2; Duration limit of 3h half & optimized duration	0.636
	B 4.1: proportional duration limit	0.701
	B 4.2: proportional duration limit of for full and half load	0.642

As seen in Table A6.4 all the alternatives in scenario A and scenario B forecast an energy consumption of an average washing machine in a very narrow window but lower than the BAU scenario. The difference between the lowest and the highest energy consumption is approximately 10%.

The scenario B2 that considers a time cap of 3.5h for full load, 2.5h for half load and 2h for quarter load is expected to provide the lowest energy consumption per average washing machine. This scenario considers that the acceptance by the consumers will be higher than at present because of the shorter duration of the treatments. However, manufacturers expressed their concerns about the feasibility of these requirements for larger machines (e.g. < 10kg). It was commented that these requirements will favour the production of smaller machines since they can fulfil the washing performance requirements in the given time while these requirements will be a barrier to put into the market large machines. This argument can be applied to scenario B1 and partially to scenarios B3.1 and B3.2

The second best alternative is scenario B3.2 that includes a limit of 3h on the duration of the half and quarter loading treatments and the display of the duration of the full load cycle on the label. Under scenario B3.2 it is assumed that the requirement of displaying the duration of the full load will incentive manufacturers to optimize this value at expenses of getting a worse energy efficiency classification. The likelihood of this alternative is considered to be quite low according to Brazil and Caulfield (2017)[21]. The authors drawn the conclusion that the attention that the consumers give to various elements within a label can vary considerably, and that the ability of label elements to provide information that can be recalled can vary considerably. The authors pointed out that consumers easily remembered information such as alphabetical grades or odours when assessing, and therefore it is expected that manufacturers will focus on optimizing the energy efficiency of the washing machine declared on the label instead of the duration of the full loading treatments. Therefore this scenario is discarded for further analysis

The third best scenario is scenario B1 that includes a constant time cap of 3h for all the treatments. This scenario has the advantage that is easily implemented. However manufacturers pointed out that this requirement is not feasible for washing machines with a rated capacity higher than approximately 8kg. Therefore, this scenario is also discarded for further analysis.

The remaining scenarios show energy consumptions that are pretty close. Scenario A2 considers a minimum temperature to be reached in the laundry core. This temperature is assumed to be 35C that is a temperature very close to the temperature claimed on the testing programme name "40C-60C cotton". This scenario includes a simple implementation procedure but a more challenging verification procedure. The other alternatives are scenario B4.1 and B4.2 consider a proportional time cap depending on the rated capacity of the machines.

6.9.2 Estimated environmental impacts for the different scenarios for household washing machines

Table A6.5 Estimated electricity consumption of the stock of washing machines for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

	Estimated energy consumption (TWh/year)						
		POWM 2POWM 2C		POWM 3		POWM 4	
Year	**BAU**	**T1**	**T1&T2**	**T1**	**T1&T2**	**T1**	**T1&T2**
2004	27.40	27.50	27.40	27.40	27.42	27.50	27.40
2005	27.53	27.64	27.53	27.53	27.50	27.64	27.53
2006	27.70	27.82	27.70	27.70	27.68	27.82	27.70
2007	27.97	28.12	27.97	27.97	27.98	28.12	27.97
2008	28.16	28.36	28.16	28.16	28.17	28.36	28.16
2009	28.42	28.68	28.42	28.42	28.43	28.68	28.42
2010	28.79	29.12	28.79	28.79	28.74	29.12	28.79

[21] W. Brazil, B. Caulfield, What makes an effective energy efficiency label? Assessing the performance of energy labels through eye-tracking experiments in Ireland, Energy research and Social science, 29 92017) 46-52

2011	29.13	29.54	29.13	29.13	29.18	29.54	29.13
2012	29.63	30.13	29.63	29.63	29.60	30.13	29.63
2013	29.09	29.69	29.09	29.09	29.11	29.69	29.09
2014	29.12	29.84	29.12	29.12	29.16	29.84	29.12
2015	29.30	30.16	29.30	29.30	29.33	30.16	29.30
2016	28.28	29.23	28.28	28.28	28.25	29.23	28.28
2017	27.97	29.06	27.97	27.97	27.95	29.06	27.97
2018	27.41	30.85	27.94	28.01	28.37	27.20	26.50
2019	26.86	30.92	27.62	27.55	28.05	26.94	26.15
2020	26.59	30.79	27.18	27.11	27.59	26.67	25.78
2021	26.40	30.64	26.77	26.66	27.39	26.40	25.39
2022	26.21	30.64	26.25	26.33	26.96	26.10	25.08
2023	26.33	30.59	25.93	25.96	26.53	25.87	24.56
2024	26.43	30.67	25.62	25.68	26.35	25.73	24.41
2025	26.56	30.68	25.59	25.53	26.29	25.70	24.32
2026	25.68	29.78	24.76	24.53	25.38	24.82	23.46
2027	25.29	29.53	24.45	24.11	24.97	24.48	23.11
2028	24.96	29.15	24.10	23.50	24.40	24.08	22.78
2029	25.11	29.41	24.30	23.58	24.44	24.21	22.90
2030	25.92	29.96	24.73	23.87	24.74	24.77	23.32

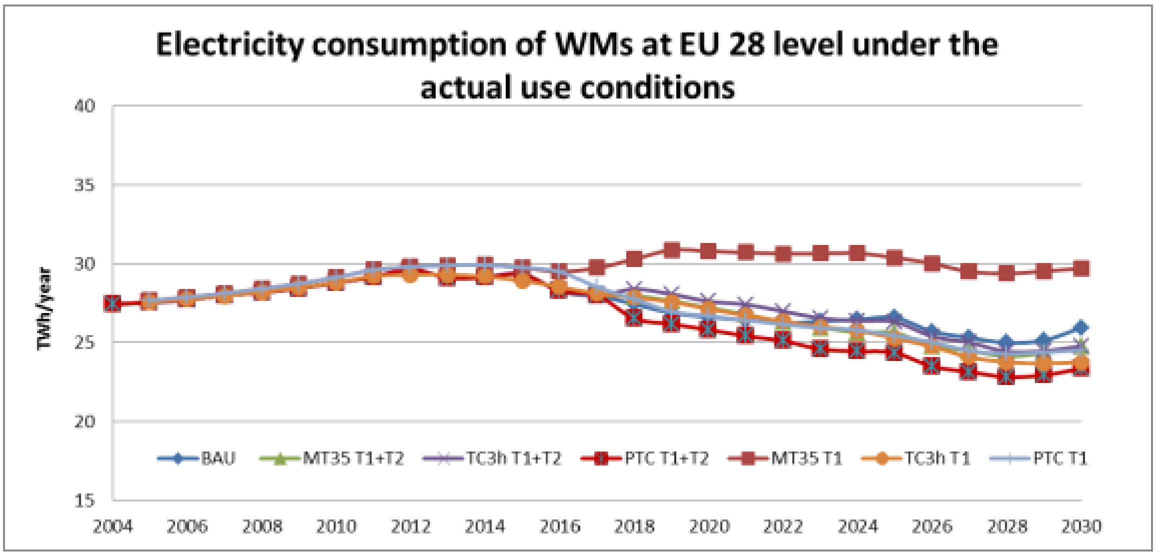


Figure A6.1 Estimated electricity consumption of the stock of washing machines for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

Table A6.6 Estimated GHG emissions of the stock of washing machines for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

	Estimated water consumption (mln CO_{2eq}/year)						
		POWM 2POWM 2C		POWM 3		POWM 4	
Year	**BAU**	**T1**	**T1&T2**	**T1**	**T1&T2**	**T1**	**T1&T2**
2006	12.12	12.16	12.12	12.12	12.13	12.16	12.12

2007	12.18	12.22	12.18	12.18	12.16	12.22	12.18
2008	12.25	12.30	12.25	12.25	12.24	12.30	12.25
2009	12.37	12.43	12.37	12.37	12.37	12.43	12.37
2010	12.45	12.54	12.45	12.45	12.46	12.54	12.45
2011	12.57	12.68	12.57	12.57	12.57	12.68	12.57
2012	12.73	12.88	12.73	12.73	12.71	12.88	12.73
2013	12.88	13.06	12.88	12.88	12.90	13.06	12.88
2014	13.10	13.32	13.10	13.10	13.09	13.32	13.10
2015	12.86	13.13	12.86	12.86	12.87	13.13	12.86
2016	12.88	13.19	12.88	12.88	12.89	13.19	12.88
2017	12.96	13.34	12.96	12.96	12.97	13.34	12.96
2018	12.51	12.93	12.51	12.51	12.49	12.93	12.51
2019	12.37	12.85	12.37	12.37	12.36	12.85	12.37
2020	12.12	13.64	12.35	12.39	12.54	12.03	11.72
2021	11.88	13.67	12.21	12.18	12.40	11.91	11.56
2022	11.76	13.61	12.02	11.99	12.20	11.79	11.40
2023	11.67	13.55	11.84	11.79	12.11	11.67	11.23
2024	11.59	13.55	11.61	11.64	11.92	11.54	11.09
2025	11.64	13.53	11.47	11.48	11.73	11.44	10.86
2026	11.69	13.56	11.33	11.36	11.65	11.38	10.79
2027	11.74	13.57	11.32	11.29	11.62	11.36	10.75
2028	11.36	13.17	10.95	10.85	11.22	10.98	10.37
2029	11.18	13.06	10.81	10.66	11.04	10.82	10.22
2030	11.04	12.89	10.66	10.39	10.79	10.65	10.07

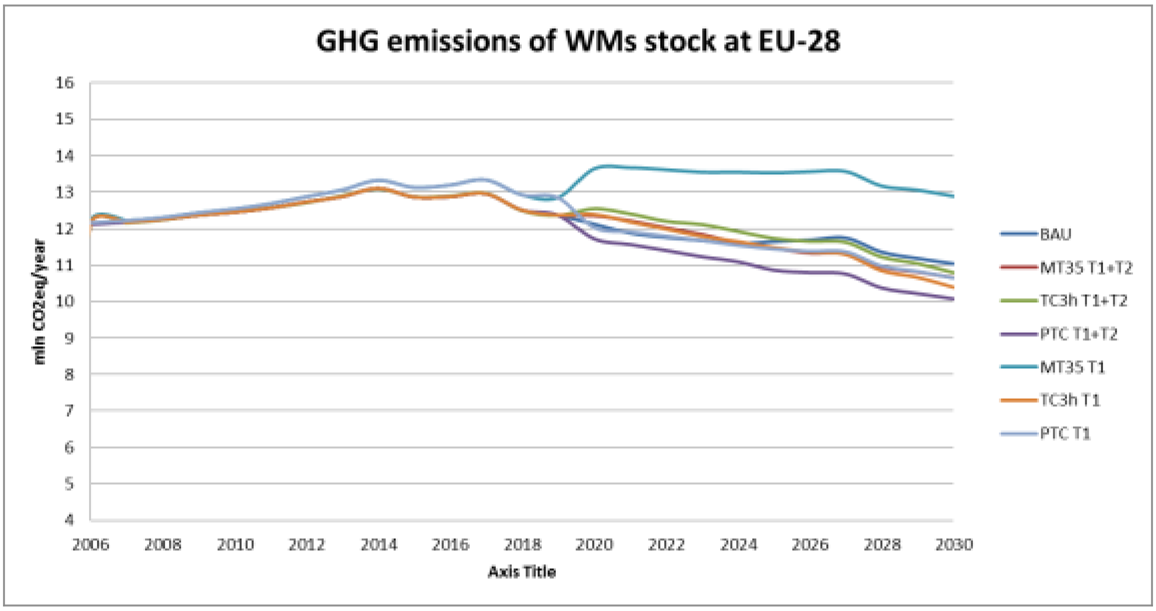


Figure A6.2 Estimated GHG emissions of the stock of washing machines for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

Table A6.7 Estimated water consumption of the stock of washing machines for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

	Estimated water consumption (mln m^3/year)						
		POWM 2POWM 2C		POWM 3		POWM 4	
Year	**BAU**	**T1**	**T1&T2**	**T1**	**T1&T2**	**T1**	**T1&T2**
2004	2354	1942	1923	1942	1923	1942	1923
2005	2356	1944	1924	1944	1924	1944	1924
2006	2362	1949	1926	1949	1926	1949	1926
2007	2376	1960	1931	1960	1931	1960	1931
2008	2372	1957	1918	1957	1918	1957	1918
2009	2369	1954	1904	1954	1904	1954	1904
2010	2359	1946	1884	1946	1884	1946	1884
2011	2355	1943	1865	1943	1865	1943	1865
2012	2349	1938	1842	1938	1842	1938	1842
2013	2311	1907	1791	1907	1791	1907	1791
2014	2290	1889	1750	1889	1750	1889	1750
2015	2272	1874	1709	1874	1709	1874	1709
2016	2187	1804	1615	1804	1615	1804	1615
2017	2133	1760	1542	1760	1542	1760	1542
2018	2058	1733	1419	1640	1360	1676	1390
2019	1982	1707	1360	1613	1304	1651	1330
2020	1922	1675	1299	1586	1245	1627	1273
2021	1866	1645	1243	1560	1200	1603	1219
2022	1817	1624	1187	1539	1150	1579	1172
2023	1786	1603	1143	1518	1104	1560	1120
2024	1758	1589	1104	1502	1072	1545	1088
2025	1738	1579	1083	1493	1049	1539	1063
2026	1661	1520	1030	1436	996	1483	1008
2027	1627	1495	1003	1410	968	1459	982
2028	1594	1473	978	1375	937	1433	956
2029	1596	1477	977	1380	930	1438	953
2030	1634	1499	989	1397	938	1469	967

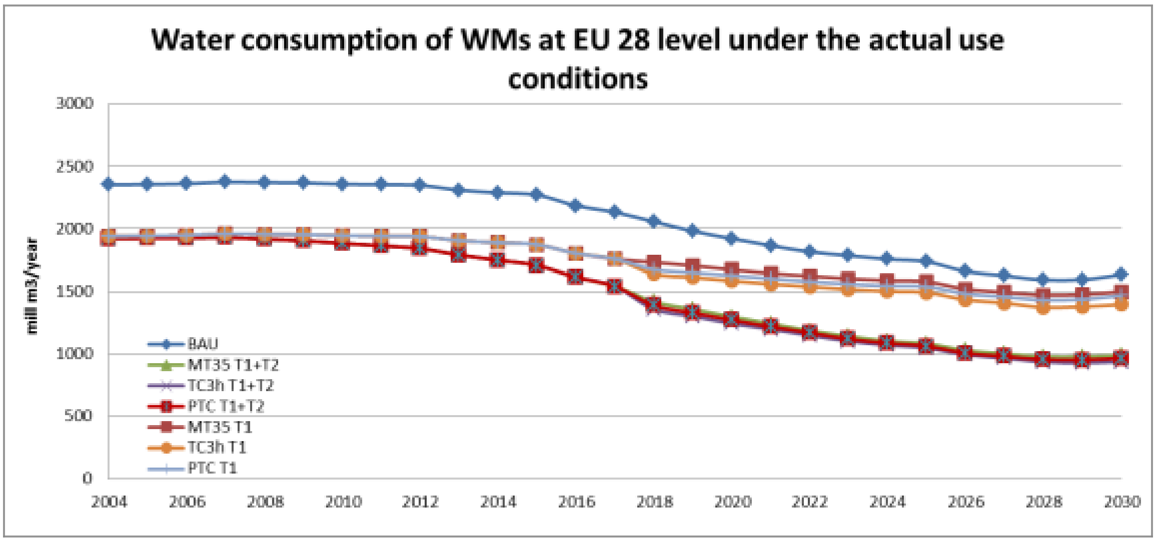


Figure A6.3 Estimated water consumption of the stock of washing machines for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

6.9.3 Estimation of the economic impacts for washing machines

Table A6.8 Estimated revenue of the EU manufacturers for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

Year	Revenue of the EU manufacturers (billions of Euro$_{2015}$)						
	BAU	POWM 2POWM 2C		POWM 3		POWM 4	
		T1	T1&T2	T1	T1&T2	T1	T1&T2
2004	1.41	1.48	1.48	1.59	1.60	1.41	1.85
2005	1.42	1.48	1.48	1.60	1.60	1.42	1.86
2006	1.42	1.49	1.49	1.59	1.61	1.42	1.86
2007	1.42	1.49	1.49	1.58	1.61	1.42	1.86
2008	1.43	1.50	1.50	1.58	1.62	1.43	1.88
2009	1.43	1.50	1.50	1.58	1.62	1.43	1.88
2010	1.43	1.50	1.50	1.57	1.62	1.43	1.88
2011	1.46	1.53	1.53	1.59	1.65	1.46	1.92
2012	1.42	1.49	1.49	1.55	1.62	1.42	1.88
2013	1.43	1.50	1.50	1.56	1.63	1.43	1.89
2014	1.44	1.51	1.51	1.54	1.63	1.44	1.89
2015	1.45	1.52	1.52	1.55	1.64	1.45	1.91
2016	1.31	1.37	1.37	1.40	1.48	1.31	1.72
2017	1.31	1.37	1.37	1.39	1.49	1.31	1.72
2018	1.32	1.38	1.38	1.39	1.49	1.32	1.74
2019	1.32	1.39	1.39	1.39	1.50	1.32	1.74
2020	1.33	1.40	1.40	1.41	1.51	1.33	1.76
2021	1.34	1.41	1.41	1.42	1.53	1.34	1.77
2022	1.35	1.42	1.42	1.43	1.54	1.35	1.78
2023	1.36	1.43	1.43	1.43	1.54	1.36	1.79
2024	1.37	1.43	1.43	1.44	1.55	1.37	1.80
2025	1.37	1.44	1.44	1.45	1.56	1.37	1.81
2026	1.38	1.44	1.44	1.45	1.56	1.38	1.81
2027	1.38	1.45	1.45	1.45	1.57	1.38	1.82
2028	1.38	1.45	1.45	1.46	1.57	1.38	1.82
2029	1.78	1.87	1.87	1.88	2.02	1.78	2.34
2030	1.83	1.92	1.92	1.92	2.07	1.83	2.40

Table A6.9 Estimated revenue of the EU retailers for the scenarios POWM 2,= POWM 3 and POWM 4=for the options T1 and T1&T2

Year	Revenue of the EU retailers (billions of Euro$_{2015}$)						
	BAU	POWM 2POWM 2C		POWM 3		POWM 4	
		T1	T1&T2	T1	T1&T2	T1	T1&T2
2004	3.77	3.95	3.95	4.26	4.27	3.77	4.96
2005	3.78	3.97	3.97	4.27	4.29	3.78	4.98
2006	3.79	3.97	3.97	4.25	4.29	3.79	4.98
2007	3.79	3.97	3.97	4.23	4.30	3.79	4.99

2008	3.81	4.00	4.00	4.23	4.32	3.81	5.02
2009	3.83	4.02	4.02	4.23	4.34	3.83	5.04
2010	3.82	4.01	4.01	4.20	4.34	3.82	5.04
2011	3.89	4.08	4.08	4.25	4.42	3.89	5.13
2012	3.81	3.99	3.99	4.14	4.32	3.81	5.02
2013	3.84	4.02	4.02	4.16	4.35	3.84	5.06
2014	3.84	4.03	4.03	4.13	4.36	3.84	5.06
2015	3.86	4.05	4.05	4.15	4.39	3.86	5.09
2016	3.50	3.67	3.67	3.74	3.97	3.50	4.61
2017	3.50	3.67	3.67	3.72	3.97	3.50	4.61
2018	3.52	3.69	3.69	3.71	4.00	3.52	4.64
2019	3.54	3.71	3.71	3.73	4.02	3.54	4.66
2020	3.57	3.74	3.74	3.76	4.05	3.57	4.70
2021	3.59	3.77	3.77	3.79	4.08	3.59	4.74
2022	3.62	3.80	3.80	3.82	4.11	3.62	4.77
2023	3.64	3.81	3.81	3.83	4.13	3.64	4.79
2024	3.65	3.83	3.83	3.85	4.15	3.65	4.81
2025	3.67	3.85	3.85	3.87	4.16	3.67	4.83
2026	3.68	3.86	3.86	3.88	4.17	3.68	4.84
2027	3.69	3.87	3.87	3.89	4.19	3.69	4.86
2028	3.70	3.88	3.88	3.90	4.20	3.70	4.87
2029	4.76	4.99	4.99	5.02	5.40	4.76	6.27
2030	4.88	5.12	5.12	5.15	5.54	4.88	6.43

Table A6.10 Estimated jobs of the EU manufacturers for the scenarios POWM 2,= POWM 3 and POWM 4 for the options T1 and T1&T2

Year	**Revenue of the EU manufacturers ('000 of employees)**						
	BAU	**POWM 2POWM 2C**		**POWM 3**		**POWM 4**	
		T1	**T1&T2**	**T1**	**T1&T2**	**T1**	**T1&T2**
2004	7.50	7.86	7.86	8.47	8.50	7.50	9.86
2005	7.53	7.90	7.90	8.50	8.53	7.53	9.90
2006	7.53	7.90	7.90	8.46	8.54	7.53	9.91
2007	7.54	7.91	7.91	8.41	8.54	7.54	9.92
2008	7.58	7.95	7.95	8.42	8.60	7.58	9.98
2009	7.61	7.99	7.99	8.41	8.64	7.61	10.03
2010	7.60	7.98	7.98	8.36	8.63	7.60	10.01
2011	7.74	8.12	8.12	8.46	8.79	7.74	10.21
2012	7.57	7.94	7.94	8.23	8.59	7.57	9.98
2013	7.63	8.00	8.00	8.27	8.66	7.63	10.06
2014	7.64	8.01	8.01	8.22	8.67	7.64	10.07
2015	7.69	8.06	8.06	8.25	8.73	7.69	10.13
2016	6.96	7.30	7.30	7.44	7.90	6.96	9.17
2017	6.96	7.30	7.30	7.39	7.90	6.96	9.17
2018	7.00	7.34	7.34	7.38	7.95	7.00	9.23
2019	7.03	7.38	7.38	7.41	7.99	7.03	9.27
2020	7.10	7.44	7.44	7.48	8.06	7.10	9.35
2021	7.15	7.50	7.50	7.53	8.11	7.15	9.42
2022	7.20	7.55	7.55	7.59	8.17	7.20	9.49
2023	7.23	7.59	7.59	7.62	8.21	7.23	9.53

2024	7.27	7.62	7.62	7.66	8.24	7.27	9.57
2025	7.30	7.65	7.65	7.69	8.28	7.30	9.61
2026	7.32	7.68	7.68	7.71	8.30	7.32	9.64
2027	7.34	7.70	7.70	7.74	8.33	7.34	9.66
2028	7.36	7.72	7.72	7.76	8.35	7.36	9.69
2029	9.46	9.93	9.93	9.98	10.74	9.46	12.46
2030	9.71	10.19	10.19	10.24	11.02	9.71	12.79

Table A6.11 Estimated jobs of the EU retailers for the scenarios POWM 2,= POWM 3 and POWM 4 for the options T1 and T1&T2

Year	**Revenue of the EU retailers ('000 of employees)**						
	BAU	**POWM 2POWM 2C**		**POWM 3**		**POWM 4**	
		T1	**T1&T2**	**T1**	**T1&T2**	**T1**	**T1&T2**
2004	62.82	65.90	65.90	70.99	71.20	62.82	82.64
2005	63.08	66.17	66.17	71.22	71.49	63.08	82.98
2006	63.14	66.22	66.22	70.91	71.56	63.14	83.06
2007	63.16	66.25	66.25	70.47	71.60	63.16	83.11
2008	63.53	66.64	66.64	70.53	72.05	63.53	83.64
2009	63.80	66.92	66.92	70.51	72.37	63.80	84.01
2010	63.71	66.83	66.83	70.04	72.29	63.71	83.92
2011	64.90	68.07	68.07	70.91	73.66	64.90	85.51
2012	63.43	66.53	66.53	68.93	72.01	63.43	83.60
2013	63.94	67.06	67.06	69.31	72.58	63.94	84.26
2014	64.00	67.14	67.14	68.85	72.68	64.00	84.39
2015	64.41	67.56	67.56	69.11	73.14	64.41	84.91
2016	58.30	61.15	61.15	62.34	66.18	58.30	76.84
2017	58.29	61.14	61.14	61.95	66.19	58.29	76.85
2018	58.65	61.51	61.51	61.82	66.62	58.65	77.35
2019	58.94	61.82	61.82	62.12	66.93	58.94	77.71
2020	59.47	62.38	62.38	62.68	67.52	59.47	78.38
2021	59.89	62.82	62.82	63.13	67.98	59.89	78.93
2022	60.33	63.28	63.28	63.59	68.47	60.33	79.49
2023	60.60	63.56	63.56	63.87	68.76	60.60	79.83
2024	60.89	63.87	63.87	64.18	69.09	60.89	80.20
2025	61.13	64.12	64.12	64.43	69.35	61.13	80.51
2026	61.32	64.32	64.32	64.63	69.56	61.32	80.75
2027	61.50	64.51	64.51	64.83	69.76	61.50	80.98
2028	61.68	64.70	64.70	65.01	69.96	61.68	81.21
2029	79.30	83.18	83.18	83.59	89.97	79.30	104.45
2030	81.39	85.37	85.37	85.79	92.33	81.39	107.18

6.9.4 Estimated environmental impacts for the different scenarios for household washer-dryers

Table A6.12 Estimated electricity consumption of the stock of washer dryers for the scenarios BAU and ED+EL for the options T1 and T1&T2

	Electricity consumption of washer-dryers (TWh/year)

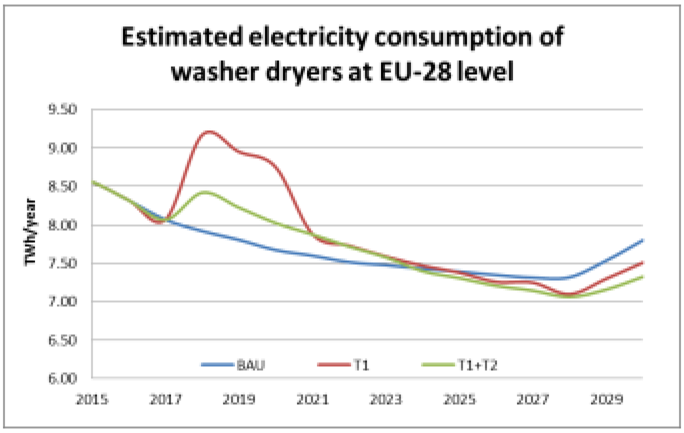
Year	BAU	ED+EL	
		T1	T1&T2
2012	9.23	9.23	9.23
2013	8.89	8.89	8.89
2014	8.71	8.71	8.71
2015	8.56	8.56	8.56
2016	8.32	8.32	8.32
2017	8.07	8.07	8.07
2018	7.92	9.17	8.42
2019	7.81	8.95	8.23
2020	7.67	8.75	8.02
2021	7.60	7.88	7.88
2022	7.52	7.73	7.72
2023	7.48	7.59	7.58
2024	7.43	7.47	7.40
2025	7.39	7.38	7.31
2026	7.35	7.26	7.21
2027	7.32	7.25	7.15
2028	7.32	7.10	7.06
2029	7.54	7.30	7.16
2030	7.80	7.51	7.33

Table A6.13 GHG emissions of the stock of washer dryers for the scenarios BAU and ED+EL for the options T1 and T1&T2

Year	GHG emissions of washer-dryers (Mln CO_{2eq}/year)		
	BAU	ED+EL	
		T1	T1&T2
2012	3.57	3.57	3.57
2013	3.37	3.37	3.37
2014	3.23	3.23	3.23
2015	3.10	3.10	3.10
2016	2.94	2.94	2.94
2017	2.77	2.77	2.77
2018	2.65	3.06	2.81
2019	2.53	2.91	2.67
2020	2.42	2.76	2.53
2021	2.36	2.44	2.44
2022	2.29	2.36	2.35
2023	2.24	2.28	2.27
2024	2.19	2.20	2.18
2025	2.14	2.14	2.12
2026	2.06	2.04	2.03
2027	1.99	1.97	1.94
2028	1.93	1.87	1.86
2029	1.92	1.86	1.82
2030	1.91	1.84	1.80

Table A6.14 Estimated water consumption of the stock of washer dryers for the scenarios BAU and ED+EL for the options T1 and T1&T2

Year	Water consumption of washer-dryers (mln m^3/year)		
	BAU	ED+EL	
		T1	T1&T2
2012	178.92	178.92	178.92
2013	169.01	169.01	169.01
2014	164.68	164.68	164.68
2015	161.07	161.07	161.07
2016	154.69	154.69	154.69
2017	148.54	148.54	148.54
2018	145.13	112.05	100.10
2019	142.42	109.47	97.88
2020	139.01	107.26	95.72
2021	132.62	93.97	93.97
2022	130.61	92.26	92.17
2023	129.51	90.59	90.50
2024	128.25	89.17	88.43
2025	127.02	88.05	87.31
2026	125.73	86.67	86.02
2027	124.59	86.46	85.21
2028	124.26	84.60	84.14
2029	127.35	86.97	85.06
2030	131.29	89.38	86.90



FigureA6.3 Estimated electricity consumption of the stock of washer dryers for the scenarios BAU and ED+EL for the options T1 and T1&T2

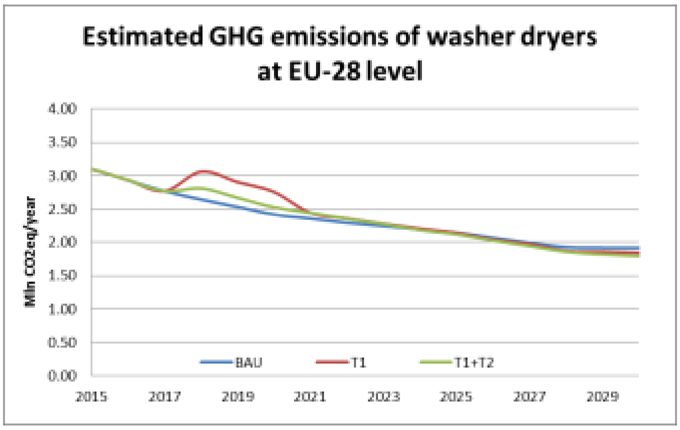
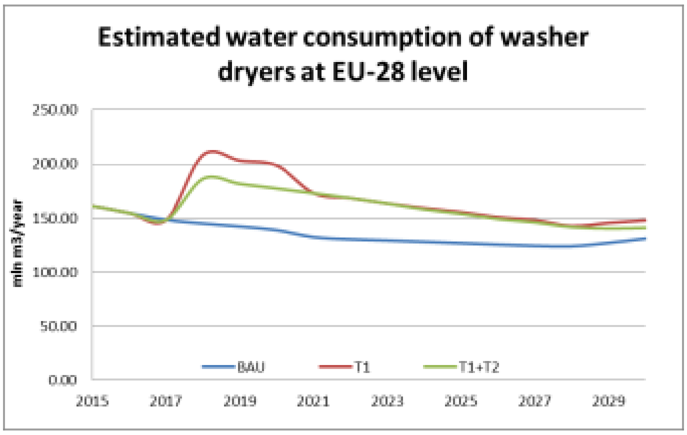


Figure A6.4 GHG emissions of the stock of washer dryers for the scenarios BAU and ED+EL for the options T1 and T1&T2



FigureA6.5 Estimated water consumption of the stock of washer dryers for the scenarios BAU and ED+EL for the options T1 and T1&T2

6.9.5 Estimation of the economic impacts for washer dryers

Table A6.14 Estimated revenue of the EU manufacturers and retailers for the scenarios POWM 2, POWM 3, POWM 4, BAU and ED+EL for the options T1 and T1&T2

Billion of euro$_{2015}$	**revenue of the EU manufacturers**			**revenue of the EU retailers**		
		ED+EL			**ED+EL**	
	BAU	**T1**	**T1&T2**	**BAU**	**T1**	**T1&T2**
2012	0.14	0.14	0.14	0.38	0.39	0.39
2013	0.14	0.15	0.15	0.38	0.39	0.39
2014	0.14	0.15	0.15	0.39	0.39	0.39
2015	0.15	0.15	0.15	0.39	0.39	0.39
2016	0.13	0.13	0.13	0.35	0.35	0.35
2017	0.13	0.13	0.13	0.35	0.36	0.36
2018	0.13	0.14	0.14	0.36	0.36	0.36
2019	0.13	0.14	0.14	0.36	0.36	0.36
2020	0.14	0.14	0.14	0.37	0.37	0.37
2021	0.14	0.14	0.14	0.37	0.38	0.38
2022	0.14	0.14	0.14	0.38	0.38	0.38
2023	0.14	0.14	0.14	0.38	0.39	0.39
2024	0.14	0.15	0.15	0.39	0.39	0.39
2025	0.15	0.15	0.15	0.39	0.40	0.40
2026	0.15	0.15	0.15	0.40	0.40	0.40
2027	0.15	0.15	0.15	0.40	0.41	0.41
2028	0.15	0.15	0.15	0.41	0.41	0.41
2029	0.20	0.20	0.20	0.53	0.54	0.54
2030	0.20	0.21	0.21	0.55	0.56	0.56

Table A6.15 Estimated number of jobs of the EU manufacturers and retailers for the scenarios BAU and ED+EL for the options T1 and T1&T2, POWM 2, POWM 3, POWM 4, POWM 4, T1&T2

Thousands of jobs	**Manufacturers' employees**			**Retailers' employees**		
		ED+EL			**ED+EL**	
	BAU	**T1**	**T1&T2**	**BAU**	**T1**	**T1&T2**
2012	0.76	0.77	0.77	6.37	6.46	6.46
2013	0.76	0.78	0.78	6.40	6.50	6.50
2014	0.77	0.78	0.78	6.44	6.54	6.54
2015	0.77	0.79	0.79	6.48	6.58	6.58
2016	0.69	0.70	0.70	5.80	5.88	5.88
2017	0.70	0.71	0.71	5.87	5.95	5.95
2018	0.71	0.72	0.72	5.93	6.02	6.02
2019	0.72	0.73	0.73	5.99	6.08	6.08
2020	0.73	0.74	0.74	6.10	6.19	6.19
2021	0.74	0.75	0.75	6.19	6.28	6.28
2022	0.75	0.76	0.76	6.28	6.38	6.38
2023	0.76	0.77	0.77	6.36	6.45	6.45
2024	0.77	0.78	0.78	6.45	6.54	6.54
2025	0.78	0.79	0.79	6.53	6.62	6.62
2026	0.79	0.80	0.80	6.61	6.70	6.70
2027	0.80	0.81	0.81	6.68	6.78	6.78
2028	0.81	0.82	0.82	6.77	6.87	6.87
2029	1.05	1.07	1.07	8.81	8.94	8.94
2030	1.09	1.11	1.11	9.13	9.26	9.26

6.10 Sensitivity analysis

In order to carry out the impact assessment for the Ecodesign and Energy Label of household washing machines and household washer dryers, several assumption were made. This annex shows the sensitivity analyses carried out on selected assumptions and check the influence of those assumptions on the final results.

6.10.1 Distribution of the sales: starting with a non-gaussian distribution that keeps smoother the real energy consumption of the machines

The impact assessment for household washing machines assumed that after entering into force the revised Ecodesign and Energy Label regulations, the models would adopt a Gaussian distribution among the new Energy Label classes and that this distribution would remain so, throughout the years included in the forecast (up to 2030). This Gaussian distribution assumption means that every year sales would comprise a large number of machines with a medium performance (i.e., representing the main body, reaching a peak), with either side of the peak being made up of a low number of machines performing either poorly or excellently.

However, checking the distribution of other appliances it seems that this type of statistical distribution is not followed over time. Additionally, it was observed that there was a substantial difference between the real energy consumption of the historical series with the predicted energy consumption of the forecasted ones. For this reason, a new distribution was proposed to check the effect of these assumptions.

The new distribution considers that the actual energy consumption of the machines remains approximately constant during the first years of implementation of the new regulations. This means that there is a distortion of the Gaussian distribution, which - in general - brings the energy consumed in each of the scenarios closer to that observed in the BAU scenario. In the example included in Tables 5 to Table 8 of the IA report, the energy consumed of the BAU scenario in 2018 reaches 117.40 kWh/y per average machine. This value reaches 130.83 kWh/year per "average machine"[22] if a Gaussian sale distribution is applied or 114.42 kWh/year per average machine if a non-Gaussian distribution is used. These new distributions provide a forecast which predicts a more optimistic penetration of the high-end technologies on the market needing an adaptation of the proposed A-G energy efficiency classes.

The results of the new sales distributions for the scenarios with two Tiers (T1+T2) being closer to the energy consumed in the BAU scenario, as well as the values reported in the impact assessment report are shown in the following tables.

[22] The energy consumption of an average machine is the weighted average of the energy efficiency consumptions of each classes weighted by the market share of each class

Table 1. Electricity consumption with a Gaussian distribution

Electricity consumption (TWh/year)	POWM 1 (BAU)	POWM 2		POWM 3		POWM 4	
		T1	T1&T2	T1	T1&T2	T1	T1&T2
2015	29.30	29.30	29.30	29.30	29.30	29.30	29.30
2020	26.59	30.79	27.18	27.11	27.59	26.67	25.78
2025	26.56	30.68	25.59	25.53	26.29	25.7	24.32
2030	25.92	29.96	24.73	23.87	24.74	24.77	23.32

Table 2. Electricity consumption with a non-Gaussian distribution

Electricity consumption (TWh/year)	POWM 1 (BAU)	POWM 2		POWM 3		POWM 4	
		T1	T1&T2	T1	T1&T2	T1	T1&T2
2015	29.30		27.41		27.41		27.41
2020	26.59		22.44		23.05		22.32
2025	26.56		20.26		21.01		20.40
2030	25.92		18.87		19.40		18.61

It is remarkable the energy savings that are obtained under these new sales distributions. As seen in the tables, the energy savings in the scenario POWM2 (T1+T2) reached 7.04 TWh/year, in the scenario POWM3 (T1+T2) 6.52 TWh/year and in the scenario POWM4 (T1+T2) 7.31 TWh/year in 2030. This means approximately 2.5 times more than the energy savings in 2030 reported in the impact assessment.

Table 3 Estimated total water consumption at EU level of the stock of WMs under actual use conditions for scenarios BAU, POWM 2, POWM 3 and POWM 4, for the options T1 and T1&T2

Water consumption (million m^3/year)	POWM 1 BAU	POWM 2		POWM 3		POWM 4	
		T1	T1&T2	T1	T1&T2	T1	T1&T2
2015	2250	2250	2250	2250	2250	2250	2250
2020	1923	1676	1299	1586	1245	1627	1273
2025	1719	1563	1083	1477	1049	1523	1063
2030	1634	1499	989	1397	938	1469	967

Table 4 Estimated water consumption for a non-Gaussian distribution.

Water consumption (million m^3/year)	POWM 1 BAU	POWM 2		POWM 3		POWM 4	
		T1	T1&T2	T1	T1&T2	T1	T1&T2
2015	2250		2272		2272		2272
2020	1923		1538		1489		1515
2025	1719		1436		1396		1421
2030	1634		1399		1354		1374

Table 5. BAU scenario

									Total sales	Aver energy consumed (kWh/y)	Aver energy declared (kWh/y)	Aver water consumed (l/cycle)
kWh/y declared	196.88	173.52	153.50	138.15	122.80	107.45	92.10	76.75				
kWh/y consumed	147.66	130.14	115.13	103.61	92.10	80.59	69.08	57.56				
Water (l/cycle)	50.65	48.14	46.00	44.35	42.71	41.06	39.41	37.77				
Year												
2018	4%	31%	40%	18%	7%				100%	117.40	156.53	46.32
2019	0%	27%	35%	25%	13%				100%	113.31	151.08	45.74
2020	0%	22%	31%	29%	15%	3%			100%	110.60	147.47	45.35
2021		18%	29%	30%	17%	6%			100%	108.39	144.52	45.04
2022		14%	27%	31%	19%	9%			100%	106.18	141.57	44.72
2023		12%	25%	33%	21%	9%			100%	105.19	140.25	44.58
2024		10%	23%	35%	22%	10%			100%	104.08	138.77	44.42
2025		8%	21%	36%	24%	11%			100%	102.86	137.14	44.25
2026		6%	19%	35%	26%	13%	1%		100%	101.06	134.75	43.99
2027		4%	18%	33%	28%	15%	2%		100%	99.38	132.51	43.75
2028		2%	17%	31%	30%	17%	3%		100%	97.70	130.26	43.51
2029		0%	15%	29%	32%	19%	5%		100%	95.55	127.41	43.20
2030		0%	12%	27%	34%	21%	6%		100%	94.17	125.56	43.00

Table 6. Gaussian distribution of the scenario POWM (T1+T2)

			G	F	E	D	C	B	A			Total sales	Aver energy consumed (kWh/y)	Aver energy declared (kWh/y)	Aver water consumed (l/cycle)
kWh/y declared	194.23	178.20	163.94	149.68	137.21	126.52	115.83	106.92	98.01	89.10	78.41				
kWh/y consumed	157.33	144.34	132.79	121.24	111.14	102.48	93.82	86.61	79.39	72.17	63.51				
Water (l/cycle)	52.03	50.17	48.52	46.87	45.43	44.19	42.95	41.92	40.89	39.86	38.62				

Year															
2018	2%	22%	42%	26%	5%	3%						100%	130.83	161.52	48.24
2019	1%	18%	43%	28%	6%	4%						100%	129.37	159.72	48.03
2020		14%	45%	29%	7%	5%						100%	128.03	158.06	47.84
2021		10%	43%	32%	9%	6%						100%	126.48	156.15	47.62
2022		7%	42%	33%	10%	8%						100%	125.20	154.57	47.44
2023		1%	39%	37%	13%	10%						100%	122.79	151.59	47.09
2024		0%	38%	35%	15%	12%						100%	121.86	150.45	46.96
2025			34%	34%	18%	14%						100%	120.72	149.04	46.80
2026			32%	32%	19%	15%	2%					100%	119.66	147.72	46.64
2027			29%	31%	21%	16%	3%					100%	118.65	146.48	46.50
2028			27%	28%	23%	17%	5%					100%	117.48	145.03	46.33
2029			24%	25%	26%	18%	7%					100%	116.09	143.32	46.13
2030			19%	23%	29%	20%	9%					100%	114.29	141.09	45.88

Table 7. non-Gaussian distribution of the scenario POWM (T1+T2)

			G	F	E	D	C	B	A			Total sales	Aver energy consumed (kWh/y)	Aver energy declared (kWh/y)	Aver water consumed (l/cycle)
kWh/y declared	194.23	178.20	163.94	149.68	137.21	126.52	115.83	106.92	98.01	89.10	78.41				
kWh/y consumed	157.33	144.34	132.79	121.24	111.14	102.48	93.82	86.61	79.39	72.17	63.51				
Water (l/cycle)	52.03	50.17	48.52	46.87	45.43	44.19	42.95	41.92	40.89	39.86	38.62				
Year															
2018			10%	35%	33%	16%	6%	0%				100%	114.42	141.25	45.90
2019			5%	31%	35%	20%	8%	1%				100%	111.99	138.26	45.55
2020			2%	25%	37%	24%	10%	2%				100%	109.80	135.55	45.24
2021				19%	39%	26%	12%	4%				100%	107.75	133.02	44.94
2022				12%	40%	28%	15%	5%				100%	106.10	130.99	44.71

2023				6%	38%	32%	18%	6%				100%	104.39	128.87	44.46
2024					31%	36%	23%	10%				100%	101.59	125.42	44.06
2025					26%	34%	25%	12%	3%			100%	99.97	123.42	43.83
2026					21%	32%	27%	14%	6%			100%	98.35	121.42	43.60
2027					17%	26%	29%	18%	10%			100%	96.28	118.86	43.30
2028					12%	23%	30%	23%	12%			100%	94.50	116.67	43.05
2029					6%	19%	32%	26%	15%	2%		100%	92.03	113.62	42.70
2030						17%	33%	29%	17%	4%		100%	89.88	110.96	42.39

6.10.2.- Faster or lower penetration of the best available technologies on the market

Another source of uncertainty is the pace at which the high-end technology can penetrate into the European market. Different scenarios can be modelled even if the same policy tools and with the same level of ambition are applied. For example, and considering the example shown in table 7 for the scenario POWM4, we can model the scenario considering the both regulations give a great incentive to the manufacturers to improve the machines and that this is well-accepted by the consumers or on the contrary, that this incentive is not enough to push the development of the market toward better machines or that these better machines are not well-accepted by the consumer (i.e. because they are more expensive).

Considering this two possibilities it was observed that a sale distribution that improves the average energy consumption of the average machine in 2030 by 1% achieved an overall energy saving that is also 1% higher. However, a sales distribution that increases the average energy consumption of a unit in 2030 per 4%, increases the overall energy consumption at EU-level in 32%.

6.10.3.- Consumer behaviour: higher or lower energy consumption at unit level due to the consumer behaviour.

The decisions by the user on to the selection of the washing programmes have also an influence on the overall energy consumed. The user behaviour is included in the ecomodelling throughout a factor that relates the energy declared and the energy consumed in the real life. The value declared is provided in the energy label and based on the testing programme. However the energy consumed is obtained by considering the mix of programmes used by the consumers as well as the capacity of the machines.

In order to check the relevance of this factor in the final results of the model, the values used for estimating the energy consumed in scenario POWM4 (T1+T2) were modified by reducing or increasing those values in 20% (this means by multiplying the consumer factors used by 0.8 or 1.2 respectively)

The results show that the consumer factor is very relevant in the final results of the model. More in detail, when the consumer behaviour is changed towards a higher energy consumption (+20% in average), the overall energy consumption of the POWM4 (T1+T2) increases in 14%, being the energy consumption in 2030 even higher than the BAU scenario. On the other hand, if thanks to the consumer behaviour, the energy consumption of each machine is decreased approx. 20% the overall energy consumption at EU level will decrease in 8%.

Annex 7: Resource efficiency

This Annex collates information related to material efficiency, in order to examine the merits of the proposed requirements on material efficiency reparability and durability.

7.1. Identification of potential measures for material efficiency: reparability and durability – Evidence examined

Additional information from ongoing studies and submissions was received post Consultation Forum. Several important sources of very recent information regarding material efficiency inputs regarding white goods, and to a large extent household washing machines and washer dryers, have been used:

- Preparatory study for household washing machine and household washer dryers: key findings.
- Post-Consultation Forum information sent to the European Commission by EU and national consumer NGOs.
- Draft information collected from an ongoing European Commission socio-technical and legal project entitled "Behavioural Study on Consumers' Engagement in the Circular Economy" – to be completed during 2018 (DG JUST)
- European Commission "design for circularity" studies being conducted – also to be completed during 2018.
- Draft information related to the horizontal standards request M543 to ESOs.

7.2. Evidence regarding sub-optimal repair practice in the EU

7.2.1 Academic Literature

The overall number of repairs (per inhabitant, in the EU) is decreasing. Where a defect occurs, appliances are increasingly being discarded, even though a repair might have increased its in-service lifetime. The reasons for discarding products might be e.g. intrinsic product design impeding repairs, the lack of, or no access to spare parts, or the relatively high costs for repairs compared to buying a new product.

Tecchio et al. (2016)[23], in their study examining dishwashers and washing machines, made the following three-way classification of reasons for not repairing a device:

(i) **too expensive** for consumers (the repair is technically possible but considered too expensive by the consumer)

(ii) **not viable** (the repair is technically possible but considered economically not feasible by the technician) and

(iii) **technically not feasible** (the repair is technically not possible, mainly because the spare parts are not available or the cause of failure is not identifiable).

The distribution of the cases into these three categories varies depending on the failure. For example, for the most frequent failure types (failures in the pumps or electronics), the main

[23] Tecchio, P.; Ardente, F. & Mathieux, F. (2016). Durability, Reusability, Reparability – Assessment for dish-washers and washing machines: Draft version June 2016.

reason for not repairing the washing machine or washer dryer is that the repair was considered too expensive by the consumer. This reason accounts for approximately 76% of the cases. The second most important reason was that it was technically not feasible (17.5%), while 'economically not viable (by the repairer)' only accounted for 6.5%.

Tecchio et al. (ibid.) draw additional LCA-based conclusions regarding the environmental benefits balance of "repair vs. replace":

- Prolonging the lifetime of the washing machines and washer dryers is environmentally beneficial for the Global Warming Potential (GWP) indicator in the large majority of the considered scenarios. In GWP terms, it is better to replace an old washing machine after the average lifetime of 12.5 years rather than prolonging its lifetime (via repair etic) if the new washing machine is at least 15% more energy-efficient.
- Regarding the ADP (Abiotic Depletion Potential) indicator (e.g., use of metals and minerals, etc.), which is mainly affected by materials used during the production phase, prolonging the lifetime of the washing machine is shown as beneficial in all cases. The ADP indicator can be reduced by over 45% when the operating life is extended by 6 years and about 7% for when the lifetime is extended by 1 year.

Stamminger et al (2018)[24] examined progress towards a durability test for washing machines, making an analysis of available durability standards and procedures, and testing the relatively rapid testing criteria that they were proposing on two test machines. The outcome via practically cross-checking the proposals showed that the work serves as valuable input to the ongoing standardisation (Ecodesign-related request// mandate M543) work in this field, but that it needs further refinement still.

7.2.2 RREUSE Network Survey: 2013

The RREUSE network, which works in the field of preparation for reuse and repair of domestic fridges, washing machines and dishwashers, conducted a survey in 2013. Apart from the before mentioned increasing lack of access to information to repair (service manuals, software and hardware), two other key obstacles to the repair of fridges, dishwashers and washing machines were identified:

- Rapid change of product design and difficulty in access to spare parts

> Rapid changes in product design and components are hampering repair efforts often without any perceived notable changes in functionality. A lack of interoperability of key components across different brands and even within brands is making repair more difficult. When replacing an electronic board for example, it must be from the same make and model of the original appliance.
>
> The cost of spare parts may also far exceed production costs. For example retail prices of timers for washing machines and washer dryers are often much higher than production costs, but are critical components of the appliance. The length of time

[24] Stamminger R, Tecchio P, Ardente F, Mathieux F & Niestrath P (2018), *Resources, Conervation & Recycling* 131 (2018), 206-215

that spare parts are available to purchase also significantly impacts the potential repair of a given product. In addition, sometimes only a full set of spare parts can be purchased when only a single part is needed.

- Increasing difficulty to disassemble products for repair

Increasing difficulty in separating individual components from the casing or in accessing key parts in the interior of appliances hinders replacement and repair and therefore renders many appliances without reuse potential. For example, if one cannot open the outer case of a product without breaking it, then the reuse potential is completely lost.

7.2.3. Behavioural Study on Consumers' Engagement in the Circular Economy (2017-18)

There is ongoing work being performed by a consortium of LE Europe, VVA Europe, Ipsos, ConPolicy and Trinomics which is one of the largest consumer surveys undertaken by the European Commission (DG JUST). Consumer surveys have been combined together with a series of behavioural experiments with consumers.

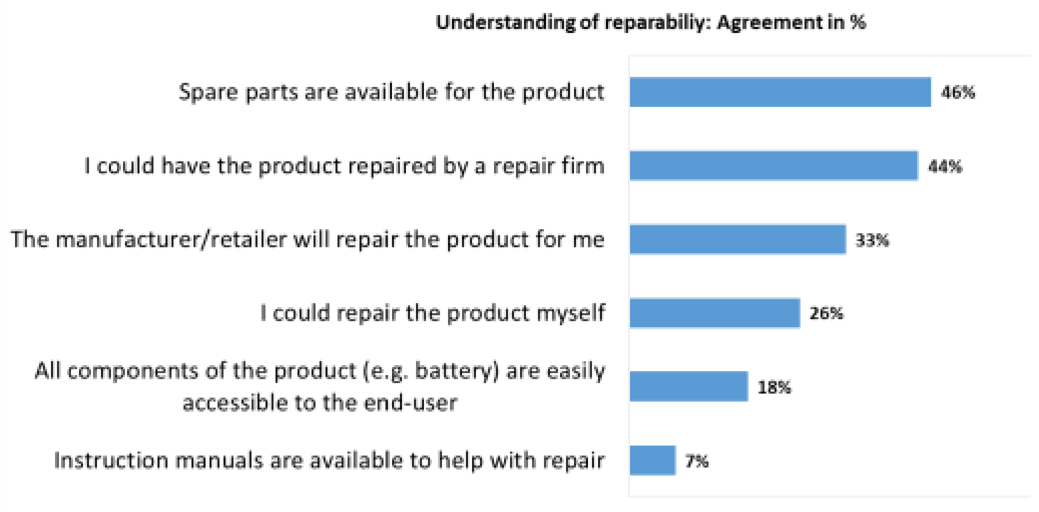
The *Behavioural Study on Consumers' Engagement in the Circular Economy* has involved 12 000 people, consisting of firstly a survey conducted with around 1 000 people in each of 12 EU Member States (a selected mixture of 'Northern', 'Southern', 'Eastern' and 'Western' MS), and secondly a behavioural experiment on "repairing equipment" and "purchasing equipment", conducted in 6 of the 12 MS, using the same 1 000 candidates per MS as in the survey. The candidates were selected to mirror representatives of the EU's populations in terms of gender and age, as shown in Eurostat's data.

The following findings are taken from a draft interim report, and should be treated as draft conclusions, together with the caveat that the JRC team performing the Impact Assessment study selected the relevant items of interest regarding dishwashers, which were viewed as representative for washing machines/ washer dryers overall, out of the five consumer products investigated (dishwashers, vacuum cleaners, televisions, mobile phones and clothes)[25] under realistic product selection and decision-making conditions.

Figure A7.1 below shows the results from the large-scale consumer survey element of the work, which underlines that "the availability of spare parts" and the fact that a repair firm could manage to repair a product are the two main "shorthand" descriptors that consumers use when describing what "reparability" means to them.

For general information about reparability, to the question "I would like to received better information on how easy it is to repair a product", 23% of the participants strongly agreed, and an additional 61% "tended to agree" with this assertion.

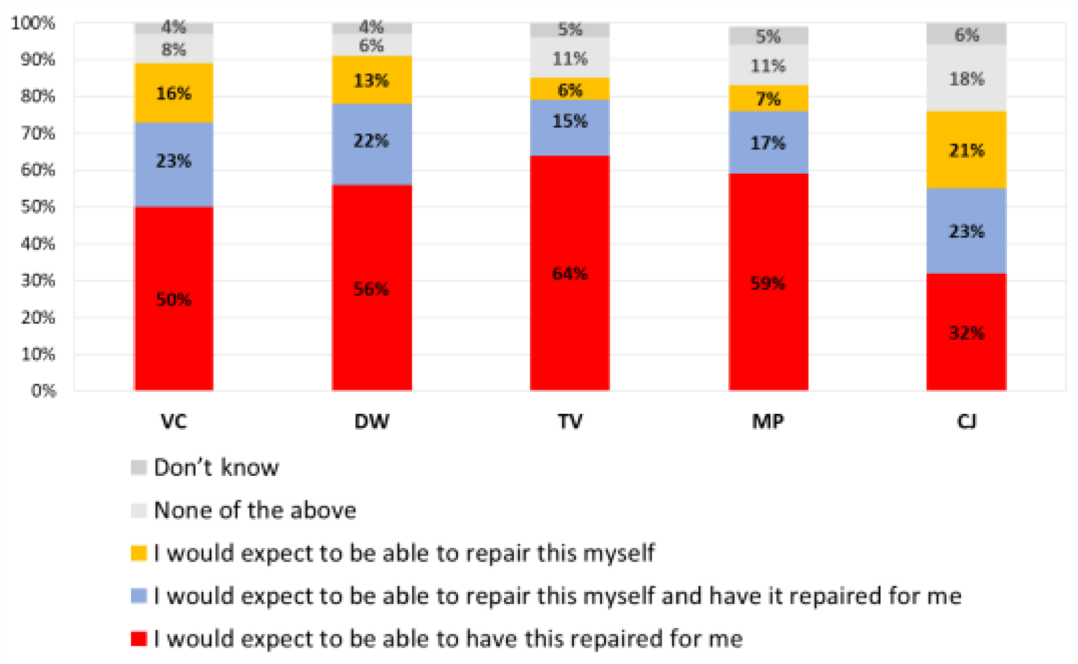
[25] Note that from the five products, three are already subject to Ecodesign and Energy Labelling regulations (dishwashers, vacuum cleaners and televisions).



Notes: The corresponding question was: "Please select the two properties you most associate with a "repairable" product." Since participants indicated the two most appropriate reasons, the totals do not sum up to 100%. N=12,064.

Figure3: General understanding of reparability (in %). Source: ConPolicy analysis of consumer survey data.

Figure A7.2 shows further results from the survey, according to the five products studied. A total share of 91% of people surveyed would expect that a dishwasher could be either repaired either by someone external competent to perform the work (56%), or both someone external and themselves (22%), or by themselves (13%). Note that overall, the trends between the five product groups examined are broadly similar, with the exception of clothes, where the expectation of being able to self-repair the product is perhaps understandably higher.



Key: VC: vacuum cleaner; DW: dishwasher; TV: television; MP: mobile phone; Cl: clothes

Figure A7.2: Expectations regarding repair services by product category (in %). Source: ConPolicy analysis of consumer survey data.

With regard to consumers' understanding of durability, Figure A7.3 stresses the twin ideas of both use for a long period of time, and also that the product will "stay in perfect working order for a long time". High duty (i.e., frequent) use and heavy duty use also figure in expectations, but to a lesser degree.

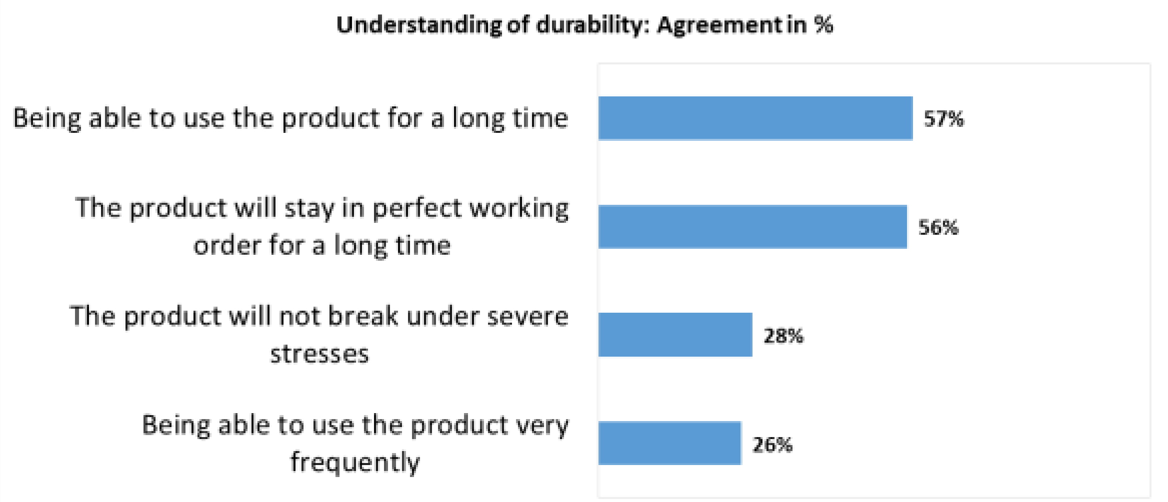


Figure A7.3: Expectations on durability by product category (in %). Source: ConPolicy analysis of consumer survey data.

With regard to expectations per product category, Table A7.1 shows that, for dishwashers, most people's durability expectations were that the products should last between 7-15 years, but with almost 25% of respondents having the low expectation of a total lifetime of less than 7 years.

Table A7.1: Expectations on durability by product category (in %). Source: ConPolicy analysis of consumer survey data.

Product	VC (%)	DW (%)	TV (%)	MP (%)	CI (%)
Less than 1 year	1.0	0.6	0.7	1.4	2.0
More than 1 but less than 2 years	2.4	1.6	1.4	6.1	5.6
More than 2 but less than 4 years	10.6	5.0	4.5	38.2	24.7
More than 4 but less than 7 years	27.1	17.6	20.3	34.9	26.4
More than 7 but less than 10 years	27.0	29.1	31.4	10.3	14.9
More than 10 but less than 15 years	21.2	28.5	28.3	4.2	11.3
More than 15 but less than 20 years	5.1	7.4	7.3	0.9	4.4
More than 20 years	2.4	2.9	2.8	0.8	5.0
Don't know	3.2	7.2	3.2	3.4	5.7

Notes: The question was: "For how long would you expect the following products to last on average under normal use conditions, in terms of the number of years before they need to be replaced? By 'normal use conditions' we mean normal frequency of use and taking into account usual maintenance, servicing and small repairs of the product. Don't worry if you do not know exactly – please provide your best estimate for each product."; N=12,064.

With regard to the possible depiction of durability information expectations per product category, Table A7.1 shows that, for dishwashers, treated as washing machines and washer dryers most people's durability expectations were that the products should last between 7-

15 years, but with almost 25% of respondents having the low expectation of a total lifetime of less than 7 years.

In the Behavioural Experiment component of the work, participants were shown realistic products via simulated prices and labelled information, and had to make firstly product purchase choices, and secondly product "repair or replace" choices. Figure A7.4 shows that manufacturers' guarantees and a depiction of "expected lifetime" have a high influence on purchasing decisions, but also that the influence of EU labels is high, via the expected reputable "trusted brand" status that this offers. Interestingly, when durability and reparability information were both shown in a "simulated EU label" style, consumers found this more confusing than when durability information solely was depicted.

Table A7.2 takes this a step further, and shows the preliminary Willingness To Pay (WTP) analyses from the observations during the behavioural experiment, where – for dishwashers, treated as washing machines and washer dryers – consumers are shown as possibly being willing to pay (more, compared to the base case of "no information") between €30-€36 per year for reputable information on products' durability, durability/ reparability, the manufacturers' guarantee or "expected lifetime" information.

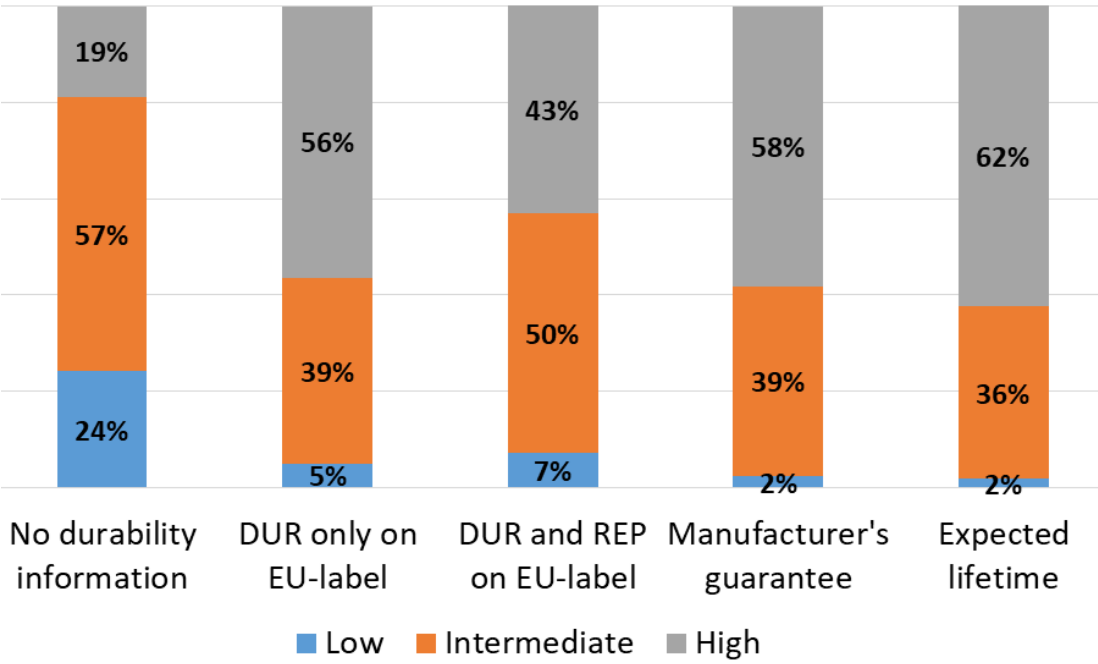


Figure A7.4: Influence on decisions in the behavioural experiment according to depictions of durability, reparability, guarantees and expected lifetime on simulate labels (in %). Source: ConPolicy analysis of consumer survey data.

WTP (in € p.a.)	VC	DW	TV	SP	CL
No info shown	Insignificant				
DUR on EU-label	33	30	126	15	18

Table A7.2: Influence on decisions in the behavioural experiment according to preliminary Willingness To Pay analyses according to the decisions made Source: ConPolicy analysis of consumer survey data.

DUR and REP on EU-label	20	31	92	12	14
Manufacturer's guarantee	33	33	128	18	24
Expected lifetime	36	36	148	18	27

7.2.4 Post-Consultation Forum Information from BEUC/ ANEC, on behalf of national Consumer Associations (data collected 2016-2017)

A number of reports were sent post-Consultation Forum to the European Commission by EU and national consumer NGOs. Table A7.3 below summarises several reports sent to the Commission by ANEC/ BEUC after the December 2017 Consultation Forum which deal with problems associated with repairs and doubts about products' durability. This information refers to "white goods" as a whole. Importantly, the emphasis of the reported questionnaires and test studies has concentrated particularly on washing machines.

Whilst the experiences related from the surveys and tests performed largely relate to "white goods" as a whole as well as washing machines, the results portray repair services which are functioning sub-optimally for the "white goods" covered. Supporting evidence for further and transparent information to enable repairs is strong, if partly anecdotal, and the costs of the repairs and the poor quality of diagnoses and suggested repair solutions are evident.

Table A7.3. Key findings from reports from national consumer associations with regard to reparability of washing machines and washer dryers and other similar appliances

1. QUEL CHOISIR (FR)	2. Verbraucherzentrale (DE)	3. Haushalt und Garten (DE)	4. Forbruker rädet (NO)	5. Test Achats (BE)
- When the repair bill represents 30% of the purchase cost the consumers are reluctant to repair. - The problems to anticipate are: Lack of a dismantling scheme Failed piece not accessible Embedded pieces that need to be broken to unfasten Proprietary tool - Planned obsolescence was not proven, nor was there evidence that the sector is intentionally organised itself to reduce the lifetime of the products.	- Durability and reparability information of electronic products would influence the purchase decision of 50% of the respondents, according to a survey (1000 participants). - 30% replaced devices because of software issues - 30% have experienced a defect within the legal guarantee period. - 30% of the repairs are done on large household appliances (the most repaired appliances) - The most important reason not to repair an appliance was signalled by 74% of respondents as the exorbitant	Two minor but important cable and wiring faults were induced by a technical test institute in 15 used **washing machines** (3 samples of 5 brands) which were situated in consumers' homes, in Germany. The tests were conducted between Oct. 2016 and March 2017. All 15 washing machines were inspected and tested beforehand, to ensure that only the induced faults should affect the performance. The faults required neither special tools nor measurement devices to correctly diagnose them. All machines were out of guarantee. - Only 7 out of the 15 machines	- Increased costs when repair requires home visit (large appliances) - Many of the companies consulted declined to answer questions such as the trip fee, the hourly rate for trouble shooting or repairing or the most common faults for WMs and WDs. - Observed: the repair of a washing machine can amount up to half of the purchase price → VAT reduction on repair would lower the cost of repair and convince consumers to repair instead of discard. A consumer survey conducted in Norway, showed that	- A better Energy Label class has been in the last years achieved by increasing the capacity of the washing machines - Large machines cost a significant amount but consumers never know how many years they will last. However, this information would be essential to know at the purchase stage. - Durability test of washing machines, in cooperation with international partners (SP, IT and PT). 10 years of working was simulated focused on the rinsing programme • In general more expensive machines had better quality parts • More expensive machines are generally larger and suffered the higher degradation (due to e.g. the faster rinsing speed)

cost.

- 70% of the consumers consider the right to repair to be important (47% very important)

were deemed "repairable"

-The purchase of a new machine was recommended as the only option for the remaining 8 appliances

- The mobilisation fees alone for the technicians were from €79-€143

- With repair (in the 7 cases where repair was deemed possible), the overall fees (including mobilisation) were min. €178, up to max. €550.

- In 6 cases out of 7 where a repair was carried out successfully (to the extent that the machine would function again), the recommended solutions were unnecessary and were therefore over-expensive (changing the motor, changing some of the electronics, changing a heating element, or damper, etc.).

- The insulation fault induced on one of the cables was not detected

- In the last 5 years half of the respondents had chosen not to repair an electrical product)
- 30% of respondents expect a lifetime of 10 years for DWs

- Some scattered replies suggest that the economic life of a washing machine is estimated to be 200€ for each 2 years with a maximum duration of 8 years. Others claim they fabricate machines to last 10 or even 15 years.
- Considering the environmental impact of manufacture and use, the lifetime should be 20 years
- 4 of the 24 machines needed to be repaired before finishing the test.

-Repairers state that there are spare parts that are very costly, or parts that are not accessible/are irreplaceable.

- A good level of reparability (considered by the source as easy dismantling, accessibility to parts, replaceability of small parts and more use of standard parts instead of proprietary) does not depend on purchase price.

- The results were:

by any of the technicians who otherwise 'repaired' the machines.

- In one case, no safety test post-repair was conducted.

- The magazine concluded that environmentally all repairs were worthwhile, but financially, depending on the age of the machine, it was worth paying a price for the repair of solely up to 20% to 50% max. of the cost of a new machine.

- Small parts integrated in large ones normally more expensive (bearings were integrated in 15 out the 24 machines)
- Electronic components are not replaceable without replacing the whole electronic board.

- Premature failure of large appliances (after 5 years from the purchase) has risen from 3.5% in 2004 to 8.3% in 2012.

7.3 Measures for Enhanced Reparability – which components of Washing machines and white goods overall need to be addressed?

According to a recent Eurobarometer survey, 77% of citizens in the EU claim a preference in making an effort in repairing their products over purchasing new ones and more than 37% are willing to buy second-hand household appliances[26]. In 2011, the social economy was accounted for 11 million jobs in the EU, an amount that represented the 11% of the total employment. Nevertheless, it must be noted that social enterprises operate mainly in the market of second-hand products whereas the repair activities have a smaller share in the sector but with an increased trend of development (e.g. repair cafés). An increased reparability could therefore promote a growth of the second-hand market of appliances. Such a prospect is expected to benefit low-income households as low-cost and good-quality products would become more affordable.

A study on socioeconomic impacts of increased reparability by Deloitte in 2016[31], goes through technical barriers to repair household washing machines and washer dryers lead as well to cost barriers to perform disassembly activities to repair or dismantling operations at the end of life, e.g. difficulties to access some internal components or the case of some parts that have to be broken to be removed.

- Electronic steering components linked to the timer can fail, but it may be difficult to identify the exact failure. These problems were less common in the past when the steering mechanisms were primarily mechanical.
- Failures in the control unit of a washing machines and washer dryers lead to usually expensive repairs costs due to the price of the control unit.
- The increasing use of electronic components in washing machines and washer dryers means that often the diagnosis of failures has to be done by attaching it to a laptop using specific diagnosis software. The technical documentation and software needed to diagnose the failure are sometimes difficult to access for repair operators that are not official after sales service providers of the manufacturers.
- In some cases, the casing of the washing machines and washer dryers is difficult to open to access the internal components. In the case when the casing is opened at the bottom of the machine, troubleshooting is made difficult, since this cannot be done in a stand-up position with the machine turned on.
- Some internal components cannot be accessed and removed easily: e.g. the heating resistors are sometimes fastened and have to be broken to be removed.

[26] Eurobarometer survey (No. 388, 2014).

More recently (2017), Deloitte also conducted a study to support Ecodesign measures to improve reparability of products in which the sector is analysed, and which presents the following characteristics:

- The number of companies has increased from 2011 till 2014 (+10%), reaching 100,000 in 2014.
- The turnover has increased by 17% between 2011 and 2014, reaching 22 bn Euros in 2014.
- The three sectors employ around 250,000 persons.
- Despite the significant increase of the number of companies and turnover, the total number of persons employed rose by only 4.5% between 2011 and 2014.
- While the number of companies specialised in grey goods represented around 54% of the sector, their generated turnover reached 77%. The sector related to repair of grey goods also employs most persons (64%).

The "circularity" of a product is thus determined not only by the intrinsic product characteristics, but also by the system of which it is a part, as the EEA report states[27]. the probability that a washing machine that is designed for easy repair is actually repaired will depend not only on the business model being used to market it, but also on the infrastructure and governance context of the country in which the appliance is sold and used, and the cost of repairing the appliance compared with the purchase price of a new one. Washing machines and washer dryers that are part of a product‑service system, and/or placed on the market in a country with low labour costs and high availability of technically skilled workers, will have a higher degree of circularity than the same machines sold in a country where a repair sector is largely absent.

The number of businesses, the employment and the turnover of repairers of household appliances dropped considerably In France, between 2009 and 2012[28]. Specifically, the number of enterprises dropped from 2,461 to 1,942, employment from 4,173 to approximately 2,611 individuals and the turnover from approximately €538 million to €382 million.

An analysis of the statistics of repair services conducted by JRC on WM and DW over the 2009-2015 period. Statistics have been derived from data by the repair centre Reparatur- und Service-Zentrum — R.U.S.Z. More than 11 000 datasets were collected, including information such as type of failure mode, repair actions, replacement of components, reasons not to repair and so forth. For washing machines and washer dryers, the electronics (14 % of cases), shock absorbers and bearings (13.8 %), doors (11.5 %), carbon brushes (9.7 %) and pumps (7.5 %). While the highest repair rates were observed for doors, carbon brushes and removal of foreign objects, the lowest rates (repaired devices over total diagnosed devices with a specific failure mode) were observed for

[27] EEA Report No 6/2017. Circular by design Products in the circular economy. https://circulareconomy.europa.eu/platform/sites/default/files/circular_by_design_-_products_in_the_circular_economy.pdf
[28] BIO by Deloitte on behalf of ADEME (2014), Panorama de l'offre de réparation en France.

bearings (24 %), drums and tubs (27 %), circulation pumps (33 %) and electronics (49 %).

According to all the information above plus a literature review from a study conducted by the JRC[29], and the network of repairers RREUSE [30] (statistical data), a more detailed list of the parts of the washing machines and washer dryers that fail the most has been compiled and proposed to be easily removed (to be replaced):

- Motors
- Pumps
- Shock absorbers
- Washing drum, drum spiders and related ball bearings
- Heaters and heating elements
- Door hinges, door seals
- Door locking assembly separable into its constituent sub-components
- Piping and related equipment including all hoses, valves and filters
- Printed circuit boards
- Liquid crystal displays
- Thermostats.

7.4 Measures for Enhanced Durability – Evidence and Discussion

The environmental impacts of household dishwashers that will be considered similar as for washing machines, have been found in the above mentioned study conducted by JRC[80]. The analysis is based on the application of the REAPro method[31] to the DW product group for the following resource efficiency criteria: reusability, recyclability, recoverability, recycled content, use of hazardous substances and durability. The analysis concludes that, due to their potential content of hazardous substances as e.g. mercury, cadmium and other heavy metals, PCBs and liquid crystal displays (LCD), when present, should be extracted from household washing machines and washer dryers before shredding in order to minimise the potential environmental impact of their improper recycling and ensure the best available end-of-life treatment. This study identified that the design for extraction of some key components can increase the recovery yields of various critical, precious and scarce metals, and thus indirectly producing relevant life cycle environmental benefits.

Consultation with industry indicated that washing machines and washer dryers are highly valuable, and therefore they expect high recovery rate in this product group. However industry has little knowledge in the end of life of household washing machines and

[29] Environmental Footprint and Material Efficiency Support for Product Policy. Report on benefits and impacts/costs of options for different potential material efficiency requirements for Dishwashers. Ardente et al. 2015
[30] Investigation into the repairability of Domestic Washing Machines, Dishwashers and Fridges. http://www.rreuse.org/wp-content/uploads/RREUSE_Case_Studies_on_reparability_-_Final.pdf.
[31] Refined methods and Guidance documents for the calculation of indices concerning Reusability/Recyclability/Recoverability, Recycled content, Use of Priority Resources, Use of Hazardous substances, Durability. 2012 (http://lct.jrc.ec.europa.eu/assessment/projects#d).

washer dryers that are not taken back to the manufacturers, i.e. disposed or recycled through other channels.

There is a comprehensive study on household dishwashers, here considered to be similar to washing machines, about EoL dismantling treatments of WEEE[32]. The study is made with copper outcome as target and state that operations done before shredding are beneficial for the recovery of materials. In particular “prior to shredding the important stage is dismantling. More careful dismantling leads to better recovery of material with less number of processing stages. In addition, dismantling by itself is a profitable Johansson and Luttropp introduced the concept of “material hygiene” as optimising the reuse of materials in products. The use of a manual operation is believed by the authors to be viable in a number of aspects including economic. Increasing the marking of products is also essential in order to achieve an industrialized system at the end-of-life for a product in view of the authors. The producer responsibility expressed in the WEEE directive is important from a number of aspects. In order to drive the designs of products towards recycling-friendly products at end of-life, there must be some feed-back from the recycling industry. This information flow is yet another challenge for the future.

The requirement to dismantle printed circuit boards (larger than 10 cm^2) and LCD (larger than 100 cm^2) or other IT components of the household washing machines and washer dryers is proposed in the regulation. Expert consultation for the Ecodesign regulation on servers and storage products indicated that the recovery rate for some other EU countries might not be as high, especially for servers and storage not part of the asset recovery / take back programme of the manufacturers. IT products can be difficult to open due to excessive amount of screws or use of materials that are glued tight together, this hinders valuable materials to be extracted. Finally, rare earth materials or critical raw materials (CRM) are typically not recovered before shredding. These barriers meant that there is a need for easy dismantling, reuse and recycling and recovery by ensuring that no gluing, welding fastening technique or excessive use of screws is used, and furthermore recovery of CRM and rare earth materials requires more incentives or a regulatory push to be realised. Countries without such advanced recycling facilities could benefit from more guidance in extraction, dismantling procedures and the material content, hence it could increase their recovery rates. During the review process of the servers and data storage products regulation, recyclers expressed that a guide on dismantling and disassembly would be a good idea.

7.4.1 Economic advantages of dismantling washing machines (from scientific literature)

In order to study the possible steering mechanisms available at government level, the sensitivity of the economically optimised EoL destination choice for different cost factors was simulated. In the study from Duflou et al. the dismantling process of a standard washing machine is considered[33]. Since dismantling processes oriented towards non-disassembly optimised product typically require a high level of manual labour, the labour cost of operators will have its effect on the selection of the optimal end-of-life scenario.

[32] J. Johansson, C. Luttropp. “Material hygiene: improving recycling of WEEE demonstrated on dishwashers”. Journal of Cleaner Production 17 (2009) 26–35.

[33] While in the study they refer to "disassembly" operations, the term "dismantling" is now preferred to refer to end of life operations

A sensitivity analysis has been used in this study to investigate the preferred end-of-life scenario for variations in the labour cost.

When varying the wages of manual labour workers between 0 and EUR 63/h, the generated value from the end-of-life treatment process of a domestic washing machine can be simulated as in Figure A7.5. The former cost represents unpaid labour while the highest considered cost level approximately corresponds to the use of highly skilled technicians in western countries. The three lines in Figure 22 represent the generated value from the optimal end-of-life treatment process. The black line stands for the neutral scenario, based on current cost data. The optimistic scenario (top red dotted line) presents the results when the boundary conditions are determined by a solid second hand market and historically high prices for raw materials. The pessimistic scenario (bottom red dotted line) on the other hand represents the generated value when more negative boundary conditions can be expected (no second hand market, low prices for raw materials, etc.).

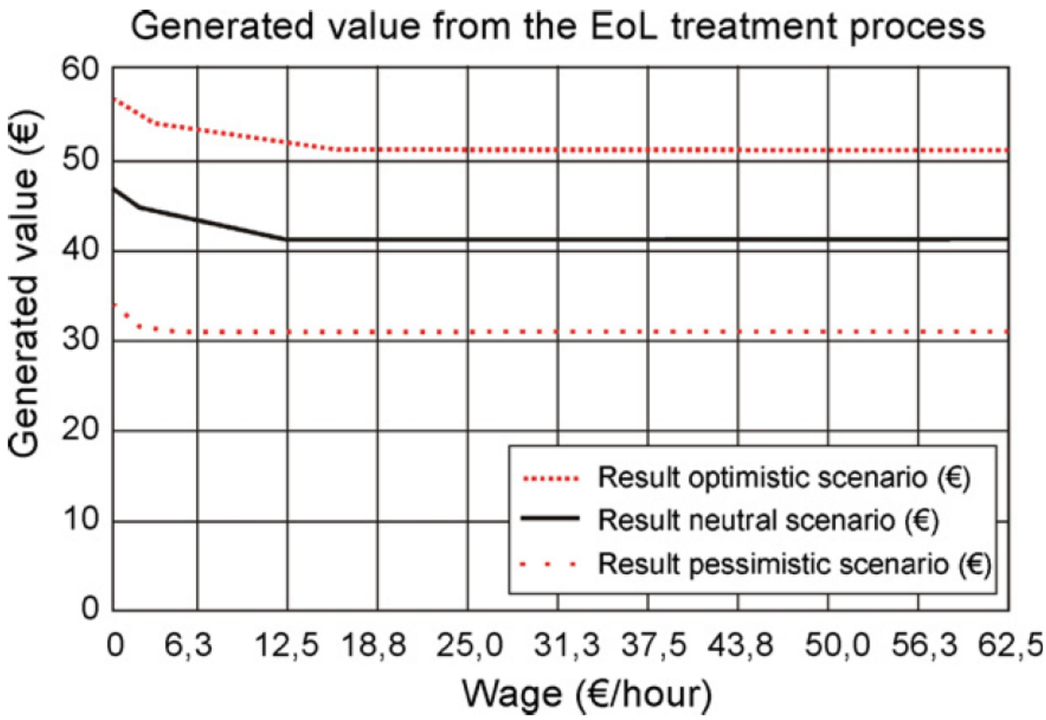


Figure A7.5. Impact of the labour cost on the generated value in the EoL treatment process of a washing machine

In Figure A7.6, the corresponding level of disassembly is represented for each scenario. If the line indicates 100%, full disassembly is performed. If the line indicates 0%, no disassembly is performed. Every level in between corresponds with partial disassembly. These two graphs are linked in such a way a level change in Figure A7.6 corresponds to a slope change in the corresponding function in Figure A7.5. Going from 38% of disassembly to full disassembly results in an increase of the slope, meaning more value is generated by the disassembly process. If no disassembly is performed, the generated value is no longer affected by the variation in the labour cost, resulting in a constant output value.

Regarding the global context of dismantling, this graph shows that if the total wage cost of an operator is higher than EUR 12.5/h, it is not economically feasible to perform any kind of disassembly. When lowering the wage cost below EUR 12.5/h, the cost of the manual disassembly process is compensated by the generated value from component reuse or material recycling. A labour cost of EUR 12.5/h facilitates a partial disassembly process of 38% of the entire product. Lowering the labour cost to less than EUR 3/h would make it economically feasible to perform full disassembly of the washing machine.

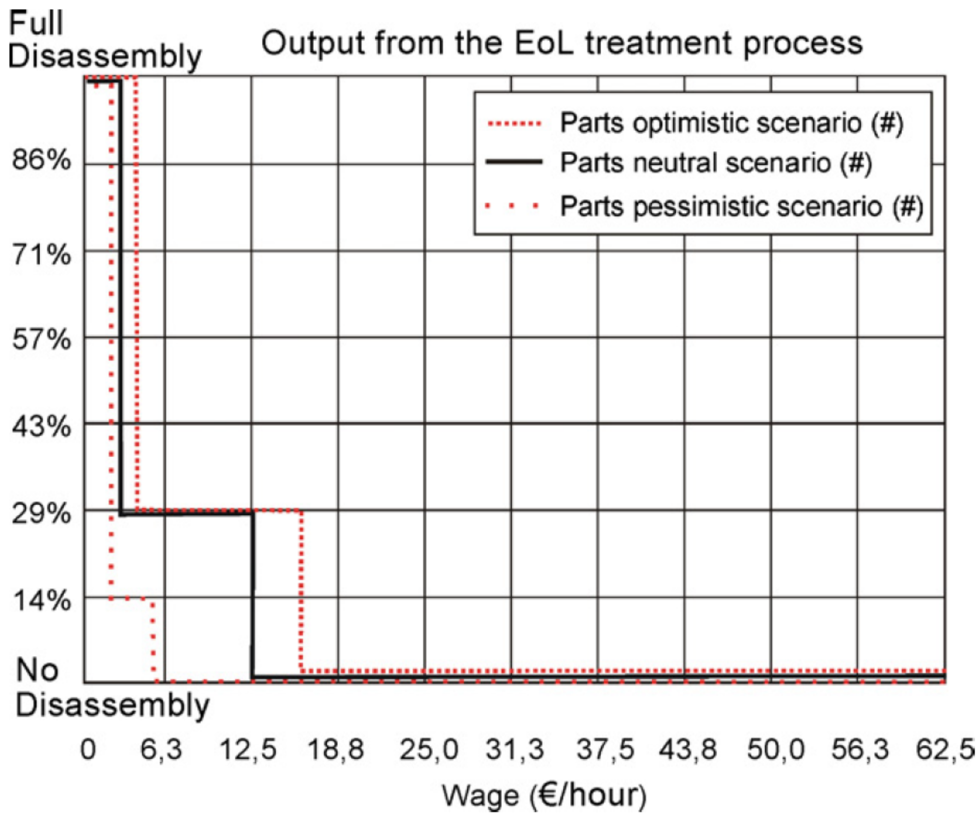


Figure A7.6. Impact of the labour cost on the level of dismantling during EoL treatment of a washing machine.

7.4.2 Economic Sensitivities to Subsidies (Ecoboni) or Penalties (Ecotaxes)

Some governments try to stimulate end-of-life treatment facilities to perform a higher level of dismantling and to reduce the fraction that is sent to landfills. In practice this can be translated into subsidies (Ecoboni) or penalties (Ecotaxes). These compensation fees are paid or charged to end-of-life (EOL) treatment facilities alternatively if they reach a dismantling target or if they do not reach the minimum dismantling level, respectively. The concept of using positive stimuli in the form of Ecoboni has not been widely implemented yet. Ecotaxes are normally only used in extreme circumstances if companies send products or components containing hazardous substances to a landfill.

In the mentioned report from Duflou et al, it was assumed that an Ecobonus is awarded if the end-of-life treatment facility performs full dismantling on a household washing machine. To investigate at which level this Ecobonus will start to have an effect on the selection of the EOL treatment process, this fee will be varied between 0 and 60€. To represent the scenario where an Ecotax is charged when hazardous substances are not removed from the product before material recycling, incineration or landfill, a penalty fee will be enforced if the disassembly level is lower than 38%.

Similarly, the Ecotax will be varied between 0 and EUR 40 to investigate the effect on the selection of the end of life treatment process. In both cases, the reference scenario equals the intermediate scenario from Figure A7.5 and Figure A7.6 where an operator salary cost of EUR 31.3/h was taken into account. Under the absence of Ecoboni or Ecotaxes, no disassembly is performed. In Figure A7.7 the overall generated value is displayed for different values of the Ecobonus and Ecotax. Figure A7.8 represents the corresponding disassembly levels. Regarding the Ecobonus, the curve on the left side of the graph illustrates that the end-of-life treatment facility will only perform dismantling if the benefits exceed the corresponding costs. To fully disassemble the washing machine, a total labour cost of EUR 48 (A in Figure A7.7) is charged. Hence, only an Ecobonus above this level will stimulate the EOL treatment facility to change its strategy from shredding towards dismantling based scenarios. Regarding the Ecotaxes on the right side of the graph, it is clear that the end-of-life treatment facility will only be motivated to perform dismantling once the cost of dismantling is lower than the penalty fee that needs to be paid when no dismantling is performed. In the case of the washing machine, the labour cost of partial dismantling (38%) equals EUR 12 (B in Figure A7.7). Hence, the tipping point where the optimal end-of-life Scenario B3a hanges from no dismantling to partial dismantling, corresponds with an Ecotax of EUR 12.

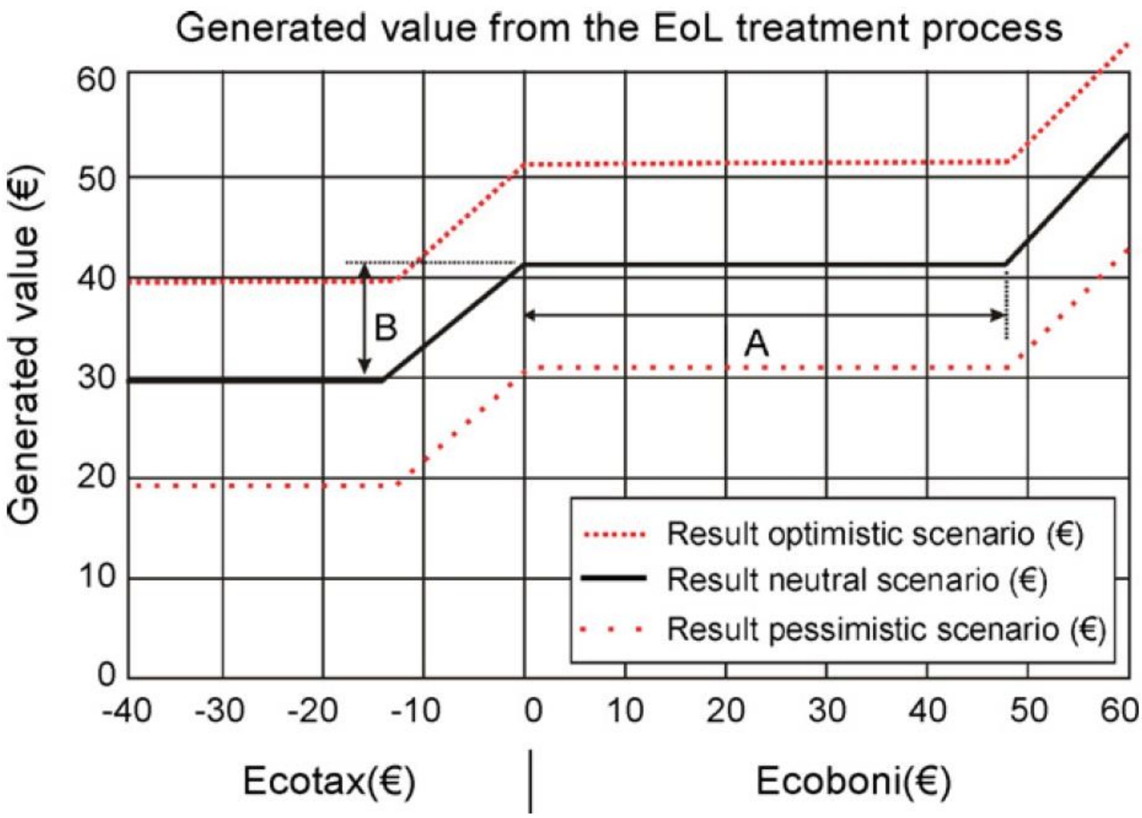


Figure A7.7. Impact of the Ecotax/Ecobonus level on the generated value from the EoL treatment process of a washing machine

Figure A7.8 represents the dismantling levels corresponding to the various Ecoboni and Ecotaxes. As described above, the optimal EOL treatment scenario will shift from no dismantling to full dismantling if the Ecobonus is larger than EUR 48. If the Ecotax is lower than EUR 12, the EOL treatment facility has no incentive to perform dismantling. If this Ecotax increased above this value, partial dismantling will be performed to remove hazardous substances from the product.

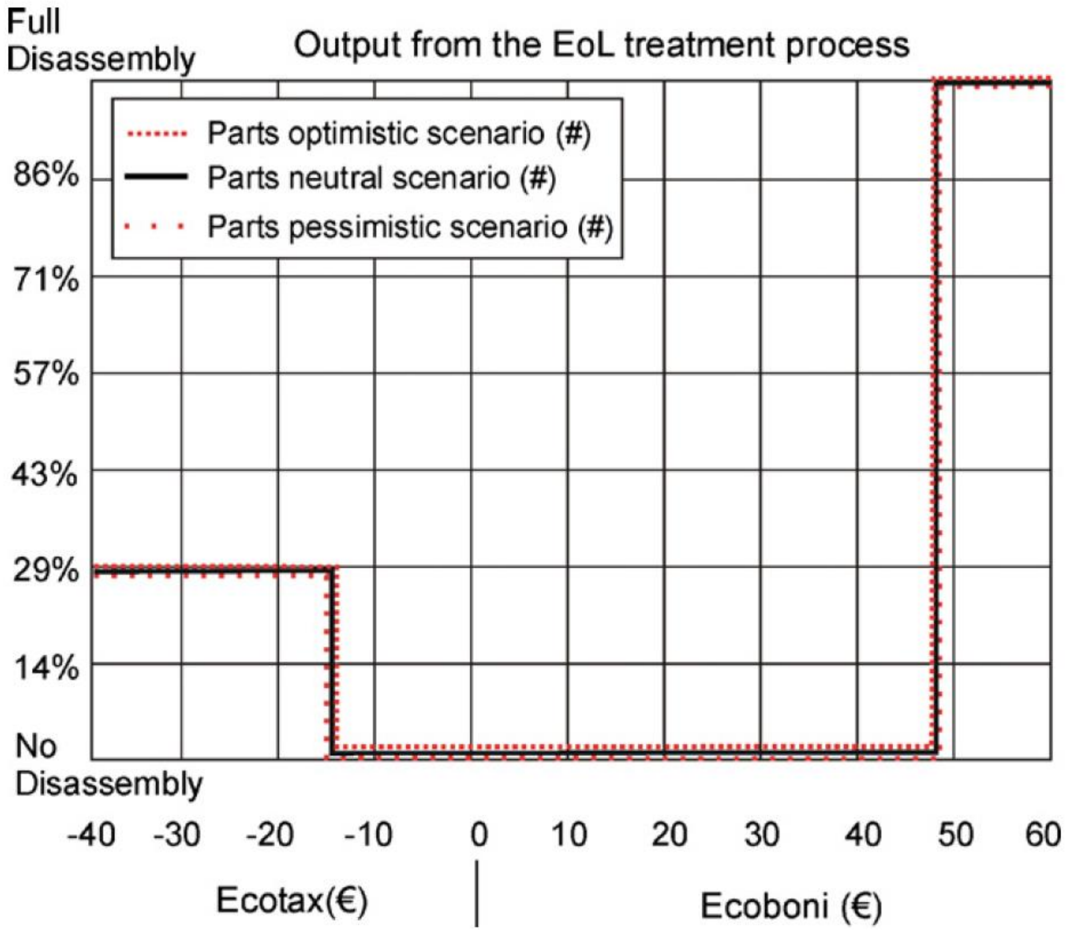


Figure A7.8. Impact of the Ecotax/Ecobonus level on the level of disassembly during the EoL treatment process of a washing machine.

Annex 8: Analysis of the impact details

8.1. Number of units removed from the market

For the distribution of sales there is not much information. It has been therefore assumed that the market will be distributed following a normal or Gaussian distribution, after the entry of the new standard and regulations. That is the energy classes will be clustered following a Gaussian distribution that evolves during time up to 2030 (Figure A8.1). This has been done for every of the scenarios assessed for washing machines.

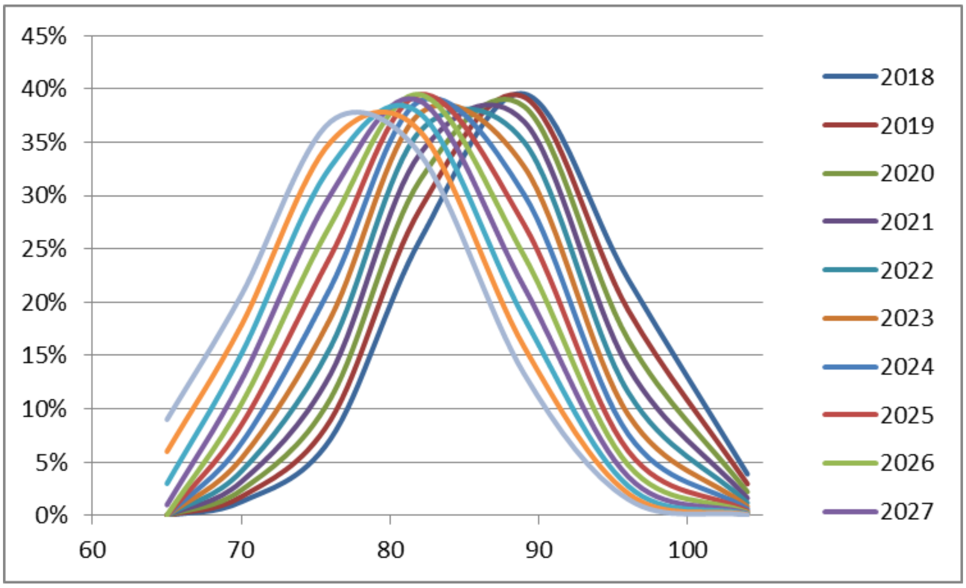


Figure A8.1. Gaussian distribution evolution of the market for washing machines

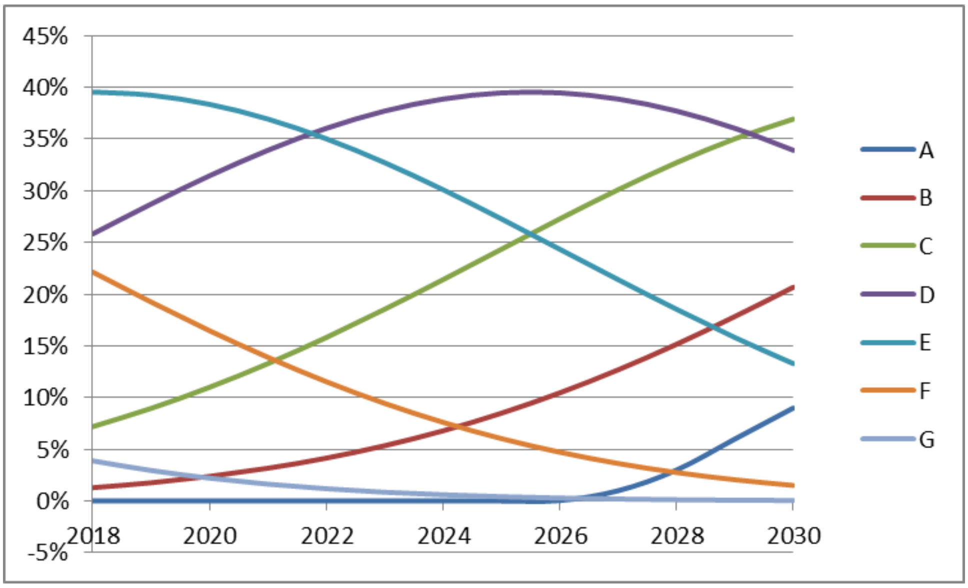


Figure 4. Detail of the evolution of the A to G energy classes for washing machines following a Gaussian distribution

Tier 2 in comparison with T1 sets the improvement in the ambition of the minimum energy requirement in 18%. Tier 2 will remove from the market in 2024, 12%, 8% and 5

% of the models for each scenario (Figure A8.2). Industry has therefore 4 years to adapt the models to the Tier 2. Keeping in mind the number of models to be adapted, this time frame is considered to be feasible.

Table A8.1. Percentage of models removed from the market in 2024

	% improvement between Tier 2 and Tier 1
POWM 2	12%
POWM 3	5%
POWM 4	8%

Considering the current regulation, two Tiers were set up in 2011 and 2013. The energy efficiency improvement between those Tiers was approximately 13%. However, the EEI limit values of the current energy labelling and eco-design values cannot be compared to with the current EEI thresholds of this proposal because the current Regulation 1015/2010 and Regulation 1060/2010 values are based on a combination of standard programmes at full and half loads and contain the low power mode consumption.

8.2. Electricity savings – energy consumption per unit

In addition to the total electricity savings, the energy consumption per unit was determined. Figure A8.3 shows the projected average energy consumption per unit placed on the market over the period 2005-2030

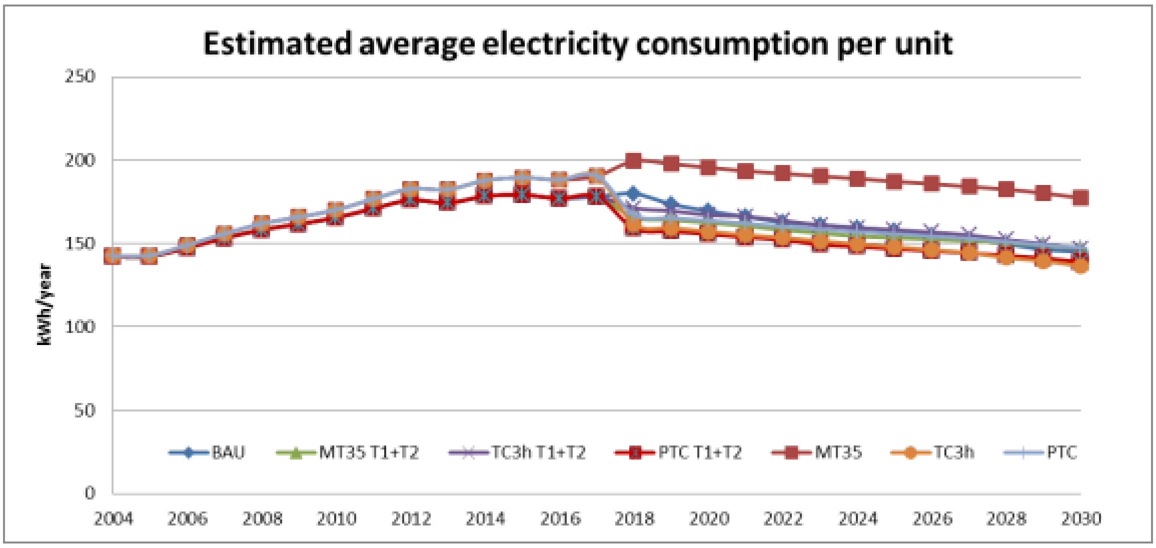


Figure A8.3. Average energy consumption of units sold over the period 2005-2030, in kWh/a electricity.

year	**Average energy consumption of units sold over the period 2005-2030**						
	BAU	**Sub-option T1**			**Sub-option T1&T2**		
		POWM 2	**POWM 3**	**POWM 4**	**POWM 2**	**POWM 3**	**POWM 4POWM 4**
2005	142.35	142.87	142.87	142.87	142.35	142.35	142.35

2006	147.42	148.99	148.99	148.99	147.42	147.42	147.42
2007	153.22	155.84	155.84	155.84	153.22	153.22	153.22
2008	158.30	161.96	161.96	161.96	158.30	158.30	158.30
2009	161.75	165.93	165.93	165.93	161.75	161.75	161.75
2010	165.57	170.27	170.27	170.27	165.57	165.57	165.57
2011	171.01	176.76	176.76	176.76	171.01	171.01	171.01
2012	176.08	182.88	182.88	182.88	176.08	176.08	176.08
2013	174.43	182.53	182.53	182.53	174.43	174.43	174.43
2014	178.49	187.94	187.94	187.94	178.49	178.49	178.49
2015	179.38	189.68	189.68	189.68	179.38	179.38	179.38
2016	177.14	188.35	188.35	188.35	177.14	177.14	177.14
2017	178.31	190.65	190.65	190.65	178.31	178.31	178.31
2018	179.97	199.59	161.63	167.21	165.71	171.37	159.09
2019	173.70	197.86	159.34	165.35	164.26	169.63	157.31
2020	169.55	195.73	157.27	163.80	162.46	167.18	155.68
2021	166.15	193.60	155.14	162.12	160.65	166.22	153.81
2022	162.76	192.12	153.52	160.17	158.13	163.79	152.24
2023	161.24	190.47	151.53	158.56	156.38	161.01	149.31
2024	159.55	188.99	149.70	157.09	154.37	159.50	148.19
2025	157.68	187.34	147.98	155.85	153.55	158.21	146.80
2026	154.92	185.86	146.17	154.33	152.62	156.78	145.50
2027	152.34	184.15	144.43	153.04	151.69	155.10	144.27
2028	149.76	182.61	141.50	151.13	150.30	152.32	142.85
2029	146.48	180.30	139.52	149.17	148.92	149.83	141.17
2030	145.07	177.52	136.50	147.53	146.54	146.64	138.98

The savings expected by 2030 for the different scenarios are calculated from the energy consumptions given in the table above. The savings of the baseline relative to 2015 are 35 kWh/year (approx. 20%). The savings of the preferred option relative to the BAU scenario are 6 kWh/year per unit, approx. 4%.

8.3. Business impacts

8.3.1. Compliance cost

In the process of conducting the preparatory study review and the Impact Assessment, it has been very difficult to obtain data from industry related to the actual compliance costs in relation to changing product energy efficiency requirements (e.g. costs to re-design household washing machines and washer dryers, change production lines, etc.). This may be due to several reasons:

- difficulties for industry to identify or be sure whether an innovation was triggered by EU provisions per se, provisions required on other markets (Third Countries), and determining whether the innovation was also (at least) partly driven by perceived customer demand, and non-regulatory factors.
- commercial secrecy/ Intellectual Property Rights (IPR)

- legal risks (sharing cost information may be considered as fraudulent commercial practice regarding EU competition law, or some industry sectors' perceptions of correct implementation of such requirements).

Given the lack of availability of sufficient detail around compliance costs, it was considered appropriate to instead use observed purchase price increases as an indicator. The analysis notes, however, that pricing strategies are of course not solely determined by compliance costs for energy efficiency, but also reflect other functionalities and characteristics (or other legal requirements) of the product such as production volume, service and after-sale services, distribution structure/margins, brand reputation, quality, etc. Prices and price increase of household washing machines and washer dryers due to Ecodesign measures and the incentives provided to the manufacturers due to the Energy Label used in this impact assessment are based on market research and stakeholder consultation (see annex)[34]

Product price increases will result in increased business revenue for manufacturers as long as the sale volume is not unduly affected. Price increases are a consequence of – inter alia - redesign efforts, including investment and updating the existing production lines, the enhancement of the intrinsic quality of the appliances, as well as the additional profit motive per se. If the volume of sales were significantly affected by the increase in the purchase price, this could have a magnified effect on the household washing machine and household washer dryer sector, and the whole supply chain (see considerations explained in Section 6.3).

Stakeholder views - Some comments of stakeholders pointed to the amount of extra costs that compliance with the criteria can represent. As long as these extra costs are not excessive, it is assumed that they can be absorbed by the industry.

8.3.2. Innovation, Research and development, competitiveness and trade

Overall, the European home appliances manufacturing sector, with a total turnover of 44 billion euros, spends ca. 3.8% on research and development (R&D). The household washing machines and washer dryers industry follows the same tendency

The revision of the household washing machines and washer dryers regulations is expected to support innovation and drive market transformation, similarly to what could be observed in the past. It is in line with on-going market trends towards higher energy efficiency, where a high Energy Label rating is a strong commercial driver. However, it is not expected that the Energy Label regulation will lead to any significant structural increase of R&D budgets because the products meeting the requirements are already commercially available on the market. Impacts will be more limited in the scenarios with one Tier and more challenging in scenarios with two Tiers.

The development of innovative energy-efficient technologies at competitive prices will enhance competitiveness of European manufacturers in home and foreign markets. On the contrary, no action (BAU scenario) could lead to lower R&D spending or declining revenues, because the demand for innovative washing machines and washer dryers would

[34] The price difference of household washing machines has been adjusted (via an exponential correlation), and additional information on product cost is provided.

be lower and hence reduce the payback on R&D investments. In general and particularly in the case of household washing machines and washer dryers, the industry is highly competitive, with Asian manufacturers rapidly expanding their global market share where product-price, rather than quality, is one of the main selling points.

It has to be noted that new requirements assessed in this Impact Assessment in scenarios T1+T2 and POWD 3 would be introduced within a timeframe that is shorter to the innovation cycle of this industry. The new requirements would be technology-neutral, as manufacturers are free to choose the options in order to improve the efficiency of their products.

Furthermore, the potential Ecodesign requirements on material efficiency are expected to create incentives for extending the lifetime of the appliances (repair or reuse) and for better recycling. It can lead to e.g. expanding market for second-hand products, for repairing of appliances, dedicated companies for providing laundry services instead of selling the products, etc. This would mean that the envisaged material efficiency requirements could have an impact for what concerns innovative business models, in particular (as mentioned before) third parties dealing with maintenance, repair, reuse and upgrading of the appliances as well as providers of the service instead of the products.

Stakeholder views – Stakeholders did not comment on Innovation, Research and Development, Competitiveness.

8.3.3. Intellectual property rights

All technologies considered in the review study, except from one, are commonly available to all major manufacturers. No stakeholder such as industry associations or individual companies raised concerns that more stringent Ecodesign requirements would impose proprietary technology on manufacturers.

8.3.4. Stranded investments

When a regulation is reviewed and tighter requirements are proposed, the question of stranded investment arises. In the case of household washing machines and washer dryers, the risk of stranded investments might in theory exist for the least energy efficiency appliances. However, these products and their components have been around since 2010 and production lines and other capital costs would have been already depreciated for 10 or 14 years.

The industry association APPLiA, representing most of the manufacturers, did not raise the issue of stranded investment. Individual manufacturers raised concern over their benefits, not for the reasons of stranded investments or investments to be done, but because of the risk of a lower demand of this type of products by the consumers.

8.4. Administrative burden

In this section more information about the administrative burden according to the Impact Assessment for the Energy Labelling Framework Regulation is given and applied to the washing machines and washer dryers in the scope.

Administrative costs are defined as the costs incurred by enterprises, the voluntary sector, public authorities and citizens in meeting legal obligations to provide information on their action or production, either to public authorities or to private parties[35]. The Commission's in-house Administrative Burden Calculator was used to calculate administrative cost for businesses and public authorities.

The different actions are explained in detail below.

8.4.1 Label transition for the A-G label

Suppliers have to supply two labels instead of one for a period of 6 months at a cost of EUR 0.3 to print a label[36]. Around 9 million household washing machines and washer dryers appliances sold in 6 months' time. This means a cost of approximately EUR 2.7 million for suppliers. Furthermore, suppliers may have to supply some replacements labels on request of dealers depending on the delivery channel for replacement labels.

Dealers have to re-label around 2.5 % of products on stock/display or on the internet. An average time of five minutes per product is assumed at a tariff of EUR 14.30/h, resulting in EUR 1.20 per label and a total of EUR 0.45 million.

8.4.2. Mandatory product registration database

The key burdens due to this option are similar to those for the product registration database for radio equipment[37]:

Training of staff to become acquainted with the system: this is a one-time investment and not considered significant.

Upload manufacturer information and obtain manufacturer code, depending on the design for the operation of the database. This is again considered not significant.

Upload product specific information: this implies selecting appropriate information, formatting, and actually uploading the information. This is considered to be significant.

For household washing machines and washer dryers an estimated average of 7745 models[38] of washing machines and 492 models of washer dryers per year (as in 2013) will need to be registered in the database[39]. Two hours of collection and registration time per model family is assumed[40]. This corresponds with the estimated administrative costs

35 Commission impact assessment Guidelines

36 Estimated at 0.50 Australian dollar (exchange rate at the time approximately 0.6 €/Australian dollar) by George Wilkenfeld and Associates Pty Ltd, Regulatory Impact Statement, Energy Labelling and Minimum Energy Performance Standards for Household Electrical Appliances in Australia, February 1999, p. 40

37 SWD(2012) 329 final, p.31

38 Equivalent models (i.e. models that are exactly the same with regard to energy efficiency, but sold under different model codes or even brand names) can be registered through a single registration and therefore count here as one model.

39 For electronic products 2500-3000 per product group based on Energy Star registrations, for many domestic appliances such as washing machines, dishwashers, tumble driers vacuum cleaners it is likely to be much lower, possibly as low as 500. Industry databases for other domestic appliances such refrigeration and cooking points to about 2000-3000. For heating/cooling equipment it is estimated to be lower, in the range of 250-1000 depending on the specific product group. For commercial and industrial products it would be in the range of 2000-3000 for motors and fans, but as low as 50 for power transformers (VHK)

40 At an employee tariff of € 32.10 per hour representative for professionals

borne by suppliers for Australia's product registration database, i.e. EUR 60/model [41]. For the respective models of appliances, this results in EUR 464700 per year for washing machines and EUR 29520 per year for washer dryers.

The burden for MSs' market surveillance authorities to obtain documents is significantly reduced by this measure. It is, however, assumed that they spend the freed-up time on other market surveillance activities instead thereby contributing to higher compliance rates.

The costs for the Commission to set up the database are likely to be similar to the product registration base for radio equipment, adjusted for the number of models to be registered and kept in the database. The cost for the product registration base for radio equipment was estimated at EUR 300000 investment and EUR 30000 annual maintenance costs for registration of 5000 models per year[42]. Based on the above estimate of 7745 models per year, share of household appliances in the total Commission investment is EUR 464700 and the maintenance costs are estimated at EUR 46470 per year for washing machines and EUR 29520 and the maintenance costs are estimated at EUR 2952 per year for washer dryers.

8.4.3. Expand the database study, Commission costs

The budget for the current three-year study covering six products was EUR 500.000[43]. The cost for the Commission to cover about 30 products would thus be approximately EUR 1 million per year. For household washer dryers appliances (1 of 30 product groups) it would amount to EUR 33000/year.

8.4.4. Change 'least life cycle cost' requirement

This measure does not require administrative effort additional to business-as-usual. However, there are likely to be compliance costs for business in order to meet the more stringent requirements. Such compliance costs are likely to be negligible for product groups that have energy labels, where almost all businesses would, because of the energy label, in any case already go beyond the minimum Ecodesign requirements. For product groups only covered by Ecodesign requirements (and no energy labels) the compliance cost in terms of redesign may be significant for some businesses. A recent case study for laptops estimated that the total design costs for compliance with the seven applicable EU internal market directives and regulations, including Ecodesign, are EUR 8 million per year[44]. Assuming that: 1) one quarter of that cost is due to Ecodesign[45]; 2) changing the

41 100 Australian dollar per model (exchange rate at the time approximately 0.6 €/Australian dollar). In addition, Australia charges a registration fee of 150 Australian dollar per model (George Wilkenfeld and Associates Pty Ltd, Regulatory Impact Statement Energy Labelling and Minimum Energy Performance Standards for Household Electrical Appliances in Australia: Supplementary Cost-Benefit Analysis on Transition to a Revised Energy Label, November 1999, p. 18)

42 SWD(2012) 329 final, Annex X

43 http://ec.europa.eu/energy/intelligent/files/tender/doc/2013/tender_specifications_eaci_iee_2013_002.pdf

44 SWD(2014) 23 final part 2, p. 52 and 54

least life-cycle cost requirement to break-even point may increase the design cost by half; and 3) laptops constitute about one third of the Ecodesign regulation for computers, the total additional compliance cost above business-as-usual for the 15 regulations for product groups which have no energy label could be EUR 45 million per year[46].

8.4.5. Support joint surveillance actions Horizon2020

Joint surveillance actions fit the requirements and description of 2014 Horizon2020 call on the energy efficiency market uptake segment of "Ensuring effective implementation of EU product efficiency legislation" for which the indicative cost was EUR 1.5-2 million for the EU budget[47]. Such a call would be opened every year with the aim to support several joint actions per year. The share of household washing machines and washer dryers (1 of 30 product groups) is estimated at EUR 60 000/year.

8.4.6. External laboratory testing

Manufacturers of household washing machines and washer dryers use self-declaration to declare relevant values for Ecodesign and Energy Label measures. All large manufacturers will have facilities for in-house testing. These facilities are used for declaration of Ecodesign and Energy Label values but also for broader Research and Development (R&D). As there are no SME in the manufacturing sector, this cost is assumed to be negligible.

8.4.7. Market surveillance costs

No precise figures on total MS expenditure on market surveillance are available, since only about half of the MSs share information of available budgets. In 2011 the budget was estimated at EUR 7-10 million[48]. Based on (incomplete) data collected from MSs it is currently likely to be around EUR 10 million. Household washing machines and washer dryers are one of thirty products for surveillance. Assuming the effort to be equally distributed per product group this amounts to EUR 330000 of market surveillance costs for surveillance of household washing machines and washer dryers.

8.4.8. Introducing reviewed legislation

Ecodesign and Energy Label regulations for household washing machines already exist, so the infrastructure of notified bodies and market surveillance authorities is already in place in MS and it will be valid as well for washer dryers. Furthermore, the legal format

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45 Although there were seven applicable EU internal market directives that caused the total cost, not all of those impacted design significantly and thus the weight of ecodesign among the seven is estimated to be higher than one seventh: at one fourth.

46 € 8 million divided by 4 (estimated share of impact of ecodesign in EU internal market directives applicable to laptops) multiplied by 0.5 (50% extra design costs on top of business-as-usual due to the change of least life cycle cost requirement to break-even point requirement) multiplied by 45 (to account for all 15 product groups, because laptops only constitute 1/3 of a product group).

47 http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/2362-ee-15-2014.html

48 P. Waide *et al.*, Enforcement of energy efficiency regulations for energy consuming equipment: findings from a new European study, Proceedings of the 6th International Conference EEDAL'11 Energy Efficiency in Domestic Appliances and Lighting

is a ‘regulation’ and thus no transposition in national law is required. As a placeholder, an amount of EUR 100 000 it is assumed that in total for all 28 MS is required for training and answering questions on the changes in the regulations.

8.5. Social impact – employment

The boundaries for the calculation of the impact on employments are:

- Only direct jobs in the production and distribution chain are considered, i.e. including OEM suppliers and business services but excluding the indirect employment effect of employees in the production and distribution chain buying/renting houses, doing their shopping, paying taxes, etc.;
- It is assumed that the increase in revenue leads to an increase in the number of jobs, but in this case, where employment is declining (see par. 6.5.2), it can also be understood as retaining jobs that would otherwise be lost;
- The total number of direct jobs is considered. However, it needs to be taken into account that typically half of the OEM jobs (16% of industry jobs) are created/ retained outside of the EU through imports of components.

Annex 9: New testing programmes and other Ecodesign requirements involving no change, or relatively minor updates

1.1. New testing programme for household washing machines

One of the main problems identified in Section 2 is the discrepancy between testing programmes and **real-life programmes**. The proposed new testing programmes would address the mismatches listed in section 2.2 between the actual use of the appliance and the reference washing machine operation used for the label declarations and Ecodesign requirements and exploit the remaining technical development potential.

The current requirements, in place since 2010, introduced two so called "*standard programmes*", used for the calculation of the energy consumption, and other parameters declared for household washing machines. The regulation text indicates that the standard programmes shall be designed to wash cotton normally soiled at 40C and at 60C, tested at full load and half load and being the most efficient programmes in terms of their combined energy and water consumption for cleaning normally soiled cotton (not including the 20C cotton).

The Review study 2017 pointed out that the testing programmes should be representative of both the use by the consumers and the operation of the appliance (in terms of e.g. mechanical stress and temperature conditions). Ideally, the testing of all the programmes in a machine would be desirable; however, this would imply excessive costs for the manufacturers and market surveillance authorities.

Taking into account the results of the consumer survey (2015)[49] as well as the performance of the machines, the testing programme should build on the normal cotton 40C° as it is the mostly used programme. The average washing temperature in Europe resulted to be 42.3C.

The normal cotton 60C is also selected by the consumers in 11% of the occasions. However, the normal cotton 60C was not included on the testing portfolio in other to limit the cost of the testing. Additionally, the difficulties to add a requirement for a minimum temperature and time to be reached prevent the inclusion of this programme in the testing portfolio. The difficulties rely on selecting the exact temperature and duration to justify the hygienic properties of this programme and on the lack of a measurement method for the temperature inside the textile load. Regarding the requirements an option could be to reach a consensus over a minimum common denominator (e.g. 55C for 2 seconds). However, depending on the conditions set the energy savings to be achieved in this programme can be very limited. Another burden is the difficulties to adapt the method for measuring the temperature in the loading core from professional WMs and therefore the lack of a standard that is ready to be used. Finally manufacturers commented that consumer may choose the hygiene programme more often as really needed, i.e. energy consumption might increase compared to today's choice of standard cotton 60C programme for hygienic needs, the lack of standard to measure the hygiene performance reached by this programme and the clustering of most of the appliances on

[49] Boyano A., Espinosa, N., Villanueva A., Follow-up of the preparatory study for Ecodesign and Energy Label for household washing machines and household washer dryers, EUR 28807 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73894-4, doi:10.2760/954441, JRC108583

few classes, reducing the influence of the label on the purchase decisions of the consumers.

Additionally, it was identified that loading adaptation is essential to adapt the energy and water consumptions to the minimum and therefore three different loadings were proposed for the testing programme. Several combinations of loadings were considered during the review study 2017, i.e. full load and half loads, full load and fixed loads (i.e. between 2-4 kg) and full load and partial loads (i.e. half and quarter, on third and two thirds, etc). The expected benefits of this measure is that machines should be subject to a demanding test that rewards those that better adapt their energy and water use to different loads, as snall loads are typical of the actual use of the consumers. The optimization of only to half load, as it is the case at present, should not be enough. The drawbacks identified are that the testing procedure can become overly complex and costly. Fixed loads (i.e. 2kg and 4kg) would allow comparability across machines, but it may also indirectly encourage the use of very small loads (2 kg) by consumers, which would not be favourable to energy savings. Furthermore, stakeholders indicated that partial loads of a full load (e.g. ½ and ¼) may in practical terms be easier (cheaper) to implement for testing than fixed loads.

Additionally, and in order to ensure a good performance of the washing machines, each of the single treatments included in the testing portfolio should achieve a washing performance > 1.03, which is the reference for a cotton 60C programme.

These changes require that the current testing standard will the thoroughly revised.

Stakeholders views. Generally speaking stakeholders agreed that the testing programmes need to be brought closer to the real use of the machines, however, no agreement was achieved on how to do it.

1.2. New testing programme for household washer dryers

The scenarios analysed for household washer dryers considered corrective measures of the standard that will bring it closer to the actual use and better reflect the distinct characteristics of the household washer dryers.

The current standard (EN 50229) is based on the use of the appliance to wash and subsequently dry a full load of laundry (as discontinuous processes). Because the rated washing capacity of the machines is higher than the rated drying capacity, this testing requires more than one drying cycles (the laundry should be divided into two or more parts). Water and energy consumption are calculated by adding up the consumption value from the wash cycle and the subsequent drying cycles (2 or more). Additionally, the household washer-dryers standard checks the washing performance through 5 cycles at 60C full load, being a mismatch with the current and new proposed testing portfolio for household washing machines.

New designs of household washer-dryers allow washing and drying loads of laundry in a continuous cycle (called "wash&dry' cycle). Additionally, the current trend of producing machines with higher drum volumes (around 3.5 kg for wash&dry cycles) makes that its rated capacity already become very close to the average wash load (3.4kg). This means that the washing and drying function can be used without interruption, load splitting nor reloading of the parts of the washed load that exceeded the drying capacity. This new feature is what distinguishes a household washer dryer from the equivalent set of two separate appliances (a washing machine and a tumble-dryer). It is also one to the main reasons why a household washer dryer is reportedly well accepted by consumers, especially by those that have room limitations at home. However, this feature is not considered neither in the current Directive 96/60/EC for household washer dryers not in the measurement standard EN 50229.

At international level, the IEC 62512[50] was prepared specifying the conditions needed to test the combined function of washing and drying in a household washer-dryer. The standard defines the procedures of how an interrupted operation cycle and a continuous operation cycle should be tested. Therefore, the dry function as part of a wash&dry cycle was proposed for measuring the performance at the wash&dry capacity.

Stakeholders views. Stakeholders shared the opinion that the testing programme of the washer dryers should reflect their main characteristic (wash&dry cycle) and that this machine is mainly used as a washing machine. However, stakeholders expressed their concerns on the testing costs of this product.

1.3. Ecodesign requirement on water consumption

The current Ecodesign requirements for washing machines include a limit on water consumption. The requirement reads as follows

for all household washing machines, the water consumption shall be,

$W_t \leq 5 \times c_{½} + 35$

where $c_{½}$ *is the household washing machine's rated capacity for the standard 60 °C cotton programme at partial load or for the standard 40 °C cotton programme at partial load, whichever is the lower.*

In the consultation forum a similar threshold was proposed. The proposal kept the formula used in the current Regulation but referred to the newly proposed testing programme, meaning that the threshold on water consumption could vary. According to tests performed in 2017 by the Swedish Agency on A+++ washing machines, the alternative cotton programmes (i.e. other than "standard cotton programme") use on average 70% more water than the programme used for testing. Other stakeholders pointed out that the level of stringency of the requirement is much lower because the water consumption is a weighted water consumption that includes the consumption at full, half and quarter loads and the weighting loading factors. The inclusion of half and especially quarter loadings will decrease the overall weighted water consumption. However, the exact change in strictness due to the change in the testing programme is uncertain.

In order to keep the same level of strictness in spite of the change in test programmes, the proposed requirement is slightly revised as follows:

From 1 April 2021:

[50] IEC 62512 Electric clothes washer-dryers for household use – Methods for measuring the performance

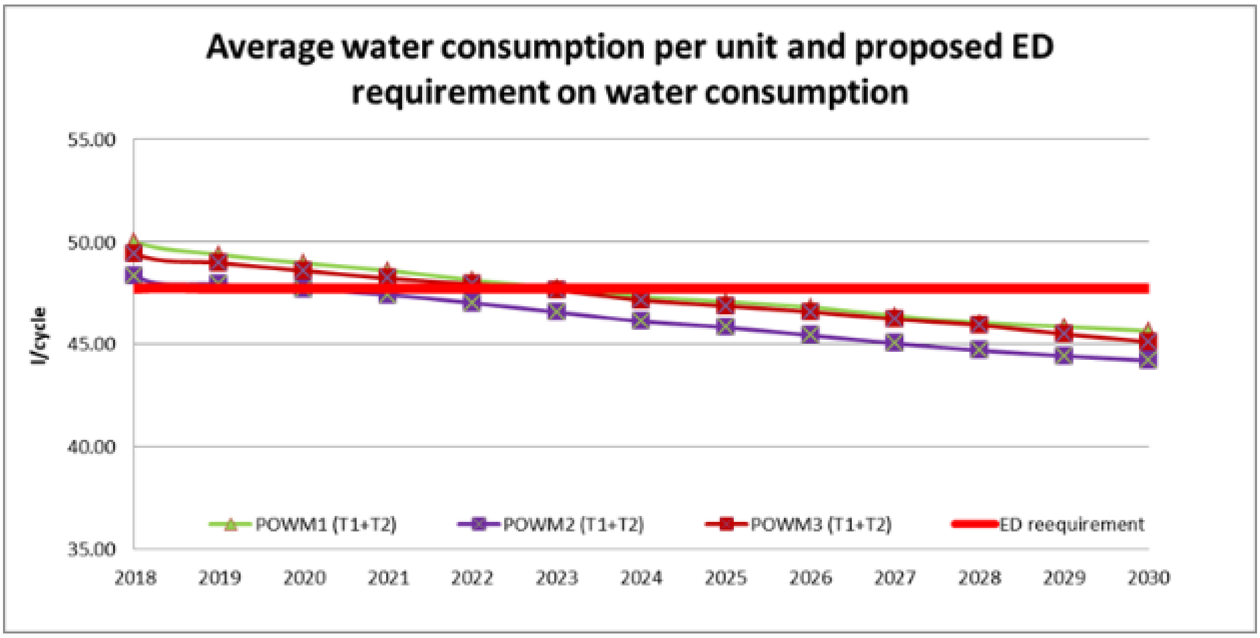
For household washing machines and the washing process of household washer-dryers, the weighted water consumption (Wt, litres/cycle) shall be:

Wt ≤ 2.25 × c + 30

where c is the rated capacity of the household washing machine or the rated washing capacity of the household washer-dryer for the '40-60 eco' programme.

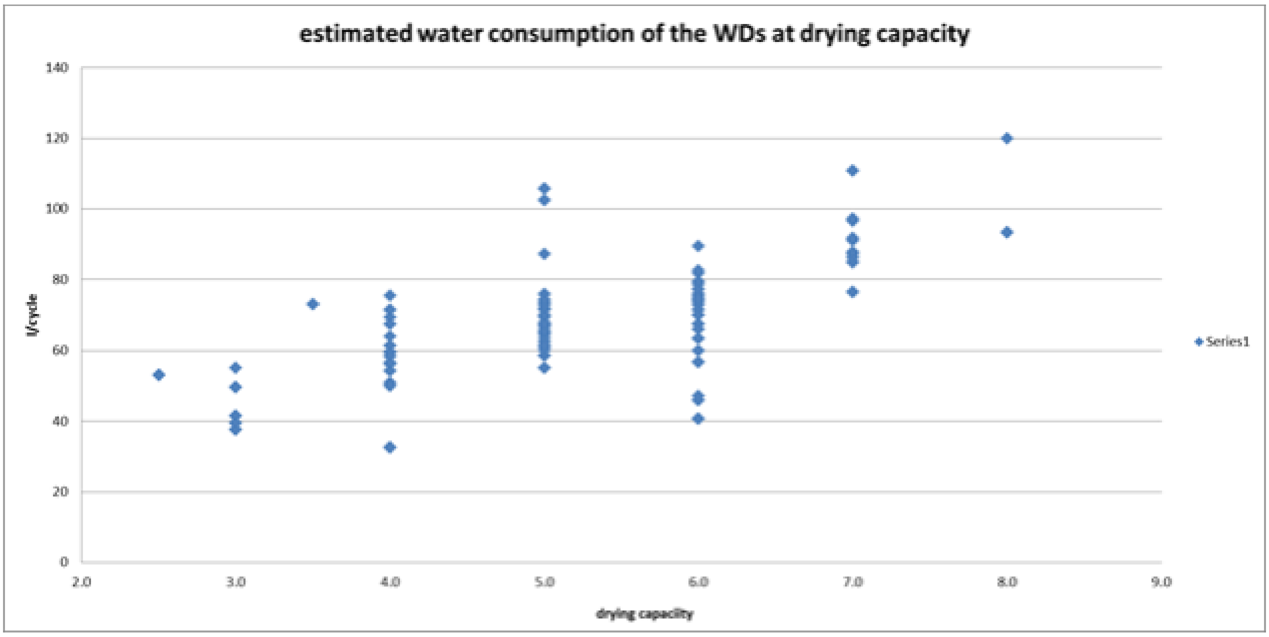
An assessment was carried out for the six policy options investigated to check if an average machine would comply with the threshold proposed. Figure A9.1 shows the water consumption of the average machine under the conditions of POWM1 (T1+T2), POWM2 (T1+T2) and POWM3 (T1+T2) and shows that the average machine fulfils the requirement. Therefore, it was considered that this threshold is achievable.

Figure A9.1. average water consumption per unit under the conditions of POWM1 (T1+T2), POWM2 (T1+T2) and POWM3 (T1+T2) and the proposed ED requirement on water consumption.



As regards washer-dryers, the estimated water consumption is shown on Figure A9.2, based on **CECED database 2014** for washer-dryers.

Figure A9.2. estimated water consumption of washer-dryers at drying capacity in litres per cycle



Taking into account the following assumptions:

- Considering that in the database, the washing process is a full load at 60C and that the new testing will be at approx. half or quarter load and at 40C
- the water consumption (without considering the influence of the diff temp and loading of the washing process) is estimated by multiplying the specific water consumption by the drying capacity. This requires the assumption that the drying capacity equals the wash&dry capacity.

The following limit can be fixed for washer-dryers, which is considered prudent and compatible with the other ecodesign requirements:

- $Wt < 10\ c + 30$

  Where c is the rated capacity of the washer-dryers for the wash and dry programme.

1.4. Rinsing performance

Rinsing is one of the typical phases of a washing cycle, together with main wash and spinning. Insufficient rinsing performance is considered as a potential source of allergic reactions and dissatisfaction of the consumers. The main programmes use 2 (considered as the minimum) to 4 rinsing phases with different water consumptions, energy consumptions and durations. Therefore, optimisation efforts aimed at saving energy and water and shortening the programmes may impact on the rinsing performance in the absence of minimum requirement.

Until 2008, there was no method for measuring the rinsing performance that was considered sufficiently reproducible and replicable. Thus, a minimum rinsing performance was not included in the current Regulation 1015/2010. However, testing methods have progressed recently and a new method (LAS) is currently available, making possible to introduce some requirements. The rinsing performance requirement is especially important if a time restriction is introduced, as shortening the programme duration could potentially lead to insufficient rinsing.

The new method for measuring the rinsing performance is based on the amount of chemicals remaining in the textile load at the end of the washing cycle for a household washing machine or at the complete operation cycle for household washer-dryers. It is measured with the use of a tracer, LAS, which is a component of the detergent used to assess the washing performances of both machines. The rinsing performance index of the washing cycle is measured for the testing programme at rated capacity.

It is difficult to establish an exact level for a good or an acceptable rinsing in a rinsing performance index, considering the novelty of the testing method and the difficulty to correlate its results with that of previous methods used by consumer organisations. Some Member States representatives considered that a suitable rinsing performance can be achieved at 4 points in the LAS-method scale; however this value will remove approximately 65% of today's machines on the market, which is considered excessive for a new parameter.

For this Impact Assessment, it was considered that setting a rinsing performance limit (at a very prudent level) would usefully lead manufacturers to consider the issue more closely, ensuring a minimum removal of detergent after the washing cycle, and would guarantee the availability of data for the next revision. **A minimum Ecodesign rinsing performance of 6 in the LAS method scale is considered.** This very prudent level ensures that only a small number of washing machines is excluded from the market (approximately 6% of the current models) and prevents any conflict with the requirement on water consumption.

After finalisation of this assessment, new results from tests undertaken by manufacturers indicate that a minimum rinsing performance of 5.0, with a verification tolerance of 1.0, would still be prudent and better represent the current stage of technologies. This limit was subsequently included in the revised draft Ecodesign measures.

Stakeholders views. A number of stakeholders have raised the issue of a potential conflict, or even a potential technical impossibility, between the Ecodesign requirement on water consumption, establishing a maximum amount of water used in the washing cycle in proportion of the machine capacity, and a new requirement on rinsing performance, as a better rinsing requires more fresh water. Given the importance of the objective of water saving and the inherent uncertainty regarding the implementation of a new requirement on rinsing performance, it is however considered that the requirement on water consumption should be maintained at the same level of stringency as in the current Ecodesign Regulation. The question may be revisited at the next revision, using the data on rinsing performance collected until then.

1.5. Low power modes

Currently, to evaluate the annual energy consumption of a household washing machine, the energy consumption per cycle is multiplied by an agreed number of cycles (220 cycles/year) and the energy consumption of low-power modes is added. The current formula consists of three parts: the energy consumption of the washing cycle, the left-on mode and the off-mode. These three kinds of modes are regulated by the Standby Regulation (EC) No 1275/2008 that is currently under revision.

During the review study, additional low power modes were identified that are not included in the annual energy consumption formula, but are present or start becoming common in this type of machines. Among these low power modes are for example the delay start mode and the smart connectivity/smart ready mode.

In order to regulate the energy consumption of the low power modes several options were considered under the review study 2017. The deletion of the energy consumption of the low power modes from the energy calculation and the introduction of specific caps on the energy consumption of each of the identified low power modes was advised as the most appropriate one.

During the Consultation Forum the Commission proposed to regulate the low power modes in a vertical way instead of keeping this product group under the Standby Regulation. This was supported by a number of Member States representatives and stakeholders but not environmental NGOs.

Additionally, it was identified that low power modes were not covered in the current Directive 96/60/EC on washer-dryers and only partially covered by the Standby Regulation. This revision will align the energy consumption of these low power modes to those of the washing machines.

The definitions of the low power modes and related aspects are proposed as follows:

Table A. Definitions of low power modes and related aspects.

Term	Definition
Off-mode	Means a condition in which the equipment is connected to the mains power source and is not providing any function; the following shall also be considered as off mode: a) a condition providing only an indication of off-mode; b) a condition providing only functionalities intended to ensure electromagnetic compatibility pursuant to Directive 2004/108/EC
Standby mode	Means a condition where the equipment is connected to the means 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 item: -reactivation function, possibly through network connection, or reactivation function and only an indication of enabled reaction function, and/or -information or status display, and/or - detection function for emergency measures.
Delay Start	Means a condition in which the equipment automatically starts its main function at a later time as programmed by the user.

The requirements on low-power modes are proposed as follows:

1) Household washing machines and household washer-dryers shall have an off-mode or a stand-by mode or both. The power consumption of these modes shall not exceed 0,50 W.
2) If the stand-by mode includes the display of information or status, the power consumption of this mode shall not exceed 1,00 W.
3) If the stand-by mode provides for network connectivity and the network connection is in the condition of networked standby as defined in Regulation

(EU) No 801/2013[51], the power consumption of this mode shall not exceed 2,00 W.

4) After the equipment has been switched on or after the end of any programme and associated activities or after interruption of the wrinkle guard function, if no other mode is triggered and there is no interaction with the equipment for 15 minutes, the equipment shall switch automatically to off-mode or standby mode.

5) If the equipment provides for a delay start, the power consumption of this condition, including any standby mode, shall not exceed 6,00 W. The user shall not be able to programme a delay start for more than 24h.

6) During measurements of energy consumption in low power modes, the display or not of information and the activation or not of network connection shall be checked and recorded. If the equipment provides for wrinkle guard function, this operation shall be interrupted by opening the equipment door or any other appropriate intervention 15 minutes before the measurement. When assessing the delay start, it shall be checked that the user is not able to program a delay start exceeding 24 hours.

7) The above requirements are without prejudice to emergency measures.

Table B. Summary of proposed requirements of the low power modes

Condition / mode	**Requirement**	**Measurement tolerances**
Off-mode	Power consumption (P_{off}) ≤ 0.5 W	The determined value of power consumption P_{off} shall not exceed the declared value by more than 0.10W.
Standby mode	Power consumption **(P_{sm})** ≤ 0.5 W In case of information display: Power consumption **(P_{sm})** ≤ 0.8 W In case of networked standby: (**Psm**) ≤ 2.0 W	The determined value of power consumption Psm shall not exceed the declared value by more than 10% if the declared value is higher than 1,00 W, by more than 0,10 W if the declared value is lower than or equal to 1,00 W.
Delay start	Power consumption in delay start **(P_{ds})** ≤ 6.0 W and duration of the delay start (T_{ds}) ≤ 24 h	The determined value of power consumption Pds shall not exceed the declared value by more than 10% if the declared value is higher than 1,00 W, by more than 0,10 W if the declared value is lower than or equal to 1,00 W.

1.6. Noise

Noise is an important characteristic of these appliances. Noise reduction can be crucial if the washing machine or the washer dryer is installed in open kitchens, i.e. kitchens that are directly integrated in the dining and/or living room. Lower noise emissions can be achieved by various technologies that would have however effects on other performance characteristics of the appliances including energy efficiency.

[51] Commission Regulation (EU) No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment, and amending Regulation (EC) No 642/2009 with regard to ecodesign requirements for televisions (OJ L 225, 23.8.2013)

It was proposed to display noise emissions on the EU Energy Label both as a digit (integer number of dB) and via noise classes, similar to the method adopted in the regulation for the labelling of tyres (Regulation (EU) No 1222/2009). Three noise classes' descriptors are proposed. The limits between classes have been discussed by the stakeholders after the Consultation Forum indicating different possibilities of scaling the noise level (e.g. A-G scale, A-C scale, etc.) and that the dB(A) are measured in a logarithmic scale.

For washer-dryers, in order to limit the number of different tests on noise, it was proposed to display noise emissions of the test washing cycle for the washing and spinning phase, and emissions of the complete cycle for the drying phase – without repeating the measurement for the washing and spinning phase for the complete cycle.

Hence, this requirement could be proposed based on the following formulation:

B. Acoustic airborne noise emission classes

The acoustic airborne noise emission class of a household washing machines and washer dryers shall be determined on the basis of the acoustic airborne noise emissions as set out in Tables A9.3 and A9.4.

The acoustic airborne emissions of a household washing machines and washer dryers shall be determined in accordance with state-of-the-art of the recommended standard

Table A9.3. Acoustic airborne noise emission classes for household washing machines and the washing cycle of household washer-dryers

Phase	*Acoustic airborne noise emission*	*Icon on the label*	*Noise (dB)*
Washing	*A*		n < 51
	B		51 ≤ n < 57
	C		n ≥ 57
Spinning	*A*		n < 74
	B		74 ≤ n < 77
	C		n ≥ 77

Table A9.4. Acoustic airborne noise emission classes for the complete cycle of household washer dryers

Phase	*Acoustic airborne noise emission class*	*Icon on the label*	*Noise (dB)*
Drying	*A*		*n < 59*
	B		*59 ≤ n < 64*
	C		*n ≥ 64*

1.7. Changes to the Energy Label

The overall layout of energy labels is under revision for all products for which the energy efficiency scales are revised in application of the framework Regulation 2017/1369. For washing machines and washer-dryers in particular, a consumer survey is ongoing and should confirm the understanding by consumers of the different parameters and units used on the label and their preferences regarding the type of information provided and logos used. The impact on consumers' choices will also be investigated through a questionnaire in addition to the behavioural experiment.

For washing machines and washer-dryers, the following information is to be shown on the energy label (with all information doubled for washer-dryers to cover both the washing cycle and the complete cycle):

(1) Re-scaled label introducing A to G classes in accordance with Regulation 2017/1369;

(2) Rated capacity in kg;

(3) Weighted energy consumption (E_c) in kWh per cycle;

(4) Weighted water consumption (W_c) in litres per cycle;

(5) Programme duration in hh:mm;

(6) Airborne acoustic noise emissions in dB(A) of the spinning phase for washing machines and the washing cycle of washer-dryers, of the drying phase for the complete cycle of washer-dryers;

(7) Clear indication that the values refer to the '40-60 eco' programme and for washer-dryer to both the '40-60 eco' programme for the washing cycle and the 'wash and dry' programme for the complete cycle;

(8) QR code linking to the product database defined in Article 12 of Regulation (EU) 2017/1369

Annex 10: Who is affected and how?

This annex explains the practical implications of a potential ecodesign and energy label regulation for household washing machines and household washer dryers on implementation of the preferred policy scenario, see Section 8.1.

10.1. Practical implications of the initiative

The ecodesign regulation will apply to household washing machines and household washer dryers manufacturers, importers and authorized representatives. Since household washing machines and household washer dryers are B2C products, generally sold by retailers, this will be another group affected by the regulations. As proposed requirements include information on operating conditions and material efficiency requirements, the regulation would affect the household repairs as well as recycling companies. The SMEs involved in repair service and recycling, they would be expected to benefit from the material efficiency requirements.

They will need to comply with the eco-design requirements summarized in

Table A10.1. Summary of the Ecodesign requirements

Who	What	When
Manufacturers, importers and authorized representative	EEI limits according to the revised standard	1 April 2021 1 April 2024
	Minimum spare parts availability of 7 years for certain parts and maximum delivery time of 3 weeks	1 April 2021
	Provision of information for maintenance and repair	1 April 2021
Suppliers	Provide Energy labels rescaled from A to G and based on the revised standard	1 April 2021
Dealers / retailers	Display Energy Labels rescaled from A to G and based on the reviewed standard	1 April 2021

10.2. Summary of costs and benefits

For the preferred option, the Table A42 and A43 below present systematically the costs and benefits which will have been identified and assessed during the impact assessment process.

Table A10.2. Overview of total benefits for all provisions –preferred option.

I. Overview of Benefits (total for all provisions) – Preferred Option		
Description	***Amount***	***Comments***
Direct benefits		
Energy efficiency savings	2.01 TWh p.a. in 2030	See section 6.2.1
GHG-emissions savings	0.84 Mln tCO_2 eq p.a. in 2030	See section 6.2.3
Water savings	--	See section 6.2.6
Material efficiency requirements	--	No quantitative analyses was performed see section 6.5
Business revenues	8.18 billion $Euro_{2015}$ by 2030	See section 6.3.1
Support of innovation, R&D and improved competition	No quantification	See section 6.3.1.2
Decreased consumer expenditure	4.35 Billion $euro_{2015}$ less by	See section 6.3.2

	2030	
Increased employment	23300 jobs extra by 2030	See section 6.4.3

(1) Estimates are relative to the baseline for the preferred option as a whole (i.e. the impact of individual actions/obligations of the preferred option are aggregated together); (2) Please indicate which stakeholder group is the main recipient of the benefit in the comment section;(3) For reductions in regulatory costs, please describe details as to how the saving arises (e.g. reductions in compliance costs, administrative costs, regulatory charges, enforcement costs, etc.; see section 6 of the attached guidance).

Table A10.3. Overview of total costs for all provisions – preferred option.

II. Overview of Costs (total for all provisions) – Preferred Option		
Reason	***Costs***	***Affected stakeholders***
For the first 6 months provide a second label and supply extra label on request to dealers	2700 000euro	suppliers
Relabelling of the products	450 000 euro on-off	dealers
Database	494 220 euro /year	suppliers
	494 220 euro on-off and 49 420 euro/year	EU

(1) Estimates to be provided with respect to the baseline; (2) costs are provided for each identifiable action/obligation of the preferred option otherwise for all retained options when no preferred option is specified; (3) If relevant and available, please present information on costs according to the standard typology of costs (compliance costs, regulatory charges, hassle costs, administrative costs, enforcement costs, indirect costs; see section 6 of the attached guidance).

Annex 11: The Ecodesign and Energy Labelling Framework

The Ecodesign Framework Directive and Energy Labelling Framework Regulation are framework rules, establishing conditions for laying down product-specific requirements in regulations adopted by the Commission. The Commission's role in the implementation of delegated and implementing acts is to ensure a maximum of transparency and stakeholder participation in presenting a proposal, based on generally accepted data and information, to the European Parliament and Council for scrutiny. Figure A11.1 gives an overview of the legislative process.

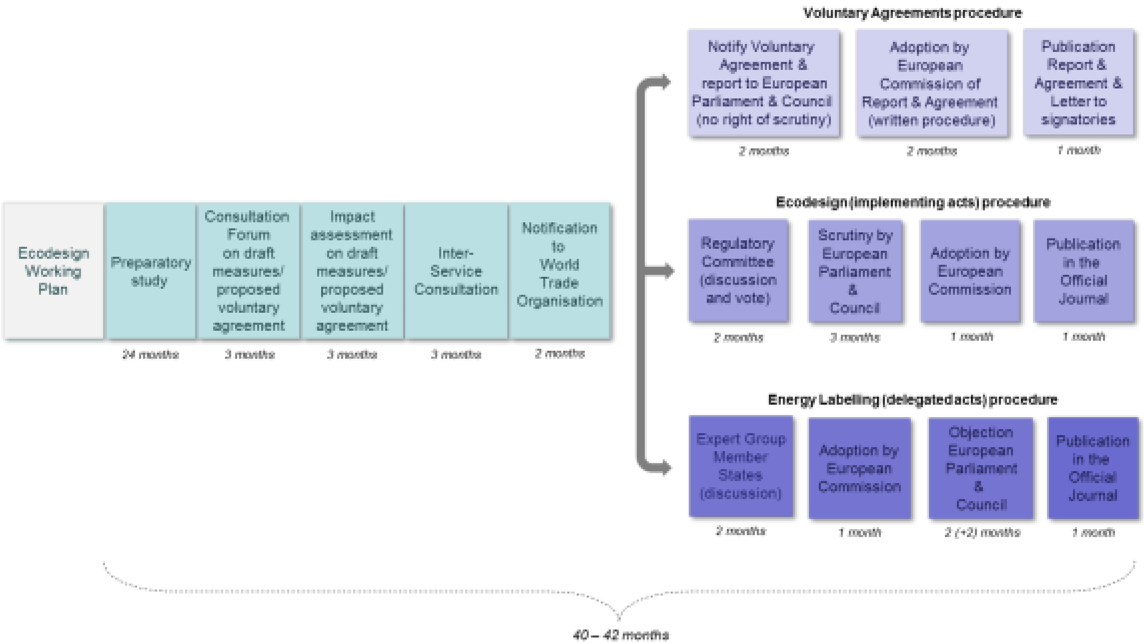


Figure A11.1: Overview of the legislative process

Energy labelling delegated acts are usually adopted in parallel with Ecodesign implementing measures laying down minimum energy efficiency requirements for the same product group. This is done to ensure a coherent impact of the two measures: energy labelling should reward the best performing products through mandatory rating, while Ecodesign should ban the worst performers.

The process starts with establishing the priorities for Union action in this area. Priority product groups are selected based on their potential for cost-effective reduction of greenhouse gas emissions and following a fully transparent process culminating in working plans that outline the priorities for the development of implementing measures.

A first list of priority product groups was provided in Article 16 of the Ecodesign Framework Directive in force at that time[52]. Subsequently, the (first) Ecodesign Working

[52] Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of Ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council. OJ L 191, 22.7.2005

Plan 2009-2011[53], the (second) Ecodesign Working Plan 2012-2014[54] and the Ecodesign Working Plan 2016-2019 were adopted by the Commission after consultation of the Ecodesign Consultation Forum (composed of MS and stakeholder experts).

The products listed in the three plans (1st working plan: 1-10; 2nd working plan: 11-18; 3rd working plan: 19-25) can be found in **Error! Reference source not found.**Table **Error! Reference source not found.**A11.1.

Table A11.1: Overview of products listed in the 3 Working plans

1. Air-conditioning and ventilation systems (commercial and industrial)	14. Enterprises' servers, data storage and ancillary equipment
2. Electric and fossil-fuelled heating equipment	15. Smart appliances/meters
3. Food preparing equipment (including coffee machines)	16. Lighting systems
4. Industrial and laboratory furnaces and ovens	17. Wine storage appliances (c.f. Ecodesign regulation 643/2009)
5. Machine tools	18. Water-related products
6. Network, data processing and data storing equipment	19. Building automation control systems
7. Refrigerating and freezing (professional)	20. Electric kettles
8. Sound and imaging equipment (incl. game consoles)	21. Hand dryers
9. Transformers	22. Lifts
10. Water-using equipment	23. Solar panels and inverters
11. Window products	24. Refrigerated containers
12. Steam boilers (< 50MW)	25. High- pressure cleaners
13. Power cables	

There were also a number of conditional products listed in the 2nd Working Plan that the Commission committed to study closer before deciding to launch full preparatory work (such as thermal insulation, power generating equipment). In the 3rd Working Plan, the Commission committed to assess certain ICT products in a separate track to determine the best policy approach for improving their energy efficiency and wider circular economy aspects and a potential inclusion in the Ecodesign working plan.

Once the product group has been selected, a preparatory study is undertaken by an independent consultant, also involving extensive technical discussions with interested stakeholders. The preparatory study follows the MEErP. Subsequently, the Commission's first drafts of Ecodesign and energy labelling measures are submitted for discussion to the Consultation Forum, consisting of MSs' and other stakeholders' representatives.

After the Consultation Forum, the Commission drafts an impact assessment, which after approval of the IAB is taken forward to the inter-service consultation together with draft implementing measures. In this and subsequent steps, the Parliament's functional mailboxes for delegated/implementing acts are copied on each message from the

[53] Communication from the Commission to the Council and the European Parliament - Establishment of the working plan for 2009-2011 under the Ecodesign Directive. COM/2008/0660 final. 21 October 2008. (Ecodesign Working Plan 2009-2011)

[54] Commission Staff Working Document Establishment of the Working plan 2012-2014 under the Ecodesign Directive - SWD(2012)434/F1 (Ecodesign Working Plan 2012-2014)

Commission services. After the inter-service consultation, stakeholders are alerted when the draft measures are published in the WTO notification database.

After the WTO notification phase is completed, the two procedures follow different paths. The draft energy labelling delegated act is discussed in a MS Expert Group where opinion(s) are expressed and consensus is sought but no vote is taken. The draft Ecodesign measure is submitted for vote to the Regulatory Committee of MS experts.

The European Parliament and Council have the right of scrutiny for which a period of up to four months, if requested, is foreseen. Within this time the co-legislators can block the adoption process by the Commission. Parliament committees sometimes discuss draft objections to measures (light bulbs and fridges in 2009) or vote to reject a measure (vacuum cleaners in 2013[55]). On one occasion an objection was even adopted in plenary, blocking the measure for televisions in 2009[56].

Today, 30 Ecodesign Regulations, 17 Energy Labelling Regulations, 3 voluntary agreements and 2 tyre labelling regulations have been implemented. An overview of these measures can be found in Table A7.2

Table A11.2: Overview of applicable measures

Framework legislation	
2017/1369	Energy labelling Framework Regulation
2009/125/EC	Ecodesign Framework Directive
1222/2009/EC	European Parliament and Council Regulation on the labelling of tyres with respect to fuel efficiency and other essential parameters
30 Ecodesign implementing regulations	
1275/2008	Standby and off mode electric power consumption
107/2009	Simple set-top boxes
244/2009	Non-directional household lamps (amended by 859/2009/EC)
245/2009	Fluorescent lamps without integrated ballast, for high intensity discharge lamps and for ballasts and luminaires (amended by 347/2010/EU)
278/2009	External power supplies
640/2009	Electric motors (amended by regulation 4/2014/EU)
641/2009	Circulators (amended by regulation 622/2012/EU)
642/2009	Televisions
643/2009	Household refrigerating appliances
1015/2010	Household washing machines
1016/2010	Household dishwashers
327/2011	Fans
206/2012	Air conditioning and comfort fans
547/2012	Water pumps
932/2012	Household tumble driers
1194/2012	Directional lamps, light emitting diode (LED) lamps and related equipment
617/2013	Computers and servers
666/2013	Vacuum cleaners
801/2013	Networked standby electric power consumption
813/2013	Space heaters
814/2013	Water heaters
66/2014	Domestic cooking appliances (ovens, hobs and range hoods)

[55] This objection was defeated in ENVI committee by 43 votes against and 4 in favour.

[56] The motivation of the objection was that the EP wanted to delay the discussion of the draft labelling measure so that it would have to become a delegated act under the recast post-Lisbon Energy Labelling Directive in 2010. The measure was indeed subsequently adopted as a delegated act.

548/2014	Power transformers
1253/2014	Ventilation units
2015/1095	Professional refrigeration
2015/1188	Solid fuel local space heaters
2015/1189	Local space heaters
2015/1189	Solid fuel boilers
2016/2281	Air heating products, cooling products, high temperature process chillers and fan coil units
2016/2282	Use of tolerances in verification procedures
17 Energy labelling supplementing regulations	
1059/2010	**Household dishwashers**
1060/2010	**Household refrigerating appliances**
1061/2010	**Household washing machines**
1062/2010	Televisions
626/2011	**Air conditioners**
392/2012	Household tumble driers
874/2012	Electrical lamps and luminaires
665/2013	Vacuum cleaners
811/2013	Space heaters
812/2013	Water heaters
65/2014	Domestic cooking appliances (ovens and range hoods)
518/2014	Internet energy labelling
1254/2014	Domestic ventilation units
2015/1094	Professional refrigeration
2015/1186	Local space heaters
2015/1187	Solid fuel boilers
2017/254	Use of tolerances in verification procedures
3 Voluntary Agreements (Report to the EP & Council)	
COM (2012) 684	Complex set top boxes
COM (2013) 23	Imaging equipment
COM(2015)178	Game consoles
2 tyre labelling amending regulations	
228/2011	Wet grip testing method for C1 tyres
1235/2011	Wet grip grading of C2, C3 tyres, measurement of tyres rolling resistance and verification procedure
Previous legal acts still in force	
92/42/EEC	Hot-water boilers efficiency Council Directive (Ecodesign)
96/60/EC	Household combined washer-driers (Energy labelling)
2002/40/EC	Household electric ovens Commission Directive (Energy labelling) – will be repealed on 1/1/2015

MSAs, designated by the MSs, will verify the conformity of the products with the requirements laid down in the implementing measures and delegated acts. These can be done either on the product itself or by verifying the technical documentation. The rules on Union market surveillance and control of products entering the Union market are given in Regulation (EC) No 765/2008[57]. Given the principle of free movement of goods, it is imperative that MSs' market surveillance authorities cooperate with each other effectively.

[57] Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93. OJ L 218, 13.8.2008, p. 30

Annex 12: Existing Policies, Legislation and Standards affecting household washing machines and household washer dryers

A number of directives and regulations affect household washing machines and household washer dryers.

12.1 EU ECODESIGN AND ENERGY LABELLING REGULATIONS

The current Ecodesign Regulation sets some generic requirements and minimum energy efficiency requirements for household washing machines. The scope covers electric mains-operated household washing machines and electric mains-operated household washing machines that can also be powered by batteries, including those sold for non-household use and built-in household washing machines.

The **current Energy Labelling Regulation** sets energy labelling requirements for household washing machines. The scope is the same as the scope of the current Ecodesign Regulation.

The **current Energy Labelling Directive** sets energy labelling requirements for household washer dryers. The scope covers to electric mains operated household combined washer-driers and excludes appliances that can also use other energy sources.

Ecodesign and energy labelling regulations on components - In addition to ecodesign and energy labelling regulations on the final products, some ecodesign requirements might be applicable on the product's components. Components that are regulated under ecodesign and/or energy labelling are the following:

- External power supplies (Ecodesign Regulation (EC) No 278/2009[58])
- Electric motors (Ecodesign Regulation (EC) No 640/2009[59]);
- Circulators (Ecodesign Regulation (EC) No 641/2009[60]);
- Fans (Ecodesign Regulation (EU) No 327/2011[61]);
- Water pumps (Ecodesign Regulation (EU) No 547/2012[62]);

[58]

[59] Commission Regulation (EC) No 640/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for electric motors. OJ L 191, 23.7.2009, p. 26.

[60] Commission Regulation (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products. OJ L 191, 23.7.2009, p. 35.

[61] Commission Regulation (EU) No 327/2011 of 30 March 2011 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW. OJ L 90, 6.4.2011, p. 8.

Horizontal ecodesign regulations - In addition to those requirements, some horizontal aspects of energy using products are regulated. Horizontal measures are:

- Electric power consumption standby and off mode (Ecodesign Regulation (EC) No 1275/2008[63]);
- Networked standby (Ecodesign Regulation (EU) No 801/2013[64]).

12.2 Other EU policies

*The **Low Voltage Directive**[65] regulates health and safety aspects including e.g. mechanical, chemical, noise related or ergonomic aspects. Apart from this, the directive seeks to ensure that the covered equipment benefits fully from the Single Market. The LVD covers electrical equipment operating with a voltage between 50 and 1000 V for alternating current and between 75 and 1500 V for direct current. Falling under this category,* household washing machines and household washer dryers *are covered by the scope of the LVD, but there is no overlapping in terms of the type of requirements.*

*The **WEEE Directive** set requirements on e.g. recovery and recycling of Waste of Electrical and Electronic Equipment to reduce the negative environmental effects resulting from the generation and management of WEEE and from resource use. The WEEE Directive applies directly t*o household washing machines and household washer dryers. *Ecodesign implementing measures can complement the implementation of the WEEE Directive by including e.g. measures for material efficiency, thus contributing to waste reduction, instructions for correct assembly and disassembly, thus contributing to waste prevention and others.*

*The **RoHS Directive**[66] restricts the use of six specific hazardous materials and four different phthalates found in electrical and electronic equipment (EEE).* household washing machines and household washer dryers *are directly covered by the RoHS Directive. There is no overlapping requirement with a proposed ecodesign regulation.*

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[62] Commission Regulation (EU) No 547/2012 of 25 June 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water pumps**.** OJ L 165, 26.6.2012, p. 28

[63] 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**.** OJ L 339, 18.12.2008, p. 45.

[64] Commission Regulation (EU) No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment, and amending Regulation (EC) No 642/2009 with regard to ecodesign requirements for televisions**.** OJ L 225, 23.8.2013, p. 1.

[65] Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits**. OJ L 96,** 29.3.2014, p. 357. (LVD)

[66] Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment**.** OJ L 174, 1.7.2011, p. 88. (RoHS Directive)

*The **REACH Directive**[67] restricts the use of Substances of Very High Concern (SVHC) to improve protection of human health and the environment. The REACH Directive applies directly to* household washing machines and washer-dryers. *There is no overlapping requirement with a proposed ecodesign regulation.*

*The **EMC Directive**[68] sets requirements for the Electro-Magnetic Compatibility performance of electrical equipment to ensure that electrical devices will function without causing or being affected by interference to or from other devices. The EMC Directive applies directly to* household washing machines and household washer dryers. *There is no overlapping requirement with a proposed ecodesign regulation.*

*The **ETS** sets a cap on the total amount of certain greenhouse gasses that can be emitted by installations. This cap reduces over time, so that the total emissions fall. Within this cap companies receive or buy emission allowances which they can trade with one another as needed. They can also buy a limited amount of international credits. The ETS does not directly apply to* household washing machines and household washer dryers, *however, it does apply to electricity production. Hence, if the electricity consumption of* household washing machines and household washer dryers *reduces, the electricity companies will have to trade less or the price of carbon will reduce under the cap system. Consequently, the price of electricity will drop.*

12.3 Policies at EU MS level

There are no measures and policies at MS level for household washing machines and household washer dryers.

12.4 Non-EU policies

The Standards & Labelling database www.clasponline.org distinguishes 280 different energy efficiency measures such as minimum efficiency requirements, comparative energy labels and endorsement labels. Countries with active energy efficiency policy tend to address household washing machines and household washer dryers. Many countries have either introduced energy labels based on or inspired by the EU energy label[69], the United States of America (USA) programmes or a combination of both, such as Mainland, Hong Kong, Taiwan, Singapore, (China), Korea, Thailand, Indonesia, Australia and New Zealand. In the Latin American Countries Argentina, Brazil and Mexico have also introduced energy labels or minimum requirements.

[67] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC. OJ L 396, 30.12.2006, p. 1–849 (REACH Regulation)

[68] Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility. OJ L 96, 29.3.2014, p. 79 (EMC Directive)

[69] European Commission Conference on Product Policy –Ecodesign & Energy Labelling, 20-21 Feb. 2014, misc. lectures.

The European standard EN 60456: 2011 consists of the text of the analogous international standard IEC 60456:2010 with common modifications prepared by CENELEC TC 59X. However, there are significant technical differences compared to IEC 60456:2010:

- a test procedure for a combined test sequence of cotton 40C and cotton 60C with full load and partial load is introduced
- a test procedure for measuring power consumption in low power modes is introduced
- a formula to calculate the energy consumption of washing machines, including low power modes, is added
- the detergent dosage is reduced to 75% for cotton and synthetic/blends; the dosage is depending on the load: 40g+12g/kg load
- the detergent dosage of the reference machine type 1 (new type in IEC60456) is adjusted to maintain the washing performance level of the reference machine type 2 (old type)
- the reference machine type 1 is to be used for testing according to Commission Regulations with regard to Energy Labelling and Ecodesign: and
- control procedures for checking measured values in comparison to values declared by the manufacturer under consideration of permitted tolerances are updated.

To safeguard competition in the EU, it is important that the EU keeps on distinguishing based on innovation and quality. Up to date requirements will enable this. In addition, the use of the standard, adapted to the EU situations, in ecodesign and energy labelling is essential for global competitiveness.

Annex 13: Glossary

Term or acronym	***Meaning or definition***
APPLiA	European Committee of Domestic Equipment Manufacturers (industry association representing manufacturers of home appliance in Europe) – formerly known as CECED (from March 2018)
BAT	Best Available Technologies
BAU	Business-as-usual (describing a scenario without any further intervention)
CECED	See APPLiA (name change, March 2018)
CF	Ecodesign (and Energy Labelling) Consultation Forum – Official stakeholder group of c. 60 permanent invited members, comprising Member States' representatives, industry/trade associations, environmental and consumer NGOs and retailers' associations, plus invited experts.
EEI	Energy Efficiency Index
ESOs	European Standardisation Organisations
GHG	Greenhouse gas
HP	Heat pump
IA	Impact Assessment
IEC	International Electro-technical Commission; global standardization organization
kW	kiloWatt, i.e., 10^3 Watt (unit of power)
kWh	kiloWatt.hour, i.e., 10^3 Watt.hours (unit of energy)
LCC	Life Cycle Cost - over the whole lifetime of a product, including purchase cost, energy costs and water costs
LLCC	Least Life Cycle Cost; used to determine the energy efficiency etc. requirements that minimise the costs of purchasing and using a product throughout its whole lifetime
MEErP	Methodology for the Ecodesign of Energy-related Products[70]
$MtCO_2eq$	Mega tonne CO_2 equivalent, 10^9 kg (or 1000 tonnes) of emissions equivalent to the Global Warming Potential compared to CO_2 (unit of greenhouse gas emissions)
MS	Member State (of the European Union)
MSA	Market Surveillance Authority (in charge of enforcing Ecodesign regulation in a Member state)
NGO	Non-Governmental Organization
OEM	Original Equipment Manufacturer
TWh	TeraWatt.hour, 10^{12} Watt.hour (unit of energy), i.e., equivalent to 1000 GWh
WD	Household Washer dryer
WM	Household Washing Machine
yr or a	Abbreviation used as denominator for units expressed per year (e.g. TWh/yr or TWh/a)

[70] The latest complete version of the methodology dates from 2011, as supplemented by additional elements contained in "Material efficiency Ecodesign Report and Module to the Methodology for the Ecodesign of Energy-related Products (MEErP) PART 1: Material efficiency for Ecodesign – Final report to the European Commission" – DG Enterprise and industry, 5 December 2013