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IMPACT ASSESSMENT

Accompanying the document

COMMISSION REGULATION (EU) .../... laying down ecodesign requirements for household dishwashers 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 1016/2010

and

COMMISSION DELEGATED REGULATION (EU) .../... supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council as regards energy labelling of household dishwashers

and repealing Commission Delegated Regulation (EU) No 1059/2010

{C(2019) 1807 final} - {C(2019) 2123 final} - {SEC(2019) 336 final} - {SWD(2019) 348 final}

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This report commits only the Commission's services involved in its preparation and does not prejudge the final form of any decision to be taken by the Commission

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

This impact assessment relates to the review of Commission Regulation (EC) No 1016/2010[1] on Ecodesign requirements for household dishwashers and Commission Delegated Regulation (EU) No 1059/2010[2] on Energy Labelling of household dishwashers.

1.1. Benefits of Ecodesign and Energy Labelling

Ecodesign and Energy Labelling are **recognised globally** as one of the most effective policy tools in the area of energy efficiency. They are central to making Europe more energy efficient, contributing in particular to the 'Energy Union Framework Strategy'[3], and to the priority of a 'Deeper and fairer internal market with a strengthened industrial base'[4]. Firstly, this legislative framework pushes industry to improve the energy efficiency of products and removes the worst-performing ones from the market. Secondly, it helps consumers and companies to reduce their energy bills. In the industrial and services sectors, this results in support to competitiveness and innovation. Thirdly, it ensures that manufacturers and importers responsible for placing products on the European Union (EU) market only have to comply with a single EU-wide set of rules.

It is estimated that by 2020, Ecodesign and Energy Labelling regulations will deliver around 175 Mtoe (i.e. about 2035 TWh) of energy savings per year in primary energy in comparison to if there were no measures in place. This is roughly equivalent to Italy's energy consumption in 2010, close to half the EU 20 % energy efficiency target by 2020 and about 11 % of the expected EU primary energy consumption in 2020[5].

The average household will invest in more expensive and efficient products, but in return saves about EUR 500 annually on its energy bills by 2020. Although the cost for industry, service and wholesale and retail sectors will increase, it will result in EUR 55 billion per year of extra revenue by 2020.

This legislative framework benefits from **broad support** from European industries, consumers, environmental non-governmental organisations (NGOs) and Member States (MSs), because of its positive effects on innovation, increased information for consumers and lower costs, as well as environmental benefits.

Household dishwasher appliances represent an important component of the consumption of domestic electricity. They have been subject to EU Energy Labelling measures[6] since 1997 and minimum Ecodesign energy efficiency requirements[7] since 2010.

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[1] OJ L 293, 11.11.2010, p. 31–40
[2] OJ L 314, 30.11.2010, p. 1–16
[3] Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee, The Committee Of The Regions And The European Investment Bank - A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. COM/2015/080 final.
[4] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Upgrading the Single Market: more opportunities for people and business COM/2015/550 final. 28 October 2015. (Deeper and fairer internal market)
[5] Ecodesign impact accounting – Overview report for the European Commission DG Energy, VHK December 2016
[6] Commission Directive 97/17/EC (OJ No L 118, 7.5.97, p.1).
[7] Commission Regulation (EU) No 1016/31 (OJ L 293, 11.11.2010, p.31).

1.2. Legal framework

In the EU, the **Ecodesign Framework Directive**[8] sets a framework requiring manufacturers of energy-related products to improve the environmental performance of their products by meeting minimum energy efficiency requirements, as well as other environmental criteria such as water consumption, emission levels or minimum durability of certain components before they can place their products on the market.

The **Energy Labelling Framework Regulation**[9] complements the Ecodesign Framework Directive by enabling end-consumers to identify the better-performing energy-related products, via an A-G/green-to-red scale. The Regulation sets out the general rules for rescaling the existing A+ to A+++ labels:

- Class A shall be empty at the moment of introduction of the label, and the estimated time within which a majority of the models falls into that class is at least 10 years;
- Where technology is expected to develop more rapidly, classes A and B shall be empty when introducing the label;
- Moreover, the A to G steps of the classification shall correspond to significant energy and cost savings and appropriate product differentiation from the customer's perspective.

In general, the boundaries of the label scale are defined by the performance of products on the market incorporating 'Best Available Technology' (BAT) and the minimum requirement under Ecodesign for those products. Subsequently, the bandwidth of the classes is determined so as to keep the same effort to move from one class to the next one. For specific product groups this may however be different to take into account appropriate product differentiation.

The BAT is determined following the MEErP methodology, and is based on purely technical grounds, i.e. the product on the market with the lowest environmental impact, while ensuring that other functional requirements (e.g. performance, quality, durability) are equivalent to the base case.

The EU Energy Label is recognised and used by 85% of Europeans[10].

The legislative framework builds upon the **combined effect** of the two aforementioned pieces of legislation. See Figure 1 for a visualisation of this effect.

[8] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of Ecodesign requirements for energy-related products. OJ L OJ L 285, 31.10.2009, p. 10

[9] Regulation (EU) 2017/1369 of the European Parliament and of the council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU. OJ L 198, 28.7.2017, p. 1 (Energy Labelling Framework Regulation)

[10] Study on the impact of the energy label – and potential changes to it – on consumer understanding and on purchase decisions - LE London Economics and IPSOS, October 2014

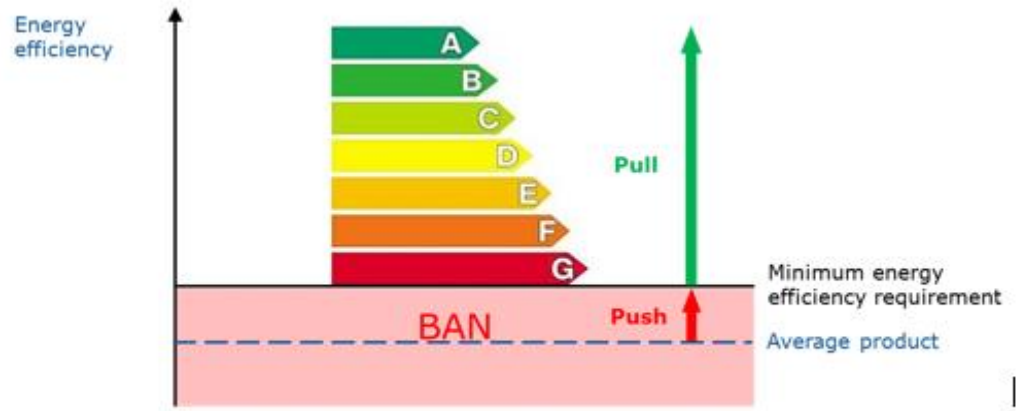

Figure 1: Synergetic effect Ecodesign and energy labelling

The Ecodesign framework Directive and the Energy Labelling framework Regulation are implemented through product-specific implementing and delegated regulations.

As an alternative to the mandatory Ecodesign requirements, voluntary agreements or other self-regulation measures can be presented by the industry sector(s) concerned (see also Article 17 of the Ecodesign Framework Directive). If certain criteria are met, the Commission formally recognises these voluntary agreements[11]. The benefits include quicker and more cost-effective implementation, which can be more flexible and easier to adapt to technological developments and market sensitivities.

For more details about the legal framework, including a full list of Ecodesign and Energy Labelling measures, see Annex 10.

Household dishwasher appliances are currently regulated under Commission Regulation (EC) No 1016/2010[12] (Ecodesign) and Commission Delegated Regulation (EU) No 1059/2010[13] (Energy Label).

An overview of existing policies, legislations and standards affecting household dishwasher appliances in the EU and outside is given in Annex 11.

1.3. Legal context of the reviews

Article 7 of the **Ecodesign Regulation for household dishwashers** and similarly Article 7 of the **Energy Labelling Regulation for household dishwashers** require the regulations to be reviewed in the light of technological progress no later than four years after their entry into force. This review should in particular assess the verification tolerances of Annex III and the possibilities for setting requirements with regard to the water consumption and the potential for hot water inlet.

[11] Commission Recommendation (EU) 2016/2125 of 30 November 2016 on guidelines for self-regulation measures concluded by industry under Directive 2009/125/EC of the European Parliament and of the Council; OJ L 329, 3.12.2016, p.109

[12] Commission communication in the framework of the implementation of Commission regulation (EU) No 1016/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to Ecodesign requirements for household dishwashers, OJ L293, 11.11.2010

[13] Commission Delegated Regulation (EU) No 1059/2010 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household dishwashers, OJ L 314, 30.11.2010.

In August 2017, the new Energy Labelling framework Regulation (EU) 2017/1369 entered into force, repealing Directive 2010/30/EU[14]. Under the repealed 2010 Directive, energy labels were allowed to include A+ to A+++ classes to address the overpopulation of the top classes. Owing to continued technological development, the A+ to A+++ classes also became overpopulated, thereby reducing the effectiveness of the labels significantly. In order to resolve this, the new 2017 Energy Labelling framework regulation requires a rescaling of existing energy labels, back to the original A to G scale. Article 11 of the Energy Labelling framework regulation lists 5 priority product groups for which new delegated acts with rescaled energy labels must be adopted at the latest on 2 November 2018. Household dishwashers are one of the priority product groups.

1.4. Political Context

Several new policy initiatives indicate that Ecodesign and Energy Labelling policies are relevant in a broader political context. The main ones are the **Energy Union Framework Strategy,** which calls for a sustainable, low-carbon and climate-friendly economy, the **Paris Agreement**[15], which calls for a renewed effort in carbon emission abatement, the **Gothenburg Protocol**[16], which aims at controlling air pollution, the **Circular Economy Initiative**[17], which - inter alia - stresses the need to include reparability, recyclability and durability in Ecodesign, the **Emissions Trading Scheme** (ETS) as amended[18], aiming at cost-effective greenhouse gas (GHG) emissions reductions and indirectly affected by the energy consumption of the energy-related products in the scope of Ecodesign and Energy Labelling policies, and the **Energy Security Strategy**[19], which sets out a strategy to ensure a stable and abundant supply of energy.

Moreover, the **Ecodesign Working Plan 2016-2019**[20] also includes the review of both regulations, requiring in particular the examination of how aspects relevant to the circular economy can be assessed and taken on board. This is in line with the Circular Economy Initiative[21], which concluded that product design is a key in achieving the goals, as it can have significant impacts across the product life cycle (e.g. in making a product more durable, easier to repair, reuse or recycle).

1.5. Need to act

The need to act is driven by the following main considerations:

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[14] Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products. OJ L153, 18.6.2010, p. 1.

[15] Global agreement in response to climate change adopted on 12 December 2015 at the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change held in Paris (30.11 – 13.12.2015) (Paris Agreement)

[16] Protocol to abate acidification, eutrophication and ground-level ozone of 1999 (Gothenburg Protocol)

[17] Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions Closing The Loop - An EU Action Plan For The Circular Economy, COM(2015) 614 final, Brussels 02.12.2015 (Circular Economy Initiative)

[18] https://ec.europa.eu/clima/policies/ets_en (ETS)

[19] Communication of the commission to the European Parliament and the Council European Security Strategy. COM(2014) 330 final, 28.5.2014

[20] Communication from the Commission Ecodesign Working Plan. COM(2016) 773 final, Brussels, 30 November 2016. (Ecodesign Working Plan 2016-2019)

[21] Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions Closing The Loop - An EU Action Plan For The Circular Economy (Circular Economy Initiative)

Cost effective increases in energy efficiency and the level of protection of the environment:

Manufacturers and consumers stand to benefit from the fact that there are still cost effective energy and water savings to be achieved in washing machines and washer-dryers, even if these savings are modest in view of EU 2030 energy and climate targets. By way of illustration, electricity savings due to the existing requirements on these products were expected to be 2 TWh per year in 2020 at the time of the previous review in 2010. In reality, the consumption of dishwashers in the EU was estimated to be 3 TWh higher than 'business-as-usual' in 2016, meaning that the savings enabled by the Ecodesign and Energy Label revision were more than compensated by the increased number of dishwashers in use.

Other policy objectives:

Several other EU policy objectives require the revisions to look beyond the technical revisions mentioned in the review article of the existing regulations, e.g.:

- renewed effort in carbon emission abatement through the Paris climate agreement;
- the EU Circular Economy action plan aiming at improving the durability, reparability, recyclability of products;
- the Better Regulation policy aiming at more efficient and effective legislation;
- the need to address possible circumvention of testing standards;
- renewed energy efficiency targets..

Rescaling of energy labels

The new Energy Labelling framework Regulation requires the Commission to rescale the existing labels for five priority product groups, including dishwashers, by 2 November 2018 at the latest, to remove the A+ to A+++ classes.

Effectiveness of Ecodesign and Energy Labelling measures

Where regulatory measures in Ecodesign and Energy Labelling are no longer effective, or no longer as effective as expected, they need to be revised (or potentially withdrawn). This may happen as a result of technological progress, consumers' choices or market evolutions. In particular, the filling up of the top classes means that the label is no longer effective. If there is still a significant difference in energy efficiency of products remaining on the market, a label will still bring added value in terms of guiding consumers to more efficient products.

2. PROBLEM DEFINITION

2.1. How the problems are defined

The review of the Ecodesign and Energy Labelling for dishwashers started in 2015 and several studies were conducted for this purpose, as described in Annex 1. These studies evaluated the impact of the current legislation, as reported in Annex 4; they also looked at the evolution of the sector (technological and economic evolution) and at stakeholders' views. Results from the studies have been used directly as input to the analysis model of Annex 5.

The results of the review are summarised in the follow-up study published in 2017 and cover the following issues:

- Energy label classes: some dishwashers already exceed the minimum level of the highest energy class A+++ in the current scale;
- Water consumption: the water consumption of household dishwashers per cycle and place setting is closely related to energy consumption, and both have been reduced significantly in the past few years. Evidence shows that pre-rinse is often applied resulting to additional water consumption
- Use of the standard programme: only 19% of consumers use the standard ("Eco") programme which is the test programme to measure energy performance; however, this use has been increasing since 2012 when the standard (Eco) programme was set as the default option.
- Programme duration: the duration of the standard (Eco) programme has recently increased to around 3.5 hours while most consumers are willing to accept a maximum of 2-3 hours.
- Technical innovation: further energy savings could be achieved by technical improvements in dishwashers, generally with a low impact on life cycle costs;
- Resource efficiency: an increased proportion of dishwashers have to be replaced in the first 5 years of use, with an impact on the average lifetime of appliances;

The problems defined in this section and the policy options defined in Section 5 build on the results of the review study and on the comments from stakeholders on these results.

2.2. Problem 1: Outdated energy efficiency requirements

The problem:

The current Ecodesign requirements for dishwashers no longer capture cost-effective energy savings, and the current energy label no longer allows consumers to effectively differentiate between the appliances on the market.

The last revision of Ecodesign requirements, in Regulation 1016/2010, introduced a new minimum requirement on energy efficiency (which came into force in the end of 2016) excluding products with an Energy Efficiency Index (EEI)[22] lower than the A+ class limit for full-size and slim-line dishwashers, and lower than the A class limit for the smaller dishwashers (<7 place-settings). As a consequence, there are now only three Energy Label classes (A+/A++/A+++) for most models of dishwasher, and four for the smaller ones. The small number of Energy Label classes led to the classification of many models in the top classes ("Energy Label congestion")[23] and to poor differentiation by consumers of the performance of dishwasher models on the market. Furthermore, the "A+", "A++" and "A+++" classes introduced by the Energy Labelling Framework Directive (Directive

[22] This limit is represented by an EEI = 63 for full-size dishwashers, and EEI = 71 for the smaller household dishwashers (< 7 place settings).

[23] Label congestion has also resulted in manufacturers and importers attaching "unofficial" labels to the best energy-saving dishwashers, from "A+++ -10%" to "A+++ -30%" (in each case, the minus representing less energy use than the regulated "A+++" performance level).

2010/30/EU) have been shown to be less effective in persuading consumers to buy more efficient products than the A to G scale[24].

Consumers do not easily understand the differences between A, A+, A++ and A+++ and purchase A or A+ class dishwashers without realising that these are the lower performing dishwashers currently on the market. Consequently, products rated in A or A+ classes currently enjoy the larger share of sales.

This problem is especially relevant because the market for dishwashers in the EU is still not saturated. There are several Member States where the market penetration of dishwashers is very low, and where the number of installed dishwashers is expected to significantly increase in the coming years. It should be noted that using a dishwasher achieves important savings on energy and water when compared to manual washing-up; up to 30% on energy consumption and up to 88% on water use according to some studies[25]. Increasing the market penetration of dishwashers therefore represents a "win-win-win" solution from an environmental, business and consumer perspective, but of course comes with an initial purchase cost - which is the probable cause of the lower market uptake in Member States with lower levels of income[26].

The drivers of the problem:

Problem driver 1: Technological progress

Since the last revision, technological progress for household dishwashers has kept evolving, bringing with it increased energy efficiency. In the 2010 Ecodesign measure, best available technology (BAT) energy consumption benchmarks for the dishwashers were cited at 0.88 kWh/cycle (15 place-settings), and 0.83 kWh/cycle (13 place-settings), and indicatively 0.80 kWh/cycle for slim-line dishwashers (9 place-settings). However, compared to these 2010 benchmarks the ***actual*** BAT figures in 2017 attained were **36% lower** (for heat pump-equipped machines), and **22% lower** (for other BAT technologies dishwashers).

For full-size dishwashers, the influence of the Energy Label on the market has led to a situation where a large proportion of high-performing products has the same highest Energy Label class A+++ (this is the "Energy Labelling congestion" observed also in other product groups, e.g. washing machines). This reduces the incentive for manufacturers to further invest in new technologies as this is not rewarded by the market. They cannot further differentiate their product within the energy class A+++, apart from using unofficial labels such as "A+++ -20%" to indicate a better level of performance than the minimum performance of the A+++ class: a solution which seems more confusing to consumers than the "A-G" label scale.

Problem driver 2: Price difference between models of different energy classes

As explained above, products rated A or A+, meaning the least efficient products on the market, enjoy the largest market share. This is due in particular to the high difference in

[24] Commission Staff Working Document Impact Assessment Accompanying the document Proposal for a Regulation of the European Parliament and of the Council setting a framework for energy efficiency labelling and repealing Directive 2010/30/EU. SEC(2015) 139 final (Impact Assessment Energy Labelling Regulation)

[25] *Daten und Fakten zum Geschirrspülen per Hand und in der Maschine*, Rainer Stamminger, 2006

[26] The purchase price of an average household dishwasher can vary between 325€ and 588€. A heat pump equipped dishwasher is estimated to costs over 3000€. The average income of Romania is 512€ and the average income of Germany is 2620€. Further information in Annex 5, Sections 5.2 and 5.3.

purchase price between the cheaper models of A/A+ and the higher-priced A++ and A+++ models on the market. The present limited number of Energy Label classes leads consumers to differentiate products on purchase price only instead of both price and energy-efficiency. The important price difference between models of different classes prevents low-income consumers to benefit of energy-efficient appliances and it negatively impacts innovation as manufacturers do not have any incentive to produce more efficient appliances. The situation reverts instead to an incentive for manufacturers and retailers to compete on price, rather than via technology offers.

Problem evolution in absence of policy measure: **obstacles to innovation**

In the absence of a suitable policy measure, technological progress is likely to slow-down or even come to a halt. The absence of reward for more energy-efficient technologies and their small market share reduce the 'learning effect' for new technological developments introduced on the market, which increases their purchasing price, and further increases the price difference with lower-performing appliances. At the same time, in a number of Member States, the low penetration rates keep pressure on prices for the market entry of (lower-performing) products. There is therefore a risk of 'vicious circle' if appropriate policy measures do not re-establish a clearer differentiation and incentives to progress – not only for the higher performing but also for the lower performing appliances.

2.3. Problem 2: Poor "circular economy" performance

The problem:

The current Ecodesign and Energy Labelling Regulations lack requirements that contribute to Circular Economy objectives, such as for durability, reparability, and recyclability. The existing requirements focus mainly on energy efficiency improvements as the most significant environmental impact during the life-cycle of household dishwashers. However, dishwashers, like many other products, can be significantly improved in terms of circular economy aspects, which could be progressively achieved through Ecodesign measures.

The main indicator of this poor performance is that of durability. The **average lifetime of a dishwasher** has reduced in recent decades from 14 to 12.5 years[27]. For a long time, the energy efficiency gains permitted by new dishwasher models justified a quicker renewal of the stock of appliances, but this is no longer the case. Furthermore, consumer NGOs (see Annex 3 and the review study 2017) have noted the following trends, both for dishwashers and other "white goods":

- An increase in the proportion of early product failures (<5 years);
- Increased complaints by consumers that repair is not as easy and beneficial as it should be;
- More resources are lost at product end of life, due to the difficulties encountered by professional dismantling/recycling entities to separate and recycle materials.

The drivers of the problem:

Problem driver 1: availability and cost of spare parts and their delivery

[27] Prakash, S. Dehoust G., Gsell M., Schleicher T., Stamminger R. (2016) Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung: Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen "Obsoleszenz" [Influence of the service life of products in terms of their environmental impact: Establishing an information base and developing policies against "obsolescence"]

Currently no measures exist which regulate the availability of spare parts for dishwashers and their delivery. The Review study 2017 suggests that a minimum availability of those spare parts that fail most frequently (see Annex 3.1) would be useful, also after production of the model ends. If spare parts are available, it is often not clear to end-users where to order them and how to replace them. In some cases it is technically unfeasible to replace certain broken parts, because they cannot be removed without damaging other parts, or because they are permanently fixed to other parts, meaning that replacing the broken part would require the replacement of a significantly larger part of the appliance. Additionally, the cost of spare parts and the cost of repair services (including travel/ labour time) are often too high in comparison with the purchase price of a new appliance[28]. Consequently, in case of problems that occur after the expiry of the legal guarantee, defective appliances are often not repaired at all but instead are replaced by new ones.

Another important issue is the time for delivery of the spare parts - a reasonable maximum time limit is needed to ensure that consumers are not discouraged due to the waiting time.

Problem driver 2: Access to repair and maintenance information

There is sub-optimal information available both to individuals and to professional repair services, to easily identify the cause of problems and carry out repairs on dishwashers. The Review study 2017 uncovered that this is especially the case for independent repairers, i.e. professional repairers other than those under a contractual relationship, or "authorised", by Original Equipment Manufacturers (OEMs). No measures currently exist regulating the availability of repair and maintenance information for dishwashers and their access to independent repairers.

For example, disassembly procedures and sometimes diagnosis software are essential prerequisites for repairs and are generally not available to independent repairers. This was confirmed through the feedback received from repair and end-of-life operators during and after the December 2017 Consultation Forum.

Difficult access to information affects the competitiveness of independent as compared to authorised repairers, while more competition in repair activities could potentially reduce prices and provide more options for consumers. It also increases the cost of repair, making it unattractive to consumers compared to replacement with a new appliance[29]. Consequently, many appliances are not repaired. The current situation is likely to result in fewer dishwashers being repaired than would be economically, socially and environmentally beneficial. This also results in sub-optimal use of resources and avoidable costs for consumers.

Problem driver 3: Incomplete information on the end-of-life of appliances

The review study 2017 found that if recyclers are given insufficient or poor quality information related to the recycling and disposal of dishwashers, as seems to be often the case, material recovery is less efficient, which then increases the treatment cost (See Annex 6). This may be linked to several causes, such as a lack of standardised methods or insufficient and not easily understandable information (e.g. dismantling at end of life,

[28] The after-sales service hourly labour rate may cost 70€. If the spare part (a new motor) costs 200€ including only one hour of service labour costs then the total cost of replacing the motor may be 270€, representing approximately 50% of the purchase price of a new appliance according to "Quel Choisir?" See more information in Annex 6.

[29] It should be acknowledged that new appliances, although costing more, usually incorporates new or up-to-date functionalities, which may be attractive to consumers, and the new product is accompanied by at least the EU-wide minimum legal guarantee of 2 years.

including exploded diagrams on how to access certain parts, and what valuable material might be contained therein, e.g., Critical Raw Materials, etc.).

The Waste Electrical and Electronic Equipment (WEEE) Directive[30] establishes a list of parts that shall be easily dismantled by recyclers, using commonly available and non-proprietary tools (Annex 7 of the WEEE Directive). Integrating those parts relevant for dishwashers into the Ecodesign Regulation would facilitate the efficient implementation of this requirement already at design stage, in complement to the enforcement of the Directive by Member States in relation to waste management.

Problem evolution in absence of policy measure:

In the absence of policy intervention, there is no prospect for significant change in current trends: the average lifetime of appliances is likely to continue diminishing, while repair activities are unlikely to develop significantly. End-of-life activities are likely to develop, driven by other legislation, but in the absence of integration with Ecodesign requirements, the cost of recycling is likely to remain high for society.

2.4. Problem 3: Low use of the Ecoprogramme by consumers

The efficiency of Ecodesign and Energy Labelling requirements is reduced by consumer habits, in particular by the low use of the Ecoprogramme, which is the programme defined by the Ecodesign Regulation for tests and therefore optimised by manufacturers for energy efficiency.

The 2017 review study collected data showing that consumers on average use dishwashers as follows: 39 % of the cycles are run in normal programmes, 19 % in ecoprogrammes, 11 % in short programmes, 9 % in intensive programmes and 9% in automatic programmes. This means that the energy efficiency required under Ecodesign requirements materialise in only 19% of washing cycles, the other cycles using less energy-efficient programmes. A related issue is programme duration: consumers indicate that they are willing to use energy-saving programmes, but programmes lasting too long (> 3-4 hours) have low acceptability[31]. The risk is that the energy savings estimated at the time of Ecodesign revisions are only partially realised.

Problem evolution in absence of policy measure: **slow resolution**

The situation seems to change progressively with the setting of the Ecoprogramme as the default programme, mandatory since the last Ecodesign revision and applicable as of December 2012. Because of the slow renewal of the stock of dishwashers, it is not possible to quantify the effect of this requirement with certainty but the one-fifth share of consumers choosing the Ecoprogramme as their regularly-used programme appears to be increasing (corroborated by data illustrating that the Ecoprogramme is used more often in newer machines). It is therefore considered that, even if the problem is still present at the time of this impact assessment, it is in way of resolution without need of additional measure.

[30] Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

[31] In addition to the perception of inconvenience of longer programmes, possibly this shows (understandably) that consumers might not be well informed about the relationship between programme duration and energy savings: usually programmes with a longer duration save more energy, but this information must be communicated more successfully to consumers.

2.5. General market failures

In addition to the product specific problem drivers described in Section 2, some general market failures have been identified:

Asymmetrical information - Without up to date energy efficiency requirements and energy labels, economic actors (both business and individual consumers) will not choose the product that is the most cost-effective over the product's life-time. This is because economic actors are limited by the information they have, their knowledge about products, and the finite amount of time they have to make a decision.

Split incentives – Without up to date energy efficiency requirements, manufacturers lack incentives to invest in new technologies and consumers lack the guarantee that the products will be cost-effective over their life-time. This is especially important for a certain group of consumers, in particular those in a landlord-tenant situations, in where the landlord buys the appliance and the tenant pays the energy bill.

Environmental externalities – The price of the products does not reflect the real environmental costs to society in terms of resources used from raw materials and production processes, waste management and missed opportunities for a more circular economy. Hence, without setting requirements that will improve "Circular Economy" aspects of the product, the different actors in the life cycle of the appliance will not be incentivised to improve the Circular Economy aspects of the product/ service offered.

2.6. Who is affected?

2.6.1. Household dishwasher appliances' manufacturers and retailers

For the **manufacturing industry and retail sectors**, the Energy Label class rating is one of the main market drivers. It is an important quality feature that allows industry and importing actors to distinguish themselves via a well-recognised and trusted label representing features associated with quality and innovation, rather than having to compete primarily on purchase price alone. **Important manufacturers** with EU production facilities are Bosch Siemens Home appliances (BSH), LG, Miele and Whirlpool. The European industry association is APPLiA (formerly known as CECED). These end-product manufacturers mainly assemble components supplied by other companies. Almost all manufacturers are large companies. SME manufacturing companies are solely present in niche markets, such as dishwashers equipped with heat-pumps with the SME V-Zug, or as suppliers of larger manufacturers.

European manufacturers are mostly affected by the outdated energy efficiency requirements and by the resulting difficulty in introducing new energy-efficient technologies on the market. The evolution to a situation of competition on price-only, rather than on both technology performance and price, is likely to have a negative effect on their competitiveness. At the same time, the non-saturation of the market gives important margins of growth, especially in central and southern European Member States, even if competition on these markets seems to be mainly driven mainly by purchase prices.

The total employment in household dishwashers is estimated at just over 44 000 jobs[10], of which around 65% are in the retail sector. It is estimated the EU 2015 annual market value for household dishwashers comprises close to 5.5 billion Euros (including VAT and levies), of which almost 2.7 billion Euros is derived from industry revenues (manufacturers' sales prices), 1.75 billion Euros in retail, and just over 1 billion Euros in taxes, levies etc. It should be noted that Eurostat data related to production, as well as to

exports and imports of household dishwashers in Europe in recent years seems to be only partially complete. However, other studies, such as Deloitte 2016[32], cited that over half of the value (54%) of the EU's annual sales of white goods relate to products that are imported from outside of the EU.

2.6.2. Repair industry

This industry consists mainly of SMEs that act locally, either as 'independent' organisations or as "authorised" repair entities that have a contractual relationship with OEMs/ retailers[33]. Activities in this sector are likely to benefit from better availability of spare parts and better access to maintenance and repair information. Ecodesign requirements on repair would facilitate better conditions for repair activities, and would help to ensure that consumers have affordable and fast repair options. Additionally, access to maintenance and repair information fosters greater competition in this sector, as conditions under which independent repairers operate as compared to OEM-authorised repairers, would start to level out. This is expected to lower the costs of repair, in line with reducing the technician's time at the consumer's home when analysing breakdowns, as the technician would have access to better product repair information.

2.6.3. Recycling industry

Recycling companies are situated all over the EU. Some of the bigger recyclers can be found in Netherlands and Belgium as well as in the UK and France. The recycling industry is presented by the European Recycling Industries' Confederation (EURIC). The recycling industry is likely to benefit from Ecodesign requirements at the end of life of appliances, through e.g. easier dismantling of electric and electronic components.

2.6.4. Consumers

For **consumers,** the EU Energy Label offers a unique opportunity to make an informed choice regarding which products offer the best environmental and energy performance, allowing them to save money over the life time of the product. Ecodesign requirements safeguard consumers from the worst-performing products.

Consumers are affected by the difficulty in differentiating between the upper classes of the Energy Label. Additionally, prompt and fair-priced spare part availability would improve the reparability of household dishwashers, and would help to ensure that consumers could have their appliances repaired, even after the final production date of a particular model. This would help extend product lifetime and save consumers expense on purchasing replacement models.

The discrepancy, in the case of dishwashers, between expected energy savings and realised (increasing) energy consumption raise the question of rebound effect, i.e. whether consumers habits reduced or cancelled the benefits of savings. Actually, this discrepancy is mainly due to the increased number of dishwasher in use. This is not a rebound effect *stricto sensu*, in the sense that this increased use lead overall to actual energy savings when

[32] Deloitte (2016) Study on socioeconomic impacts of increased reparability: final report. Prepared for the European Commission DG ENV. Available at: https://publications.europa.eu/en/publication-detail/-/publication/c6865b39-2628-11e6-86d0-01aa75ed71a1/language-en

[33] This contractual relationship gives the sub-contracting repair/ maintenance organisation the "badge" of being an approved supplier of the main manufacturer or retailer, but – especially with the former – often requires the sub-contractor to sign up to various manufacturer/ retailer training sessions per year at a cost, and also sometimes the obligation to carry several thousand Euros worth of original spare parts in repair vans, or at the repair organisation's base.

taking into account the impact of handwashing. As for the impact of the under-loading of machines, this indeed reduces the expected savings and it is unlikely to change in future. Dishwashers are generally perceived to run at full load according to the consumers' opinion, which is however a lower load than during the testing of the machines[34].

Consumers are represented by the Bureau Européen des Unions de Consommateurs (BEUC), and the European Association for the Co-ordination of Consumer Representation in Standardisation (ANEC).

2.6.5. Society as a whole

For society as a whole, ambitious policies in the area of energy efficiency are important tools to mitigate climate change. Effective and efficient Energy Labelling and Ecodesign regulations contribute to achieving goals set in the Paris Agreement and they help achieve the EU's 2030 energy and climate goals.

Environmental organisations are represented by the European Environmental Citizens Organisation for Standardisation (ECOS), the European Environment Bureau (EEB), TopTen, the Collaborative Labelling and Appliance Standards Program (CLASP).

For EU and Member State policy-makers, more effective and efficient Energy Label and Ecodesign regulations mean that these policies will make additional contributions to achieving policy goals regarding the single market, energy efficiency, environmental protection, technological innovation, energy security of supply, carbon emission abatement and furthering the aims of the "Circular Economy", thus saving resources.

3. WHY SHOULD THE EU ACT?

3.1. Legal basis

The legal basis for acting at EU level through the Ecodesign framework Directive and the Energy Labelling framework Regulation is Article 114 and Article 194 of the Treaty on European Union and the Treaty on the Functioning of the European Union (TFEU)[35] respectively. Article 114 relates to the "the establishment and functioning of the internal market", while Article 194 gives, amongst others, the EU the objective "in the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment" to "ensure security of energy supply in the Union" and "promote energy efficiency and energy saving and the development of new and renewable forms of energy".

The Ecodesign Framework Directive and Energy Labelling Framework Regulation include a built-in proportionality and significance test. For the Ecodesign Framework Directive, Articles 15(1) and 15(2) state that a product should be covered by an Ecodesign or a self-regulating measure if the following conditions are met:

- The product should represent a significant volume of sales (indicatively, a value of more than 200 000 units a year);
- The product should have a significant environmental impact within the EU;
- The product should present a significant potential for improvement without

[34] As reported in the Review Study in section 3.1.4 outcomes a consumer survey point indicate that although 94% of consuemrs perceive to fully load their dishwasher actually only ap. a 40% of them do so with another 41% being moderately loaded (i.e. between 60 and 90% of max. dishwasher capacity).

[35] Consolidated version of the Treaty on the Functioning of the European Union. OJ C 326/49, 26.10.2012 (TFEU)

entailing excessive costs, while taking into account:

- an absence of other relevant Community legislation or failure of market forces to address the issue properly,
- a wide disparity in environmental performance of products with equivalent functionality;

The procedure for preparing such measures is described in Article 15(3). In addition, the criteria of Article 15(5) should be met:

- No significant negative impacts on user functionality of the product;
- No significant negative impacts on health, safety and environment
- No significant negative impacts on affordability and life cycle costs
- No significant negative impacts on industry's competitiveness (including SMEs - see Section 6.3).

The Energy Labelling Framework Regulation includes similar criteria for products covered by an energy label:

- The product group should have significant potential for saving energy and where relevant, other resources;
- Models with equivalent functionality should differ significantly in the relevant performance levels within the product group;
- There should be no significant negative impact as regards the affordability and the life cycle cost of the product group;
- The introduction of energy labelling requirements for a product group should not have a significant negative impact on the functionality of the product during use.

During the review process (Review study 2017), it was established that household dishwasher appliances fulfil the above eligibility criteria.

3.2. Subsidiarity: Necessity for EU action

Action at EU level gives end-users the guarantee that they buy an energy and resource efficient product and provides them with harmonised information no matter in which MS they purchase their product. This is becoming even more relevant as the (cross-border) online trade increases. With Ecodesign and Energy Labelling at EU level, energy and resource efficient products are promoted in all MSs, creating a larger market and hence greater incentives for the industry to develop them. It should be noted that the intra-EU trade represents around 60% of the sales of dishwashers, to be compared with 35% of extra-EU imports[36].

It is essential to ensure a level playing field for manufacturers and dealers in terms of requirements to be met before placing an appliance on the market (under Ecodesign) and in terms of the information supplied to customers for sale across the EU internal market (under both Ecodesign and Energy Labelling). For this reason EU-wide legally binding rules are necessary.

Market surveillance is carried out by the Market Surveillance Authorities (MSAs) appointed by MSs. In order to be effective, the market surveillance effort must be uniform across the EU to support the internal market and should incentivise businesses to invest resources in designing, making and selling energy efficient products.

[36] Data from Eurostat, 2015 – see more information in the Review study (2017), Section 2.1.5

Finally, Regulation (EU) 2017/1369 requires the Commission to update the current Energy Labelling Regulation for dishwashers, in particular to rescale the label from A to G classes and to remove the A+ to A+++ classes.

3.3. Subsidiarity: Added value of EU action

There is clear added value in requiring minimum energy and resource efficiency levels and energy label class limits at EU-level. Without harmonised requirements at EU level, MSs would have to lay down national product-specific minimum requirements in the framework of their environmental and energy policies. This would undermine the free movement of products and the level playing field for retailers across different Member States. Before the existing Ecodesign and energy label measures were implemented at EU level, this was in fact the case for many products.

In the case of dishwashers, the estimated energy saving potentials are expected to be relatively small (partly due to the high development of the products during recent years), but the revision is nonetheless considered worthwhile for the following reasons:

- the proposed recalibration of the Energy Labelling scheme will allow consumers and industry to take advantage of technological advances;
- revised minimum energy efficiency requirements should maintain the momentum of technological progress of dishwashers placed on the EU internal market;
- new Ecodesign requirements should relate to previously unregulated material efficiency aspects of the performance, repairability and durability of the machines.

4. OBJECTIVES: WHAT IS TO BE ACHIEVED?

4.1. General objectives

Following the legal basis in the TFEU, the general objectives are to:

1. Facilitate **free circulation** of efficient household dishwashers in the internal market;
2. Promote **competitiveness** of the EU household dishwashers industry through the creation or expansion of the EU internal market for sustainable products;
3. Promote the **energy efficiency** of household dishwashers as a contribution to the Commission's objective to reduce energy consumption by at least 30 % and domestic greenhouse gas (GHG) emissions by 40 % by 2030; implement the energy efficiency first principle established in the Commission Communication on Energy Union Framework Strategy; and
4. Increase **energy security** in the EU and reduce energy dependency through a decrease in energy consumption of household dishwashers.

There are several synergies between these objectives: reducing electricity consumption (by increasing energy efficiency) leads to lower carbon, acidifying and other emissions to air; tackling the problem at EU level enhances efficiency and effectiveness of the measure; and, following the Ecodesign Working Plan 2016-2019, Ecodesign and Energy Labelling measures also contribute to the objectives of the Circular Economy Action Plan to facilitate the transition towards a more resource-efficient and circular economy in the EU.

4.2. Specific objectives

In line with technological developments, the Ecodesign Directive and the recently revised Energy Labelling framework Regulation, the specific objectives to be pursued by the

policy options are to correct the problems and underpinning drivers identified in Section 2, are to:

1. Update the energy efficiency requirements and the energy label to achieve cost-efficient savings of energy and other resources.
2. Maintaining and supporting the past market trend towards progressively more energy efficient and more environmentally friendly appliances.
3. Contribute towards a circular economy in the EU by supporting longer-lasting products, *inter alia*, by facilitating their repair, and by increasing their recyclability at the end of life.

These objectives will drive investments and innovations in a sustainable manner, increase monetary savings for the consumer, contribute to the Energy Union Framework Strategy and the Paris Agreement, contribute to the Circular Economy Initiative and strengthen the competitiveness of EU industry.

5. WHAT ARE THE AVAILABLE POLICY OPTIONS?

The procedure for identifying policy options follows the Better Regulation Toolbox[37]. Specific measures in the policy options are the result of a combination of initiatives mentioned in the Review study 2017, the evaluation of the efficiency and effectiveness of the Ecodesign and Energy Labelling (Annex 4), the Inception Impact Assessment[38], comments received on working documents at and after the Ecodesign Consultation Forum meeting, and – importantly - alignment with the 2009 Ecodesign Framework Directive and the recast 2017 Energy Labelling framework Regulation.

In view of the issues identified in Section 2, the policy options should address two challenges at the same time, which normally would call for opposite solutions: the revised energy classes should lead to better differentiate between products and the differences in purchase price between appliances of different classes should be more than compensated by the savings in energy and water; at the same time, the strengthening of minimum energy efficiency should not halt the increase in penetration rate of dishwashers in those Member States where this rate is low – as the increased use of dishwasher is overall beneficial to energy and water savings overall when compared to handwashing. The increase in purchase prices generally associated with technological progress risks therefore to put in question the overall savings generated by the increased use of dishwashers.

5.1. Issues not subject to assessment

During the review study and subsequent stakeholders' consultations, several issues were the object of a large consensus between stakeholders. They are not re-discussed in detail in this report. These issues are the following:

- Acceptance of the changes in the IEC and CENELEC standards on the measurement of dishwasher performance (e.g., inclusion of plastic elements, pots and changes in the shape of the dishes, etc), as well as the measurement of the combined cleaning and drying efficiency. These changes have been widely accepted by stakeholders, they are in line with the prior changes in directly relevant

[37] https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-17_en_0.pdf (Better Regulation Toolbox)

[38] Inception impact assessment -Regulatory measure on the review of Ecodesign requirements for household dishwashers - (EC) No 1016/2010 and Inception impact assessment -Regulatory measure on the review of energy labelling for household dishwashers - (EU) No 1059/2010

international standards, and they bring the testing parameters closer to consumers' real use of the machines.

- Exclusion of the low power modes from the average energy consumption per cycle, and their separate regulation (i.e., dishwasher-specific, rather than via the "horizontal" Standby Regulation currently under revision). Regulating the low power modes separately for dishwashers has been welcomed by industry stakeholders since it streamlines the calculation of the current annual energy consumption. However, environmental NGOs and consumer associations would prefer dishwashers to be covered by the horizontal regulation or by both.
- Maintenance of the minimum cleaning efficiency ($I_c > 1.12$) and drying efficiency ($I_d > 1.08$). These minimum performance parameters guarantee the satisfactory functioning of dishwashers, and consumers expressed their satisfaction with the current limits.
- the non-inclusion of requirements on hot water inlet, because related energy savings are too dependent on the household heating system efficiency.

Additionally, the water consumption has been considered as a non-independent design parameter, owing to its strong interlinkage with electricity consumption. It has been observed that a reduction in the energy consumption of dishwashers triggers a reduction in their water consumption, up to a certain level. In this phase, energy savings are realised by reducing the amount of water to be heated up, and therefore by reducing in parallel both overall water and energy consumption. However, going beyond this level of energy efficiency, to the levels of ultra-high energy efficiency dishwashers, a slight increase in water consumption per cycle is observed, owing to the different technology that they use. Regulating water consumption in addition to energy efficiency risks to trigger unwanted effect such as a reduction in the rinsing of dishes.

Finally, the duration of the dishwashing programmes was not considered as a crucial parameter to be regulated. The average duration of the Eco-programme (around 3.5h) exceeds only by a small extent the time range preferred by consumers (2 to 3h) and this does not seem to push consumers to choose alternative programmes when the Eco-programme is set as default programme.

In addition to the measures described in the options above, some measures were considered as *de minimis* changes to the current Ecodesign and Energy Labelling regulations on dishwashers. This corresponds to highly technical changes or changes with negligible impacts, for which it does not seem possible or proportional to propose several options for assessment. They are however implicitly included in the different options, except for the baseline, and will be integrated into the preferred option.

These measures concern:

- Low-power modes
- Noise
- Cleaning and drying efficiency

Further information on these measures and assessment of their impacts can be found in Annex 8.

5.2. Policy options subject to assessment

The policy options in Table 1 aim to address the problem drivers (Section 2) and to achieve the policy objectives (Section 4). Some policy options considered and discarded at an early stage are presented in Section 5.3.

Option	Name	Short name	Description
Option O	Baseline	BAU	No further action - the household dishwashers regulations currently in place remain unchanged
Option A	Combinations of more ambitious Ecodesign requirements and Energy Labelling	ED+EL BAT=33	Implementation of revised requirements under Ecodesign and revised Energy Labelling, with BAT considered at EEI = 33.5 Several scenarios can be considered here, as described under 0.
Option B	Combinations of less ambitious[39] Ecodesign requirements and Energy Labelling	ED+EL BAT=39	Implementation of revised requirements under Ecodesign and revised Energy Labelling, with BAT considered at EEI = 38.9[40] Several scenarios can be considered here, as described under 0.
Option C	Combinations of additional Ecodesign requirements on material efficiency	ME	Horizontal measures applicable in addition to the requirements of Options O, A or B. New requirements under Ecodesign on material efficiency aspects. Several sub-options can be considered here, as described under 5.2.

Table 1: Policy options

In all options the calculation formula of the Energy Efficiency Index (EEI) of a household dishwasher model is the same as described in Annex 5.

5.3. What is the baseline from which options are assessed?

In the baseline, the current Ecodesign and Energy Labelling Regulations and all other relevant EU-level policies and measures are assumed to continue.

According to the Energy Labelling framework Regulation, products have to be registered in a new product database (EPREL[41]) from 1 January 2019 onwards, for all models placed on the market after 1 January 2019; and by 30 June 2019 for models placed on the market between 1 August 2017 and 1 January 2019. Also in the application of the Energy Labelling framework Regulation, the energy efficiency classes have to be updated for a number of product groups including dishwashers. In a 'Business as Usual' approach, this would be done while keeping the same limits of existing classes.

Annex 5, Section 5.1 describes how the situation would evolve in a baseline scenario in terms of energy savings, circular economy and scope. The patterns of technological progress were assessed based on historical data, e.g., it was observed that the penetration of higher energy efficiency classes tends to follow a normal distribution, being shaped by the regulations in place. This approach was thus maintained when modelling the technological progress in all scenarios.

[39] Compared to Option A

[40] For dishwashers, the EEI calculation method used means that a higher EEI results in higher energy use. A policy option with a higher EEI is thus less ambitious in terms of energy savings than a policy option with a lower EEI.

[41] European Products Registration database for Energy Labelling

5.4. Description of policy options

5.4.1. Policy option 0 -- BAU 2015

This option implies that the current regulations stay in place and are not revised, even though the associated problems, and the need for action, have already been explained in Sections 2 and 3. This option is retained as a baseline BAU (2015) scenario,

In the BAU scenario, the efficiency of all dishwashers is assumed to continue the trend observed in recent years[42]; i.e. improvement is expected to be slow and to remain close to the existing minimum requirements because of the suboptimal market development (absence of, or limited competition on technology, and no push and pull effect by regulation).

5.4.2. Policy option A -- Combinations of more ambitious Ecodesign requirements and Energy Labelling

This option considers the revision of Ecodesign requirements on energy efficiency in combination with Energy Labelling, as a combined market "push and pull" effect. The simultaneous revision of both regulations would ensure that the pushing effect of the Ecodesign requirements, with possible removal of the least efficient models from the market, and the pulling effect of the Energy Labelling, with new energy efficiency scales, would be coordinated.

Regarding the energy efficiency classes of the **Energy Label**, the new framework Regulation requires leaving Class A empty when the revised Regulation enters into force. In consequence, the limit of Class A would be fixed at the first integer below the index of the technology considered as BAT. Other classes are then defined up to the limit fixed by the minimum requirement for slim-line dishwashers (the last Class G being accessible only to counter-top dishwashers). Note that the distribution of Energy classes could be done using classes of either regular or irregular width, depending on the level(s) of market incentives being created for appliances to improve and move from one class to another.

Under policy option A, the share of products classified in Class A is expected to remain very limited in the next ten years: depending on the specific scenarios, the projected share of Class A in 2030 should vary between 0% and 2%. This is because great efforts are needed to reach this level of performance, leading to higher purchase prices and limited uptake.

Regarding **Ecodesign minimum requirements** on energy efficiency, and distinguishing three size ranges as in the current legislation (full-size, slim-line and counter-top[43]), 2 sub-options are considered: the requirements could remain at the same level of stringency as in the current Regulation[44] or they could be made more stringent for full-size appliances[45]. The last sub-option concerns the date of entry into force: revised minimum requirements

[42] It is important to note that "BAU" in this sense does not mean 'freezing at one moment' the current technologies and the state of play of the market (models offered and sales share). Rather, it means that the pace of progress and trends will continue "as it is".

[43] The term ‘full-size’ is used for dishwashers with a rated capacity equal to or higher than 11 place settings and for dishwashers with a rated capacity of 10 place settings and a width higher than 45 cm; ‘slim-line’ is used for dishwashers with a rated capacity of 8 or 9 place settings and for dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm; ‘counter-top’ is used for dishwashers with a rated capacity equal to or less than 7 place settings.

[44] $EEI_{\text{full-size DWs}} < 63$; $EEI_{\text{slim-line DWs}} < 63$; $EEI_{\text{counter-top DWs}} < 71$

[45] $EEI_{\text{full-size DWs}} < 58$; $EEI_{\text{slim-line DWs}} < 63$; $EEI_{\text{counter-top DWs}} < 71$

can enter into force immediately or via two Tiers, the first Tier maintaining the current level of ambition and stricter measures applying 4 years later in a second Tier.

A higher level of stringency is proposed only for the full-size appliances because they are the only dishwashers that at present can accommodate new and more energy efficient technologies, in terms of the physical space available within the dishwasher dimensions. For example, technologies such as adsorption drying technologies or heat pumps are only present in the full-size dishwashers.

In order to analyse the impact of the different combinations of the Energy Labelling measures defined for this option and the different sub-options for Ecodesign, several scenarios were considered:

- **Scenario A1** with no increased stringency of the current Ecodesign requirement on energy consumption.
- **Scenario A2** with more stringent Ecodesign requirement on energy consumption for full-size appliances via a second Tier that enters into force in 2024.
- **Scenario A3** with more stringent Ecodesign requirement on energy consumption for full-size appliances but entering into force earlier, in a single Tier in 2021.

For all scenarios the **Energy Label** is to be introduced in **April 2021,** with a proportional sequence of Energy bandwidths, where – with a value of EEI=71 as the lower limit for the "G" class - every higher class limit represents an EEI improvement value of approximately 14%, as shown below in Table 2. Class "G" will be left empty for full-size and slim-line household dishwashers, but will still be populated by top-counter household dishwashers.

Additionally, a fourth scenario is considered to assess the possibility of using non-proportional bandwidths in the Energy Label, as smaller bandwidths in the lower classes may incentivise the improvement of the least efficient models.

- **Scenario A4:** same Ecodesign minimum requirements as in the A2 scenario; Energy Label with non-proportional classes.

Finally, the impact of a lower demand of products due to an estimated increase in the cost of the appliances has been analysed for the Scenario A4 through a sensitivity analysis, in comparison with a similar analysis realised for the Scenario B3. The results of this analysis are presented in Section 6 as Scenario A4a.

Stakeholders views: Option A corresponds to the ambition level recommended by some Member States, consumer associations and environmental NGOs during and after the December 2017 Consultation Forum. These stakeholders consider that the current BAT level is defined by the **heat pump-equipped dishwashers** (HP), with a declared EEI=33.5. Furthermore, these stakeholders believe that the costs of reaching a higher ambition level are not as high as were described in the Review study 2017.

5.4.3. Policy option B -- Combinations of less ambitious Ecodesign requirements and Energy Labelling

This option also considers the revision of Ecodesign requirements on energy efficiency in combination with Energy Labelling.

Regarding Energy Labelling, Option B corresponds to the proposal expressed by some Member States and manufacturer representatives, whereby in their opinion the current BAT level should NOT be defined by the HP equipped dishwashers, but instead by other

technologies (the best non-heat pump technology having a declared energy efficiency index set at EEI=38.9).

The rationale for this alternative proposal is based on several current functional limitations of HP equipped dishwashers, compared to conventional dishwashers:

i. HP technology is not capable of performing two consecutive Ecoprogrammes;
ii. HP technology cannot supply the high temperatures needed for example in intensive programmes;
iii. HP technology requires a long duration for the Ecoprogramme cycle, and this could discourage consumers from using the Ecoprogramme for which the HP is optimally designed.

In **Option B**, the **Energy Label** is also introduced in **April 2021**, but a value of EEI=38 is used as the lower limit for the "A" class. Proportional improvements are used for the Energy Label class bandwidths – each class limit represents a 10% proportional improvement on the previous class, as shown in Table 2.

Under Policy Option B, the share of products that are projected to be classified with Energy Label Class A after ten years (in 2030) is relatively high: approx. 20% of the market. This higher estimated market share, in comparison with Option A, is based on two factors: firstly, current BAT machines already reach EEI values close to EEI=38, and secondly manufacturers' efforts involved in increasing the energy efficiency of products with higher EEI values is lower – and cheaper – in relative terms than increasing the energy efficiency of products with lower EEIs.

As in Option A, Class "G" will be left empty for full-size and slim-line household dishwashers, but will be populated by top-counter household dishwashers.

In order to analyse the impact of the different combinations of the Energy Labelling measures defined for this option and the different sub-options for Ecodesign, several scenarios within Option B were considered:

- **Scenario B1** (similar to A1) with no increased stringency of the current Ecodesign requirement on energy consumption.
- **Scenario B2** (similar to A2) with more stringent Ecodesign requirements on energy consumption for full-size appliances via a second Tier in 2024.
- **Scenario B3** (similar to A3) with more stringent Ecodesign requirements on energy consumption for full-size appliances already from 2021.

Additionally, the impact of a lower demand of products due to an estimated increase in the cost of the appliances has been analysed for the Scenario B3, throughout a sensitivity analysis. The results of this analysis are presented in Section 6 as Scenario B3a. This correspond to comments made by industry stakeholders and it is assessed on the most stringent scenario (in terms of requirements and timing) to simulate a 'worst-case' scenario.

Stakeholders' views: option B corresponds to the ambition level, for the energy label, recommended by industry stakeholders and some Member States. Regarding the ecodesign requirement on energy efficiency, industry recommends to keep the current level, as in scenarios A1 and B1, while environmental NGOs and most Member States consider that the level should be increased, at least at the level of scenarios A3 and B3 or even beyond. Scenarios A2, A4 and B2 represent a tentative compromise between these positions.

5.4.4. Policy option C -- Combinations of additional Ecodesign requirements on material efficiency

The possible Ecodesign requirements described in this option aim to solve the market failures highlighted in Section 2 that are associated with the reduction of the average lifetime of the appliances, premature disposal of repairable appliances and the lack of or difficult access to maintenance and repair information.

The measures considered here were identified during the review study, based on the different studies and initiatives on this field summarised in Annex 6. They relate to the following aspects:

a. End-of-life of appliances
b. Spare parts availability and delivery
c. Repair and maintenance information

The possible requirements on material efficiency are presented separately of other policy options for the sake of presentation and assessment. They should nevertheless be considered as additional (not alternatives) to the requirements on energy efficiency presented in the previous options and, after assessment, they should ultimately be combined with requirements on energy efficiency.

Three possible scenarios have been envisaged in this Impact Assessment:

Under **Scenario C0,** two measures are considered: the marking of refrigerating gases in case of the use of a heat-pump (as per the F-gas Regulation)[46] and the safe removal of key electrical and electronic components (as per Article 8(2) of the "WEEE" Directive[47]). Building on the Directive Annex VII, the key components for washing machines and washer-dryers include:

- Printed circuit boards (larger than 10 cm^2);
- Electrolyte capacitors containing substances of concern (height > 25 mm, diameter > 25 mm or proportionately similar volume);
- Liquid crystal displays (larger than 100 cm^2);
- Batteries;
- Heat pumps.

These measures implement the WEEE legislation already in force – except for heat pump, which is not mentioned as such in the Directive Annex VII. However, since Annex VII to the WEEE Directive includes a minimum list of substances and components to be removed from WEEE, components such as heat pumps which have similar technical characteristics with components listed in Annex VII should be removed for the WEEE as well for the achievement of the objectives of these measures. The measures should also be seen in relation with the platform of exchange of information[48] between producers and recyclers, established in implementation of the WEEE Directive. The inclusion of these measures in the Ecodesign Regulation would facilitate their implementation by clarifying the role of

[46] Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006
[47] Directive 2012/19/EU on Waste Electric and Electronic Equipment
[48] https://i4r-platform.eu/

producers and of Market Surveillance Authorities, without changing the nature of existing obligations. Their cost is therefore considered as negligible for economic actors.

Scenario C1 includes Ecodesign measures on repair and end-of-life in addition to the measures stemming from existing legislation as described under C0. This scenario builds on the measures included in the working documents discussed at the Consultation Forum in December 2017, with only few changes for clarification.

This Scenario considers specific requirements for disassembly for the purpose of repair in addition to the requirements for dismantling for the purpose of depollution and material recycling. Manufacturers shall ensure that household dishwashers are designed so that there is easy access to and removal of same components listed under C0 plus the following:

- motor;
- piping and related equipment including all hoses, valves and filters.

With regard to spare parts, their availability for a minimum period of time of 7 years after the last model was produced and a maximum delivery time of 3 weeks are included. This concerns spart parts necessary for the use of the dishwashers, which include:

- Motor
- Circulation and drain pump
- Heaters and heating elements
- Door hinge and seal
- Piping and related equipment including all hoses, valves and filters
- Structural and interior parts related to door assemblies, spray arms, seals and interior racks.
- Printed circuit boards
- Liquid crystal displays

The measures on spare parts reflect the current practice, as least for the major brands represented on the market, which offer the same or better conditions for the provision of spare parts. The measures aim therefore at creating a level-playing field by setting the same minimum conditions for all producers and importers and establishing the basis for the controls of Market Surveillance Authorities and for possible complaints of consumers and repairers in case of failure to meet the requirements. Their additional cost is also considered as negligible in comparison with the current obligations and practice.

In addition, wider access to Repair and Maintenance Information by professional repairers is foreseen, with the possibility of proportional fees. Professional repairers include authorised repairers, i.e. repairers under contract with one or several brands, and independent repairers.

The access of independent repairers would be new for part of the information concerned, for example the access to digital codes for diagnosis and reprogramming. In order to avoid possible risks regarding intellectual property and liability issues expressed by stakeholders, conditions are imposed on independent repairers to declare that they have the appropriate skills (as covered by national legislation and possible registration) and liability insurance. Checking these conditions represent an extra cost, of administrative nature, for those manufacturers willing to check the access of independent repairers.

This access should also be seen in relation with competition rules: in EU competition law, some vertical arrangements that impose restrictions on the supply of spare parts by their manufacturers to third parties have such a potential for being anticompetitive that they do not benefit from the so-called 'block exemption regulation' (Regulation EC/330/2010). The objectives pursued with the Ecodesign requirements on making available spare parts and repair information equally to independent repairers and repairers under contract of manufacturers are therefore consistent with those of EU competition law.

Scenario C2 includes Ecodesign measures on product durability, repair and end-of-life. This Scenario would require, in addition to the measures introduced in Scenario C1, a requirement for the product to have a minimum in-service lifetime of 10 years or an equivalent commercial guarantee by manufacturers, with the objective of extending the average lifetime of the appliances from the current 12.5 to 16 years, and preserving the corresponding resources.

Stakeholders' views: the measures on circular economy were supported by environmental NGOs and consumer associations, and by associations or representatives of recyclers and of repairers in the Consultation Forum. Representatives of manufacturers are not favourable to the measures on spare parts under C1 and C2, for which they would prefer simple declarations without minimum requirements, and they are opposed to the access of independent repairers to repair and maintenance information because of the risks on intellectual property and on liability and quality issues, which in their view risk impacting their reputation. Member States have diverging views or have not expressed an opinion.

The responses to the Open Public Consultation (see Annex 2) have confirmed the importance of material efficiency requirements for stakeholders: 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%) 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".

5.4.5. Summary of Policy Options

The different options and scenarios are summarised in the following Table 2.

Option	Scenario	Minimum Energy Rating 2021	Minimum Energy Rating 2024	Energy Labelling classes – EEI bands
Option O – BAU		$EEI_{\text{full-size DWs}} < 63$ $EEI_{\text{slim-line DWs}} < 63$ $EEI_{\text{counter-top DWs}} < 71$		
Option A ED-EL BAT=33 *(set with respect to heat pump-equipped dishwashers)*	A1	$EEI_{\text{full-size DWs}} < 63$ $EEI_{\text{slim-line DWs}} < 63$ $EEI_{\text{counter-top DWs}} < 71$		$A \leq 32$ $32 < B \leq 36$ $36 < C \leq 42$ $42 < D \leq 47$ $47 < E \leq 54$ $54 < F \leq 62$ $62 < G$
	A2	$EEI_{\text{full-size DWs}} < 63$ $EEI_{\text{slim-line DWs}} < 63$ $EEI_{\text{counter-top DWs}} < 71$	$EEI_{\text{full-size DWs}} < 58$ $EEI_{\text{slim-line DWs}} < 63$ $EEI_{\text{counter-top DWs}} < 71$	
	A3	$EEI_{\text{full-size DWs}} < 58$ $EEI_{\text{slim-line DWs}} < 63$ $EEI_{\text{counter-top DWs}} < 71$		

	A4	$EEI_{full\text{-}size\ DWs} < 63$ $EEI_{slim\text{-}line\ DWs} < 63$ $EEI_{counter\text{-}top\ DWs} < 71$	$EEI_{full\text{-}size\ DWs} < 58$ $EEI_{slim\text{-}line\ DWs} < 63$ $EEI_{counter\text{-}top\ DWs} < 71$	$A \leq 32$ $32 < B \leq 38$ $38 < C \leq 44$ $44 < D \leq 50$ $50 < E \leq 56$ $56 < F \leq 62$ $62 < G$
Option B ED-EL BAT=39 *(set with respect to other non-heat pump BAT options)*	B1	$EEI_{full\text{-}size\ DWs} < 63$ $EEI_{slim\text{-}line\ DWs} < 63$ $EEI_{counter\text{-}top\ DWs} < 71$		$A \leq 38$ $38 < B \leq 42$ $42 < C \leq 46$ $46 < D \leq 52$ $52 < E \leq 56$ $56 < F \leq 62$ $62 < G$
	B2	$EEI_{full\text{-}size\ DWs} < 63$ $EEI_{slim\text{-}line\ DWs} < 63$ $EEI_{counter\text{-}top\ DWs} < 71$	$EEI_{full\text{-}size\ DWs} < 58$ $EEI_{slim\text{-}line\ DWs} < 63$ $EEI_{counter\text{-}top\ DWs} < 71$	
	B3	$EEI_{full\text{-}size\ DWs} < 58$ $EEI_{slim\text{-}line\ DWs} < 63$ $EEI_{counter\text{-}top\ DWs} < 71$		
Option C *(material efficiency considerations)*	To be combined with Options O, A or B			
	C0: existing legislation			
	C1: requirements on repair and end-of-life			
	C2: requirements on durability, repair and end-of-life			

Table 2. Overview of options and scenarios

5.5. Options discarded at an early stage

5.5.1. Voluntary Agreement

Voluntary Agreements (VA) are given priority, subject to certain regulatory efficiency provisions, according to the framework provisions of the 2009 Ecodesign Directive. However, no VA proposal has been made by any industry sector active on this market. Minimum mandatory requirements are already in force for this product; therefore, if they were to be substituted by a VA, there could arguably be a risk of free-riders, if the VA were not signed up to – and complied with - by all actors present on the market. Hence, this option is discarded from any further analysis.

No stakeholders have expressed support for this option.

For all the reasons given above, this option is discarded.

5.5.2. Mandatory Energy Labelling scheme only

This option would consider the use of energy labels according to the Energy Labelling Regulation No 2017/1369 and the withdrawal of the requirements under the Ecodesign Directive. A labelling scheme (as "pull-effect") alone will be much less effective that the setting of this policy together with minimum Ecodesign energy efficiency requirements. The mandatory Energy Label makes the relative efficiency of products transparent to consumers, and thus gives incentives to manufacturers to compete on energy efficiency of products. However, Energy Labelling alone cannot achieve the withdrawal of inefficient products from the market, which is the strong point of Ecodesign measures. Energy Labelling alone might allow products with a lower energy efficiency than permitted today to re-enter the market; they could then compete on cheap purchase price alone (rather than the complete Life Cycle Cost [LCC]).

Also, the effectiveness of Energy Labelling alone would have to rely heavily on consumers' understanding of the Energy Label, in order to make informed decisions. However, consumers may not always choose the most efficient dishwasher model for several reasons, such as split incentives or asymmetrical information. Consumers may often base their purchase decisions on purchase price only, and on other factors such as availability in the shop or warehouse, rather than on the long-term optimal life cycle costs and relative environmental impact of the product to be chosen.

No stakeholders expressed support for this option, however.

For all the reasons given above, this option is discarded.

6. WHAT ARE THE IMPACTS OF THE POLICY OPTIONS?

6.1. Methodological considerations and key assumptions

This section describes for each scenario the associated environmental, economic and social impacts on manufacturers, retailers, consumers and general environment, comparatively to the baseline (scenario BAU 2015). The measures introduced in Options A and B have been assessed following the analytical methods described in detail in Annex 5. The material efficiency requirements introduced in Option C are assessed qualitatively based on the information summarised in Annex 6.

With the adoption of the Ecodesign Working Plan 2016-2019 in November 2016, the Commission committed for the first time explicitly to systematically explore resource efficiency requirements in Ecodesign. As a result, the methodological basis for the inclusion of such requirements is not yet fully developed; there are no well-established and uniformly accepted methodologies in place to identify these requirements in the context of mandatory legislation.

Therefore, the 'circular economy' requirements that are proposed here are based mainly on stakeholder input, existing studies and evidence of product failure (e.g. on spare parts), and focus on measures that can be relatively easily implemented. As such, they can be considered a starting point that can subsequently be complemented or refined when the methodological tools are available.

In several Member States, initiatives or legislation exists that stimulate circular elements. Some Member States already establish requirements on the availability of spare parts for repair (such as Spain) or have taken legal action to reduce premature obsolescence (France). Several Member States set themselves targets for circular initiatives such as increasing reuse or reducing the production of waste, on top of EU requirements. However, most experiences with circular economy considerations at Member State level are relatively young. Regulation of professions, including repairers, is at the discretion of Member States and related requirements seem to differ between them, including as concerns requirements for registration and insurance. While it is evidently not feasible to address all these issues in the legal context of Ecodesign, the measures proposed do take these circumstances into account.

There is also a lack of methodologies to quantify the costs and benefits of such criteria in the context of the 'least life cycle cost' (LLCC) calculations applied for energy efficiency in Ecodesign, in particular as regards the assessment of trade-offs.

Although a fully quantified impact assessment of such requirements has not been possible at this stage, a qualitative impact assessment was made, based on inputs taken from

technical, scientific and policy-making literature, and nascent evidence from other similar product groups. This forms the basis of an assessment, which can be refined over time and be supplemented with actual quantitative data collected via the monitoring and the evaluations. These data will also serve at the time of the next revisions of the product regulations.

To support improvements in the methodological framework, the Commission mandated CEN/CENELEC to develop standards for material efficiency under Ecodesign and a first set of horizontal standards is expected next year. These will be integrated in the MEErP methodology as appropriate. A broader update of the MEErP is foreseen in 2019, in particular to see how circular economy aspects could be better integrated in preparatory and review studies, including the LLCC calculations.

The key assumptions used in this impact assessment are explained in Annex 5. In general, uncertainty on the results is due to the assumptions made on the simulation of future consumption of dishwashers. In order to estimate the energy consumption values, the declared energy consumption values were transposed (adapted) to "real" consumption values that are closer to real use by incorporating correction factors for user behaviour and future sales distributions for the projected lifetime of product types.

6.2. Environmental impacts

6.2.1 Electricity consumption

All scenarios save energy compared to the BAU at unit level, even if the total energy consumption of dishwashers at the overall EU level is expected to increase, due to the related increase in the EU stock. Figure 2 and 3 show electricity consumption in the policy options BAU, A and B. BAU results in an energy consumption of circa 489 TWh/year in 2030. When compared to BAU, Scenarios A1 to A4 save between 1.92 and 3.83 TW/h in 2030, while Scenarios B1 to B3 save between 0.41 and 2.15 TW/h in 2030.

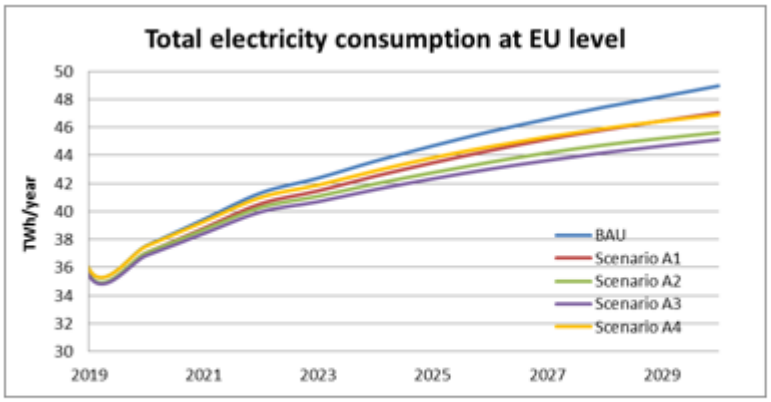


Figure 2. Estimated total electricity consumption at EU level for scenarios BAU and A1, A2 and A3

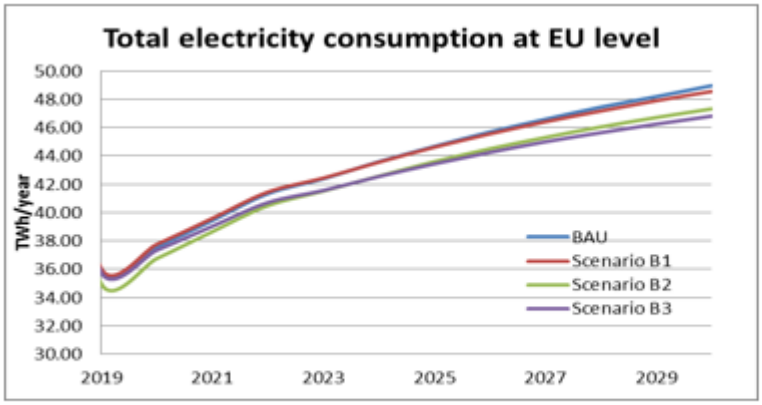


Figure 3 Estimated total electricity consumption at EU level for scenarios BAU and B1, B2 and B3

A conclusion from the above graphs is that, the stricter the Ecodesign measure on minimum energy efficiency, the higher the energy savings. The projected savings should however be viewed cautiously, as they can be uncertain if the volume of sales of household dishwashers is not in line with the assumptions. Scenario B3a analyses the possible effects of the stricter requirement on the volume sales of the household dishwashers. Scenario B3a has the same conditions as scenario B3, but it considers that the demand of household dishwashers in the future would be different considering reported price elasticities of demand for this appliance as well as the cross price elasticity with low energy efficiency appliances.

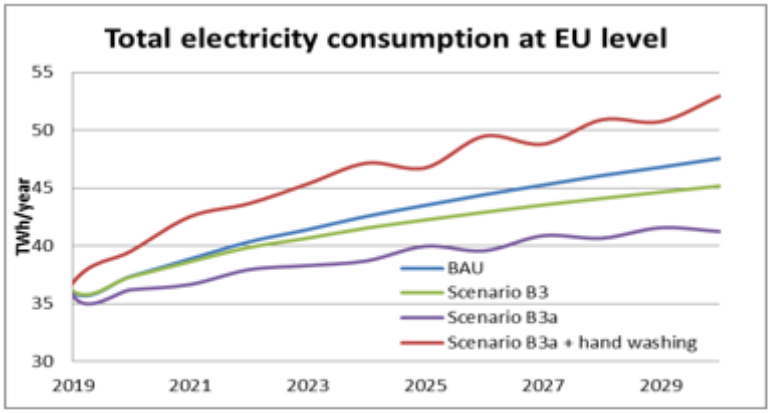


Figure 4 Estimated total electricity consumption at EU level under actual use conditions for scenarios BAU, B3 and scenario B3a and scenario B3a + energy estimated in handwashing

Figure 4 shows the results of the sensitivity analysis (scenario B3a) and the results including the energy needed for handwashing of dishes that are not washed by the dishwashers. Scenario B3a has the highest savings of ca. 6.3 TWh p.a. in 2030. However, the estimated energy consumption of "scenario B3a + handwashing"[49] is higher even than the energy consumption of the BAU scenario, if the resources consumed in handwashing are taken into account (5.39 TWh or +30% more in 2030).

The above sensitivity analysis exercise was repeated for Scenario A4 (irregular Energy Labelling bandwidths, plus two Tiers of Ecodesign minimum requirements). Scenario A4a (as in Scenario B3a) analyses the possible effects of the stricter requirements on annual

[49] It should be noted that the modelling of handwashing is a disputed issue, building on assumptions which have been challenged by several stakeholders during consultations. Results including handwashing should therefore be considered as indicative only.

dishwasher sales figures at EU level. Figure 4a gives the results, which shows similar relative trends for Scenarios A4/ A4a to those which were observed when comparing Scenarios B3/ B3a. That is, lower sales of dishwashers result in lower energy consumption of dishwashers in the EU, but in higher energy consumption overall when taking into account handwashing. However, this negative impact – on sales and on energy consumption when taking into account handwashing – is limited in comparison with Scenario B3a.

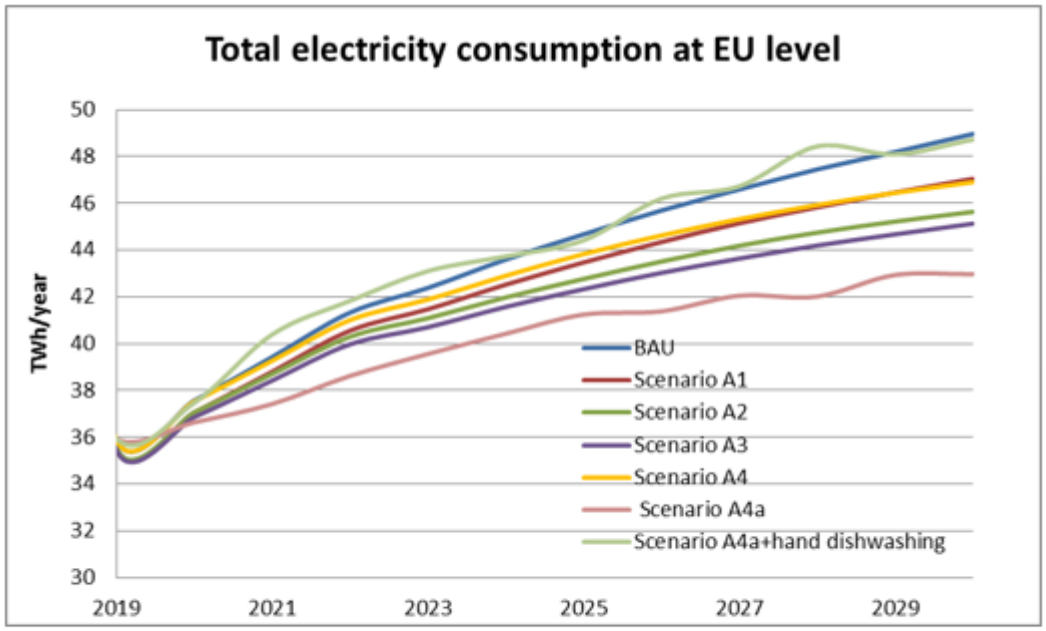


Figure 5a Estimated total electricity consumption at EU level under actual use conditions for scenarios BAU, scenario A1, scenario A2, scenario A3, scenario A4, scenario A4a and scenario A4a + energy estimated in handwashing

Note that the energy consumed by handwashing is not taken into account for scenarios other than the sensitivity analyses B3a and A4a. That is, in all the other scenarios examined, the dishwasher sales patterns are assumed to follow constant historical trends, and the energy and water use *per machine* are the only aspects which are changed, depending on the hypotheses of each scenario.

6.2.2 Greenhouse gas emissions

One of the main environmental impacts is the greenhouse gas (GHG) emissions from electricity consumption during the use phase. The trends in scenarios for GHG emissions are similar to the energy consumption trends. However, the main difference is that the absolute savings over time are higher due to the continuous decrease of specific GHG emissions per kWh electricity. The decrease of specific GHG is because of the increased use of renewable energy sources in EU electricity production, and the shift toward cleaner fossil fuels such as natural gas.

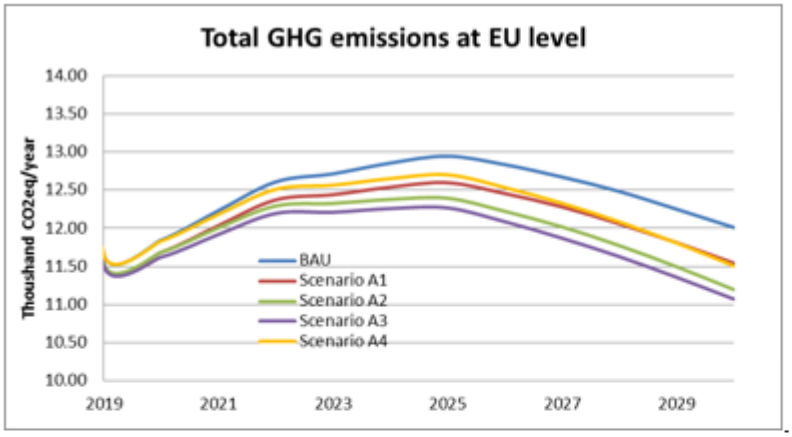


Figure 5. Estimated total GHG emissions at EU level under the conditions of scenarios BAU, A1, A2 and A3

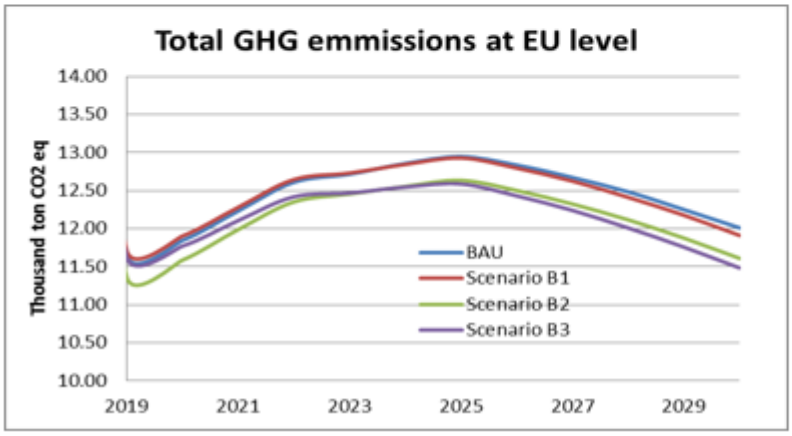


Figure 6. Estimated total GHG emissions at EU level under the conditions of scenarios BAU, B1, B2 and B3

Note that the Scenario B3a and A4a sales perturbation effects on energy use (Section 6.2.1) would also be reflected proportionally with regard to GHG emissions, but it was not considered necessary to repeat this exercise here.

6.2.3. Water savings

Figure 7 and Figure 8 show the total water consumption for the scenarios considered in this impact assessment. The BAU values are given in the graphs for comparison. There are water savings over time for all the scenarios examined, compared to the BAU.

Scenarios A2 and A3 show the same amount of water savings (14 million m^3/year in 2030), and provide around twice the water saving volumes yielded by Scenarios B2/ B3.

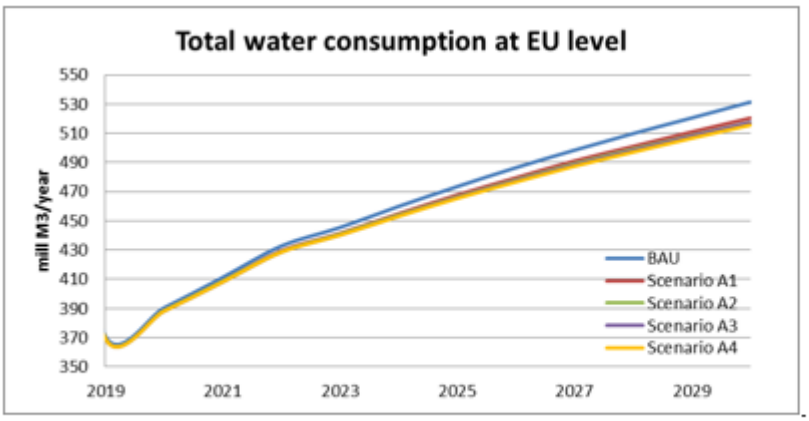


Figure 7. Total water consumption at EU level under the conditions of scenarios BAU and A1, A2 and A3

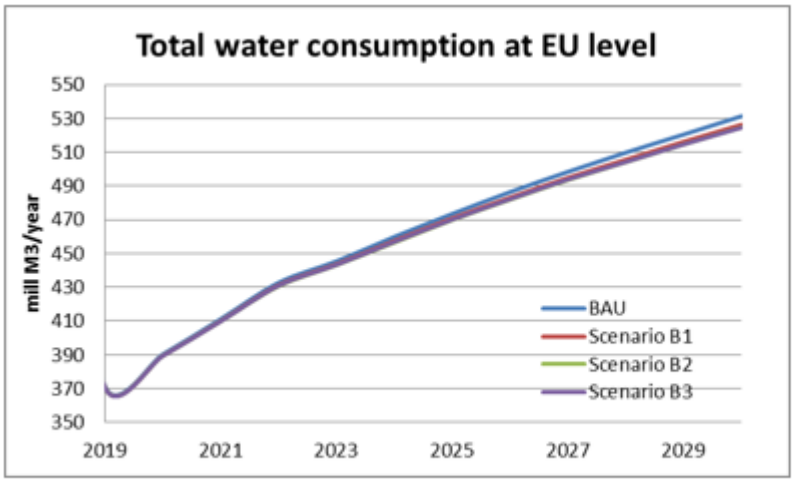


Figure 8. Total water consumption at EU level under the conditions of scenarios BAU and B1, B2 and B3

Scenario B3 provides a much larger 59 million m^3 of water saving in 2030, when the market penetration of dishwashers is maintained. However, the sensitivity analysis with a reduced market penetration modelled in Scenario B3a results in high *increases* in water consumption of ca. 95 million of m^3 in excess of the BAU scenario, when the water consumed in additional hand dishwashing activities is considered.

6.2.4. Environmental impacts of material efficiency requirements

6.2.4.1. Energy consumption, greenhouse gas emissions and water savings

The impact of longer product lifetimes through increased reparability on energy consumption, greenhouse gas emissions and water savings would likely be negative, as replacement machines would be expected to be more energy efficient in these fields than older machines that are replaced. However, the increase of energy efficiency of dishwashers is no longer improving as rapidly as in the past (it is now estimated in the order of 1% annually), to the extent that the gains due to the higher energy efficiency of new appliances cannot compensate for the environmental burdens of the disposed appliance. Similarly, the extra cost involved cannot be recuperated during the product lifetime (see 2.1). A recent study[50] found that even when taking increased efficiency of newer models into account, extending the lifetime of a dishwasher by 4 years can potentially achieve savings of up to 27% of environmental impact due to resource use[51] and reduce other relevant environmental impacts such as ecotoxicity and freshwater eutrophication by up to 20%.

6.2.4.2. Resources used in production

Longer product lifetime means less of a requirement for new replacement machines per year, reducing the environmental impacts associated with the production (energy, water and material use). A recent study[52] shows that while the manufacturing process itself has comparatively low impact, the materials used in a dishwasher cause environmental impacts, most notably abiotic depletion, Ecotoxicity and freshwater eutrophication. The

[50] Ardente, F. & Talens Peirò, L. (2015). 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. Available at http://publications.jrc.ec.europa.eu/repository/bitstream/JRC95187/lb-na-27200-en-n.pdf.

[51] Measured in Abiotic depletion potential - element

[52] Ardente, F. & Talens Peirò, L. (2015). 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. Available at http://publications.jrc.ec.europa.eu/repository/bitstream/JRC95187/lb-na-27200-en-n.pdf.

level of impact of course depends on the amount of certain materials used in the dishwasher and the potential reduction of this impact due to repair depends on the amount of product life saved, but the impact will always be positive.

6.2.4.3. Recycling and depollution at end-of-life

The improvement in disassembly at the end-of-life phase as a consequence of the proposed measures is expected to make recycling and depolluting easier, providing a large positive environmental effect by making available recycled materials (particularly steel and copper) that can replace virgin materials.

6.3. Economic impacts

6.3.1 Business impacts of Options A and B

The increased acquisition costs by consumers, discussed afterwards in Section 6.3.2, can be translated into a revenue increase for all or some of the economic actors. According to the review study, it is estimated that ca. 49% of the increase of the purchase price will become additional revenue for the manufacturing industry and 39% for the retail sector. However, for manufacturers, additional investment costs should be taken into account, in order to adapt the models to the requirements of the proposed regulations. Table 3 shows that the total business revenue[53] increases between 5% and 9% in 2030 for the Option A scenarios and between 0% and 2% for the Option B scenarios (not considering the sensitivity analyses performed in A4a and B3a). Note that the modelling of revenues takes into account not only extra production costs based on today's pricing, but also a learning effect that reduces production costs.

Sector	**Industry**			**Retailer**			**Total**			% increase by 2030
Scenario	**2020**	**2025**	**2030**	**2020**	**2025**	**2030**	**2020**	**2025**	**2030**	
BAU	1502	1630	1865	1525	1703	1920	3027	6653	3785	
Scenario A1	1514	1717	1907	1564	1794	2059	3078	7008	3966	5%
Scenario A2	1533	1786	1955	1590	1866	2136	3123	7290	4091	8%
Scenario A3	1552	1800	1970	1603	1881	2148	3155	7348	4118	9%
Scenario A4	1498	1699	1960	1565	1774	2048	3063	6933	4008	6%
Scenario A4a	1490	1690	1920	1560	1760	2010	3050	3450	3930	4%
Scenario B1	1143	1635	1849	1508	1709	1932	2651	3260	3781	0%
Scenario B2	1457	1675	1872	1522	1750	1956	2979	2129	3828	1%
Scenario B3	1460	1677	1886	1526	1752	1971	2986	1264	3857	2%
Scenario B3a	942	1233	1356	984	1298	1418	1926	2531	2774	-26%[54]

Table 3 Overview business revenues for BAU scenario and each of the scenarios under study, in million Euro2015

The industrial net present value (INPV)[55] and estimates of the free cash flows (FCFs)[56] of a representative manufacturer have been considered in this IA for the BAU scenario and the

[53] The total revenues are estimated as the number of units sold in one year multiplied by the average price of the unit at the manufacturers' door. It does not reflect the additional investments that the manufacturer might have done to adapt to the new regulations.

[54] Scenario B3a simulating a decrease in the volume of sales as well as a shift towards cheaper and less energy efficiency products provides a significant impact on business revenues. Note that scenario B3a is a worst-case situation, which has only a remote possibility of being realised.

[55] The industrial net present value (INPV) is a tool to evaluate the financial long-term impact of amended regulations. The model compare the INPV in the BAU with the INPV in various scenarios and the difference represents the financial impact of the revised regulations on manufacturers.

[56] Revised or new regulations can affect manufacturer cash flows in three distinct ways: 1) by creating a need for increased investment, 2) by raising product costs per unit, and 3) by altering revenue due to higher per-unit prices

different scenarios. These parameters provide an estimate of the economic impact that implementing the scenarios will have on the industry. The INPV is useful for evaluating the long-term effects and the cash flow is an important indicator of the industry's financial situation in the short-term. This analysis was done in this impact assessment in particular because of the specific market situation in the dishwasher sector, with a need to assess whether stricter minimum energy requirements could damage the sector via price increases, with associated decreases in sales. Further information can be found in Annex 5.3.5.

Figure 9 shows the simulated evolution of the Free Cash Flows (FCFs) for the scenario BAU and the scenarios A1 to A4. The comparison of evolution of FCFs with BAU after implementation year show lower FCF for scenario A1 by -3% on average and higher FCF for A2 and A4 (between 14% and 16.5%) and for scenario A3 (by 27.5%). However, the necessary investments mean that FCFs for Scenarios A3 (in 2021) and A2 (in 2024) will become sharply negative by comparison to the BAU for the relevant years of implementation because of the initial investment needed from manufacturers.

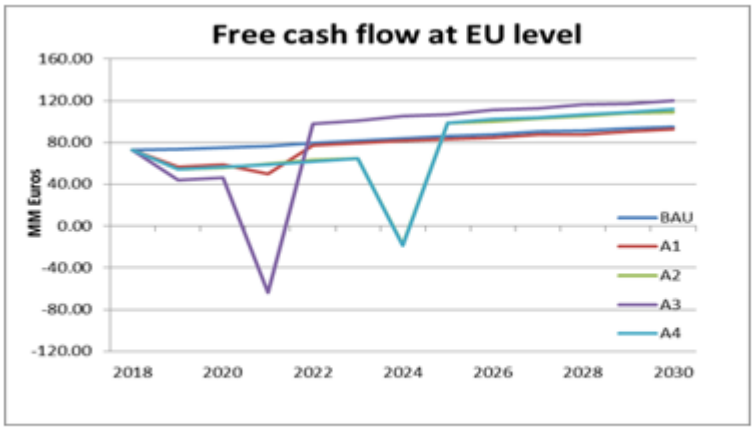


Figure 9. Free cash flow evolution at EU level for BAU and scenarios A1, A2, A3 and A4.

Figure 10 shows as an example the expected evolution of the Free Cash Flows (FCFs) for the scenario BAU and the scenarios B1 to B3. The scenarios B2 and B3 show FCFs grow by 15% and 27.5% respectively after the implementation year, considering BAU as a baseline. However, as for scenarios A2, A3 and A4, the necessary investments mean that FCFs for Scenarios B3 (in 2021) and B2 (in 2024) will become sharply negative by comparison to the BAU for the relevant years of the implementation because of the initial investment needed from manufacturers.

and/or possible changes in sales volumes. These effects have been modelled in a cash-flow analysis of a representative manufacturing industry by analysing the changes in the free cash flows.

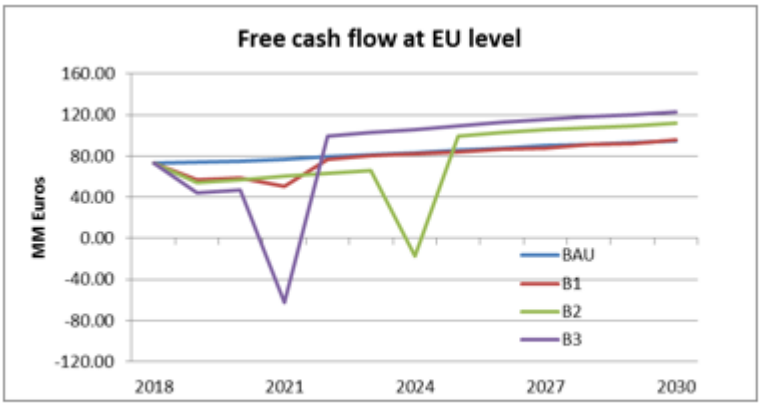


Figure 10. Free cash flow evolution at EU level for BAU and scenarios B1, B2 and B3.

Figures 11a and 11b describe the effect of decreasing the demand. The FCFs are lower for Scenario B3a than for Scenario B3, and for Scenario A4a in comparison with Scenario A4, since the increase in the prices of appliances lowers the sales volumes.

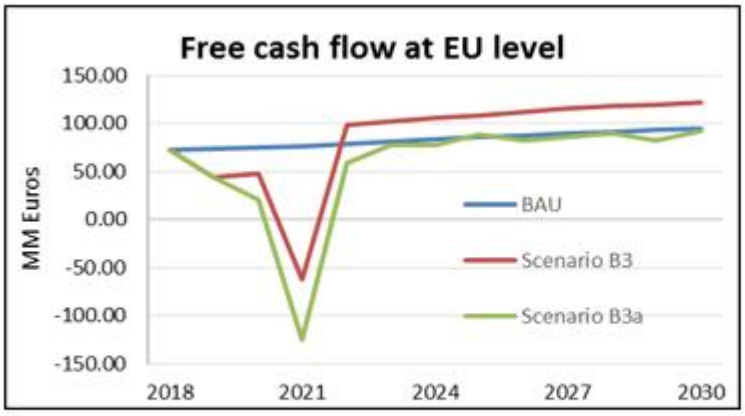


Figure 11a. Free cash flow evolution at EU level for BAU and scenarios B3 and B3a.

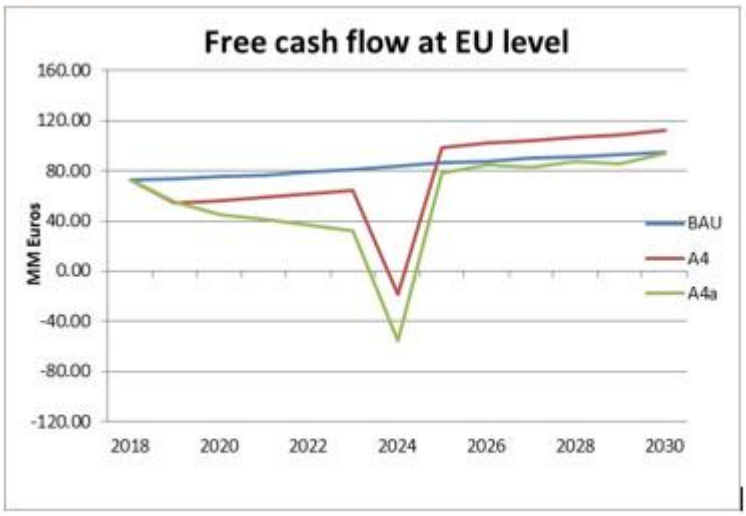


Figure 11b. Free cash flow evolution at EU level for BAU and scenarios A4 and A4a.

However, it should be noted that the FCFs of Scenario A4a and B3a are approximately equal to those resulting from BAU by the year 2030.

This study addresses uncertainties and examines the robustness of the FCF and INPV results by applying sensitivity analyses, which consider variations in the following

parameters: capital conversion cost (CCC), product conversion costs (PCC), stranded assets and weighted average cost of capital (WACC). These analyses show that the results are sensitive to all of the above-mentioned parameters. However, it is important to note that the INPV remains positive in all conditions, even in the worst-case modelled situations. Furthermore, the results from the calculation of the ratio of EBIT (earnings before interests and tax): Revenues indicates that it is feasible for industry to apply the regulatory requirements.

Annex 5, Section 5.3.5 contains the related information on assumptions, uncertainties, and the robustness of the results obtained, together with additional information on FCFs and the industrial net present value (INPV).

Other impacts on business such as on innovation, research and development, competitiveness and trade, stranded assets and intellectual property have also been further analysed in Annex 5.3.

6.3.2 Business impacts of Option C

The material efficiency requirements will impact different business sectors differently. Effects are foreseen for the following sectors:

6.3.2.1. Effects on manufacturers

An unavoidable impact of achieving the policy goal of longer product lifetimes is a corresponding decrease in the number of new products sold, which negatively impacts manufacturers. The expected increase of repairs (after expiry of the legal guarantee) would offset this to a certain extent, which will vary, depending on the profit margins of manufacturers on spare parts and provided repair services. Some studies indicate a very large variation in the rates charged for spare parts and repair services between different manufacturers and even the same manufacturers in different Member States[57].

The overall impact on manufacturers in scenario C1 is expected to be neutral to negative, and negative for Scenario C2.

6.3.2.2. Effects on retailers

Retailers who act only as an intermediate between manufacturers and consumers would be expected to be negatively impacted by lower annual sales volumes due to longer product lifetimes. This would be compensated in part by the expected corresponding increase in the market for spare parts, which retailers can also profit from. Also, given the fact that the market for dishwashers is not saturated in a number of Member States, in those Member States the effects on sales would be expected to be lower.

The overall impact on retailers is expected to be neutral to slightly negative.

6.3.2.3. Effects on independent repair businesses

A stated aim of the material efficiency measures in scenario C1 is to improve the competitiveness of independent repairers vis-à-vis manufacturers repair services. The impacts on these businesses, mostly SMEs[58], would be expected to be positive. Increases

[57] See Annex 6, Section 6.2.2

[58] on average repair companies employ 2.,5 persons, so most would be expected to be micro-enterprises

of 15%-20% of repairs were observed after the consumption law came into force in France[59].

The measures requiring availability of spare parts and access to repair information should help independent repairers to overcome barriers currently limiting their capability to compete in a fair way, widening the range of products which they could repair. This is expected to greatly outweigh the potential negative effect of lower profit margins due to more competition between repair services. Also the lower costs for repair are expected to drive up the overall demand for repairs, as studies show that consumers currently cite (perceived) high costs as the main reason to not repair but replace a dishwasher.

The overall impact on repair businesses is expected to be positive in scenarios C1 and C2.

6.3.2.4. Effect on reuse operators/second-hand retailers

Longer product lifetimes would have an evident positive impact on second-hand retailers. Better and cheaper repair options would in particular benefit businesses that combine repair and second-hand sale of appliances. A minimal product lifetime of 10 years resulting from more durable products (in scenario C2) would greatly improve the market value of second-hand devices younger than 10 years.

The overall impact on second-hand retailers of both scenarios C1 and C2 is expected to be positive.

6.3.2.5. Effect on recycling businesses

Longer product lifetime could mean less availability of discarded machines to recyclers, which would be a negative impact. However, the requirements for disassembly in all scenarios C0, C1 and C2 will facilitate extraction of valuable materials from discarded devices and make it easier to depollute materials. This will cause a strong positive effect in the long term (from the moment devices marketed under this regulation reach recycling facilities). Improved extractability of the key components due to better disassembly will increase the recovery rate of copper and precious metals such as gold, palladium and silver, with an estimated yearly potential economic benefit of 6.3-6.6 million euros[60].

The overall impact on recycling businesses is expected to be positive for all scenarios.

6.3.3 User expenditure

User expenditure consists of acquisition costs, maintenance/repair and running costs (including detergent, salt, rinsing agent, electricity and water costs). The running costs due to the consumption of detergents, salt and rinsing agents by one single user were estimated at EUR 50.1 per year and the repair costs at EUR 57.36 per year[10].

[59] Consumption law of 17 March 2014) obliges since March 2015 product retailers to inform the customer about how long spare parts will be available for the products in the market.
[60] Ardente, F. & Talens Peirò, L. (2015). 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. Available at http://publications.jrc.ec.europa.eu/repository/bitstream/JRC95187/lb-na-27200-en-n.pdf.

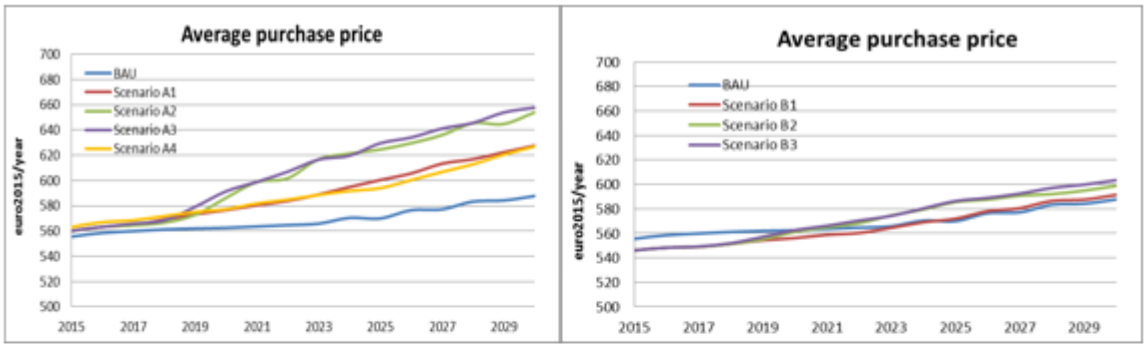


Figure 12. Average purchase price for the scenario BAU and the scenarios A1, A2 and A3 (left-hand figure) and B1, B2 and B3 (right-hand figure)

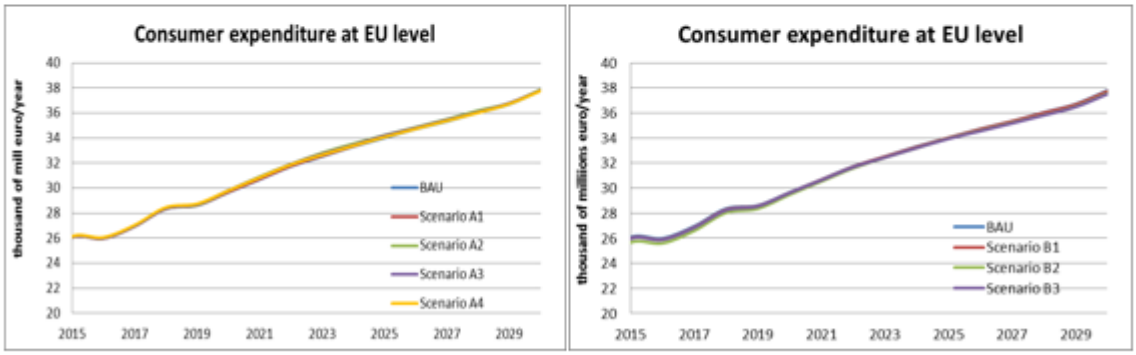


Figure 13 Average consumer expenditure at EU level for scenario BAU and the scenarios A1, A2, A3 and A4 (left-hand figure) and B1, B2 and B3 (right-hand figure)

The acquisition costs with various scenarios are summarised in Figure 12. In all scenarios an increase in the purchase price is observed. According to these estimates, the stricter the energy label, the higher the average acquisition costs of the machines (considering that the sales are not affected by the increase in the purchase price). This increase in the purchase price is largely due to the introduction of more complex technology in the machines.

Once low-cost improvement options have been exhausted, manufacturers have to resort to more advanced and more costly design options. Scenarios A1, A2 and especially A3 indicate that manufacturers would have to use these more advanced and costly options if they wanted products to be awarded with the higher/ highest energy efficiency classes (i.e. to adopt the heat pump technology or compete with it via other technologies). Thus, Option A will be more challenging for the average consumer in terms of affordability (purchase cost), as these additional costs will be (at least partly) passed on to consumers.

However, the projected increase in the purchase price is not fully reflected in the predicted user expenditure at EU level, as shown in Figure 13. Considering together the impacts of both acquisition and running costs, the trends in overall consumer expenditure (see Figure 13) are as follows: in the BAU scenario, consumer expenditure is predicted to reach ca. 38 billion $euro_{2015}$ in 2030, representing an increase of 47% between 2015 and 2030. The total user expenditure for all scenarios is of the same order of magnitude, even if there are differences in the average purchase price for each scenario. Scenarios B2 and B3 relatively save the most at EU level in consumer expenditure, but the saving is estimated to be only 1% with respect to BAU in 2030, which is well within the uncertainties of the estimations. The LLCC for dishwasher products can only be examined by simulating the situation for the "single user", which is discussed below and shown in Table 4.

Single user expenditure

Table 4 shows the user expenditure for an average dishwasher for each scenario. The single user expenditure considers an average product under each of the conditions of the policy scenario or the scenario under consideration in year 2030. The LCC includes the average purchase price divided by the lifetime of the product, the average water and energy consumption in 2030 as well as the consumption of auxiliaries and maintenance and repair costs for that year. As can be seen, the differences between the options are not sufficiently conclusive to determine which minimum energy requirement is more beneficial.

$Euro_{2015}$/year	**BAU**	**A1**	**A2**	**A3**	**A4**	**B1**	**B2**	**B3**
Purchase price	47.02	50.21	52.32	52.62	50.49	47.32	47.91	48.28
Electricity	55.66	52.11	49.45	49.38	42.26	54.42	52.39	51.59
Water	16.97	16.26	16.02	16.12	14.55	16.62	16.59	16.52
Detergents	107.52	107.52	107.52	107.52	107.52	107.52	107.52	107.52
Total	227.16	226.10	225.31	225.65	214.81	225.88	224.40	223.91

Table 4. Single user expenditure for the scenarios. Costs calculated for the average product in year 2030 and reported in Euro 2015 (cost of electricity=0.212 euro2015/kWh, cost of water = 5.9 euro 2015/m3) based on PRIMES 2016 model.

Stakeholders' views – Industry disagrees that the current LLCC could be set at an overall lower EEI level (e.g. at an EEI=58 instead of the current limit set at EEI=63). The industry association APPLiA presented to the Consultation Forum another approach, and compared the LCC of each of the energy efficiency class currently available on the market. The calculation presented does not consider how the market can evolve in the future. The analysis (summarised in Table 5) was performed according to the data provided by Eurostat, Eurocommerce and GfK and shows that the LLCC is reached for the current A+ class and therefore, industry proposed that the minimum Ecodesign requirements for energy consumption should not become stricter.

However, the difference in LCC between the energy efficiency class A+ and the next energy efficiency class A++ is approximately 3.5%. As in the previous calculations, this difference is too small to be considered conclusive to fix the minimum energy requirement.

	EEI< 33	**40<EEI<49**	**49<EEI<55**	**55<EEI<63**
Electricity consumption per cycle (kWh/cycle)	0.55	0.83	0.92	1.05
Observed purchase price (EUR, 2016)	1886	588	423	325
Life cycle cost (EUR)	2294.29	1224.86	1120.01	1082.16
Assumptions	Average electricity cost: 0.2052 EUR/kWh kept constant during the lifetime Lifetime: 12.5 years and 280 cycles/year Capacity: 13 ps The first column corresponding to EEI<33 is referred to heat pump dishwashers			

Table 5. LLCC analysis from the market perspective, presented by APPLiA in the consultation forum.

APPLiA questioned the feasibility of the more ambitious Ecodesign Tiers incorporating enhanced minimum performance requirements, with respect to the situation in several Eastern European MS in terms of consumer expenditure and affordability (see Annex 5, Section 5.2.6).

Regarding material efficiency requirements of Option C, longer product lifetimes would have a positive effect on consumer expenditure (i.e. lower expenditure). This would certainly apply to scenario C2 and also to scenario C1 if - as a consequence of the

measures proposed - repair costs were lowered to below the threshold that consumers are willing to spend on repair (estimated to be around 30% of the price of a new product).

6.3.4 Administrative burden

The administrative burden of new measures under the Energy Labelling Framework Regulation was calculated in the Impact Assessment for the Energy Labelling Framework Regulation. The costs for household dishwasher appliances are summarised in Table 6.

Administrative burden	**one-off**	**annual**	**BAU**
For the first 6 months provide a second label and supply extra labels on request to dealers	3200		-
Dealers re-labelling around 2.5% of products on stock/display or on the internet	310		-
Database, supplier costs		17.5	-
Database, EU budget	3.6	0.36	-
Joint support actions, EU budget (e.g. EEPLIANT)		33	x
Support joint surveillance actions (Horizon2020)		60	x
External laboratory costs (SMEs)		--	x
Market surveillance, Member State costs		330	x
Total business-as-usual (BAU)		**423**	
Total new costs of measures	**3514**	**17.36**	

Table 6: Administrative burden in '000 euros (Impact Assessment Energy Labelling Regulation)

The above-mentioned table considers no additional administrative burden for industry. More details to be found in Annex 7.

Stakeholder views – No comments were made on the administrative burden.

6.4. Social impacts

6.4.1 Product cost and affordability

The investment required by the industry in order to realise energy, water and emissions savings has to focus on the redesign of the cleaning programmes and the replacement of some existing working stations used in the production lines. More efficient household dishwashers tend to incur higher labour costs and to require more materials of higher quality. The average purchase price of the appliances has been estimated considering the sales distribution among the energy efficiency classes, and the purchase price of a representative product in each of the energy efficiency classes. The purchase price of each of the classes is calculated by adding the costs of the enhanced energy efficiency technologies to the base case machine. The distribution of the sales is modelled considering the current market state, the past market penetration patterns and the influence of the regulation. For example, the introduction of a second Ecodesign minimum requirements Tier is considered to push the market share towards higher energy efficiency classes and therefore towards more expensive products. Therefore, the above modelling means that a different annual average purchase price is assigned to each scenario.

As a consequence, the selling price of the products at the factory gate is expected to increase. It is not clear, though, how the manufacturers' cost increase will be passed through the supply chain to the consumers. An important share of the total production price is negotiated with the retailers prior to production. In this case, the expected manufacturer's price increase could be partially absorbed by one or several agents of the supply chain. In all scenarios, it is assumed that an increase in the manufacturing costs is fully passed on to consumers.

The increase in manufacturing costs and consequently in products purchase price has a consequence in the affordability of the products. Table 7 shows the average projected purchase prices in the scenarios assessed as well as the average annual energy costs. As can be seen, in all the scenarios the differences are not significant. Scenarios B2 and B3 show a decrease in the energy costs that equals or exceeds the increase in the product purchase price.

		BAU	A1	A2	A3	A4	B1	B2	B3
Purchase price $Euro_{2015}$	2015	556	556	556	556	556	556	556	556
	2025	568	604	627	632	595	575	592	592
	2030	588	628	654	658	631	591	599	603
	%	5%	11%	15%	16%	12%	6%	7%	8%
Electricity cost $Euro_{2015}$	2015	55.54	55.54	55.54	55.54	55.5	55.54	55.54	55.54
	2025	57.66	54.68	52.35	51.70	54.36	57.04	54.61	53.77
	2030	53.7	50.5	47.78	47.69	42.3	52.56	50.91	50.17
	%	-3%	-10%	-16%	-16%	-31%	-6%	-9%	-11%

Table 7. Purchase prices and energy costs of the different scenarios under study. Prices and costs in Euro2015

In most of the scenarios the increase in the purchase price is compensated by the decrease in the electricity costs. However, there are situations where the purchaser (e.g. the landlord) is not the person paying the energy bill (e.g. the tenant), or where the purchaser buys the appliance as a "quick fix" for an apartment that he/she plans to leave after a short while, leaving the dishwasher behind. In those cases the economic considerations for the purchaser may be different. Because dishwashers may be considered as a relatively luxury product[61], it was assessed that these cases would not happen frequently.

As regards the material efficiency requirements of Option C, manufacturers and retailers could incur an increase in costs due to the requirements to make spare parts available for an extended period after a model has been taken out of production. This could result in a small increase in product price. However, this would be offset by the longer product lifetime, reducing the frequency at which products would need to be replaced. Alternatively, the extra costs could be covered by the prices charged by manufacturers and retailers for spare parts. Better reparability of appliances may also positively impact their affordability by further developing the second-hand market with repaired appliances. Overall, the effect on affordability and the cost of new products is expected to be insignificant in all scenarios of Option C.

6.4.2 Health, safety and functionality aspects

There are no specific health and safety aspects related to the measures analysed under Options A and B.

The measures proposed in Option C on disassembly would be beneficial to the safety and health of workers in the repair as well as the recycling businesses, because requirements in these two scenarios include providing information on – and action regarding - easier and safer access to components containing hazardous substances.

[61] Those household appliances with a saturated market are considered as non-luxury products such as washing machines, refrigerators and cookers or kitchen appliances.

6.4.3. Employment

The EU employment impact is estimated from the increase in revenue and turnover per employee. For a proper understanding it is important to define the boundary. In this impact assessment:

- 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 section 6.3), it can also be understood as retaining jobs that otherwise would be lost;
- the total number of direct jobs is considered; however, it should be taken into account that approximately 50% of the OEM jobs and 20% of the retailer jobs are created/ retained outside the EU through imports of components and other services.
- There is no employment effect calculated for the maintenance and repair industry, although positive effects on these sectors are expected due to the implementation of material efficiency requirements

Table 8 gives an overview of the employment impact according to these rules for the manufacturing sector. In that sense, considering that the sales are not affected by the implementation of the Ecodesign requirements, Scenario A3 would deliver approximately 11 000 jobs in the manufacturing sector. For all scenarios of options A and B, an increase between 2% and 12% is expected in the number of jobs in the manufacturing sector by 2030. However, Scenario B3a simulating a decrease in the volume of sales as well as a shift towards cheaper and less energy efficiency products results in a significant impact on the number of jobs. Note that scenario B3a is a worst-case situation, which has only a remote possibility of being realised. This impact is not so strong for scenario A4a, even if some decrease in the sales is considered.

	year	BAU	Scenario A1	Scenario A2	Scenario A3	Scenario A4	Scenario A4a
Manufacturers	2020	8	8	8.5	8.5	8	8
	2025	9	9.5	9.9	10	9.4	9.4
	2030	10	10	11	11	11	11
Retailers	2020	25	26	26	27	26	26
	2025	28	30	31	31	30	29
	2030	32	34	36	36	34	33
Total	2020	34	34	35	35	34	34
	2025	37	39	41	41	39	39
	2030	42	45	47	47	45	44

	year	BAU	Scenario B1	Scenario B2	Scenario B3	Scenario B3a
Manufacturers	2020	8	8	8	8	0.7
	2025	9	9	9.3	9.3	1.2
	2030	10	10	10	10	1.6
Retailers	2020	25	25	25	25	0.8
	2025	28	28	29	29	1.3
	2030	32	32	33	33	1.7
Total	2020	34	33	33	34	1.6
	2025	37	38	39	39	2.5
	2030	42	42	43	43	3.4

Table 8. Overview of the direct employment per scenario, in thousands of jobs

50% of the manufacturers are supposed to be European with a ratio of EUR 188 000 per job; 80% of the retailers are supposed to be European with a ratio of EUR 60 000 per job

As regards material efficiency, a number of studies contain useful information on the social impacts of making available spare parts and repair information:

- According to a horizontal study across various household products by Deloitte[31], positive social impacts for the EU employment are expected due to the material efficiency requirements. As in the case of the economic impacts, there might be some reductions on the projected increase of jobs in the manufacturing sector - part of which will occur outside the EU. However, the creation of a significant amount of jobs in the repair sector would correspond to the development of quality jobs, largely in SMEs and smaller companies, mostly in the EU.

- In 2011, the social economy accounted for 11 million jobs in the EU, an amount that represented around 11% of total employment[62]. It should be noted that social enterprises operate mainly in the second-hand market for products, whereas repair activities have a smaller share in the sector, but have an increased development trend (e.g. repair cafés). An increase in reparability could therefore promote a growth of the second-hand market of appliances. Such a prospect is expected to benefit low-income households, because low-cost and good-quality products would become more affordable[63].

Overall, impacts on employment in both scenarios C1 and C2 are expected to be positive.

7. HOW DO THE OPTIONS COMPARE?

7.1. Summary of the impacts

7.1.1. Impacts of Options A and B and associated scenarios

Impact	Unit	Scenarios								
		A1	**A2**	**A3**	**A4**	**A4a**	**B1**	**B2**	**B3**	**B3a**
Electricity savings	TWh/yr	1.91	3.33	**3.83**	2.06	5.16	0.41	1.63	2.15	6.30
CO_{2eq} reduction	million tonne	0.65	1.13	**1.30**	0.70	1.75	0.14	0.55	0.73	2.14
Water savings	million m^3	11	14	14	**16**	16	*5*	7	7	59
Extra purchase cost	million EUR_{2015}	509	846	893	500	--	**118**	223	280	--
Energy costs savings		406	705	**812**	436	--	86	346	455	--
Water cost savings		57	72	73	**82**	--	26	35	35	--
Net cost savings		-46	-68	-8	18	--	-19	145	**182**	--
Business impacts OEMs	million EUR_{2015}	1907	1955	**1970**	1960	1920	1849	1872	1886	1070
Business impacts retailers		2059	2136	**2148**	2048	2010	1932	1956	1971	1119
Job creation OEMs	thousands of jobs	10	**11**	**11**	**11**	**11**	10	10	10	1.6
Job creation retailers		34	**36**	**36**	34	34	33	33	34	1.6

Table 9. Overview main annual impacts of the scenarios in 2030. Best values in Bold

7.1.2. Impacts of option C

While it was not possible to quantify the impacts in the same detailed fashion as for the other requirements modelled here regarding Ecodesign and Energy Labelling combinations for dishwashers, Table 10 presents an overview of the potential impacts of establishing material efficiency measures included in scenarios C1 and C2, in comparison with BAU.

Impact categories	Scenarios

[62] Study on socioeconomic impacts of increased reparability, Biodeloitte 2016
[63] O'Connell et al (2012) Evaluating the sustainability potential of a white goods refurbishment program.

	C0	C1	C2
Environmental impacts	=	++	++
a. energy consumption	=	+	+
b. greenhouse gas emissions reduction	=	+	+
c. water consumption	=	+	+
d. resource used in production	=	++	++
e. improved recycling and depollution	+	++	++
Economic impacts	=	+	+
a. Impact on manufacturers	=	=/-	-
b. Impact on retailers	=	=/-	=/-
c. Impact on independent repair businesses	=	++	+
d. Impact on reuse operators/second-hand retailers	=	++	++
e. impact on recycling businesses	+	+	+
f. User expenditure	=	+	++
Social impacts	=	+	+
a. affordability and product cost	=	+	+
b. employment in the EU	=	+	+
c. health and safety aspects	+	+	+

Table 10. Evaluation of potential impacts of material efficiency requirements

Qualitative assessment: + means positive effect (e.g. lower costs), - means negative effect (e.g. more energy consumption), = means no or negligible effect

7.2. Market Surveillance

All proposed policy options would be subject to Article 15(8) of the Ecodesign Framework Directive, as well as Article 8(1) and (3) of Energy Labelling Framework Regulation, which requires that MSAs can verify the conformity of a product with all regulatory requirements.

In Annex 6, section 6, further information is provided in particular on the verification of material efficiency requirements.

The estimated cost for market surveillance organised by MSs is the same for all scenarios, i.e. EUR 330 000 annually (see Annex 9, Section 9.5.7).

Stakeholders' views – Industry associations have emphasised the importance of securing a sufficient level of market surveillance to ensure that only compliant products are placed on the market.

7.3. Assessment regarding Article 15(5) of the Ecodesign Framework Directive

As required in Article 15(5) of the Ecodesign Framework Directive, future implementing measures should fulfil a number of criteria (see Section 6).

An assessment of the options with regard to these criteria is shown in Table 11 below (to be viewed with Table 9 above, as a summary of the impacts described in Section 6).

Significant impacts as stipulated in Art 15 of the ED Directive	BAU	Option A				Option B			Option C		
		A1	A2	A3	A4	B1	B2	B3	C0	C1	C2
No significant negative impacts on the functionality of the product from the perspective of the user	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Health, safety and environment shall not be adversely affected	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No significant negative impact on consumers in particular as regards affordability and life-cycle costs	✓	✗	✗	✓	✓	✗	✓	✓	✓	✓	✓
No significant negative impacts on industry's competitiveness	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓
Setting of an Ecodesign requirement shall not have the consequence of imposing proprietary technology on manufacturers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Impose no excessive administrative burden on manufacturers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 11. Evaluation of policy options in terms of their impacts compared to the baseline

7.4. Assessment with regard to the objectives

Table 12 below presents an overview assessment of the options with respect to the objectives noted in Section 4 (also cross-compare with Table 9, above).

	BAU	Option A				Option B			Option C		
		A1	A2	A3	A4	B1	B2	B3	C0	C1	C2
General objectives											
Ensure free circulation of efficient products within the internal market	0	+	+	+	+	+	+	+	0	+	+
Promote competitiveness of the household dishwasher appliance through the creation of expansion of the EU internal market for sustainable products	0	+	++	++	++	+	++	++	0	+	+
Promote the energy efficiency of household dishwasher appliances as contribution to the EU's objective to reduce energy consumption by 30% and domestic GHG emissions by 40% by 2030; and	0	+	++	++	++	+	++	++	0	0	0
Increase the security of energy supply in the Union through a reduction in energy consumption of household dishwashers.	0	+	++	++	++	+	++	++	0	0	0
Specific objectives											
Update the energy efficiency requirements and the energy label to achieve cost-efficient savings of energy and other resources.	0	+	++	++	++	+	++	++	0	0	0
Maintaining and supporting the past market trend towards progressively more energy efficient and more environmentally friendly appliances.	0	+	++	+	++	+	++	+	+	+	+
Support longer-lasting products, *inter alia*, by facilitating their repair and by increasing their recyclability at the end of life.	0	0	0	0	0	0	0	0	+	++	++

Table 12. Score of impacts against objectives (see section 4)

Scores: - small negative impact, - - large negative impact, 0= no change; + limited improvement; + + significant improvement

8. PREFERRED OPTION

8.1. Preferred option – Why?

As seen in Table 11, in terms of the impacts on functionality, all the scenarios are expected to have a neutral or a positive impact.

When assessing the options, the objectives of maintaining the affordability of products by consumers and the competitiveness of industry prevailed, together with the objective to achieve high energy and water savings.

Scenarios A1, A2 and B1 would cause consumers' net expenditure (taking into account purchase cost, and energy and water bills) to increase by respectively 46, 68 and 19 million Euros. Such net cost increases for consumers go against the condition of maintaining the overall affordability of products. Therefore these scenarios do not respect the corresponding criteria of Article 15(5) of the Ecodesign Framework Directive. For Scenario A3, the increase in consumers' net expenditure is much lower than for the 3 scenarios mentioned before; it is not eliminated on this basis.

Scenarios A3, A4, B2 and B3 have the potential to achieving high energy and water savings when compared to the BAU scenario.

In addition, under these scenarios, the least-performing products are expected to be removed from the market.

However, Scenarios A3 and B3, implementing reinforced minimum energy efficiency requirements as from 2021, have the drawback that they will force producers to rapidly invest large sums to adapt their products to the new regulations, shortening their development cycles for new models. Financing will also be needed by manufacturers to realise the investments needed in the shorter timeframes required in Scenarios A3 and B3. For consumers, both of these scenarios will considerably raise product prices, at least in the short-term; this may endanger the affordability of new products and it may impact on the market penetration rate of dishwashers, as illustrated by Scenario B3a. Impacts on the market penetration rate of dishwashers also have an environmental impact, as higher amounts of water and energy are needed for hand-dishwashing. Therefore, Scenarios A3 and B3 present the risk that anticipated higher energy and resources savings may not materialise because of the notable reduction in sales volumes. For these different reasons, Scenarios A3 and B3 are considered to have significant negative impacts on industry's competitiveness and therefore not to respect the corresponding criteria of Article 15(5) of the Ecodesign Framework Directive.

Note that none of the scenarios proposed is expected to impose proprietary technology on manufacturers, or to impose significant administrative burden.

Hence, two potential scenarios remain in competition: A4 and B2. On balance **Scenario A4 would be the preferred option** for the following reasons:

- Scenario A4 offers the higher energy savings and associated GHG emission reductions , whilst also delivering high beneficial impacts in most other categories, if one refers to Table 9 in conjunction with Tables 11-13;

- A4 provides the highest water savings and water cost savings of the assessed options;
- A4 provides a compromise middle solution regarding extra purchase cost, and a small but positive EU-wide net cost saving, whilst maintaining the "technology-neutral" stance of including and incentivising the further development of the heat pump-equipped dishwasher (HPED) technologies option as BAT;
- The two Ecodesign Tiers (2021 and 2024), coupled with the non-proportional Energy Labelling bandwidths for classes B to G, will allow both HPED and – in the near-term – the other technologies closely competing for BAT status to co-exist in the top Energy Labelling class of "B"; the smaller bandwidths for classes E to G (in comparison with A2) will also provide incentives for the lower performing appliances to progress;
- Scenario B2 provides much larger (over 7 times) net costs savings per year to consumers than Scenario A4. However, Scenario A4 provides more incentives for HPED and other BAT technologies to compete and, at the lower end, provides also incentives for the least performing technologies to progress. Over time, it is expected that technological progress will be possible at a lower cost, so that the overall life cycle costs for consumers come closer to the more commonly-available dishwasher technologies;
- A4 provides higher positive OEM business economic impacts (EUR 1960 million) and middle-ranking economic impacts for retailers (EUR 2048);
- A4 provides the highest job creation figures for OEM (ca. 11 000 jobs) and the second highest job creation figures for retailers (ca. 34 000 jobs);
- Scenario A4 provides a balanced outcome of the sometimes diverging views of industry representatives, NGOs and MS regarding the introduction of stricter Ecodesign requirements;
- Scenario A4 also provides sufficient time for industry sectors to adapt to new and stricter stepped Ecodesign requirements (see Section 5 for more details).

With regard to material efficiency, as seen in Table 10, both Scenarios C1 and C2 show comparable results in most fields. However, there are concerns over the enforceability of durability requirements of Scenario C2. There is currently no standard test for durability, and therefore a requirement on durability would not be verifiable by Market Surveillance Authorities. For this reason, **Scenario C1 is the preferred option** at this stage.

It should be noted that a new series of generic standards covering Ecodesign requirements related to material efficiency aspects is being developed under EC Mandate 543 (2015). These standards could help provide more clarity as to what is covered by durability and how this can be tested efficiently and accurately. The inclusion of durability requirements could be revisited in the next revision of the regulation.

Overall, the preferred option is a combination of Ecodesign minimum energy efficiency requirements and recalibrated Energy Labelling classes as provided by **Scenario A4** and material efficiency requirements provided by **Scenario C1**. A staged implementation is proposed: **April 2021** for requirements for which the market can rapidly prepare and **April 2024** for requirements implying a more demanding market transformation.

After completion of this impact assessment, new information from standardisation experts working in the relevant CENELEC Technical Committee, based on recent results of the Round Robin Test on the revised IEC and CENELEC standards on the test of dishwasher performance, shows a small impact of this new standard on the measurement of energy efficiency and drying efficiency: the same levels of efficiency result in slightly lower measurement values. This does not put in question the assessment made or the conclusions from this impact assessment, but it leads to adjust marginally the ecodesign requirement for the drying efficiency index (from 1.08 to 1.06) and the scale of the energy label for the preferred option as follows:

Energy efficiency class	**Energy Efficiency Index**
A (most efficient)	EEI < 34
B	34 ≤ EEI < 39
C	39 ≤ EEI < 44
D	44 ≤ EEI < 50
E	50 ≤ EEI < 56
F	56 ≤ EEI < 63
G (least efficient)	EEI ≥ 63

A summary of the benefits and disadvantages of the preferred option is given below, compared to the BAU option in the year 2030:

- Electricity savings of ca. 2.1 TWh/year, water savings of 16 million m^3/year and GHG emissions abatement of 0.7 $MtCO_2$ eq/year; this represents a contribution of 0.14% to the EU target on energy efficiency by 2030 and 0.07% to the EU target on CO_2 emissions reduction by 2030.

- Extra overall OEM and retailers' combined business revenues of ca. EUR 4 billion per year are generated, which translates into approx. 11 000 additional jobs in the EU manufacturing sector and ca. 34 000 jobs in the retail sector in comparison to the BAU scenario, if demand for these products is not damaged

- Within the margin of error, the measures are cost-neutral regarding annual end-user expenditure at the overall EU level, whilst consumers benefit from using new technologies

- The competitiveness of EU industry is maintained, as well as its leading role as high-quality manufacturers of dishwasher products

- Innovation and medium-term cost reduction is promoted, which should lead to progressively more efficient household dishwashers being developed.

The measures related to circular economy should drive higher revenues and profits for independent companies (such as SMEs) working in the field of repair and refurbishment of products.

8.2. REFIT (simplification and improved efficiency)

This section will describe how the preferred option is expected to improve the efficiency of the existing measures.

The preferred option will slightly decrease the total consumer expenditure compared to the baseline. This consumer expenditure includes the acquisition cost and the energy and water costs. The acquisition cost will be higher, but the total cost for energy and water will decrease compared to the baseline (due to the gain in efficiency). In addition, this option will improve industry's revenues if the demand for this product remains at the levels anticipated.

There is a one-off cost linked to the application of the new Energy Labelling Framework Regulation. For suppliers, there is a cost of EUR 3.6 million, for providing two sets of labels (one according to the current regulations and one according to the new measures) over an "overlap" period of 6 months. For dealers, a cost of EUR 0.36 million is assumed for the necessary relabelling of approximately 2.5 % of their products that will be on display. This cost is not included in Table 15, because it is a one-off cost, which will not have an impact anymore in 2030.

Table 13 gives an overview of the increment in costs and as compared to the baseline.

	2030	**Comment**
Acquisition costs (EUR million)	500	These costs represent the additional acquisition costs rewarded by total consumer expenditure decrease, due to reduced product Life Cycle Costs (not including projected reductions in appliance repair costs)
Energy costs (EUR million)	-436	
Water costs (EUR million)	-82	
Consumer expenditure (EUR million)	-18	
Industry revenue (EUR million)	1960	There is an increase in the revenues for the manufacturing and retail industries
Retail revenue (EUR million)	2048	

Table 13. Increment p.a. in costs, revenue and administrative burden of the preferred option in 2030

9. HOW WILL ACTUAL IMPACTS BE MONITORED AND EVALUATED?

The main monitoring element will be the tests carried out to verify compliance with the Ecodesign and Energy Labelling requirements, and information checks in the case of the circular economy requirements. This monitoring should be carried out by MS market surveillance authorities to ensure that the set requirements are met.

The impact of potential Ecodesign and Energy Labelling regulations should be measured both through the evolution of overall environmental impacts and through an analysis of the products on the market (sales figures, performance, etc.) to determine if a shift towards more resource efficient products has happened. The following indicators reflect the general and specific objectives:

- Reduction of the electricity consumption and related GHG emissions of household dishwasher appliances;
- Increasing the economic savings for European consumers;
- Safeguarding the competitiveness of the European household dishwasher appliances industry and the full value chain;
- Improving regulatory effectiveness and the efficiency of the regulation;
- Compliance with energy efficiency requirements, i.e. maximum EEI for the different product categories;
- Compliance with material efficiency requirements
    - spare part availability/delivery time,

- disassembly of key components,
- access to repair and maintenance information.

Annex 1: Procedural information

1.1. Lead DG, Decide Planning/CWP references

DG ENER and DG GROW are co-responsible for Ecodesign and DG ENER is responsible for Energy labelling. DG ENV is the lead DG for this product group.

Household dishwasher 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 1016/2010), 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 dishwasher Energy Label Commission Delegated Regulation (EU) No 1059/2010 was prepared and entered into force.

The following DGs (Directorates General) are part of the Interservice Group on Ecodesign and Energy Labelling: ENER, SG, GROW, ENV, CNECT, JUST, ECFIN, REGIO, RTD, CLIMA, COMP, TAXUD, EMPL, MOVE, TRADE, and the JRC and they were consulted on the draft Impact assessment in April 2018.

1.2. Organisation and timing

As mentioned, Article 7 of both regulations 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 review study was needed. This review study took place in the period March 2015 - September 2017. On the basis of the review study, 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 dishwasher appliances continue to be a priority product group. Furthermore, the recent Energy Label Regulation (EU) 2017/1369 stipulated that household dishwasher appliances 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.

1.3. Consultation of the Regulatory Scrutiny Board

This impact assessment report was discussed by the Regulatory Scrutiny Board on 13 June 2018. The Board issued a positive opinion with reservations. The main considerations and detailed comments given by the board, and the way they are incorporated in the present final version of the Impact Assessment, are summarised in the following table:

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 8.1.
2) 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 8.1. The elaboration of options, including the balance between policy objectives, is also introduction at the beginning of Section 5.
3) 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 5.4.4 and the approach followed for their assessment is explained in Section 6.1.
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) The report should better motivate the choice of the preferred option. Light should be shed on the relative importance of the objectives. Energy savings are clearly most important, but it remains unclear which of the other objectives are more important than others (environmental objectives like water consumption or consumer behaviour and price elasticity). Additionally, the report should explain the trade-offs considered when making the choice, including the interests of consumers and industry. In this context, it should describe the weighing of cost and benefits against each other. Furthermore, it should clarify why a different set-up of energy labelling bands makes such a difference in the estimated purchase price.	The choice of the preferred option has been further elaborated in Section 8.1. Clarification on the impact of the set-up of energy labelling bands on the estimated purchase price has been provided in section 6.4.1.
2) The report should provide a better narrative. Most importantly, it should become clearer what has already been decided and what still needs to be decided. In this context, it is especially important to describe which options are still up for discussion after the conclusion of the consultation forum with stakeholders. The report should include an indication of the degree of consensus among stakeholders on each issue. Additionally, it should introduce the issues that characterise this policy area early on: - the rebound effect - the importance of the duration of the washing programme in comparison with energy and water consumption, i.e., the choice of programme by consumers	This is the object of a new Section 5.1. The stakeholders' views were complemented for the proposed options in Sections 5.2 to 5.4 The questions of the rebound effect and the impact of partial loading is now discussed in Section 2.6.4 The choice of programmes by consumers is the object of a new 'Problem 3' in Section 2.4 and the

- the low degree of machine loading by consumers	conclusion on the programme duration is drawn in Section 5.
3) Some of the modelling results need further explanation. Employment estimates, for example, seem to be the product of revenues and a fixed multiplier. Additionally, the report should point out the large level of uncertainty, especially in comparison to the absolute energy savings. In particular, it should better explain why an analysis including the effects of higher costs on the demand for dishwashers has only been conducted on the less ambitious option. A similar analysis would seem relevant also for the preferred option, as the cost increase is even higher there. Furthermore, it needs to clarify why it only uses the cash flow calculations for dishwashers and not in calculations for other products covered by this package of proposals.	The modelling assumptions have been introduced in 6.1 and further explanations are given in Annex 5. The effect of higher costs on the demand for dishwashers has been done for the preferred option also and the results now reported in 6.2.1. The explanation on the use of cash flow calculations for dishwashers only has been added in 6.3.1.
4) The report should be more transparent about the early stages that the sector's efforts on circular economy are in, including the lack of experience, the outdated methodology (MEErP) and the lacking standardization. The report needs to discuss the trade-offs that the inclusion of circular economy requirements into the ecodesign framework requires. The report should include a discussion of the existing legislation (in Member States) on issues regarding circular economy, such as spare parts and recyclability. Additionally, the report needs to establish the proportionality of some of the proposed measures; for example, the requirements that spare parts need to be available within three weeks seem demanding and might be undermined by the affordability of the spare parts. The circular economy efforts should be integrated into the introduction and the sections on subsidiarity and monitoring of the report.	Additional text is added under 6.1 to present the context of including circular economy requirments and limitations as for their assessment, including as regards the methodology. The trade-offs associated with the inclusion of circular economy requirements are discussed in section 6.2.4.1 and in Annex 6. This issues has been added to 6.1 Circular economy aspects are now discussed in a more consistent way in the different sections of the report.
5) The report has to clarify a number of issues on the content of the options: - The estimated energy savings of this initiative are relatively small relative to overall saving potentials. The report should motivate why the initiative is nonetheless worthwhile. - The report should explain why energy efficiency requirements are only considered for full-sized dishwashers. Additionally, it needs to justify why setting stricter targets for slim-line dishwasher in the second tier (2024) would not be prudent. - The report should explain the strong interlinkage between water and electricity consumption in the case of dishwashers to justify why water consumption is not used as one of the design parameters. - The report should explain the logic behind a number of elements relative to setting the	The modest contribution of this product group to EU energy and climate objectives is now ackowledged in section 1.5 and the need to act nevertheless is discussed in the same section and in section 3.3. A higher level of stringency is proposed only for the full-size appliances because they are the only dishwashers that at present can accommodate new and more energy efficient technologies, in terms of the physical space available within the dishwasher dimensions as indicated now in section 5.4.2 The water consumption has been considered as a non-independent design parameter, owing to its strong interlinkage with electricity consumption as now explained in section 5.1

energy labelling classes, i.e., leaving the top class empty, why it is expected that after a period of ten years most products will be classified in the top class, and why it is assumed that the same amount of effort is required to move from one class to the next. In this context, the report should briefly touch upon how the expected technological process was judged.	The rules for re-scaling the energy labelling classes are now explained in Section 1.2. The expected technological changes are mentioned in the evaluation conclusions in Section 2.1 and Annex 4.
6) The report does not clearly draw conclusions from the evaluation. It should clarify that there has been a review of the overall legislative framework, but not of product-specific pieces of legislation. Additionally, the problem description should summarize the findings of this review and explain how they are taken into account in this report. In this context, it should establish why there is still the need to act after the success of the previous legislation.	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. The need to act is the object of the new Section 1.5.
7) 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 Board takes note of the quantification of the various costs and benefits associated to the preferred option of this initiative, as assessed in the report considered by the Board and summarised in the attached quantification tables.	The impact assessment reports have been aligned to the extent possible considering the specificities of each product.

Table 1.1 Comments of RSB and integration into IA report

1.4. Political and legal context

There is a track record of around 20 years regarding the effectiveness and efficiency of these regulatory instruments in contributing to EU policy goals on the single market, energy savings and emission abatement. Energy and carbon savings, since the beginning and compared to 'Business-as-Usual', are around 40%, the administrative burden is modest and all market actors on the supply and demand sides are positive in their views on the impact of these policy instruments on the market.

The revision of Ecodesign and Energy labelling measures for household dishwasher appliances follows Article 7 of both acts, i.e. Commission Regulation (EC) No. 1016/2010 and Commission Delegated Regulation (EU) No. 1059/2010 respectively. In both regulations the Article 7 reads that *"The Commission shall review this Regulation in the light of technological progress no later than 4 years after its entry into force and present the result of this review to the Ecodesign Consultation Forum. The review shall in particular assess the verification tolerances set out in Annex III, the possibilities for setting requirements with regard to the water consumption of household dishwashers and the*

potential for hot water inlet". The Commission's 2014 'Omnibus' review [64] indicated that there is still a large untapped saving potential making the regulations eligible for a revision. This was confirmed by the preparatory review study, concluded in November 2017[65].

Furthermore, following Art. 5 of Regulation (EU) 2017/1369 on Energy Labelling (EL), a new delegated act for energy labelling of household dishwasher appliances must be adopted at the latest 2 November 2018.

In the Commission's Ecodesign Working Plan 2016-2019[66] the revision of the implementing act for household dishwashers is mentioned as one of the priority subjects.

On top of that, there are new policies that force the revision to look beyond the strict scope mentioned in the review articles of the existing implementing and delegated acts for household dishwasher appliances: A renewed effort in carbon emission abatement through the Paris climate agreement[67], the Commission's Circular Economy package -- including measures to increase reparability and durability-- of the 7th Environmental Action Plan (EAP7)[68], the Better Regulation policy aiming at more efficient and effective legislation[69] [70], the diesel-gate scandal stressing the need to deeper scrutinise legislation further on the possibilities for circumvention, etc.[71].

At the technical level, there is the introduction of a new global IEC test standard for household dishwashers that can make a significant contribution to the above-mentioned policy objectives[72].

1.5. Consistency with other EU policies

Improved energy efficiency of household dishwashers would contribute to the EU energy use reduction target of 30% by 2030. It is fully in line with the third dimension of the Energy Union[73] ("Energy Efficiency First") in which Ecodesign plays a major role. It is coherent with the Commission priorities for the internal market ("A deeper and fairer internal market")[74], as it would encourage investment in R&D and provide for a level playing field for all market actors across the Union market. It is also consistent with

[64] 'Omnibus' Review Study on Cold Appliances, Washing Machines, Dishwashers, Washer-Driers, Lighting, Set-top Boxes and Pumps, consortium of VHK, VITO, Viegand Maagøe, Wuppertal Institut für Klima, Umwelt, Energie for the European Commission, DG ENER-C3, Brussels/Delft, April 2014.

[65] Boyano A., Moons H., Villanueva A., Graulich K., Rüdenauer I., Alborzi F., Hook I., Stamminger R., Ecodesign and Energy Label for household dishwashers, EUR 28645 EN, doi: 10.2760/024232, 2017.

[66] COM(2016) 773 final, Brussels, November 2016.

[67] http://ec.europa.eu/clima/policies/international/negotiations/future/index_en.htm

[68] Closing the loop - An EU action plan for the Circular Economy". COM(2015) 614 final, Brussels, 2.12.2015

[69] https://ec.europa.eu/info/law/law-making-process/overview-law-making-process/evaluating-and-improving-existing-laws/reducing-burdens-and-simplifying-law/refit-platform_en

[70] http://ec.europa.eu/smart-regulation/better_regulation/key_docs_en.htm#_br

[71] http://www.europarl.europa.eu/committees/en/emis/home.html

[72] IEC 60436:2015, Electric dishwashers for household use - Methods for measuring the performance

[73] COM/2015/080 final. Communication from the Commission to the European Parliament, the Council, the European Economy and the Social Committee, the Committee of the Regions and the European Investment Bank – A framework strategy for a resilient energy union with a forward-looking climate change policy.

[74] COM/2015/550 final. . Communication from the Commission to the European Parliament, the Council, the European Economy and the Social Committee and the Committee of the Regions – Upgrading the single market: more opportunities for people and business.

updated EU priorities on Sustainable Development[75] which refers to energy efficiency, and is aligned with the 2015 EU Action Plan for the Circular Economy (which includes comprehensive commitments on Ecodesign). The Circular Economy perspective has been incorporated into the proposed measures on material efficiency.

[75] COM/2016/739. . Communication from the Commission to the European Parliament, the Council, the European Economy and the Social Committee and the Committee of the Regions – Next steps for a sustainable European future European action for sustainability

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

The Review Study 2016 started in 2014 and was completed in 2017. It followed the structure Methodology for Ecodesign of Energy related Products (MEErP)[76].

The review study covered household dishwasher appliances 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 http://susproc.jrc.ec.europa.eu/Dishwashers/index.html 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 23rd June 2015 in Seville and 17th November 2015 in Brussels and a webinar was held on 7th October 2016. The minutes of these meetings are available at:
http://susproc.jrc.ec.europa.eu/Dishwashers/documents.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 19 December 2017, they were discussed in the Ecodesign Consultation Forum meeting.

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

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

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 Commission services' Working Document received during and after the Consultation Forum can be summarised as follows:

Minimum energy efficiency requirement under Ecodesign

Industry stakeholders recommended not to set stricter requirements than what applies currently, as this would negatively impact the affordability of appliances and slow down the penetration of dishwashers in countries with low income, while even the worst performing dishwashers are more energy efficient than handwashing. According to industry experts, the current class A+ (lowest class for full-size dishwashers) correspond already to the Least Life Cycle Cost (LLCC). On the contrary, environmental NGOs considered Commission proposals as the lowest possible ambition possible and requested a second tier with stricter requirements.

Calculation of the Energy Efficiency Index (EEI)

All stakeholders asked to revise the distinction between larger and smaller appliances in the calculation of the energy efficiency index, where there is currently a discrepancy between the Ecodesign requirement and the calculation, and which gives an unfair advantage to bigger appliances according to consumer organisations.

Technology to be recognised as BAT and repartition of Energy Label classes

Stakeholders were split on the technology type to be considered as Best Available Technology (BAT), and, following the provisions of the new Energy Labelling regulation, this choice has a major impact on the level of the highest classes of the Energy Label. Some Member States and industry actors consider that the heat pump-equipped dishwasher technology cannot be considered as BAT because enabled energy savings do not compensate for its higher purchase price and because of its limited availability on the market. Other Member States and environmental NGOs consider that it is currently the best technology on the market and it should be considered as such.

On the further repartition of energy classes, industry stakeholders called to keep an incentive for the lower performing appliances to progress by providing smaller bandwidth classes than currently proposed (towards the lower end of the scale), considering that the current proposal would see the majority of currently-available appliances rated as E or F (once re-scaled).

Material 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 were 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.

Noise

Some Member States and industry stakeholders proposed to revise the proposed classes on noise emissions in a more lenient manner.

Low-power modes

Many stakeholders saw a need to revise the proposed provisions on low-power modes, where some wording was considered as too vague and not fully consistent.

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

2.4. OPEN PUBLIC CONSULTATION

An *online public consultation (OPC)*[77] 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%.

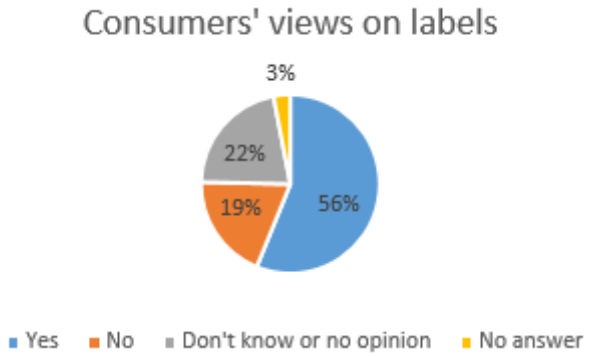
[77] https://ec.europa.eu/info/consultations/public-consultation-ecodesign-and-energy-labelling-refrigerators-dishwashers-washing-machines-televisions-computers-and-lamps_en

2.4.1 Overall results

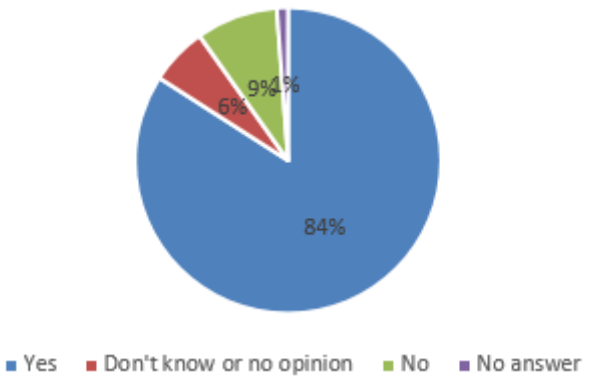
The first part of the questionnaire asked general questions aimed at EU citizens and stakeholders with no particular specialised knowledge of Ecodesign and Energy Labelling regulations.

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%)[78] 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)[79] 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 Dishwashers

Regarding technical questions on household dishwashers, of the participants who answered this question (c. 47%), only half of the respondents were aware that dishwashers are required to reach minimum cleaning performance requirements, and that this means that pre-rinsing is therefore not necessary. Approximately 30% of respondents were aware that longer time duration dishwasher programmes tend to use less energy than shorter programmes (caveats: c. 20% were not aware of this relationship, and a further 51% gave either no answer or responded "don't know/ no opinion").

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

[79] SMEs < 250 employees

With regard to what should be displayed on the EU Energy Label, c.50% of participants considered that information on the combination of time and energy consumption for dishwashers should be made more clearly available.

In order to be able to evaluate the performance of household dishwashers, participants considered the inclusion of the following aspects as "important" or "very important"[80]: most frequently used programmes (45%), most energy-intensive programmes (35%), programme duration (34%), and low power modes (33%). Consumers also considered that the most relevant parameters to be communicated on the EU Energy Label were the following parameters: water consumption, energy consumption and energy efficiency; this group was followed by a second group comprising noise emissions, capacity (amount of plates and glasses, etc.) and the combined cleaning and drying performance.

Regarding material efficiency elements, respondents gave the following answers for "important" and "very important" rankings: quick repair time (40%), post-repair warranty (38%), a detailed quotation for a complete repair (37%), a list of spare parts and instructions to enable self-repair (36%), a list of certified repairers (35%). If the "somewhat important" ranking is included for each of the above elements, this captures in each case an additional 9%-11% of respondents.

The two most numerous responses for the expectation of how long spare parts were expected to remain available for dishwashers were: more than 10 years (c.32% of respondents), and between 5-10 years (c.20%). Fewer than 2.5% of respondents cited a period of 5 years or less. (9% "don't know/ no opinion" responses were recorded, and c.37% 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 1016/2010 and (EU) No 1059/2010 was carried out between January and March 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. The additional data and information collection focussed on:

- additional market data, especially the differences between number of models and volume of sales of the energy efficiency classes for the period 2003-2013
- fine tuning of the metrics (revised standard)
- possible impacts on manufacturers

Inception Impact Assessments (IIAs) on *"Regulatory measures on the review of Ecodesign requirements for household dishwashers"* and "*Regulatory measure on the reviews of energy labelling for household dishwasher (EU) No 1059/2010*" were published[81] before the Consultation Forum. Feedback on both IIAs were received (11 and 9 comments respectively) on a number of aspects. In general, the feedback supported the Ecodesign and

[80] The response scale used ranged from the following possible evaluations: not important, somewhat important, important, very important, don't know or no opinion and no answer.
[81] Registered under references ARES (2018) 476416 and ARES (2018) 476380

Energy Label requirements for household dishwashers as they help mitigate climate change, help EU citizens save on their energy and water bills, and better integrate domestic appliances in a Circular Economy through the proposed reparability and recyclability requirements.

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. Feedback also focused on the resource efficiency aspects that are in general 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[82] was to inform the Commission on the impact of possible different icons and layouts of the revised energy labels for household dishwashers 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 household dishwashers, 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 (in terms of the number of place settings for dishwashers 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.

[82] 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 drying efficiency of dishwashers.

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 number of place settings, programme duration, and noise level, three icon alternatives were developed and tested. The icons were combined into the energy labels (see Table 2.1). Furthermore, the labels include an indication of the tested programme. The position of this information varies across the label alternatives.

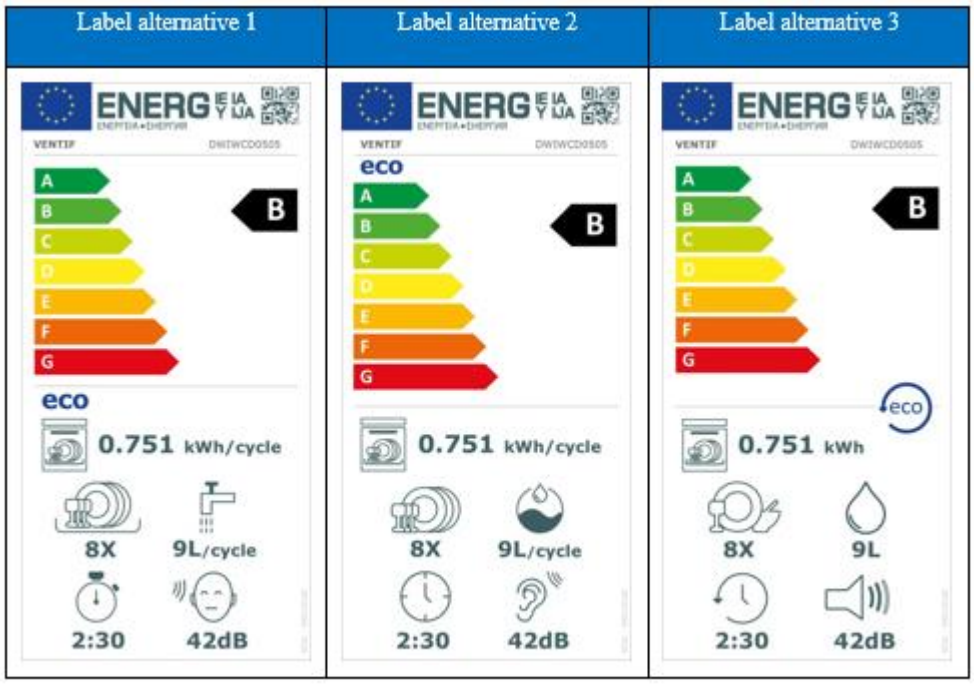


Table 2.1 Energy label alternatives

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 dishwashers, most respondents considered information on the water consumption relevant to include on the label (71.5%, see Table 2.1.1).

	% of respondents who find it important that the feature is displayed on the energy label
	Dishwashers
Water consumption	71.5%
Load capacity	58.7%
Programme duration	66.5%
Noise level	63.4%

Table 2.2. Perceived importance

Comprehension of the icons

Table 2.3 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.

Icons	Icon alternative 1	Icon alternative 2	Icon alternative 3
Water consumption	 39L	 39L	 39L
Number of place settings (dishwashers)	 12X	 12X	 12X
Programme duration	 4:00	 4:00	 4:00
Noise level	 72dB	 72dB	 72dB

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

Table 2.4 has the summary of the subjective comprehension results for dishwashers,. 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.

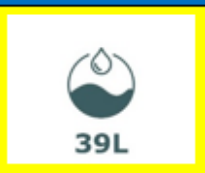
Icons	Icon alternative 1	Icon alternative 2	Icon alternative 3
Water consumption			
Number of place settings			
Programme duration			
Noise level			

Table 2.4. Dishwashers: subjective comprehension

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 is the summary of the results on objective comprehension for dishwashers, 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.

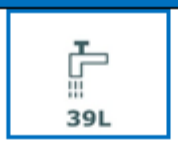
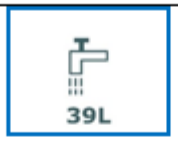
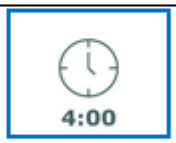
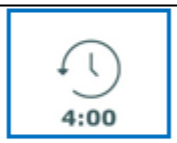
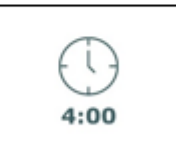
Icons		Icon alternative 1	Icon alternative 2	Icon alternative 3
Water consumption	Isolated icon			
	Icon in product context			
Number of place settings	Isolated icon			
	Icon in product context			
Programme duration	Isolated icon			
	Icon in product context			
Noise level	Isolated icon			
	Icon in product context			

Table 2.5. Dishwashers: objective comprehension

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 2.6) 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%.

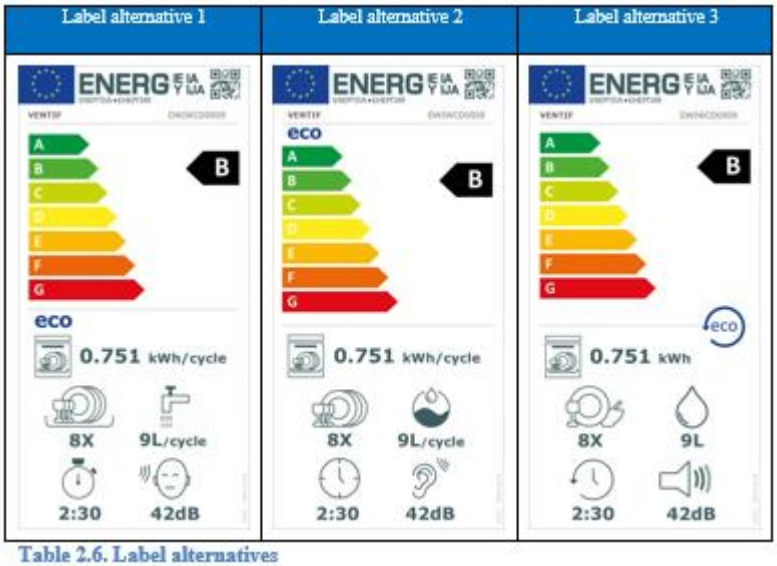


Table 2.6. Label alternatives

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.

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

THE COMMISSION REGULATION (EU) NO 1016/2010 ON ECODESIGN REQUIREMENTS FOR HOUSEHOLD DISHWASHERS;
THE COMMISSION REGULATION (EU) NO 1059/2010 ON ENERGY LABELLING REQUIREMENTS FOR HOUSEHOLD DISHWASHERS

BRUSSELS, 19 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 1016/2010 and Regulation (EU) No 1059/2010 and the proposed draft working documents and a point of information on ongoing activities on material efficiency aspects in Ecodesign and energy labelling.

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 1016/2010 and 1059/2010.

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:

- From the consumer studies undertaken during the review study, the "Eco programme" is used in 19% of washing cycles but the proportion seems to increase in recent years and is expected to continue increasing, as long as the duration of the "Eco programme" does not increase further than the current average duration of 3.5 hours.

- The high number of dishwasher models classified in the highest Energy Label class of the current regulation indicates that technological advances for the product group may not be fully exploited. Re-scaling of the Energy Label is expected to bring resource savings at minimal cost. New minimum Ecodesign requirements will push the market towards more energy efficient products.

- Material efficiency requirements may extend the lifetime of the appliances and bring additional benefits.

Some clarifications were requested:

UK asked whether, given the penetration rate of the heat pump technology dishwashers, a rescaling of the Energy Label would be needed in five or ten years. The **Commission** answered that the market penetration of the heat pump-equipped machines would most likely not reach a significant market share in 5-10 years.

DK enquired about the age of the data used and the effect of machine loading. The **Commission** confirmed that databases date from 2014-2015, and that the issue of loading (i.e., the proportion used of maximum capacity load) is not as crucial for dishwashers as it is for washing machines, i.e. the difference between the declared energy consumption and the actual energy consumed under common use conditions is not such that different loadings should be considered in the regulation.

SE requested the publication and distribution of the slides, which was confirmed.

NL asked if the new revised international IEC standard had been taken into account. **SE** enquired if the changes in the Energy Efficiency Index (EEI) were due to changes in the items loaded in the new IEC test. **CENELEC** (TC 59 WG 2) clarified that the changes in the new IEC standard consisted, inter alia, of the inclusion of new items (e.g., plastic items and pots), as well as the use of a different detergent, which corresponds more closely to current detergents on the market. The adaptation of the international standard to the European standard is underway, but it is important to emphasise that no other major changes are currently envisaged. Energy and water use are slightly affected when measured in accordance with the current, or the new standard, but the variations are within permitted tolerance error margins, therefore, the EEI should remain unchanged. **CECED** highlighted that the changed new standard represents an important progress in dishwasher performance testing. It is now more precise and relevant for consumers, includes different shapes and materials, and puts more emphasis on drying performance. These changes should also influence the present and future design of dishwashers to better reflect the interest of consumers.

AT considered that the proportion of use of the "Eco programme" had remained stable in recent years, even though the review study concluded that the use of the "Eco programme" by consumers was increasing. **CECED** clarified that since 2013, the "Eco programme" has been set as the default programme for new dishwashers, which has triggered the apparent increase in use. However, it should be noted that in older machines the Eco programme used to be called "normal programme", and therefore the real use of the equivalent "Eco programme/ normal programme" in the EU's dishwasher stock is actually much higher than indicated in the slides.

3.5 Presentation of the working documents

The Commission services presented the working documents via means of summary slides, with a subsequent discussion (see point 5 of these draft minutes).

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 Presentation of industry views

CECED presented the current market penetration of dishwashers and their breakdown in different Member States (MS), which varied from 3% to 77%.

It was highlighted that the number of models does not correlate with the volume of sales by model, e.g., models classed as A+++ according to the current Energy Label regulation only account for 9% of total sales, while models rated in lower classes account for the major part of sales. However, the new Ecodesign thresholds on maximum energy consumption presented in working document would exclude up to 50% of models currently on the market. The exclusion of "basic models" would go against realising the high energy and water savings potential in MS where market uptake is low, as dishwashers are more resource efficient than handwashing dishes.

CECED also presented Least Life Cycle Cost (LLCC) data for the average European case, as well as for outliers on the overall EU average household income spectrum, namely Germany (high) and Romania (low). According to CECED's calculations, the lowest overall life cycle cost would be achieved by dishwasher models that are proposed to be excluded from 2020 onwards.

3.7 Discussion of the working documents

3.7.1 Ecodesign

The **Commission** highlighted that common definitions and elements of the working documents would be revised following the input provided during CF held on the revision of the Ecodesign and Energy Label regulations for household washing machines and household washer dryers.

Article 1 – Subject matter and scope

No comments.

Article 2 - Definitions

DE suggested the term "dishwasher" be changed to "household dishwasher". **IT** commented that "*stand-by mode*" does not exist for dishwashers, therefore the definition should refer to "left-on mode" instead. **IT** also requested the definition of "*spare part*" be changed to that of "*necessary spare par*t", and that the definition of "*independent operator*" be redrafted in order to restrict the access of information to professional repairers only. **BE** agreed with IT and preferred the definition for "*independent operator*" as drafted in the working documents for household washing machines and household washer-dryers. **BE** also requested that the requirements on "*networked standby*" be double-checked.

CENELEC informed stakeholders that it is preparing a paper with new and redrafted definitions in line with the new IEC standard, which will be sent to the Commission.

CECED disagreed with the horizontal approach to low-power modes and related definitions.

Article 3 – Ecodesign requirements

CECED proposed that a reference to harmonised standards be included, since several standards might be used by MS to measure dishwashers' performance levels and Paragraph 4 only mentions that "*requirements should be measured in accordance with the methods set out in Annex II*". The Commission replied that it considers the present reference to the Annex to be satisfactory. **IT** proposed removing the word "*methods*" from the article, and only referring to Annex II where the harmonised standards are referred to.

No comments were made on **Articles 4, 5, 6 and 7.**

Article 8 - Revision

UK recommended including consumer behaviour and the hot fill technology.

CECED requested an assessment of the overall market penetration rate across the EU; **ANEC** asked for a reference to refrigerants regarding the heat pump dishwasher technologies.

CECED informed that it is carrying out studies on user behaviour on vacuum cleaners and tumble dryers, and that they might also be relevant for the discussion on dishwashers. The studies are being carried out by external consultants. The CF will be consulted for input and the information will be shared.

No comments were made on **Articles 9 and 10.**

Article 11 – Entry into force and application

Regarding the entry into force of the regulation, CECED requested 12-month minimum between the publication of the regulation and the entry into force in order for manufacturers to prepare for changes in the relevant standard, overlap and double labelling during the transition period, etc.

Annex I – Ecodesign requirements

Regarding point 1(1), **CECED** indicated that the spelling of "Eco" should not be written using three capital letters, but only with capital ‘E’. CECED will provide guidance on formatting in line with standards. The Commission will examine this point, with reference to standards.

BE proposed deleting the last sentence in point 1.1 "*The only other additional information which could be combined with the term "ECO" is temperature*". **CECED** clarified that the temperature itself has to be added to the name, to qualify cycles such as "Eco 45^{o}C", or "Eco 50^{o}C". The term in the standard is clear on this point. It states that only the temperature in numbers can be added and that only one "Eco" programme is permitted per appliance.

DE commented that the word "*divert*" in point 1(2) presents difficulties regarding interpretation by market surveillance authorities (MSAs). **DE** wanted information on the main programmes to be included in the product information sheet, adding that consumers generally do not read the booklet of instructions.

On this point, **CECED** commented that the list of names that may "divert" consumers from choosing the Eco programme is an open list. It would be better to include a fixed list rather than a negative list and be careful of possible misunderstandings due to translations.

IT did not agree with the term "*indicative information"* in point 1(3)(c). **IT** considered it to be ambiguous regarding MSA verification, as it is not indicated for which programmes it has to be provided. **IT** also requested point 1(3)(d) to be redrafted regarding pre-rinsing, omitting the last part of the sentence "…. *and is not needed to achieve the minimum cleaning performance*", since if the machine was not capable of achieving the minimum cleaning performance, it would not be placed on the market. **CECED** agreed with the inclusion of indicative information and therefore disagreed with IT, but agreed with deleting the last part of the sentence.

CECED pointed out that under point 1(3) there are several types of information, such as installation instructions and user instructions, which might be better provided in different documents or sources of information, e.g. information for installing built-in appliances, where a life-size foldable template is commonly provided. Therefore, it would make sense to continue allowing different formats of information.

Regarding point 1(4), **IT** asked what the term "sub-programmes" meant, as it is not defined in Article 2 of the Act.

UK indicated there are plenty of ways to load a dishwasher "*incorrectly*", therefore it is better to delete this term from point 1(4)b.

AT enquired if point 1(4)g ("door opening between cycles"…) is needed for dishwashers or whether this was a typographical error. **CECED** confirmed that it is needed, due to a technology based on opening the door that assists during the drying phase. Therefore, information should be provided to consumers.

IT suggested that in point 1(4) there should be separate instructions regarding maintenance and repair where breakdown occurs. **IT** also requested that information in points 1(4)k and 1(4)l be deleted as they could create additional confusion.

Regarding point 2, **CECED** remarked that the dismantling sequence regarding access to components is not necessary since industry has set out a platform in line with Article 15 of the WEEE Directive that contains sheets with information on dismantling several products. CECED therefore viewed Annex 2, point 2 clause to be redundant.

DE welcomed the proposal under point 2(1) of marking the heat pump-equipped dishwashers, as well as the link to the Article 15 of the WEEE Directive, and pointed to some aspects for consistency between both pieces of regulation.

BE suggested that the word "*documenting*" in point 2(2) be further specified to include where and to whom this information should be provided. This information can be very useful for recyclers, but not for other actors, and thus it could be provided separately or upon request.

IT suggested requesting the disclosure of information only at the end of the manufacturer's guarantee period, on the grounds that the repair would be undertaken by the manufacturer during this period in any case, and that the economic value of the information would diminish after 2 years.

Regarding point 3 ('Specific Ecodesign Requirements'), **NL** suggested that points 3(a), (b), (c) and (d) refer to the "Eco" cycle. **NL** also requested a maximum duration of 4 hours for the Eco cycle and the provision of 'off-mode' in addition to a 'left-on' mode and a 'pre-cycle'. Additionally, NL pointed out that, if networked standby is included, the requirements on left-on mode should be modified because the appliance should remain in the networked standby mode and not revert to the off-mode.

IT agreed that the requirement on point 3 (f) should be dependent upon the provision or absence of an energy management system. On this basis, the duration of the left-on mode should be determined and if and when it should revert to the off-mode. **BE** asked for clarifications on the activities performed by the dishwashers during the 20 min before reverting to the off-mode. **CENELEC** explained that this time is needed for the appliance to perform several checks such as leakage or safety checks. If consumers wish to know the result of these check-ups, a network connection has to be used, therefore the dishwasher cannot revert to the off-mode during this time.

UK, CECED, ANEC, DE and other stakeholders pointed out errors in points 3 (a) and (b) where the minimum energy requirements refer to 7 place settings, instead of 10 place settings. The **Commission** confirmed that the aim is that all types of dishwasher have the same difficulties to achieve good energy label classes. The calculation formula provided in Annex II, intends to reflect the different conditions between full-size and slim-lime dishwashers, with different calculation methods. However, both calculation methods and requirements can be revised to correct the spotted error and take account of comments received. **DE** warned against possible perverse effects for machines that are on the border between slim-line and full-size (i.e., 11ps products)

ECOS highlighted that the energy efficiency requirements proposed represent the lowest possible ambition and were not in line with the LLCC in the Review Study. CECED calculations were based on market prices and not on the cost of the technology. ECOS also noted that there was only one Tier, starting in 2020. Considering that this may be the last revision of Ecodesign requirements for household dishwashers, due to the small energy saving potential now left for this product group, it is important to fix it well. The alternative would be the set a second tier now and to keep the possibility to revisit it at the time of the next revision, i.e. in five years. This would give the time necessary to industry to adapt to the outcomes of the next revision.

CECED replied that the proposed limits are above and beyond the maximum. The reason for this is that 50% of the market is planned to be phased out, even though this would only achieve savings of 0.76 TWh. CECED concluded that resource savings should come from other aspects, e.g., a higher market penetration rate, and that regulation should not only target richer MS. Higher energy savings (up to 40TWh in 2030) could be achieved by making dishwashers attractive to those consumers that do not yet use them, via an Energy Label aimed at incentivising the purchase of good products, promoting the use of Eco cycles, and encouraging full loading.

IT commented that at certain point there should be a discussion on whether the Ecodesign minimum requirements could be relaxed in order to foster the higher market penetration rate (as referred to by CECED), keeping in mind resource savings compared to hand dishwashing. IT suggested scheduling a revision of the proposed measures in five years and to monitor closely the product's market penetration rates in the meantime. IT suggested this discussion be held at the Regulatory Committee, when MS will re-discuss the level of ambition.

ECOS responded that an informed debate is needed. More information on cultural aspects, elasticity price-demand by region, etc., is needed. ECOS noted that, thanks to stricter minimum requirements, people with a lower purchase power, will be able to buy better appliances and have lower energy bills during the use phase. ECOS added that the minimum Ecodesign thresholds are not designed to promote heat pump-equipped dishwashers.

CENELEC highlighted the high efficiency of current dishwashers that use approximately 10 litres/ cycle with an electricity demand of 1 kWh/ cycle. This is not reflected in the scenario proposed.

The **Commission** noted that it shared the objective of lowering the overall energy consumption in the EU related to dishwashing and therefore encouraging the use of dishwashers, but the Commission also highlighted that not all the expected savings would result from higher product uptake. The consumer studies carried out as part of the Review Study uncovered several reasons for not using a dishwasher at home, including cultural issues, smaller houses, etc. Furthermore, more stringent energy efficient requirements does not necessary mean more costly appliances for consumers and does not necessary limit the penetration rate of dishwashers in MS with low levels of income. Data on elasticities and price, considering the introduction of better technologies in the appliances would be welcome, in particular as input for the upcoming impact assessment.

IT expressed surprise that elasticity and other economic aspects had not already been considered in detail during the Review Study. The **Commission** confirmed that parameters such as elasticity in price demand are not usually considered. The MEErP methodology does not require price elasticity to be considered in the studies.

CECED would like to include among measures the provision of information that dishwashers save resources compared to hand dishwashing. CECED also remarked that energy and water consumption per person is generally higher in smaller households. Smaller households have a higher energy saving potential per capita than larger families and therefore the use of dishwashers should be encouraged. The purchase of a dishwasher does not only depend on the income but also on household size, as well as other factors.

DK asked CECED how much of the 50% market share claimed to be phased out (based on the proposed working documents) will still be on the market in three years, and if there are any market projections related to the dishwashers currently labelled "A+". **CECED** replied that A+ dishwashers have been on the market for a long time and are constructed to be the most affordable machines. **CECED** claimed that if the new revised regulations allow them to be placed on the market in the future, they will be purchased, especially by households that do not yet have a dishwasher. The availability of models on the market should be preserved. CECED members offer machines in the three present most popular Energy Label classes (A+, A++ and A+++). However, sales are concentrated in the A++ and A+

classes, as consumers calculate the LLCC and see class A+ as a reasonable option. A study carried out by DENA in households near Berlin showed that even when full-size DW were not fully loaded, they were able to save resources compared to hand dishwashing. These partial loads consume (a bit) less energy than full loads because there is a lower mass of dishes to heat up, and save energy even in comparison with energy consumption values declared on the Energy Label.

Annex II – Measurements

Stakeholders provided general comment on the title of the tables and the name of the standard cleaning cycle. **CENELEC** suggested to align the tables with the standard and will provide related information.

Annex III – Product compliance verification by market surveillance authorities

Regarding verification compliance by market surveillance authorities (MSAs), **BE, IT** and **NL** pointed out the need to revise the tolerances based on test reproducibility and the formatting of the decimal places (e.g., it should be "0.1W", rather than "0.10W"). The reference to the "*low power modes before starting the cleaning cycle"* was criticised as being vague.

CENELEC informed that the calculation of the drying efficiency index will be updated in the IEC Standard and that the relevant calculation formulae will be sent to the Commission. A round-robin test (RRT) will be performed and its results may be useful to update the tolerances included in Table 3.

NL noted that the timing of adoption of the revised Regulation does not allow waiting for the RRT results but keeping the tolerances unchanged should be a safe option, considering that the new standard should provide a more reproducible test method. This was confirmed by CECED. However, **CECED** considered that a RRT at European level should be conducted regardless.

Annex IV – Indicative benchmarks

UK and ANEC pointed out that the benchmarks on water consumption, time duration or noise emissions do not correspond to the same products. **CECED** reminded stakeholders that all the parameters are dependent on one another, and consequently one single product cannot reach all the benchmarks simultaneously. Also, if all the specific parameters for all kind of appliances were listed, the list would be very long.

DE indicated that even though the heat pump-equipped DW is the most energy-efficient technology on the market, it should not be considered for the determination of benchmarks because of the high price of the technology and its low availability on the EU market.

TOPTEN replied that the heat pump-equipped dishwashers have been on the market since 2014, and that the products are produced in small series. The business model of the manufacturer is to place the model on the market via installers, rather than via mass distribution via supermarkets.

BE suggested to include a reference to the database where the benchmarks were identified. **NL** indicated that this annex was included to keep a record of the measures to foster energy-efficient products in Member States. The use of this annex is currently limited.

IT suggested to replace the annex with a reference to a dynamic benchmark database so that the benchmarks would be regularly updated (e.g. EPREL[83]). The **Commission** replied that referring to a database is possible, but also commented that the Energy Efficiency Directive (EED) includes a reference to this annex in relation to public procurement. This means that if the annex was replaced by a dynamic database, there may be consequences on MS budgets. **SE** stressed that the EED indicates that buying products that fulfil the benchmarks is only required if there is enough competition at the level of national markets and if it is economically feasible.

ECOS noted that the reference to the database could be fixed at a given date, and ECOS would prefer the reference to be additional rather than replacing the annex. **SE** commented that not all the products are covered by both Ecodesign and Energy Label regulations so a reference to the Energy Labelling database could not replace the benchmarks in all cases.

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

Comments from the CF on washing machines will be considered also for dishwashers.

3.7.2 Energy Labelling

No comments were made on **Article 1, 2 and 3**.

Article 4 – Obligations of dealers

RetailEurope requested the removal of the requirement to display the label on the front door of the appliance and suggested that the Energy Label be placed close to or inside the product, but not necessarily on it. **DE** disagreed on this point but pointed out that practices differ between MS, therefore clarification is needed. **IT** and **NL** agreed with **DE**. **BE** pointed out that if the requirement is considered inadequate by consumers or inspectors, enforcement becomes difficult. **IT** noted that retailers used the excuse that built-in products (e.g. in a kitchen) are not displayed for sale and therefore the label was not necessarily displayed; this needs to be addressed.

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

Article 7 - Revision

Several stakeholders asked that it be aligned with the Ecodesign regulation and other product groups.

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

Article 9 – Entry into force and application

CECED and **DE** expressed concerns about the gap between the repeal of one regulation and the entry into force of the new regulation and its associated requirements. The **Commission** confirmed that it will be revised.

Annex I – Definitions

[83] European Products Registration database for Energy Labelling

Several stakeholders pointed out that the definition of "*Eco programme or cycle*" must be in line with the Ecodesign regulation.

Annex II – Energy efficiency classes

NL stated that the heat pump-equipped machines should not distort the rest of the classes. NL ascertained that dishwashers as a product group were not a fast-moving technology and, therefore, the Energy Label Class B should be populated from the beginning. If heat pump-equipped dishwashers are not considered as reference products, dishwashers equipped with other technologies would then have a wider spread between the seven Energy Label classes. **DE** supported the comments of NL on the non-consideration of heat pump-equipped dishwashers and requested that energy efficiency class G should also be populated by full-size and slim-size dishwashers, and not only by table-top dishwashers (< 7ps). Additionally, **DE** commented that the requirements for light noise are very strict and that 38 dB(A) should move to 41 dB(A). **UK** reminded stakeholders that, according to the new 2017 revised Energy Labelling framework regulation, the Commission is obliged to revise the Energy Label if Class A is not populated during the next period of 8-10 years. The draft requirements are based on wrong assumptions in UK's view. **SE, HU, CECED and IT** agreed with UK and **SE** added that the objectives of the energy label will not be met if in 2030 only 10% of the products are in in Energy Label Classes A and class B.

ECOS disagreed with the suggestion that a technology can be ignored when it is already on the market. The Energy Label Regulation clearly states that Energy Class A should be empty at the time of writing the regulation. On the other hand, the classes could be rearranged, so as to place more products in Energy Label Classes C or D, in order to prevent these products from being poorly viewed by consumers. It must be made clear to consumers that hand dishwashing is not more environmentally friendly than using a dishwasher. Populating the yellow or green Energy Label classes to an extent would ensure that people understand that there are also good and very good products.

IT suggested that noise emission classes should follow an A-G scale, in line with the general energy label. IT also recommended that this A-G noise label have common dB(A) ratings for all products subject to Energy Labelling. **IT** viewed the proposed icons as open to circumvention.

IT asked to re-introduce drying efficiency on the Energy Label or to clarify why it has been withdrawn. **CENELEC** clarified that the drying efficiency is currently only in the technical documentation, together with a value. **CECED** considered that, for consumers, the presentation in classes are more important than the figures to understand this information and to compare easily the performance of different appliances.

The **Commission** confirmed that no product can be placed in Energy Label Class A at the moment of writing the regulation. **CECED** commented that the heat pump-equipped dishwasher technology is a benchmark when measured with the current standard, but that possibly it might not have "benchmark" status according to the new revised standard. **NL** proposed to include a time cap on the duration of the "Eco programme"; if this were set at 4-hour following consumers' preference, this would mean that heat pump-equipped dishwashers would currently not meet this requirement. **BE** agreed with NL and pointed out that the inclusion of an additional parameter on duration in the calculation of the EEI could be another way to address this situation. **IT** suggested taking inspiration in the air

conditioners regulation for a correction factor on duration taking into account the global warming potential of refrigerants.

ECOS expressed concern about the suggestion to exclude a product that is already on the market, because it is seen as too efficient. **DK** agreed and added that future technology developments may change the situation quicker than expected, as happened already in the past.

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

Annex IV – Label

DE recommended the use of "waves" to improve the understanding of the three noise classes proposed, and to keep the energy consumption per year (rather than per wash cycle) because it is more meaningful to consumers. DE considers that the time cycle icon is not relevant for dishwashers as duration is not such an issue; information on place settings capacity is not important and overloads the label with information.

AT and **SE** disagreed with the removal of the time icon and support the Commission's proposal.

ANEC stated that the issues of time and noise icons should be tested in the consumer survey still to be carried out before conclusions are drawn on the label. The **Commission** supported this point.

Annex V – Product information sheet

CECED commented that according to Article 3 of the 2017 Energy Label Framework Regulation (2017/1369), the product information sheet can also be provided in the database instead of on printed material. **CECED** asked for clarification on this point, since manufacturers would need to provide printed information in all languages for all models. Additionally, **CECED** asked for clarification regarding the change of information in the product information sheet, especially regarding Energy Label class, following e.g. reclassification or innovation/ improvement. Should the model be entered in the database as a new model? If so, this would produce redundant information in the database due to small changes in model properties.

IT commented that some information will be obsolete when the product database is introduced. Regarding the previous CECED comment, **IT** does not think there is need for new entry if the change is due to a change in the Regulation. However, if the change is decided by the manufacturer, then the revised model is to be included in the database as a new model.

On (f), **DK** noted that figures for power consumption should not be rounded to the nearest integer but to 2 digits.

No stakeholder comments were made on **Annexes VI, VII and VIII**.

Annex IX – Product compliance verification by MSAs

IT requested the deletion of the sentence immediately following point (7), which allows multiple test methods and tolerances, and insisted this be applied equally to the Ecodesign

regulations, since a unique tolerance value for the two phases of the verification is already foreseen for other products covered by ecodesign and energy labelling Regulations. Due to the horizontal nature of the verification procedure there is no reason for using a different approach when similar parameters are verified.

CECED explained that, statistically, there is no reason why tolerances applied to more than one treatment should be different. However, **NL** clarified that if more measurements are taken and if there is a normal distribution, the higher the number of testing, the variation decreases by a square factor – this is why the results from 3 and 5 measurements can be different. However, for verification and market tolerances it is important to identify the outliers. **SE** clarify that there are differences with the number of measurements, but it depends on the parameter to be measured. For example, if the variation in production is measured, it makes sense to have different tolerance values but not if the performance is measured. 5% seems to be already a good value and does not need to be reduced. **BE** proposed to omit the practice of undertaking three subsequent tests. The **Commission** replied that it cannot be left out from the verification procedure as such.

CECED commented on point (3) regarding equivalent models. As there will be a large product database in which all individual models will be listed, there should be a minimum cross-check before excluding all equivalent models to examine if the non-compliance is due to typographical errors, and if all other equivalent models are correctly noted. **IT** agreed but pointed out that this process should also be applied the other way around, i.e., if a model is found to be non-compliant, all equivalent models should also be noted as being non-compliant. However, **NL** considered the current drafting of point (3) to be appropriate, and that if MSAs identify a model that is non-compliant, then the MSA must contact the manufacturer, so that remedial action can be taken, and report the non-compliance accordingly.

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

3.8 Conclusions

The **Commission** thanked the speakers and all participants for their contributions to the Dishwashers consultation, as well as to the afternoon Material Efficiency session. Comments on the working documents are expected by 2 February 2018.

The next steps for the Dishwashers file would include the drafting of an amending regulation, the Impact Assessment, followed by the usual steps of Inter-Service Consultation and WTO notification. The Commission 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 a Regulatory Committee and an Expert Group meeting in October 2018, for its inclusion 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 Health, Food chain Safety and Environment
BG	Ministry of Economy
CH	Swiss Federal Office of Energy
CZ	Ministry of Industry and Trade
DE	Federal Environment Agency
	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
HU	Department of Industrial Control, Ministry of National Economy
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
CLASP
CLC/TC 59X
ECOS
EuRIC
EuroCommerce
FEICA
Independent Retail Europe
ORGALIME
TOPTEN

Annex 4: Evaluation of the Ecodesign and Energy Labelling Regulations for household dishwashers

In the context of the Better Regulation policy[84], 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[85] was carried out by the Commission in 2015. Main findings and conclusions were presented in a Report to the European Parliament and the Council[86]. 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 from 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 regulation: ensuring a transition towards more energy-efficient household dishwasher appliances, and achieve significant energy savings. Other impacts are quantified but are not analysed in depth.

4.1.1. Conclusions of the review study

The review shows that further improvement potential for the energy efficiency of household dishwashers is possible and that resource efficiency requirements are important. The review study made a number of recommendations on ecodesign and energy label requirements that could be introduced or modified for dishwashers. These were based on the technical, market and economic analysis that was carried out. The European Commission has used these recommendations, together with the most recent data available from industry, as the basis for the proposed revision of Ecodesign and EU Energy Label requirements.

These aspects can be summarised as follows:

- Energy label classes: some dishwasher models already exceed the current EU Energy Label class A+++, especially those appliances with a higher rated capacity

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

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

[86] 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

and which are equipped with heat pumps. An update of the energy labelling classes should provide a continuing incentive for manufacturers to carry on improving their appliances.

- Water consumption: the water consumption of household dishwashers per cycle and place setting is closely related to energy consumption, and both have been reduced significantly in the past few years. On the other hand, the consumer survey shows that a large share of households still usually pre-rinse each item, or at least pots, pans and casseroles under the tap which consumes additional water (and energy, if hot water is used).

- Use of the standard programme: for household dishwashers, only 19% of consumers use the standard ("Eco") cleaning programme that is prescribed for testing the appliance's energy performance. The normal/regular programmes are used more often (39% altogether) and consume more energy and water than the standard programme. It should be noted, however, that since the introduction of an obligation in 2012 to clearly mark the standard (Eco) programme on the machine, and set it as the default option, its use has increased. The increased use of the standard (Eco) programme among consumers underlies the continued selection of this programme for measurement purposes. Moreover, certain aspects of the standard are currently under revision so as to better reflect the real-life use of the dishwashers.

- Programme duration: the standard (Eco) cleaning programme, whose energy consumption value is displayed on the EU Energy Label and thus influences the purchase decisions of consumers, is designed and configured to improve energy efficiency. However, lower standard (Eco) programme energy consumption values are often achieved via firstly reducing the cleaning temperature and secondly prolonging the programme duration (characteristics that, according to the so-called "Sinner's Circle" principle, consumers find inconvenient). The 2015 user survey indicates that most consumers are willing to accept a maximum of 2-3 hours, whereas there is a reluctance to accept a total cleaning/ drying cycle duration of more than 3 hours. However, the use of the standard (Eco) programme has recently increased even though its duration has stabilised at around 3.5 hours.

- Technical innovation: the results from the review study show that additional energy savings could be achieved by implementing further technical improvement design options, such as fans, automatic door opening, improved sensors, heat exchangers and consumer feedback mechanisms. These options barely influence the life cycle cost. The use of a heat pump increases the life cycle cost and does not obtain the energy saving results to the extent that would be expected from the increase in the energy efficiency performance of the standard (Eco) programme. This is due to the fact that, in real-life, other programmes are preferentially used, in which the heat pump is responsible for negligible, or very low additional emergy savings.

- Resource efficiency: there are statistical indications that the proportion of household dishwashers that have to be replaced earlier than the expected average lifetime has oncreased, especially within the first 5 years. Another contributing factor may be potential misuse of appliances by consumers.

This review study makes a number of recommendations on the Ecodesign and EU Energy Label requirements that could be introduced or modified for dishwashers. These were based on the technical, market and economic analysis that was carried out. The Commission has used these recommendations, together with the most recent data available from industry, as the basis for the proposed revision of Ecodesign and EU Energy Label requirements. These revisions aim to address the market failures that have led to some utilisation of sub-optimal design features by manufacturers, and a lower than expected use by some consumers of dishwasher programmes which contain improved environmental performance feautres, The revised requirements aim to:

- Realise the potential for cost-effective improvements to the energy efficiency of dishwashers;
- Reduce the use-phase energy consumption and emissions associated with dishwashers, thus reducing the overall effect that these products have on the environment;
- Realise the potential for increased resource efficiency, via requirements that facilitate repair (e.g. provisions and design for easy repair);
- Realise the potential for increased resource efficiency via requirements that facilitate recycling and depollution at the appliance EoL (e.g. design for dismantling, for the prupose of depollution, recovery and recycling).

4.1.2. Market transformation and innovation

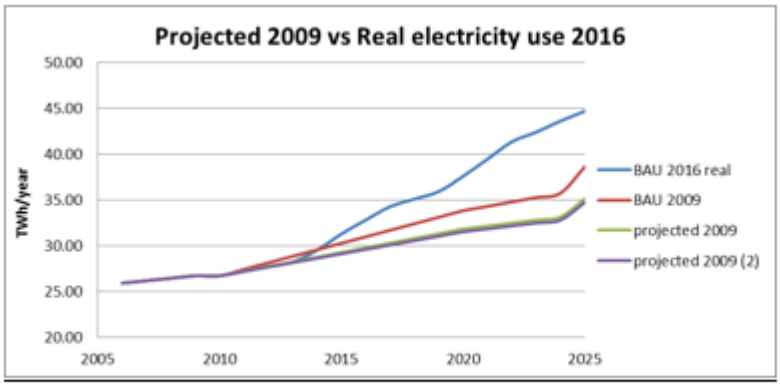


Figure A4.1: Electricity consumption of household dishwashers 2002-2025. According to BAU and projected 2009 scenarios assessed in 2009 version versus real 2016 (BAU 2016) scenario

Figure A4.1 gives the real energy use up to 2016 and continuing trend under BAU, compared with the estimated BAU and projected energy consumption in the impact assessment 2009[87]. The comparison shows an important divergence between the assessment and reality. An energy use of approximately 30 TWh was expected in 2016 but in reality the energy use was close to 33 TWh. This is due to the higher number of appliances in use. The financial crisis caused sales and stock not to grow around 2010-2012, but the total number of appliances in 2016 exceeded again what was expected.

[87] EC. Impact assessment, SEC (2009)

The technical innovations came from a series of innovations at component level and system level as described in Review study 2017. In absolute numbers, the electricity consumption increased during the period under analysis due to the increase in the sales and the stock. However, as shown in Figure A4.2 the energy consumption per place setting or per cycle experienced a notable improvement. Therefore, it can be concluded that the current regulations have driven the market in the desirable direction and therefore can be considered as effective.

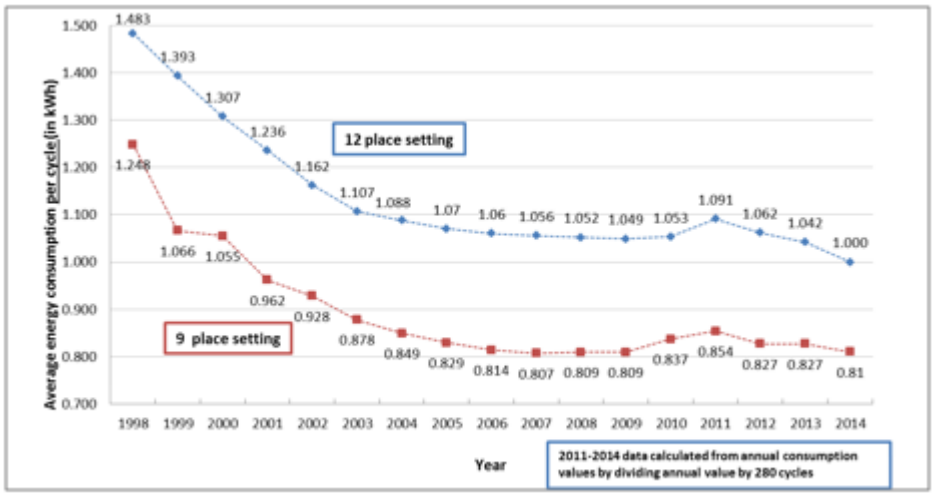


Figure A4.2: Electricity consumption of an average household dishwashers 2002-2014

Regarding the water consumption the impact assessment 2009 forecasted a water consumption of 389 million m^3 in 2020 and estimated a possible saving of 63 million m^3 water for 2020 in comparison to the BAU scenario. In reality, the consumption of water in 2020 is expected to be 390 million m^3. Considering the increasing stock, it can be considered that the regulations have also been effective for this resource.

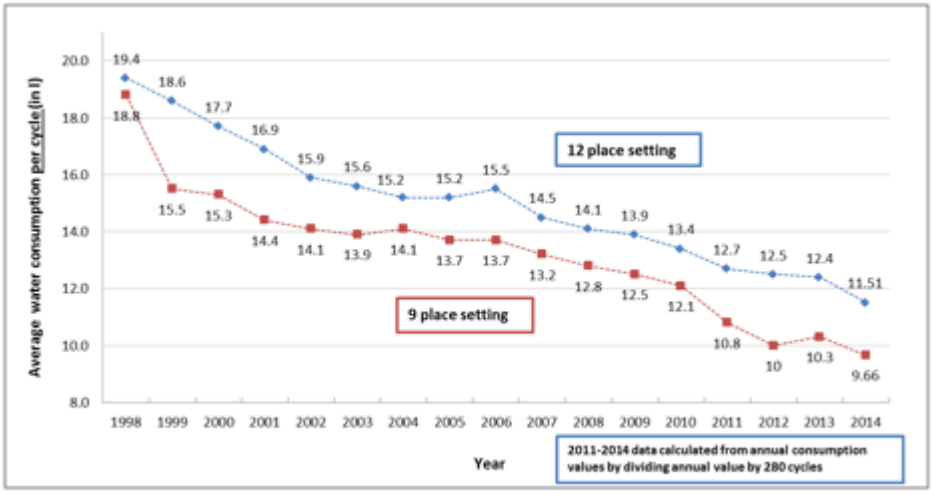


Figure A4.3: Water consumption of an average household dishwashers 2002-2014

4.2. Efficiency

This section describes how efficient the current Regulations have been in delivering the above mentioned benefits.

Table A4.2 gives an overview of the different average prices per appliance in a scenario where no measures were 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 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	544	569	578
Current impact assessment (fixed 2015) EUR		557	566
Reality (EUR)			573

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 9 euro extra compared to the BAU scenario. This amount is distributed among the different actors as follows:

- VAT (20%) = EUR 1.5

- Retail = EUR 2.95

- Industry = EUR 4.54

At almost 8.5 million units sales per year this means an extra revenue of EUR 12 million for the tax office, EUR 25 million for retail and EUR 39 million for industry.

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

	2015 - BAU	**–2015- A 4**
Average price per appliance (EUR)	557.13	565.80
Average electricity consumption (kWh/a)	262.53	237.55
Average water consumption (m^3/a)	2.87	2.70
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)	689.15	623.57
Water cost over the product life (12.5 years) (EUR)	165.64	155.93
Total life cycle cost (EUR)	1411.92	1345.29

Table A4.3: Life cycle cost calculation in a BAU and A4 in fixed 2015 Euros.

In total consumers will pay EUR 66.63 less per unit, which, considering 8.5 million unit sales per year, means savings of around EUR 566 million for consumers. The administrative burden of the current legislations was calculated at EUR 0.02 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 dishwashers effectively. Moreover, they deliver substantial savings.

However, higher savings could be achieved by revising the requirements. This forms the basis of the proposal for an updated regulation. Moreover, the current regulations not only regulate the energy efficiency of the appliance but also the use of the resources (material efficiency). The Review study 2017 indicated that household dishwashers can contribute substantially to the Commission's Circular Economy Initiative.

Annex 5: Analytical model used

5.1 General introduction

Given the long track record of energy label and eco-design regulations of household dishwashers, the data availability is good. APPLiA collects data of all models on the EU-market and has done so for many years. These data are not sales-weighted. However, market consultant provided with sales data for several years. Correlations between the number of models and the number of units sold have been used based on these data.

The calculation formula of the Energy Efficiency Index (EEI) of a household dishwasher model for all policy options is the same and is based on the comparison of the Eco programme energy consumption (EPEC) of the household dishwasher to its standard programme energy consumption (SPEC).

(a) The Energy Efficiency Index (EEI) is calculated as follows and rounded to one decimal place:

$$EEI = \frac{EPEC}{SPEC} \times 100$$

EPEC = Eco programme energy consumption of the household dishwasher;
SPEC = standard programme energy consumption of the household dishwasher.

(b) The standard programme energy consumption (SPEC) is calculated in kWh/cycle as follows:

(i) for household dishwashers with rated capacity ps ≥ 10 and width > 50 cm:

$$SPEC = 0.025 \times ps + 1.350$$

(ii) for household dishwashers with rated capacity ps ≤ 9 or width ≤ 50 cm:

$$SPEC = 0.090 \times ps + 0.450$$

where ps = number of place settings

The use of different formulas for full-size dishwashers and for smaller dishwashers (slim-line and counter-tops) is kept from the current Ecodesign Regulation EC (EU) No 1016/2010. The reason for this is that as the review study confirmed the presence of a distinctive market segment for the smaller dishwashers, which consumers choose when there is no space for a bigger appliance. This segment represents less than 10% of appliances sold. As the markets are different, it is considered that smaller appliances will be compared between them as regard energy efficiency and bigger appliances between them.

5.2 Baseline

Market Take-up of Dishwashers in Households in the EU and the Future Market Penetration Rate

The total annual sales of household dishwashers in the EU-28 were close to 10 million units p.a. (2016), and 10.5 million p.a. (2017). These figures relate to an average market penetration rate across Europe of 46%[88], i.e., just under half of the EU's households now possess a dishwasher. Of the c. 85 million of household dishwashers in service in 2015, approximately 85% were full-size household dishwashers (with a rated capacity of ≥ 10ps and width > 50 cm), and 14% were slim-line dishwashers (with a rated capacity of ≤ 9 ps, and/or household dishwashers with a width ≤ 50 cm). The amount of (even smaller) so-called "counter-top dishwashers" (less than 7 ps) was negligible.

In recent years, an increase in the rated capacity of household dishwashers offered on the market has been noted (see Figure A5.1). This may be partially an indirect effect of the Energy Labelling Regulation, as appliances with high rated capacity are often classified in the higher energy classes. This phenomenon is common with other household appliances (such as washing machines and tumble dryers) and a number of stakeholders, in particular environmental NGOs and some Member States, consider that the calculation of the Energy Efficiency Index (EEI, which forms the reference for the limit levels used in the Ecodesign and Energy Labelling dishwasher regulations) should be revised to counter-balance this trend. However, due to "maximum standard size" limitations in fitted kitchens (60cm x 60 cm x 90 cm), this trend for ever larger dishwasher rated capacities now seems to have run its course, because the physical limits of how many place settings may be incorporated within the above volume limit seem now to have been reached.

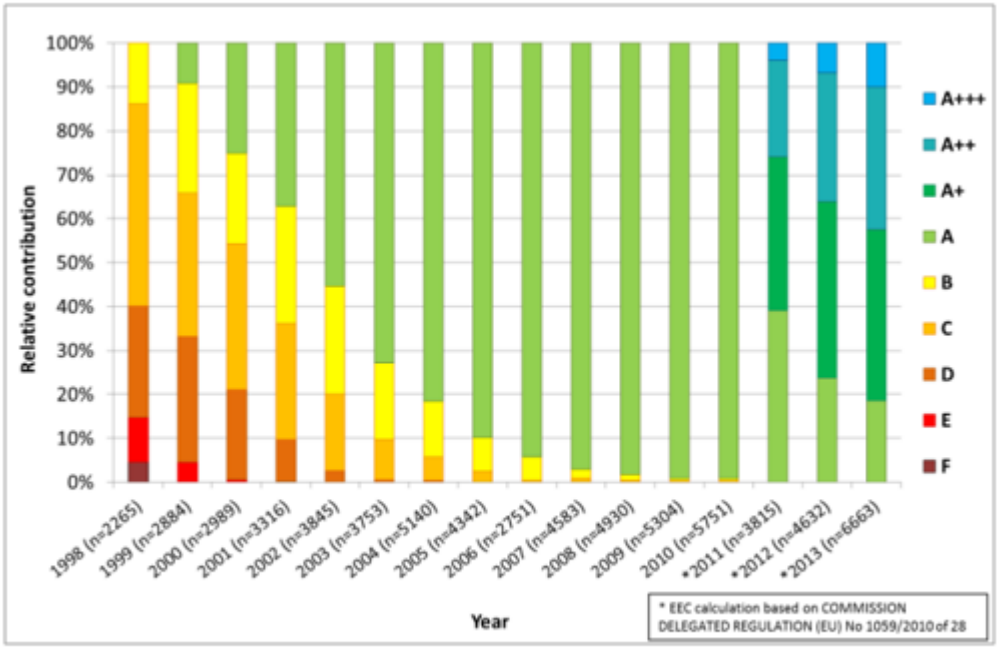


Figure A5.1: Development of the distribution of available dishwasher models with regard to the EU Energy Label classes, up to and including 2013 on the

[88] Source: APPLiA (2018): all units sold in 2017, and penetration rates based on an EU number of households cited of 216.8 million.

During the last four years the dishwasher market has not only split by size, but it has also diverged according to efficiency classes, as shown in Table 19. The trends illustrated in Figure A5.2 are shown even more in updated 2016 marketing data received from APPLiA in late 2017 (see Table A5.1). For the larger (≥ 10 ps) dishwashers, around one-third (2016 data) of the models in the product ranges qualify for the A+++ highest energy class, with just under half being in the A++ class. Comparative figures for 2013 are 10% (A+++), and around one-third in both A++ and A+. This shows the rapid pace of technological development offered in the more popular larger machines, but progress for the smaller machines is much steadier.

Table A5.1. Energy efficiency class distribution over time, depending on the rated capacity of the household dishwashers

Year	Energy efficiency class	Larger dishwashers: rated capacity ≥ 10 ps and width > 50 cm **(c. 85% of sales overall)**	Rated capacity ≤ 9 ps and/or with a width ≤ 50 cm	Rated capacity ≤ 7 ps
2016	A+++	31%	8%	0%
	A++	44%	23%	0%
	A+	25%	57%	85%
	A	0%	12%	15%
2015	A+++	14%	6%	3%
	A++	43%	50%	20%
	A+	43%	10%	47%
	A	0%	34%	30%
2014	A+++	18%	3%	0%
	A++	41%	12%	0%
	A+	41%	52%	16%
	A	0%	33%	84%
2013	A+++	10%	2%	
	A++	36%	8%	
	A+	38%	42%	63%
	A	10%	49%	37%

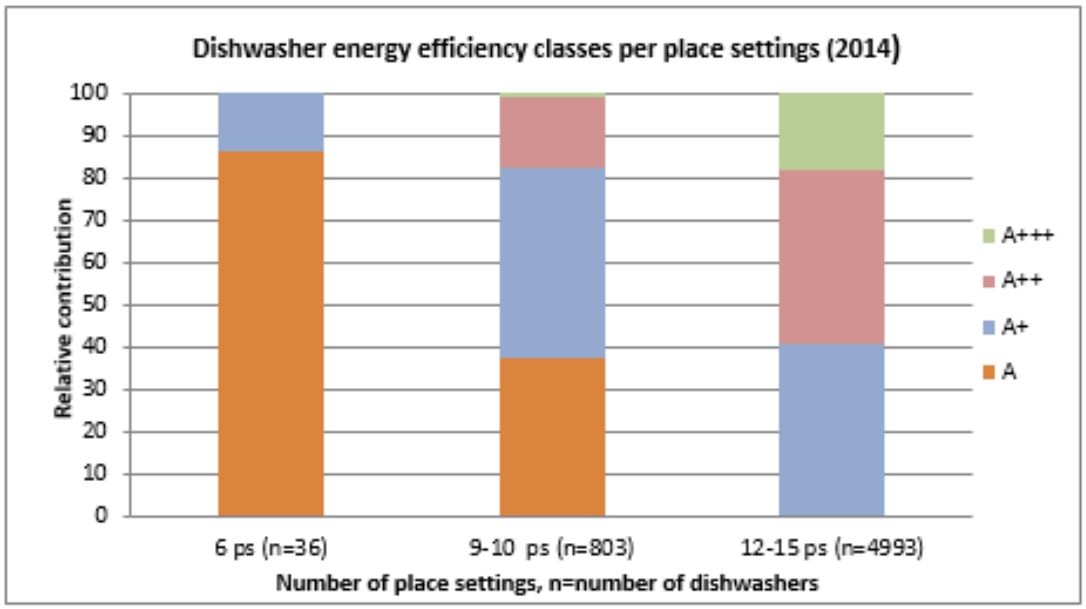


Figure A5.2: Sales Distribution of models of dishwashers with different rated capacities into A to A+++ EU Energy Label classes on the European market (2014) (data from CECED, personal communication)

Sales of household dishwashers show a continuous upwards trend in the EU-28 overall. In Western Europe (former EU-15), market penetration rates of 50% to 77% are not uncommon, while in Eastern Europe (former EU-13) there is more potential for additional sales, since market penetration rates are still much lower.

For example, Romania had a penetration ratio close to 3% in 2016 (reported by APPLiA in the Dec. 2017 Consultation Forum). The overall drivers for the market are mainly the product sales per se, which then lead to an increase in the sales for replacement parts for in-service machines, and the increases in the number of (overall, especially smaller) households in general throughout the EU-28.

For the business-as-usual (BAU) scenario, dishwasher sales are assumed to maintain present growth rates, to go from the present **46%** market penetration (overall EU-28), to reach an average penetration ratio at EU-27 level of approximately **65%** in 2030. The current electricity consumption of household dishwashers is 31.27 TWh (2015 data), which has grown from 14.64 TWh in 2006. Under the BAU scenario, electricity consumption would increase to 48.96 TWh/year by 2030, owing to the growth in stock.

Similarly, the current water consumption of household dishwashers is 318 million m^3 (2015), which has more than doubled since 2006 (144 million m^3). BAU projections are that water consumption would increase to 531 million m^3/year 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, in 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 as analysed, and Timeline Distribution of Dishwasher Sizes on the Market

The base cases with larger major market shares are 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 the base cases identified for the impact assessment are the same as in the review study, but some of their characteristics have been reviewed.

TableA5.2. Summary of the base cases for dishwashers extracted from the preparatory study[63]

	BC1 (13 ps)	BC2 (10 ps)	Sources
Nominal rated capacity (ps)	13	10	BC1 "13ps": 31% 13ps models and 25% 12ps models in 2014 BC2 "10ps": 7.7% 9ps models and 6.1% 10ps models in 2014
Width (cm)	60	45	BC1 "13ps": most 13ps models with 60 cm width BC2 "10ps": most 10ps models with 45 cm width
Manufacturing cost (in EUR)	205	205	BC1 "13ps": Calculated from the assumed average recommended retail price (RRP) Manufacturing costs plus 28% costs for manufacturers' marketing & administration, multiplied by a factor 2.5 to account for the sales margin plus 21.6% for average EU VAT 2015.

	BC1 (13 ps)	BC2 (10 ps)	Sources
			BC2 "10ps": no difference in manufacturing cost compared to BC1.
Recommended Retail Price (RRP)	800	750	According to own investigations and stakeholder feedback.
Observed Retail Price (ORP)	526	516	Based on analysis of top seller products at *Mediamarkt* store national websites (IT, BE, DE, ES, PL, SE) (13ps and A++; 9 or 10ps and minimum A+) Obviously many appliances are sold for prices lower than the RRP. However those price reductions do not have a direct relation to the manufacturing costs or the RRP and differ greatly between retailers and trade channels.
Maintenance and repair costs (in EUR/lifetime)	57	57	BC1 "13ps" / BC2 "10ps": assumption that 37% of the dishwashers are repaired once in their lifetime at 155 Euros
Energy Consumption			
Energy consumption Eco programme (kWh/cycle)	0.96	0.87	BC1 "13ps" / BC2 "10ps": annual average energy consumption divided by 280 cycles per year (annual energy consumption of left-on and off-mode neglected, estimated around 4kWh/year, i.e. 0.01 kWh/cycle)
Energy consumption including other programmes (real-life conditions) (kWh/cycle)	1.04	0.97	Based on the use and energy consumption of other programmes than the Eco programme
Water consumption			
Water consumption Eco programme (L/cycle)	9.8	10.3	BC1 "13ps" / BC2 "10ps": annual average water consumption divided by 280 cycles
Water consumption including other programmes (real-life conditions) (L/cycle)	10.9	12.1	Based on the use and water consumption of other programmes than the Eco programme (see **Error! Reference source not found.** and **Error! Reference source not found.**)
Detergent consumption:			
Detergent consumption (g per cycle)	20	20	Assumption as 20 g as mostly tabs are used with on average content of 20 g detergent.
Rinsing agent (g or ml per cycle)	3	3	Data taken from [89]
Regeneration salt (g per cycle)	19	19	Own estimation
Other parameters:			
Noise (dB(A))	45	48	BC1 "13ps" / BC2 "10ps": CECED database 2014: average noise level of 13 ps DW models (n=1 821) and 10 ps DW models (n=362)
Cycle time (min) (Eco programme / real-life conditions)	196 / 124	185 / 123	Based on direct input of stakeholders
Lifetime (years)	12.5	12.5	BC1 "13ps" / BC2 "10ps": First useful service life of dishwashers replaced due to a defect (i.e. technical product lifetime) is 12.5 years

[89] Revision of European Ecolabel Criteria for the six detergent product groups: Technical report and draft criteria proposal. For the second AHWG meeting (Draft), last accessed on 07 Oct 2015.

Figure A5.3 illustrates the progression of sales via market share of 9 ps, 12 ps, 13 ps and 14 ps models during the period 1998-2013 (APPLiA, 2017). The following is noteworthy:

a) *Full-size household dishwasher*: according to the information provided in the review study the majority of household dishwasher models offered on the market are full-size dishwashers. In this category appliances with larger capacities are increasing in market shares. Dishwasher models with a rated capacity of 12 ps show a downward trend from a market share of 40% in 2013 to a market share of 25% in 2014. However, 14 ps dishwashers have increased their market share from 11% in 2013 to 23% in 2014.

Full-size dishwashers with a capacity of 13 ps had the highest market share (31%) in 2014 and are selected as the base case representing the full-size household dishwashers.

b) Slim-line household dishwasher: in this product group those dishwashers with a rated capacity of 9 ps are still the majority (7.7% in 2014) but show a slightly downward trend. However, 10 p s dishwasher models show an upward trend (4% market share in 2013, up to 5.7% in 2014). Due to this increasing trend, dishwashers with a nominal rated capacity of 10 ps were chosen as the base case of slim-line dishwashers.

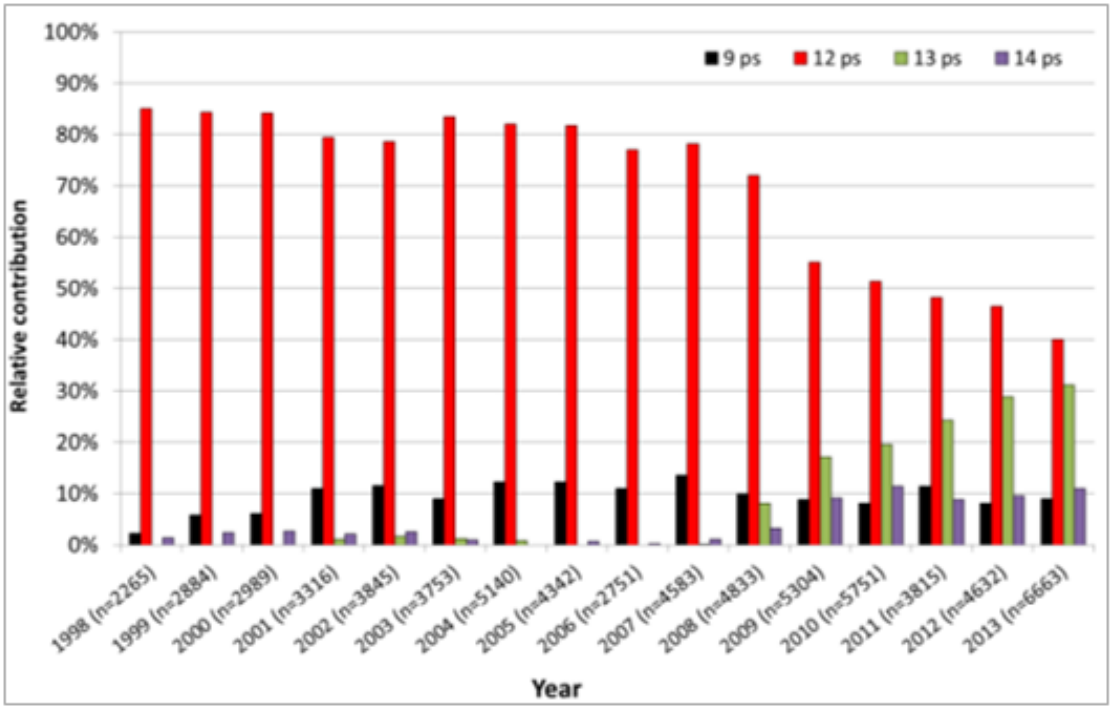


Figure A.5.3. Shift of market shares of dishwasher capacities (in ps = place settings, n = number of dishwasher models available on the European market in a certain year) [data from APPLiA, personal communication]

5.3 Analytical model used

This impact assessment has made a major effort to reduce the inherent uncertainty of quantitative data within above mentioned limitations. It has subdivided the market in two segments, full- size and slim-line household dishwashers, each with their specific commercial and technical characteristics. The market shares of each of the types of dishwashers have been kept constant at 86% and 14%, respectively.

5.3.1 Sales and Stock

General data availability for the scenario analyses of household dishwasher appliance is good. For sales, stock and prices of the dishwashers stakeholders provided information and for energy efficiency there are time series of APPLiA database. However, the data represent the numbers of models which are placed on the EU market, and are *not* sales-weighted. This is an important point to note, and this limitation was highlighted by APPLiA during the CF. In order to overcome this limitation, the number of models was checked against approximate data sales provided by market research institutes for several years (2008, 2011-2013 and 2016-2017) that are periodically acquired by stakeholders. This comparison provides an overview on how models and sales correlated for the last years.

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.

Several methods can be applied to estimate the sales and stock of household dishwashers. Eurostat data were interpreted to estimate the stock of the household dishwashers in-service based on the penetration rate (number of household dishwashers per household). This information was complemented by other studies such as VHK 2014[90] projections and POTENCIA[91] as well as the information checked against manufacturers as collected and reported in the review study.

For the market estimation, the so-called "*stock model*" was used as basis for estimating the EU stock of household dishwashers from the penetration ratio (number of households that own a household dishwasher) 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)[92] 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)[93]. 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

[90] 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
[91] https://ec.europa.eu/jrc/en/potencia
[92] 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"].
[93] 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

between the full-size household dishwashers and the slim-line household dishwashers has been kept (86% and 14% respectively).

5.3.2 Purchase price

The purchase price is estimated based on the information included in Section 0 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 dishwasher 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.

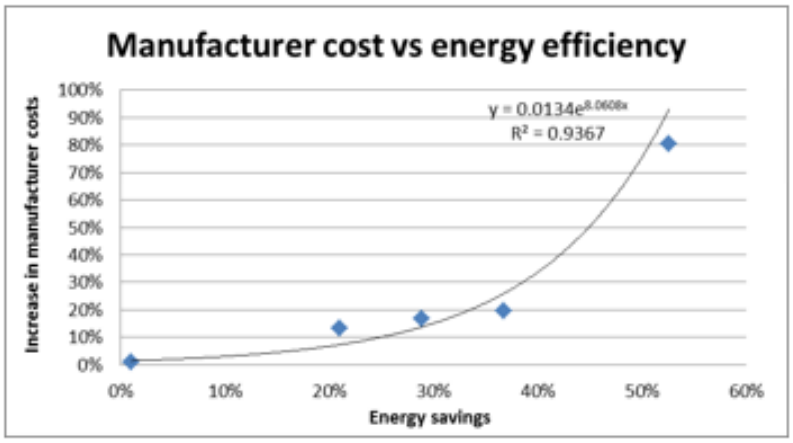


Figure A5.4. Estimate manufacturer costs increase due to energy efficiency increase for scenario BAU and scenarios A and B

As seen in Figure A5.4, the increase in energy efficiency has been considered to have an important effect in the manufacturer costs and consequently in the purchase price, although this relation is not so clear in the current market.

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 (e.g. EUR 400 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.

These estimations were validated throughout representative prices related to the energy efficiency classes, in the larger Member States were estimated in the review study based on the analysis of top seller products at six well-known appliance retailer national websites by the end of 2015 (IT, BE, DE, ES PL, SE). Additionally, the prices were adjusted to the energy efficiency of the models by a mathematical correlation. This enables the estimates of the price increases that would follow from the review of the Ecodesign measures; on the long run these prices increase will diminish due to a "learning curve" effect set differently depending on the maturity of the technologies under consideration.

5.3.3 Operating costs

The operating costs consist of the electricity and water costs, maintenance and repair costs, and costs of auxiliaries. 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.

In this Impact Assessment, the energy prices were assessed from Eurostat and for future projections the forecast of PRIMES 2016[94] was taken into account. This approach deviates from the recommendations included in MEErP[95] but it was considered more realistic. All prices and costs are expressed in Euro 2015, therefore inflation and discount rates were not needed in this analysis

The water consumption is calculated in a similar way. The energy and water consumption of each dishwasher 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. 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 dishwasher. 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, dishwashers 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.

5.3.4 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.

[94] 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

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

5.3.5 Business impacts and employment impacts

The industrial net present value (INPV) and the annual cash flows are used to compare the economic impacts of different scenarios and policy scenarios with the BAU scenario. The model considers the cash flows from 2016 to 2030. This timeframe models both the short-term impacts on the industry from the announcement of the new regulations until the compliance date, and a long-term assessment over the 10-years analysis period immediately after.

The difference between the BAU and the scenarios is an estimate of the economic impact that implementing that particular alternative would have on the industry. While the INPV is useful for evaluating the long-term effects of amended regulations, short-term changes in cash flow are also important indicators of the industry's financial situation. For example, a large investment over one or two years could strain the industry's access to capital. Consequently, the sharp drop in financial performance could cause investors to flee, even if recovery is possible. So a large disturbance can have long-term effects that the INPV does not capture.

During 2018 and 2020, annual cash flows are driven by the level of conversion costs and the portion of investments made each year. After the announcement date, industry cash flows decline as companies use their financial resources to prepare for the new regulations. The more stringent the new regulation, the greater the impact on industry cash flows in the years leading up to the compliance date, as product conversion costs lower cash inflows from operations and capital conversions costs increase cash outflows for capital expenditures.

Free cash flow at the year of entering into force the regulation can also be affected by the stranded assets. Stranded assets are for example tooling and equipment that would have enjoyed longer use if the new regulations had not made them obsolete. In that year, manufacturers write down the remaining undepreciated book value of existing tooling and equipment rendered obsolete by the new regulations. This one time write down acts as a tax shield that alleviates decreases in cash flow from operations in the year of the write-down. In this year, there is also an increase in working capital that reduces cash flow from operations. A large increase in working capital can be attributed to more costly production components and materials, higher inventory carrying to sell more products with more expensive components, and higher accounts receivable for more expensive products. Depending on these two competing factors, cash flow can either be positive or negative affected in the year the regulations come into force.

In the years following the entry into force of the regulations, the impact on cash flow depends on the operating revenue. The amount of revenues will depend on a combination of the profit policy of the manufacturers and the expected demand of the products. if the manufacturer decides to keep constant his/her gross margin (mark-up of the manufacturer), more stringent regulations typically have a positive impact on cash flows relative to the BAU scenario, because manufacturers are able to earner higher operating profit, which increases cash flow operations. However, there is very little impact on cash flow from operations if the manufacturer decides to preserve the earnings before interests and tax (EBIT) because the option is calibrated to have the same EBIT as in the BAU scenario in the year after the regulation takes effect. In this scenario, the production costs increase, but EBIT remains approximately equal to the BAU scenario, effectively decreasing profit margins as a percentage of revenue.

Therefore, the industrial net present value (INPV) and estimates of the cash flows of a representative manufacturer have been considered in this IA for the BAU scenario and the different scenarios. These parameters provide an estimate of the economic impact that implementing the scenarios will have on the industry. The INPV is useful for evaluating the long-term effects and the cash flow is an important indicator of the industry's financial situation in the short-term.

The following paragraphs analyse the effect of the regulation implementation to the industrial free cash flows at EU level. The assumptions considered in these analyses are shown in Table A5.3.

Table A5.3 Capital conversion costs, product conversion costs and stranded assets

	Levels of implemented measurements		
(MM Euros)	Level 1	Level 2	Level 3*
Capital conversion costs (CCC)	19.5	65	65
Product conversion costs (PCC)	27	90	90
Stranded assets	17	170	170

** The values of that column have been obtained from GRIM model and adapted to the level 3 case. Level 1 stands for the case of no Ecodesign requirements, therefore, the stranded assets are assumed to represent 10% of level 3 while CCC and PCC are about 30%.*

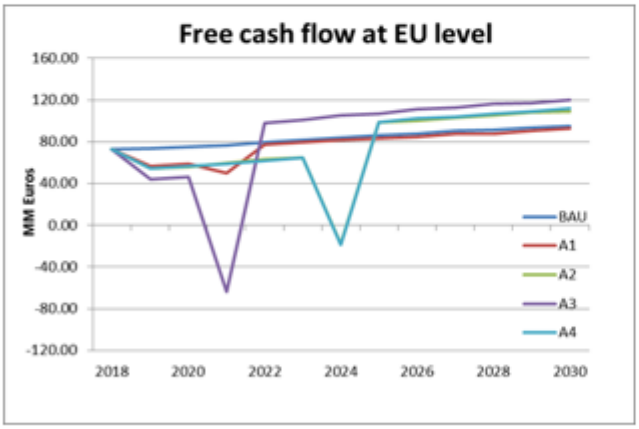


Figure A5.5 Industrial free cash flow development at EU level under the conditions of scenario BAU and scenarios A1, A2, A3 and A4.

Figure A5.5 indicates the development of the industrial free cash flows (FCFs) at EU level considering the BAU and the scenarios A1, A2, A3 and A4. The diagram shows a decrease of FCFs of the scenarios A1, A2, A3 and A4 next to the implementation year as result of the investments to perform the required changes. More precisely, during the investment time a sharp decline of FCFs, in comparison to the BAU, is indicated which for the Scenario A1 is caused due to new investments and altered technology. At the implementation year the fall is 34.5% of the BAU. Next to the regulation implementation, an average FCF difference of 3% between BAU and scenario A1 is assessed.

Scenario A2, A3 and A4 require higher investments than A1, therefore, the FCF falls approximately by 1.4 for A2 and A4 and 2.4 times for A3 respectively to A1. Additionally, the decrease of scenario A1 FCF on the year of the regulation implementation is 34.5% of the BAU. The scenarios A2, A3 and A4 generate obsolete equipment that affects the FCFs as well. The FCFs of scenario A3 drop approximately 121% in comparison to the BAU. However, scenario A2 generates FCF on average 13.7% higher than the BAU scenario. Concluding, scenario A3 generates FCFs on average 25.4% higher next to the implementation year until 2030.

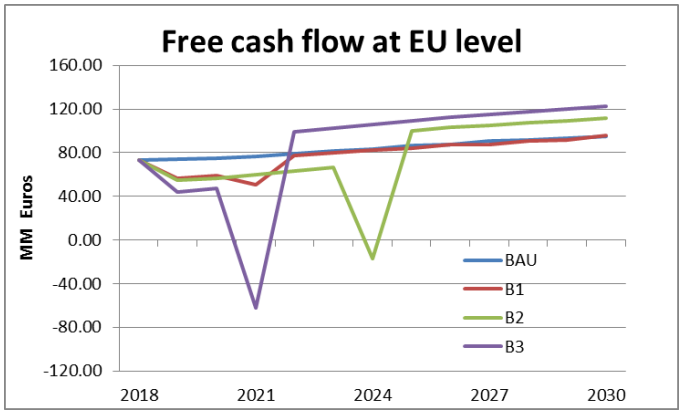


Figure A5.6 Industrial free cash flow development at EU level under the conditions of the scenarios BAU and B1, B2 and B3.

Scenarios B1, B2 and B3, demonstrate a similar trend to the corresponding scenarios A1, A2 and A3. However, the development of the FCFs differentiates slightly to those of scenarios A due to different energy efficiency requirements on the energy classes (see Section 5.2.3). Beginning from the scenario B1, it indicates 20% FCF decline in comparison to BAU as a consequence of the necessary investments to perform the changes. The fall of the FCFs in the implementation year is about 34.5% of the BAU. Next to the implementation year, the FCFs of scenario B1 will remain on average 2% lower than those of the BAU up to the year 2030.

The scenarios B2 and B3 show FCF growth by 15% and 27.5% respectively after the implementation year, considering BAU as a baseline. Moreover, the necessary investments cause a fall of FCFs by 1.5 times for scenario B2 with respect to the BAU and more than 2.9 times for scenario B3. The costs of altered technology will also affect the FCFs negatively. The FCFs of the scenario B2 and B3 will fall correspondingly by 121% and 181% times in comparison to the BAU for the specific year of Ecodesign measurements implementation.

Figure A5.7 depicts the effect of price increases and price-demand elasticity to the FCFs (Scenario B3a) and also portrays the FCFs development about the BAU and scenario B3. As indicated, the FCFs are expected to be lower than scenario B3 as the increase of the appliances prices lowers the sales volume. However, following the trend of scenario B3, the FCFs of Scenario B3a approximate that of BAU by the year 2030. The average FCF difference between Scenario B3a and BAU is approximately 25% next to the implementation year; however, this difference is smoothed to 2.3% by 2030.

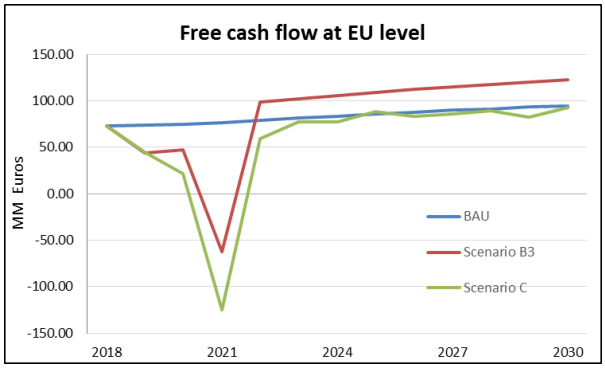


Figure A5.7 Industrial free cash flow development at EU level under the conditions of the scenarios BAU, scenario B3 and Scenario B3a.

Next to the free cash flow analysis, the INPV stands for an additional economic parameter related to the implementation of the regulation and its effect on the industry at EU level. The following Table A6.4 contains the percentage changes of the INPV for the scenarios A1, A2 and A3 about the BAU at the year of implementation and next to that. The INPV at year of implementation includes the necessary investments at that year while next to that the INPV shows the amount of change in normal operating conditions.

Table A5.4 INPV percentage change in comparison to BAU for the scenarios A1, A2 and A3.

Period	**Scenario A1**	**Scenario A2**	**Scenario A3**
Ecodesign measurements implementation year	-34.3%	-121.4%	-182.8%
Next implementation year	-2.9%	14.2%	25.3%

The INVP percentage changes for the scenarios B1, B2 and B3 are presented in Table A5.5.

Table A5.5 INPV percentage change in comparison to BAU for the scenarios B1, B2 and B3.

Periods	**Scenario B1**	**Scenario B2**	**Scenario B3**	**Scenario B3a**
Ecodesign measurements implementation year	-34.5%	-121.1%	-181.3%	-263%
Next to implementation year	-1.5%	10.3%	27.3%	-3.3%

The table as mentioned above highlights a similar tendency to the A scenarios. The INPV is positive during normal operating conditions for the scenarios B2 and B3. The amount of change about the BAU on the year of implementation is negative for all three scenarios, however, less severe for B1. Accomplishing the analysis of the INPV, Table A6.4 shows its changes for the Scenario B3a. Scenario B3a considers price elasticities of the appliances and the impact on the sales volumes. The percentage changes for Scenario B3a are negative on the implementation year and next to it. One should note the difference between Scenario B3a and scenario B3, which represent the equivalent to C without elasticities, is more than 24% in favour of the B3 scenario.

Owing to a paucity of data, the assumptions made have relied mainly on the U.S. GRIM model. However, sensitivity analyses have been carried out, in order to check their influence on the final results. The parameters that were analysed comprise the following: capital conversion cost (CCC), product conversion costs (PCC) and stranded assets.

Two scenarios have been created: **A4 S1** examines how a 20% increase of CCC, PCC and stranded assets affects the FCFs, and **A4 S2** investigates a decrease of a similar magnitude.

According to the data obtained, and as depicted in Fig A5.8, an increase in the three parameters (A4S1) will lead FCFs to decrease by 103%. The opposite evaluation (A4 S2), i.e., a decrease in the three parameters CCC, PCC and stranded assets, leads to an increase of more than 100% in the FCF, compared to the baseline. If the latter scenario applies, the FCFs also remain positive in the year in which (2024) the proposed measures need to be complied with.

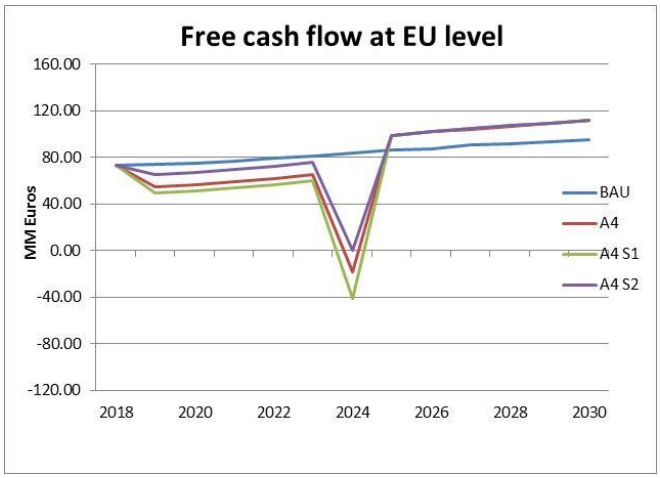


Figure A5.8 Sensitivity analysis and its results on industrial free cash flow

The industrial net present value (INPV) was estimated, in order to assess the impacts of the Ecodesign regulation on the affected industry sectors. To estimate this value, financial and economic data was requested on repeated occasions from the most relevant trade association, APPLiA (formerly CECED). However, when such data were finally not forthcoming from APPLiA, working assumptions were required to be made. The assumptions and their sources are described in Table A5.6, below.

Table A5.6 Assumption related to FCF and INPV calculations

Parameter	Assumption	Source of information
SG&A	13.30% of the revenues	GRIM model
R&D	2.3% of the revenues	GRIM model
Capital expenditure	3.2% of the revenues	GRIM model
Tax rate	33.3%	Average European tax rate
Working capital	7% of the revenues	GRIM model
WACC	8.55%	estimated
Capital conversion costs	65 million Euros	GRIM model
Production conversion costs	90 million Euros	GRIM model
Stranded assets	170 million Euros	GRIM model

As referred to in Table A5.6, the WACC (Weighted Average Cost of Capital) was estimated. This was performed, via considering the sources and values described below in Table A5.7.

Table A5.7 Assumptions related to WACC evaluation

Parameter	Assumption	Source of information or calculation
Net costs of debt		= Tax return (1- gross costs of debt)
Gross costs of debt	4.80	GRIM model
Debt/total capital	0.31	GRIM model
Equity/total capital		= 1- Debt/total capital
Cost of equity		= risk free-rate + (beta x risk of premium)
Risk-free rate	3.20	GRIM model
Beta	1.90	GRIM model
Risk of premium	4.10	GRIM model

It should be noted that the WACC value may be affected by macroeconomic variables varying over years, and across countries and economic sectors. Therefore, four sensitivity scenarios were studied considering a variation of +20%, +50%, -20% and -50% of the WACC and aiming to capture moderate and severe WACC changes. The results suggest a strong WACC influence on the INPV.

More specifically, if the WACC value decreases by 20%, the respective INPV may rise by nearly 100% about the baseline (INPV A4), while INVP growth of more than 300% is forecast in the case of 50% WACC decrease.

On the contrary, when the WACC rises by 20% and 50%, the IVPV is predicted to fall by approximately 51%, and 77%, respectively. It should be noted that the INPV for the period 2018-2030 remains positive even assuming a 50% WACC increase. IT should also be noted that the ratio EBIT**:** Revenues remains positive (on average > 5%) throughout the period 2018-2030, except during the compliance year, when It registers a value of -3.76%. From this, we may tentatively conclude that from the indicators examined, with the assumptions made, it is feasible financially for the manufacturers concerned to put all measures into place in order to correctly be in compliance with the proposed regulatory requirements.

Employment impacts are derived from revenue per employee. The turnover is partitioned over the manufacturers and retailers according to the mark-ups of each sector. Even though it is a rough estimation, it provides an initial insight. Local levies and recycling contributions are not taken into account. Employment impacts were based on data reported in (Impact Assessment for Washing Machines 2009)[96] on the basis of the average turnover per employee in each sector (manufacturing industry: 188 000 euros/employee and white good retailers: 60 000 euros/employee).

Almost half of the household dishwashers sold in Europe are currently manufactured by one corporation which, together with other manufacturers, cover 80% of the market. None of these 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.

The model estimates the creation of jobs in the manufacturer and retailer sectors in the BAU and the scenarios 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 A5.6.

[96] SEC(2010)1353, Impact Assessment. Draft commission regulation implementing Directive 2009/125/EC of the EU Parliament and the Council with regard to Ecodesign requirements for household washing machines

Table A5.6 Ratios used for the estimation of job creation in the household dishwasher

Sector	Turnover/employee	% jobs in EU	% revenue of the sector
Manufacturer	180000 EUR/employee	50%	49%
Retailer	60000 EUR/employee	80%	32%

5.3.6. User expenditure

The consumer expenditure accounts for the purchase price, utilities costs and auxiliary costs. APPLiA pointed out that the consumer expenditure can be different across Europe but for the current market situation and current utilities prices, the LLCC is found in class A+. Figure A6.8 is provided by APPLiA and shown the LCC of several dishwasher models in several countries.

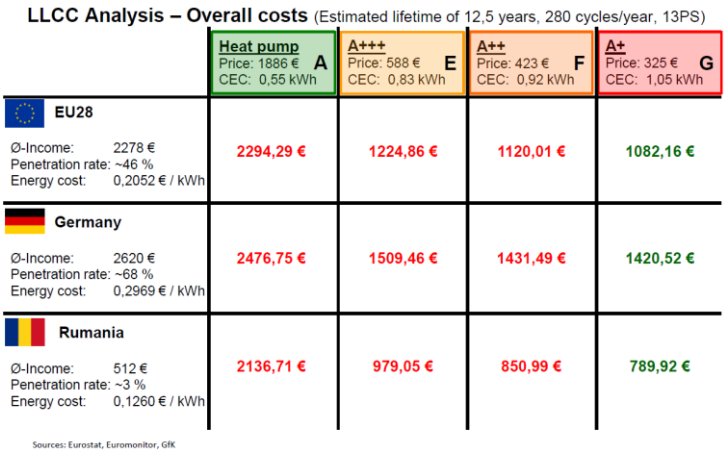


Figure A6.8 LCC for several current dishwasher models in EU, Romania and Germany.

5.3.7. Price demand elasticities

With respect to sensitivity of demand, there are many studies that deal with elasticities of demand of electricity and energy but few that deal with elasticities of demand for household durables. Jain and Rao (2005)[97] look at four durable goods using diffusion models, while Golder and Tellis (1998)[98] use a similar approach for 31 different durables in the US economy. This empirical research suggests that the price elasticity of demand for household energy-consuming appliances is in the range of -05 to -2. However, these studies do not provide estimates of cross elasticities[99]. Galarraga et al (2011)[100] provided a combined approach reliable price elasticities (own and cross) for household dishwashers and for close substitutes (e.g. those with similar energy efficiency). The authors estimated an impact of 1% change in the price of low energy efficiency dishwashers on the demand for high energy efficiency dishwashers ranged from 0.15 to 2.4, depending on the assumed

[97] Jain, D., Rao R., 2005, Effect of the price on the demand for durables: modelling estimation and findings, J. of Business and Economic statistics 8 (2) 163-170
[98] Golder, P., Tellis G., 1998. Beyond diffusion: an affordability model of growth on the new consumer durables, J. of forecasting 17, 250-280
[99] Cross price elasticity can be defined as the sensitivity of demand for high energy efficiency appliances to changes in the prices of low energy efficiency appliances and vice-versa
[100] Galarraga, Gonzalez-Eguino, Markandya, Willingness to pay and price elasticities of demand for energy-efficient appliances: combining the hedonic approach and demand systems, Energy Economics 33 (1):66

own-price elasticity of demand for low energy efficiency dishwashers (ranging from -0.5 to -2, varying 0.1 each time). This parameter can be important for Scenario B3a and in the analysis of the high energy efficiency dishwasher market, as it reveals how much demand may be shifted over towards higher energy efficient appliances. The authors also estimated how the demand for high energy efficient dishwashers can react to changes in the price (varying from -0.55 to -2.8) and the cross effect of changes in prices of high energy efficient dishwashers on the demand for low energy efficient ones (from 0.1 to 1.6). The demand for high energy efficient dishwashers is more elastic than the demand for low energy efficient ones, while the impact of changes in the price of high energy efficient goods affects the demand for low energy efficient ones less than changes in the price of low energy efficient ones affect the demand for high energy efficient ones. These results are in line with the elasticities considered in GRIM study[101] as well. The highest values of the own and cross elasticities for high energy efficiency dishwashers found by Galarraga et al (2011) were considered in Scenario B3a for the full-size dishwashers, despite the authors recommended not to extrapolate these values outside the region of study, because no other values were found in the literature or provided by the industry.

5.3.8 Model structure

The model is built in MS Excel, using a one-year time step. The input data start in 1998, but peak up from the previous 2009 study, and correct for the changes in the APPLiA database and information coming from the stakeholders about volume of sales since then, up till 2016. From 2016 onwards each of the scenarios follows the trends, taking into account a slightly diminished or enhanced effectiveness of the Energy Label and the Ecodesign requirements.

5.3.9 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 6) or have been recently conducted for the European Commission (e.g. Deloitte 2017, 2018). On the basis of this information, the impacts of the three scenarios on material efficiency described under 5.2.4 (C0, C1 and C2) have been assessed as compared to the baseline scenario BAU. Because C0 is very close to BAU, the impacts of this scenario are considered negligible unless mentioned otherwise.

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 under C1 and C2 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[31], technical and cost barriers to repair household dishwashers are related to

[101] Technical support document: Energy Efficiency program for consumer products and commercial industrial equipment. DOE, US, December 2014

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 6) It is precisely these barriers that the measures proposed in scenario ME1 aim to take away.

Estimates of the lifetime of a dishwasher range from 10 – 17 years, but most studies find an average of 12.5 years (see annex 6). 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 dishwasher. 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.

The requirement of minimum product lifetime of 10 years as contained in scenario C2 (in addition to the measures of C1) is a more direct way to achieve the goal of longer product lifetime.

5.3.10 Outputs

Total electricity consumption At EU level in TWh/year					
year	**BAU**	**Scenario A1**	**Scenario A2**	**Scenario A3**	**Scenario A4**
2006	14.64	14.38	14.40	14.40	14.38
2007	16.51	16.25	16.29	16.29	16.25
2008	15.71	15.46	15.48	15.48	15.46
2009	19.67	19.42	19.46	19.46	19.42
2010	20.97	20.73	20.78	20.78	20.73
2011	23.92	23.69	23.75	23.75	23.71
2012	25.95	25.72	25.78	25.78	25.77
2013	27.72	27.49	27.56	27.56	27.57
2014	29.49	29.25	29.31	29.31	29.38
2015	31.27	31.00	31.07	31.07	31.20
2016	32.79	32.50	32.56	32.56	32.76
2017	34.24	33.94	34.00	33.98	34.26
2018	52.47	51.75	51.97	51.84	52.54
2019	35.90	35.49	35.56	35.46	35.91
2020	37.56	37.06	37.05	36.86	37.52
2021	39.42	38.80	38.70	38.42	39.26
2022	41.32	40.55	40.29	39.97	41.00
2023	42.38	41.47	41.08	40.70	41.88
2024	43.59	42.52	41.97	41.57	42.90
2025	44.67	43.47	42.76	42.33	43.83
2026	45.69	44.34	43.51	43.02	44.62
2027	46.59	45.15	44.18	43.63	45.32
2028	47.44	45.82	44.74	44.19	45.92
2029	48.19	46.46	45.21	44.67	46.44
2030	48.96	47.04	45.63	45.13	46.90

Total electricity consumption At EU level in TWh/year

year	BAU	Scenario B1	Scenario B2	Scenario B3
2006	14.64	14.38	11.84	14.30
2007	16.51	16.25	13.67	16.15
2008	15.71	15.46	12.93	15.36
2009	19.67	19.42	16.85	19.28
2010	20.97	20.73	18.20	20.56
2011	23.92	23.72	21.38	23.52
2012	25.95	25.79	23.57	25.58
2013	27.72	27.60	25.52	27.39
2014	29.49	29.44	27.51	29.23
2015	31.27	31.29	29.53	31.09
2016	32.79	32.87	31.28	32.68
2017	34.24	34.39	32.98	34.21
2018	52.47	52.84	51.62	52.58
2019	35.90	36.09	35.02	35.82
2020	37.56	37.75	36.74	37.33
2021	39.42	39.58	38.64	39.02
2022	41.32	41.44	40.48	40.70
2023	42.38	42.43	41.51	41.56
2024	43.59	43.55	42.57	42.54
2025	44.67	44.61	43.59	43.43
2026	45.69	45.55	44.50	44.25
2027	46.59	46.41	45.30	45.00
2028	47.44	47.17	46.05	45.64
2029	48.19	47.90	46.71	46.25
2030	48.96	48.55	47.32	46.81

Total water consumption at EU level in mill m3/year				
year	**BAU**	**Scenario B1**	**Scenario B2**	**Scenario B3**
2006	144	144	144	144
2007	163	163	163	163
2008	155	155	155	155
2009	195	195	195	195
2010	208	208	208	208
2011	238	238	238	238
2012	260	260	260	260
2013	279	279	279	279
2014	298	298	298	298
2015	318	318	318	318
2016	335	335	335	335
2017	352	351	351	351
2018	547	546	546	546
2019	371	371	371	371
2020	390	389	389	389
2021	411	410	410	410

2022	433	431	431	431
2023	445	444	443	443
2024	460	458	456	457
2025	473	471	470	470
2026	486	483	482	482
2027	498	495	494	494
2028	510	506	504	504
2029	521	516	515	515
2030	531	526	525	525

Annex 6: 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.

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

Additional information from ongoing studies and submissions was received after the Consultation Forum. Several important sources of recent information regarding material efficiency inputs regarding white goods, and to some extent dishwashers have been used:

- Preparatory study for household dishwashers: 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 543 to ESOs.

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

6.2.1 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)[102], 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 reason for not repairing the dishwasher 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%.

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

Ardente & Talens Peirò (2015)[103] conducted a life cycle assessment (LCA)-oriented study to identify and address potential measures for resource efficiency of dishwashers. The study points out again that the use and repair phase are the most relevant followed by the production phase. However, the production phase contributes to over 50% of freshwater toxicity, human toxicity, ozone depletion and abiotic depletion of elements (ADP elements), and it is noteworthy that it is mainly the electronic components that are responsible for many environmental impacts in the production phase.

Tecchio et al. (2016) draw additional LCA-based conclusions regarding the environmental benefits balance of "repair vs. replace":

- Prolonging the lifetime of the dishwashers 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 dishwasher after the average lifetime of 12.5 years rather than prolonging its lifetime if the new dishwasher 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 dishwasher is shown as beneficial in all cases. The ADP indicator can be reduced by about 45% when the operating life is extended by 6 years and about 7% for when the lifetime is extended by 1 year.

6.2.2 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 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 dishwashers are often much higher than production costs, but are critical components of the appliance. The length of time 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

[103] Ardente, F. & Talens Peirò, L. (2015). 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. Available at http://publications.jrc.ec.europa.eu/repository/bitstream/JRC95187/lb-na-27200-en-n.pdf.

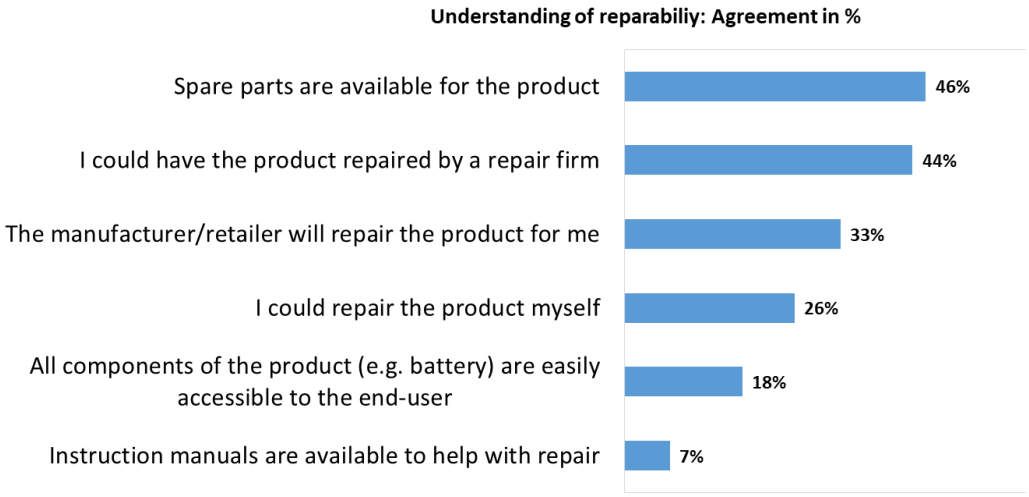
Increasing difficulty in separating individual components from the casing or in accessing key parts in the interior of appliances hinders replacement and repair and therefore renders many appliances without reuse potential. For example, if one cannot open the outer case of a product without breaking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

6.2.2. Behavioural Study on Consumers' Engagement in the Circular Economy (ongoing 2017-18) for the European Commission (DG JUST):

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. 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 have selected the relevant items of interest regarding dishwashers, which were one of five consumer products investigated (dishwashers, vacuum cleaners, televisions, mobile phones and clothes)[104] under realistic product selection and decision-making conditions.



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.

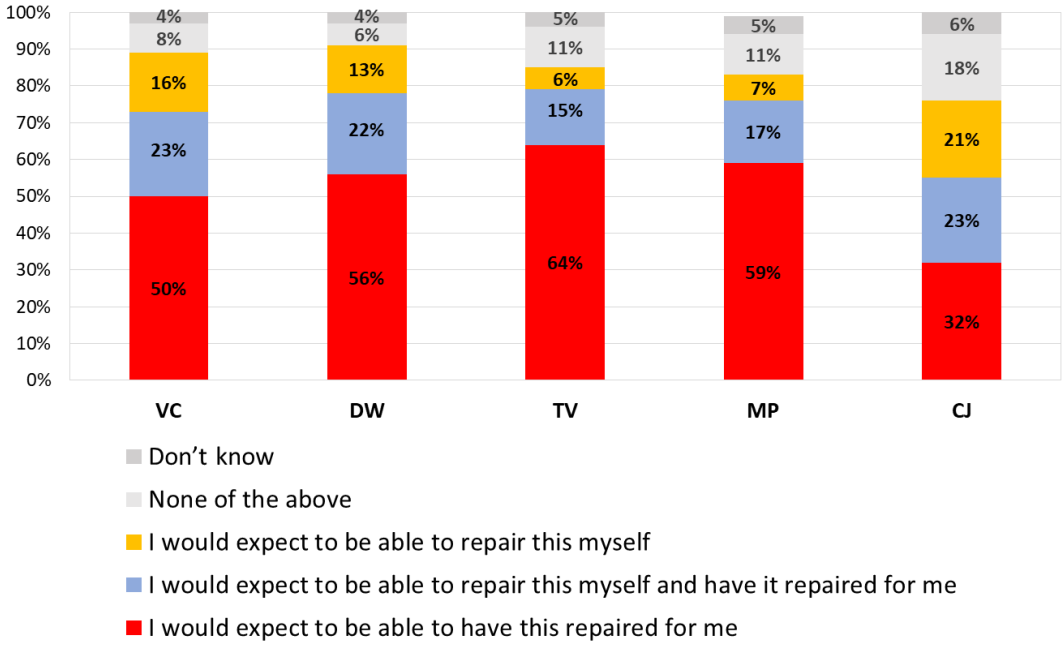
Figure A6.1: General understanding of reparability (in %). Source: ConPolicy analysis of consumer survey data.

Figure A6.1 above 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

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

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.



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

Figure A6.2: Expectations regarding repair services by product category (in %). Source: ConPolicy analysis of consumer survey data.

Figure A6.2 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.

With regard to consumers' understanding of durability, Figure 3.C 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.

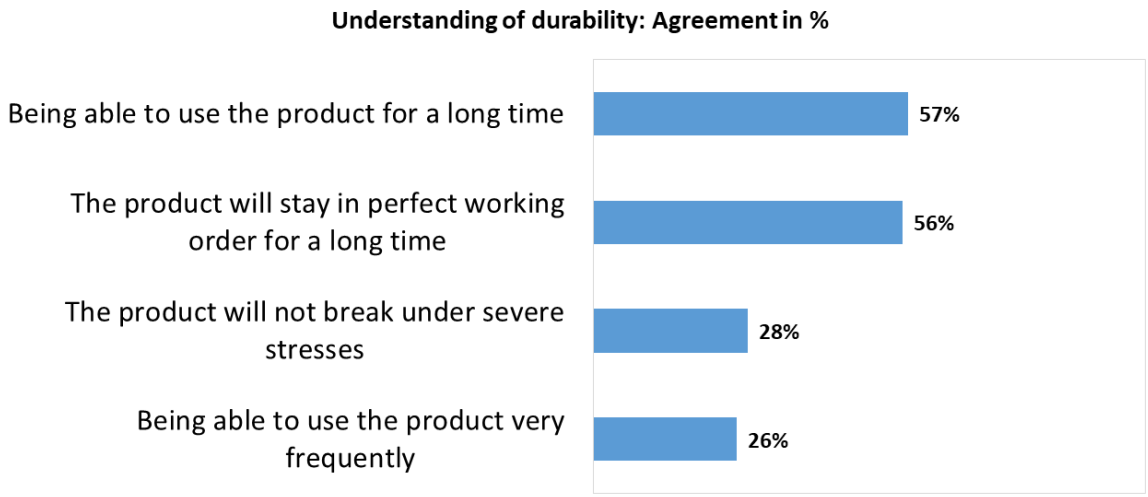


Figure A6.9 Expectations on durability by product category (in %). Source: ConPolicy analysis of consumer survey data.

With regard to expectations per product category, Table A6.3 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 A6.1: 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 A6.1 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.

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 A6.4 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 A6.2 takes this a step further, and shows the preliminary Willingness To Pay (WTP) analyses from the observations during the behavioural experiment, where – for dishwashers – consumers are shown as possibly being willing to pay (more, compared to the base case of "no information") between EUR30-36 per year for reputable information on products' durability, durability/ reparability, the manufacturers' guarantee or "expected lifetime" information.

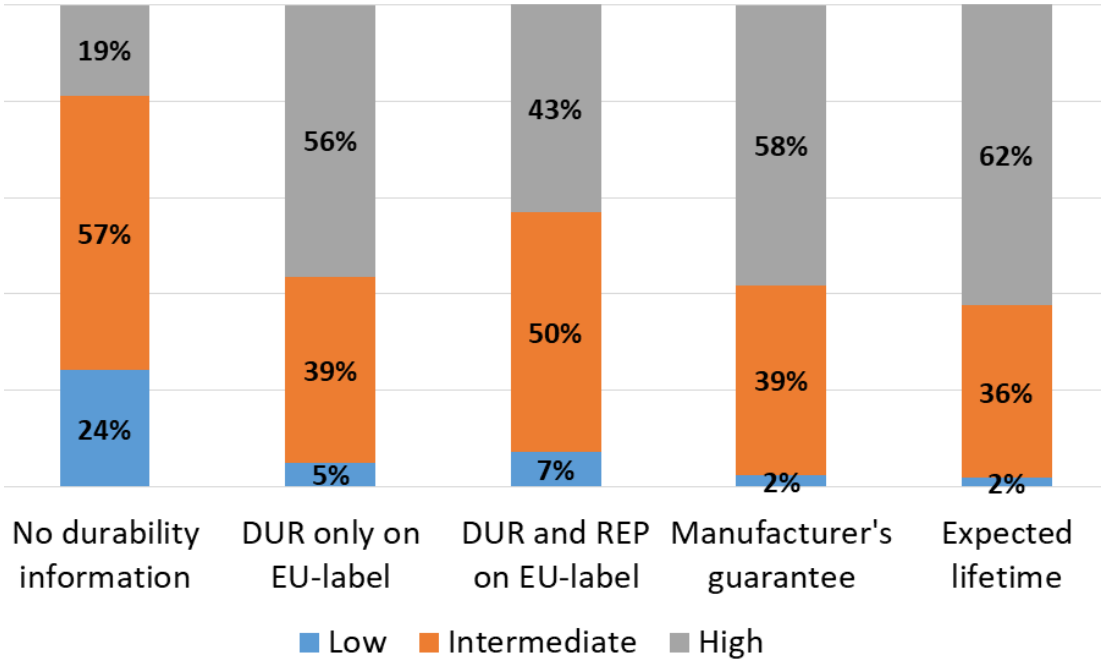


Figure A6.4 : Influence on decisions in the behavioural experiment according to depictions of durability, reparability, guarantees and expected lifetime on simulate labels (in %). Source: ConPolicy analysis of consumer survey data.

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

Table A6.2 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.

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

A number of reports were sent after the Consultation Forum to the European Commission by EU and national consumer NGOs. Table A6.3 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, rather than dishwashers, and the emphasis of the reported questionnaires and test studies has been performed on washing machines, to date.

Whilst the experiences related from the surveys and tests performed largely relate to "white goods" as a whole, or to washing machines in particular, the results do not portray an optimally-functioning repair service 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 is evident.

Table A6.310. Key findings from reports from national consumer associations with regard to reparability of dishwashers and other similar appliances

Quel choisir (FR)	Verbraucherzentrale (DE)	Haushalt und Garten (DE)	Forbruker rädet (NO)	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 cost. - 70% of the consumers consider the right to repair to be important (47% very important)	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. NB The **same brands** are also main players present in the **dishwashers** market. 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 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 EUR79-EUR143 - With repair (in the 7 cases where repair was deemed possible), the overall fees (including mobilisation) were min. EUR178, up to max. EUR550. - In 6 cases out of 7 where a repair was carried out successfully (to the extent that the machine would	- 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 • 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	- 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 program • 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) • Some scattered replies suggest that the economic life of a washing machine is estimated to be 200EUR200EUR 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

		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 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.		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: • 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.

6.3 Measures for Enhanced Reparability – which components of Dishwashers 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[105]. 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 dishwashers 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 dishwasher lead to usually expensive repairs costs due to the price of the control unit.

- The increasing use of electronic components in dishwashers 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 dishwasher 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.

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:

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

- 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[106]. the probability that a dishwasher (or a washing machine as the example of the report) 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. Dishwashers 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[107]. 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 EUR 538 million to EUR 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 dishwashers, recurring failures involved pumps (almost 24 % of cases), electronics (16.7 %), aquastop and valves (8.4 %), foreign objects (6.9 %) and doors (6.4 %).

According to all the information above plus a literature review from a study conducted by the JRC[102], and the network of repairers RREUSE [108] (statistical data), a more detailed

[106] 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

[107] BIO by Deloitte on behalf of ADEME (2014), Panorama de l'offre de réparation en France.

[108] 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.

list of the parts of the dishwashers that fail the most has been compiled and proposed to be easily removed (to be replaced):

- Motors,
- Circulation and drain pumps
- Heaters and heating elements
- Door hinges and seals
- Piping and related equipment including all hoses, valves and filters
- Structural and interior parts related to door assemblies, spray arms, seals and interior racks.
- Printed circuit boards
- Liquid crystal displays;

6.4 Measures for Enhanced Durability – Evidence and Discussion

The environmental impacts of household dishwashers have been found in the above mentioned study conducted by JRC. The analysis is based on the application of the REAPro method[109] 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 dishwashers 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 dishwashers 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 dishwashers that are not taken back to the manufacturers, i.e. disposed or recycled through other channels.

There is a comprehensive study on household dishwashers about EoL dismantling treatments of WEEE[110]. 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

[109] 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).
[110] J. Johansson, C. Luttropp. "Material hygiene: improving recycling of WEEE demonstrated on dishwashers". Journal of Cleaner Production 17 (2009) 26–35.

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 X cm^2) and LCD (larger than x cm^2) or other IT components of the household dishwasher 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, and 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.

6.4.1 Economic advantages of dismantling (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[111] but its conclusions seem largely valid also for dishwashers. 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. 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 per hour, the generated value from the end-of-life treatment process of a domestic washing machine can be simulated as in Figure A6.5. 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 A6.5 represent the generated value from the optimal end-of-life treatment process. The black line stands for the neutral

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

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.).

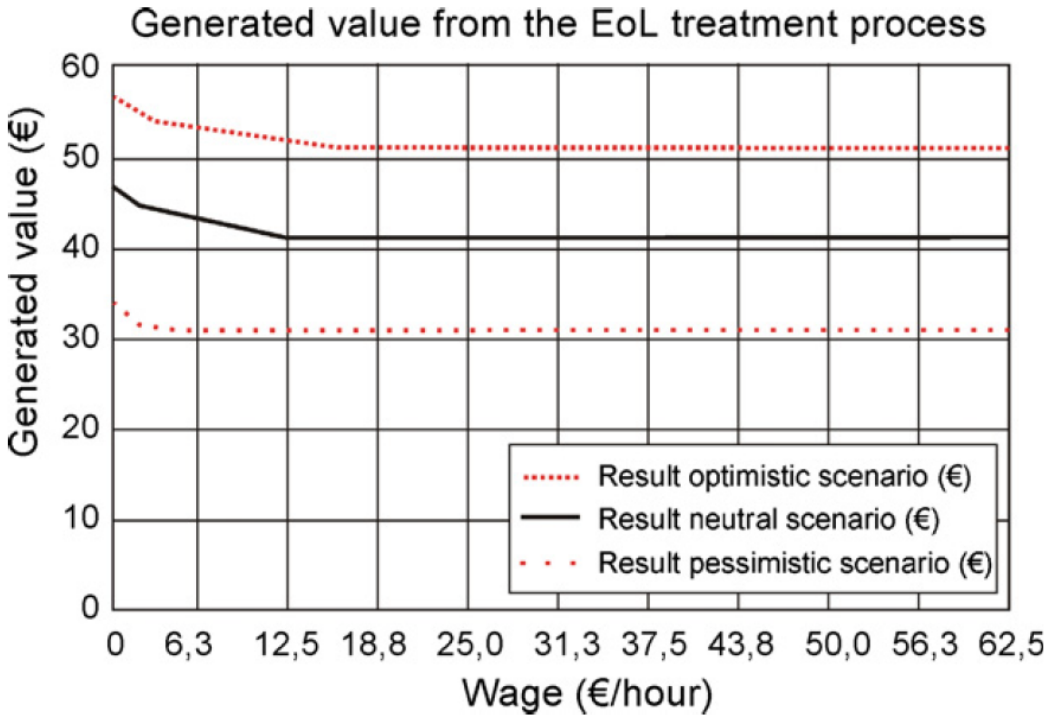


Figure A6.5 Impact of the labour cost on the generated value in the EoL treatment process of a washing machine

In Figure A6.6, 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 A6.6 corresponds to a slope change in the corresponding function in Figure A6.5. 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/h 12.5, it is not economically feasible to perform any kind of disassembly. When lowering the wage cost below EUR/h 12.5, the cost of the manual disassembly process is compensated by the generated value from component reuse or material recycling. A labour cost of EUR/h 12.5 facilitates a partial disassembly process of 38% of the entire product. Lowering the labour cost to less than EUR/h 3 would make it economically feasible to perform full disassembly of the washing machine.

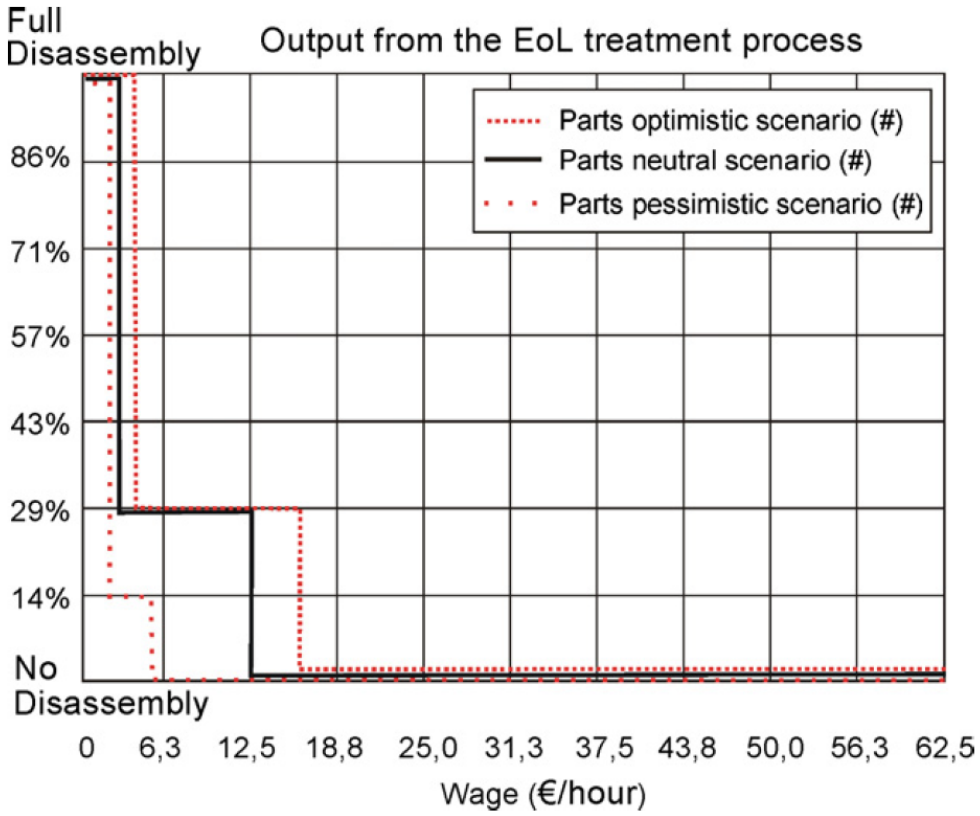


Figure A6.6. Impact of the labour cost on the level of dismantling during EoL treatment of a washing machine.

6.4.2 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 washing machine, which can be similar case to a household dishwasher. 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 EUR 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 A6.5 and Figure A6.6, where an operator

salary cost of EUR/h 31.3 was taken into account. Under the absence of Ecoboni or Ecotaxes, no disassembly is performed. In Figure A6.7 the overall generated value is displayed for different values of the Ecobonus and Ecotax. Figure A6.8 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 A6.7) 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 A6.7). Hence, the tipping point where the optimal end-of-life Scenario B changes from no dismantling to partial dismantling, corresponds with an Ecotax of EUR 12.

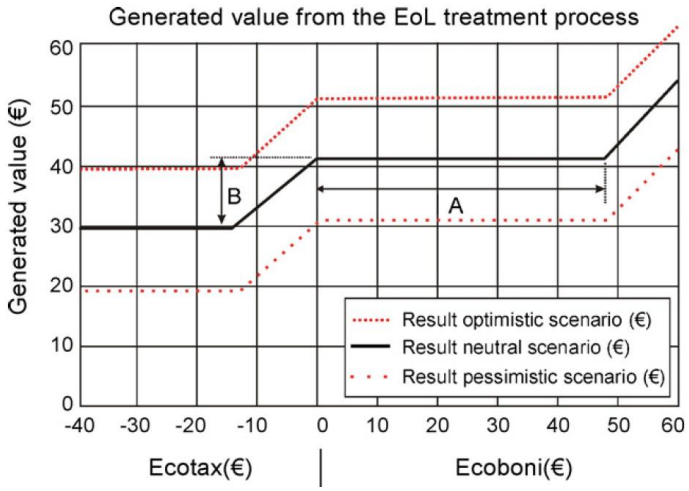


Figure A6.7 Impact of the Ecotax/Ecobonus level on the generated value from the EoL treatment process of a washing machine

Figure A6.8 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.

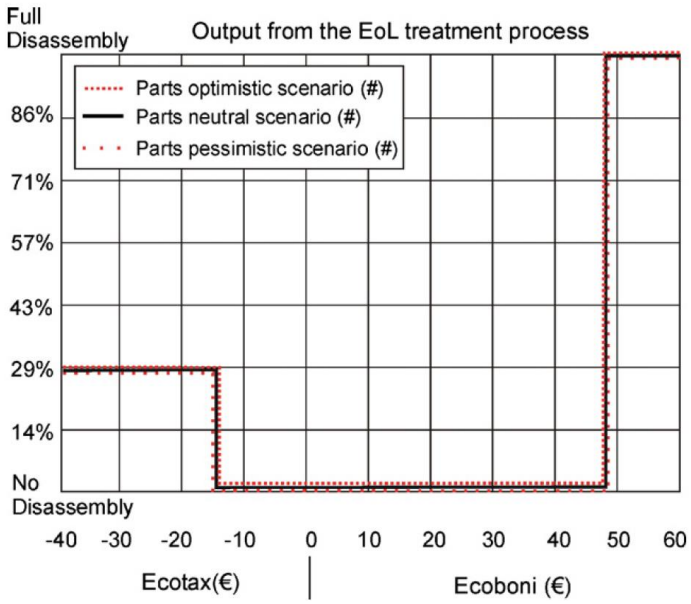


Figure A6.8. Impact of the Ecotax/Ecobonus level on the level of disassembly during the EoL treatment process of a washing machine.

6.5 Verification of resource efficiency parameters

The integration of circular economy requirements (or resource efficiency parameters) requires a new type of verifications to be undertaken by market surveillance authorities. In order to guide this process, the following procedure has been drafted on the basis of scenario C1:

(1) 'Availability of necessary spare parts'

The verification of compliance to this requirement has to be planned by the Market Surveillance Authority in the following period:

- More than two years after the first product of the model under verification is placed on the market; if this event is not known by the market surveillance authority, the date of declaration of conformity of the model can be used as the beginning of the two year period;
- Less than seven years after the last product of the model under verification is placed on the market; if this event is not known by the market surveillance authority, the date of declaration of conformity of the model can be used as the beginning of the seven year period.

The market surveillance authorities should (i) check that the list of necessary spare parts and the procedure for ordering them are publicly available and check that the list of necessary spare parts cover the items listed in point (1); (ii) select one or more of the items in the list of point (1) and order the said item(s) from the manufacturer or importer, following the relevant procedure; (iii) check that the part delivered corresponds to the

order. In the event that the items delivered do not correspond to the order, the order should be repeated.
The manufacture or importer should be considered as not fulfilling the Regulation’s requirement if the list of necessary spare parts or the procedure for ordering them are not publicly available, or if the necessary spare parts selected are not available for order or if the delivered items do not correspond to the order for two separate orders of the same parts.

(2) 'Necessary spare parts maximum delivery time'
Market surveillance authorities should verify that the necessary spare parts ordered under the previous point (1) have been delivered within three weeks. The date of the order should be the starting date of the three weeks period. In the event that the parts ordered are delivered correctly but not within the three weeks period, the market surveillance authority should repeat the verification with another sample of necessary spare parts.
A manufacturer or importer should be considered as not fulfilling the Regulation's requirements if, for the same product, three discrete orders of necessary spare parts do not meet the three weeks maximum delivery time without acceptable justification of an event of force majeure.

(3) 'Access to Repair and Maintenance Information'
Market surveillance authorities should check that the access to repair and maintenance information is provided and includes the information requested. The market surveillance authorities may organise a blind test with a professional repairer to verify that the information is accessible to professional repairers in non-discriminatory conditions.
A manufacturer or importer should be considered as not fulfilling the Regulation’s requirement if the access to information is denied, or if the conditions of access are considered discriminatory or if the information provided does not correspond to the information required in the measure or to the sub-set of information requested by the repairer.

(4) 'Information requirements for refrigeration gases':
Market surveillance authorities should access the relevant parts of the appliance (heat pump) and check that the chemical name, or an equivalent reference, of the principal component of the refrigerant gas is visibly and legibly marked on the exterior of the appliance. The market surveillance authorities should ask the manufacturer to show evidence, for example through the documentation of chemicals used in production, that the name or reference corresponds to the refrigerant gas used for this model. A reference, other than the scientific name of the chemical, is considered equivalent if it is commonly used and understandable by recyclers in the Member State concerned. More than one reference can be used for the same chemical if the manufacturer considers it useful.
A manufacturer or importer should be considered as not fulfilling the Regulation’s requirement if no marking is found, or if (at least one of) the reference(s) used is not

considered understandable or if there is no evidence that the refrigerant used corresponds to the name or reference marked. Where the refrigerant gas is covered by Regulation (EU) No 517/2014, the verification procedure implemented by the Member State in implementation of that Regulation replaces the procedure above.

(5) ‘Requirements for disassembly for the purpose of repair and for material recovery and recycling while avoiding pollution'

Market surveillance authorities should disassemble with commonly available tools the components (as listed under point (5) of the measure) when present in the appliance, or a selection of them, following the manufacturer's instructions and check that the type and the number of fastening techniques(s) to be unlocked and the tool(s) required correspond to the document provided.

A manufacturer or importer should be considered as not fulfilling the Regulation’s requirements if the documentation required is not available or if the operation requires a tool, which is not common or not readily available for purchase, or if the type or number of fastening techniques differs significantly from the type documented.

If the compliance of a manufacturer or importer with the requirements above is considered as unsatisfactory, the market surveillance authority should take appropriate measures to ensure compliance. The manufacturer should then take subsequent corrective actions, amendments and/or supplements as requested by the market surveillance authorities and provide proof of compliance within a period of 1 month.

Annex 7: Analysis of the Impact Assessment details

7.1. Business impacts

7.1.1. 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 dishwashers, 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 dishwashers 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 5, Section 5.2.2)[112]

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 dishwasher sector, and the whole supply chain.

7.1.2. Innovation, Research and development, competitiveness and trade

Overall, the European home appliances industry, with a total turnover of 44 billion euros, spends 3.8% on research and development (R&D). The revision of the household dishwasher appliance 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

[112] The price difference of household dishwashers has been adjusted (via an exponential correlation), and additional information on product cost is provided (also in Section 0).

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 on investments in innovation, research and development are expected to be lower for Scenarios A1 and B1 (as only the Energy Labelling dynamic effects will perturb market conditions, and not any changes to Ecodesign minimum criteria). Conversely, investment requirements will be higher for Scenarios A3 and B3, as they comprise both Ecodesign and Energy Labelling actions in a short period of time.

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 dishwashers would be lower and hence this would reduce the payback on R&D investments. In general - and particularly in the case of household dishwashers - the "white goods" industry is highly competitive. EU and Third Country innovation-based and quality-based manufacturing needs to be encouraged, via a transparent level playing field, whereby product quality and whole Life Cycle Costs for end-consumers drive the market, rather than competition via short-term low purchase prices often coupled with low quality appliances. Via encouraging progressive increases in appliance quality and lifetime resource efficiency, the Circular Economy aims of the EU can be better fulfilled, at an optimally lower LCC, which at the same time should foster increased employment, hopefully with knock-on international effects.

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, for example, an expanding market for second-hand products, for increased repair of appliances, dedicated companies for providing dishwashing services instead of selling the products, etc. This would mean that the envisaged material efficiency requirements could have an impact for elements concerning 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 a service, rather than the products concerned only.

7.1.3. Intellectual Property Rights (IPR)

All technologies considered in the review study, except for one technology which is protected by international patents, are commonly available to all major manufacturers. No stakeholder, such as any relevant industry association, or individual company has raised concerns that more stringent Ecodesign requirements would impose proprietary technology(ies) on manufacturers.

7.1.4. Stranded investments

When a regulation is reviewed and tighter requirements are proposed, the question of stranded investment arises. In the case of household dishwasher appliances, the risk of stranded investments might in theory exist for the least energy efficiency appliances (e.g. EEI between 58 and 63). 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.

7.2 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 dishwashers 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[113]. 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.

7.2.1 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[114]. Around 10.5 million household dishwasher appliances sold in 6 months' time. This means a cost of approximately EUR 3.2 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 resulting in a total cost of EUR 0.31 million.

7.2.2. Mandatory product registration database

The key burdens due to this option are similar to those for the product registration database for radio equipment[115]: a) Training of staff to become acquainted with the system: this is a one-time investment and not considered significant. b) Upload manufacturer information and obtain manufacturer code, depending on the design for the operation of the database. This is again considered not significant. c) Upload product

[113] Commission impact assessment Guidelines

[114] 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

[115] SWD(2012) 329 final, p.31

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

For household dishwasher equipment an estimated average of 600 models[116] per year will need to be registered in the database[117]. Two hours of collection and registration time per model family is assumed[118]. This corresponds with the estimated administrative costs borne by suppliers for Australia's product registration database, i.e. EUR 60/model [119]. For the 600 models this results in EUR 17 500 per year.

The burden for MS 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 300 000 investment and EUR 30 000 annual maintenance costs for registration of 5 000 models per year[120]. Based on the above estimate of 600 models per year, share of household dishwasher appliances in the total Commission investment is EUR 3 600 and the maintenance costs are estimated at EUR 360 per year.

7.2.3. Expand the database study, Commission costs

The budget for the current three-year study covering six products was EUR 500 000[121]. The cost for the Commission to cover about 30 products would thus be approximately EUR 1 million per year. For household dishwasher appliances (1 of 30 product groups) it would amount to EUR 17 520/year.

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116 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.

117 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)

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

119 100 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)

120 SWD(2012) 329 final, Annex X

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

7.2.4. 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[122]. Such a call would be opened every year with the aim to support several joint actions per year. The share of household dishwashers (one of 30 product groups) is estimated at EUR 60 000/year.

7.2.5. External laboratory testing

Manufacturers of household dishwashers 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.

7.2.6 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 associated budget was estimated at EUR 7-10 million[123]. Based on (incomplete) data collected from MSs it is currently likely to be around EUR 10 million. Household dishwasher appliances are one of thirty products for surveillance. Assuming the effort to be equally distributed per product group this amounts to EUR 330 000 of market surveillance costs for surveillance of household dishwasher appliances.

7.2.7 Introducing reviewed legislation

Ecodesign and Energy Label regulations for household dishwasher appliances already exist, so the infrastructure of notified bodies and market surveillance authorities is already in place in MS. Furthermore, the legal format is a 'regulation' and thus no transposition in national law is required. As a "placeholder", an estimated amount of EUR 100 000 is assumed in total for all 28 MS to cover requirements for training and answering questions on the changes in the regulations.

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

[123] 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

Annex 8: Other Ecodesign requirements involving no change, or relatively minor updates

8.1 Low power modes requirements

These product-specific implementing measures are related partly to Commission regulations on electrical power consumption by electrical and electronic household and office equipment in "standby", "low power" and "off mode" (EU No 1275/2008 - currently under revision) and - since 2013 – "network-connected standby".

During the Dec. 2017 Consultation Forum, industry stakeholders and some Member States supported the exclusion of household dishwashers from the so-called "horizontal requirements" (i.e. across all domestic appliances with the scope of Ecodesign measures), which are laid down in the proposals for a revised regulation. Instead, new proposals for dishwashers may regulate low-power modes vertically (i.e. on a product-specific basis).

The definitions of the low power modes and related aspects are proposed as follows (Table A8.1)

Table A8.1 Definitions of low power modes and related aspects.

Term	Definition
Active mode	Means a condition in which the equipment is connected to the mains power source and at least one of the main function(s) providing the intended service of the equipment has been activated.
Main function	Means the main service(s) for which a product is designed for, and that correspond to the intended use of the product.
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 mains power source and provides only the following functions, which may persist for an indefinite item: -reactivation function, or reactivation function and only an indication of enabled reaction function, and/or -information or status display, and/or - safety function.
Interaction mode	Means a condition in which the equipment is connected to the mains power source and provides functionalities intended for interaction with the user such as programme set-up, delay start set-up, information to user, etc.
Delay Start	Means a condition in which the equipment automatically starts its main function at a later time as programmed by the user.
Network standby	Means a condition in which the equipment is able to start or resume a function by way of a remotely initiated trigger from a network connection.

The requirements on low-power modes are proposed as follows:

1) The equipment shall have an off-mode or a stand-by mode or both. The power consumption of these modes shall not exceed 0.5 W.
   By exception, if the stand-by mode includes the display of information or status, the power consumption of the stand-by mode shall not exceed 1.0 W.

2) If the equipment provides for a network standby, the power consumption of this mode shall not exceed 2.0 W.

3) After switching on the equipment, the equipment shall be in interaction mode. Interaction mode enables the user to switch to active mode, to delay start or to network standby, depending on the functionalities provided by the equipment.

4) In interaction mode, 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, standby mode or network standby.

5) If the equipment provides for a delay start, the power consumption of this condition shall not exceed 6.0 W. The delay start shall not be programmed for more than 24h.

6) The standby mode and network standby shall switch to interaction mode in case of reactivation by the user or reactivation through the network connection.

7) After the end of a programme and therefore of the active mode, the equipment shall be in interaction mode.

8) If the delay start or the active mode is interrupted by the user, either through direct interaction or through a network connection, the equipment shall switch to interaction mode.

9) 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 10%.
Standby mode	Power consumption **(P_{sm})** ≤ 0.5 W Exemption, in case of information display: Power consumption **(P_{sm})** ≤ 1.0 W	The determined value of power consumption P_{sm} shall not exceed the declared value by more than 10%.
Network standby	Power consumption in network standby mode (P_{nsm})≤ 2.0 W	The determined value of power consumption P_{nsm} shall not exceed the declared value by more than 10%.
Delay start	Power consumption in delay start mode **(P_{dsm})** ≤ 6.0 W and duration of the delay start mode (T_{dsm})≤ 24 h	The determined value of power consumption P_{dsm} shall not exceed the declared value by more than 10%.
Interaction mode	Duration of the interaction mode (T_{im})≤ 15 min.	The determined value of duration T_{im} shall not exceed the declared value by more than 10%.

8.2 Noise

Noise reduction is increasingly important due to 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 household dishwasher including energy efficiency.

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.

Note that most small dishwashers, i.e., table-top machines with ps $\leq$ 8, would be classified in the loudest noise class. For the standard machines, there is sufficient variation to span the three noise classes, although the majority of the machines would fall in the middle "Normal"-rated class, i.e. between 38 dB(A) and 47 dB(A).

Hence, this requirement could be proposed based on the following formulation (or similar):

B. Acoustic airborne noise emission classes

The acoustic airborne noise emission class of a household dishwasher shall be determined on the basis of the acoustic airborne noise emissions as set out in Table A8.3.

The acoustic airborne emissions of a household dishwasher shall be determined in accordance with state-of-the-art of the recommended standard

Table A8.3. Acoustic airborne noise emission classes

Acoustic airborne noise emission	*Icon on the label*	*Noise (dB)*
Night mode		*n < 41 dB*
Whispering		*41≤ n < 47*
Normal		*n ≥ 47*

8.3 Cleaning and drying efficiency

A revision of the cleaning and drying efficiency has been carried out in the revision of the standard for measuring the performance of the dishwashers. The cleaning Efficiency Index and the Drying Efficiency Index are in the last revision measured in a combined way avoiding possibilities for circumvention.

Additionally, the standard for measure the performance of the dishwashers has been revised to bring it closer to the current user behaviour. The test and calculation methods will be performed in accordance with the revised EN version of 50242 "*Electric dishwashers for household use – methods for measuring the performance*". In 2016,

CENELEC updated the EN standard (based on European Commission mandate M481). At the same time, it was aligned to changes that had been made in the relevant IEC standard (IEC 60436). The new standard has a test load which aims to more closely reflect realistic consumer use, i.e., also including plastic items, coffee mugs, stainless steel pots and glass bowls. The total mass of the new test load is 2.5 kg to 3 kg lower than previous (depending on the capacity of the dishwasher); hence, energy consumption may be expected to be slightly lower for most dishwashers when tested with the new load. Another change is related to the combined cleaning and drying (CCD) assessment; today, cleaning and drying performance are assessed in different test runs, and energy and water consumption is only measured for the cleaning performance test runs. With the new measurement standard, both cleaning and drying will be assessed at the same time, and the energy and water consumption will be measured with this combined test run. In addition, the proposed calculation method is streamlined, and now excludes the energy consumption of the low power modes.

. Overall, taking these elements into account, the changes in the revised standard are expected to have an effect on the EEI values. In particular, the energy consumption per load can be expected to become slightly higher. Experts indicated that this effect is different across appliances. Efficient appliances machines that nowadays declared a lower energy consumption and with an higher EEI are likely to show a higher increase, because the additional energy consumption needed to dry the plastic elements is higher in proportion to the overall energy consumption (the less is heated up the water the more energy is afterwards needed for drying). Based on expert input the use of the new standard will impact in terms of EEI values to an increase ranging from 1 to 4 EEI points.

Annex 9: Who is affected and how?

This annex explains the practical implications of a potential eco-design and energy label regulation for household dishwashers on implementation of the preferred policy scenario, see Section 8.1.

9.1. Practical implications of the initiative

The Ecodesign regulation will apply to household dishwasher manufacturers, importers and authorized representatives. Since household dishwashers are B2C products, generally sold by retailers, this will be another group affected by the regulations. As the 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 sector of the industry of manufacturers and assembles of the final product would be affected by the regulation. In the responses to the Open Public Consultation, 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.

The above affected stakeholders will need to comply with the Ecodesign requirements, as summarised in Table A9.1.

Table A9.1. 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

9.2. Summary of costs and benefits

For the preferred option, Tables A9.2 and A9.3 below present systematically the costs and benefits which have been identified and assessed during the impact assessment process.

Table A9.2. 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	Ca. 2.1 TWh p.a. in 2030	See Section 6.2.1
GHG-emissions savings	0.7 Mt CO_2 eq p.a. in 2030	See Section 6.2.2
Water savings	16 Million m^3 p.a. in 2030	See Section 6.2.2
Material efficiency requirements	--	No quantitative analyses was performed – but see Section 6.5
Business revenues (EUR_{2015})	EUR 4 billion in year 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 (EUR_{2015})	EUR 18 million less in year 2030	See Section 6.3.2
Increased employment	5000 jobs extra by 2030	See Section 6.4.3

Table A9.3. 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	EUR 3 200 000	Suppliers
Relabelling of the products	EUR 310 000	Dealers (retailers)
Database	EUR 17 500	Suppliers
	EUR 3 600	EU

Annex 10: 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 A7.1 gives an overview of the legislative process.

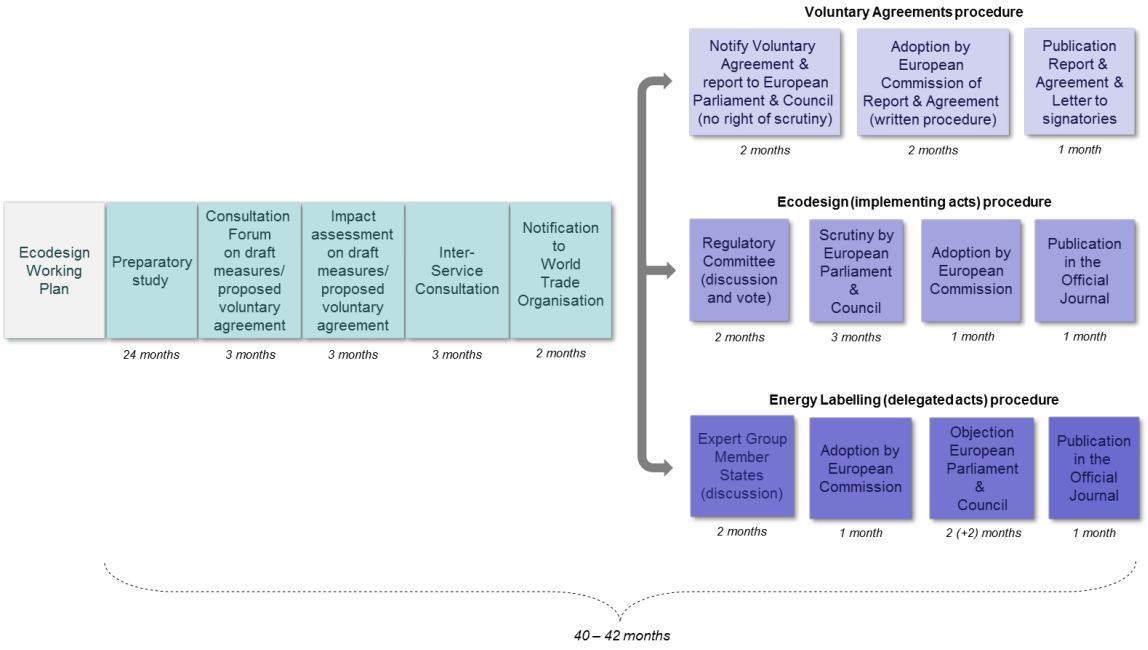

Figure 10.1: Overview of the legislative process

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[124]. Subsequently, the (first) Ecodesign Working Plan 2009-2011[125], the (second) Ecodesign Working Plan 2012-2014[126] 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 Table A10.1.

Table A10.1: 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.

[124] 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

[125] 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)

[126] Commission Staff Working Document Establishment of the Working plan 2012-2014 under the Ecodesign Directive - SWD(2012)434/F1 (Ecodesign Working Plan 2012-2014)

After the Consultation Forum, the Commission drafts an impact assessment, which after approval of the Regulatory Scrutiny Board (RSB) 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 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[127]). On one occasion an objection was even adopted in plenary, blocking the measure for televisions in 2009[128].

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 A10.2.

Table A10.2: 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

[127] This objection was defeated in ENVI committee by 43 votes against and 4 in favour.
[128] 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.

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)
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[129]. Given the principle of free movement of goods, it is imperative that MSs' market surveillance authorities cooperate with each other effectively.

[129] 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 11: Existing Policies, Legislation and Standards affecting household dishwashers

A number of directives and regulations affect household dishwashers.

11.1 EU ECODESIGN AND ENERGY LABELLING REGULATIONS

The current Ecodesign Regulation sets some generic requirements and minimum energy efficiency requirements for household dishwashers. The scope covers electric mains-operated household dishwashers and electric mains-operated household dishwashers that can also be powered by batteries, including those sold for non-household use and built-in household dishwashers.

The **current Energy Labelling Regulation** sets Energy Labelling requirements for household dishwashers, with the same scope as the current Ecodesign Regulation.

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[130])
- Electric motors (Ecodesign Regulation (EC) No 640/2009[131]);
- Circulators (Ecodesign Regulation (EC) No 641/2009[132]);
- Fans (Ecodesign Regulation (EU) No 327/2011[133]);
- Water pumps (Ecodesign Regulation (EU) No 547/2012[134]);

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[135]);

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131 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 Ecodesignecodesign requirements for electric motors. OJ L 191, 23.7.2009, p. 26.

132 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 Ecodesignecodesign requirements for glandless standalone circulators and glandless circulators integrated in products. OJ L 191, 23.7.2009, p. 35.

133 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 Ecodesignecodesign 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.

134 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 Ecodesignecodesign requirements for water pumps. OJ L 165, 26.6.2012, p. 28

135 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 Ecodesignecodesign requirements for standby and off mode

- Networked standby (Ecodesign Regulation (EU) No 801/2013[136]).

11.2 OTHER EU POLICIES

The **Low Voltage Directive**[137] 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 dishwashers 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 to household dishwashers. 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**[138] restricts the use of six specific hazardous materials and four different phthalates found in electrical and electronic equipment (EEE). Household dishwashers are directly covered by the RoHS Directive. There is no overlapping requirement with a proposed Ecodesign regulation.

The **REACH Directive**[139] 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 dishwashers. There is no overlapping requirement with a proposed Ecodesign regulation.

The **EMC Directive**[140] sets requirements for the Electro-Magnetic Compatibility

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electric power consumption of electrical and electronic household and office equipment**.** OJ L 339, 18.12.2008, p. 45.

[136] Commission Regulation (EU) No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to Ecodesignecodesign 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.

[137] 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)

[138] 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)

[139] 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)

[140] 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)

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 dishwashers. There is no overlapping requirement with a proposed Ecodesign regulation.

The **ETS** (Emissions Trading System) 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 dishwashers; however, it does apply to electricity production. Hence, if the electricity consumption of household dishwashers reduces, 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.

11.3 POLICIES AT EU MS LEVEL

There are no measures and policies at MS level for household dishwashers.

11.4 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 dishwashers.

Many countries have either introduced energy labels based on or inspired by the EU energy label[141], the United States of America (USA) programs or a combination of both.

The International Energy Agency (IEA) Energy Efficient End-use Equipment (4E) Benchmarking programme has made a comparison of the efforts in several countries, based on a normalised kWh/a Annual Unit Energy Consumption, as shown in the following Figure A11.1.

The International Electrotechnical Commission (IEC) recently updated the standard applicable to the testing of dishwashers: IEC standard 60436. The new standard has a test load which aims to more closely reflect realistic consumer use, i.e., also including plastic items, coffee mugs, stainless steel pots and glass bowls. Another change is related to the combined cleaning and drying (CCD) assessment: both cleaning and drying will be assessed at the same time, and the energy and water consumption will be measured with this combined test run.

To safeguard competition in the EU, it is important that the EU keeps on distinguishing

[141] European Commission Conference on Product Policy –Ecodesign & Energy Labelling, 20-21 Feb. 2014, misc. lectures.

products and manufacturing/ placing of appliances on the EU market 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 12: 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
HPED	Heat pump-equipped household dishwasher
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[142]
$MtCO_2eq$	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

[142] 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

OEM	Original Equipment Manufacturer
ps	Place settings
TWh	TeraWatt.hour, 10^{12} Watt.hour (unit of energy), i.e., equivalent to 1000 GWh
yr or a	Abbreviation used as denominator for units expressed per year (e.g. TWh/yr or TWh/a)