BEYOND EFFICIENCY
ANCHORING ABSOLUTE ENERGY SAVINGS
IN THE ECODESIGN DIRECTIVE AND THE
ENERGY LABELLING DIRECTIVE

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1 BACKGROUND

The Ecodesign Directive and the Energy Labelling Directive (ELD) for energy-related products (ErP) are two policy instruments aiming to lessen the negative environmental impacts of products in the European Union, in particular with regard to their energy usage.

Lowering *absolute* energy consumption is the prerequisite for reducing greenhouse gas emissions sufficiently in order to achieve the European Union’s climate goals. Positive side effects of such an absolute reduction in energy consumption include increasing independence from energy imports from crisis states and lower energy costs for consumers. In the past, however, the goals of the Ecodesign Directive and the ELD were mainly to enhance the energy efficiency of products, thus lowering energy consumption only in *relative* terms. Energy efficiency, defined as the ratio between the amount of energy used and the benefit derived from it, does not provide information about a product's absolute energy consumption. Numerous recent studies have shown that total energy consumption of individual products or of the totality of products in use is not decreasing as much as efficiency is improving, often despite significant efficiency gains, or that it is even increasing (e.g. GVSS et al. 2011, Breakthrough Institute 2011). The causes for this development include increasing size, new functions, an increasing number of products in many areas, or more frequent use, which offset part of the savings achieved by enhancing efficiency.

The goal of the present study is to show which approaches suggest themselves with regard to the policy tools of ecodesign and energy labelling to shift attention towards reducing absolute energy consumption when implementing these directives. Both directives are currently subject to review at European level. The present study is intended to contribute to the discussion around this process. A comprehensive analysis currently under preparation in the context of this review\(^1\) mentions the problem raised by the strong focus on energy efficiency. That study includes the (preliminary) recommendation to focus more on implementing approaches in future that also take absolute energy consumption into account (see Ecofys 2014, pp. 6, 77, 89 f.)

The present study is based on an evaluation of the literature, an assessment of product criteria from ecodesign implementing measures and ecolabels, and a survey of experts. The experts were surveyed in guided telephone interviews or in writing using a questionnaire. The survey included seven respondents, of whom six responded by telephone and one in writing, from the following fields in Germany and other EU Member States: environmental agencies, energy agencies, environmental organisations, consumers’ organisations, and business associations. The respondents’ assessments were included in the evaluation of the possible approaches, and new ideas were incorporated in the study.\(^2\)

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1 See, among others, the draft study by Ecofys (2014), see also www.energylabelevaluation.eu.
2 The authors would like to take this opportunity to thank their interviewees once again.
2 ABSOLUTE ENERGY SAVINGS: POTENTIALS AND LIMITS OF PRODUCT-POLICY INSTRUMENTS

2.1 Ecodesign Directive

The Ecodesign Directive\(^3\) is a central instrument for product-related environmental protection. It provides the basis for defining obligatory EU-wide minimum standards for important environmentally relevant product characteristics – for example concerning energy consumption, resource use, or emissions during the product life cycle\(^4\). For this reason, the directive is a powerful instrument that can decide whether a product is granted access to the internal European market. Products that do not fulfill the requirements regarding defined environmental aspects are denied access to the market.

Implementation of this instrument has so far been particularly focussed on enhancing the energy efficiency of energy-using products (EuP). Yet the directive is not necessarily limited to energy efficiency. Although it does use this term first and foremost, some passages of the text suggest that its goal is also to reduce energy consumption in absolute terms\(^5\). In the end, the purpose of the Ecodesign Directive is, besides other environmental aspects, to reduce greenhouse gas emissions caused by energy carriers as well as to improve the security of the energy supply\(^6\). These two goals can be accomplished only by reducing energy consumption in absolute terms.

In addition to the energy consumption arising when end users use products, energy from the most varied sources is required to produce the products themselves. This ‘embedded’ energy, i.e., energy bound in products, accounts for a significant share of the energy required across the entire product life cycle of a number of energy-using products, in particular those with many manufacturing-intensive electronic components. Although it is true that it should prove difficult to use the Ecodesign Directive to directly affect the energy consumption of production processes, implementing measures under the directive can have indirect impacts on production processes by regulating product-related parameters (see Jepsen et al. 2012). Such product-related parameters may involve extending the product’s durability and thus its operating life, for example. In many cases, this can have the effect of lowering total energy consumption, as the purchase of a product to replace an old one is postponed, or a product can be used by multiple users, which means that fewer new products need to be manufactured.

On the other hand, the directive, in keeping with its approach, does not provide the opportunity to limit the total number of the products falling within its field of application. For example, rising energy consumption because of an increasing number of computers per household cannot be contained by means of ecodesign of individual products. This applies to the Energy Labelling Directive at least to the same extent. Thus, the directives are limited to impacting the energy consumption of individual products – increasing consumption due to the total number of

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\(^4\) See Annex I of the directive.

\(^5\) For example, in Annex II: ‘Concerning energy consumption in use, the level of energy efficiency or consumption must be set aiming at […]’.

\(^6\) See for example recitals 6 and 14 as well as Article 1 Par. 2.
products could be affected only by environmental-policy instruments following a more macroeconomic approach.\(^7\)

A further limit lies in the fact that both the Ecodesign Directive and the ELD can have only very limited effects on the ways in which users actually use a product. The process of defining minimum standards involves a calculation of the expected absolute energy consumption of the individual products of a product group employing formulas based on typical patterns of use. However, actual, individual patterns of use may result in consumption deviating significantly from the calculated values (it can be higher or lower). For example, if a user leaves a television set on all day long, energy consumption will be significantly higher than the standard consumption value based on four hours of use per day. If users frequently leave the door of a cooling appliance open for a long time and/or select the lowest possible temperature setting, this will also result in higher consumption. Ecodesign implementing measures cannot directly affect the use of a product. However, they can require provision of information on energy-saving operation of a product and thus impact user behaviour indirectly. In addition, energy-saving functions such as automatic switch-off in the absence of user interaction can help to a certain extent (see section 3.2.3).

### 2.2 Energy labelling

Parallel to the Ecodesign Directive, the Energy Labelling Directive (ELD)\(^8\) is being implemented for many product groups. The two instruments are closely linked.\(^9\) Energy labelling aims in particular to accelerate market development in favour of especially environmentally-friendly products. Its purpose is to inform buyers about energy consumption and, as appropriate, consumption of other resources, and it permits comparison between different products available on the market. An energy efficiency index (EEI), calculated according to a formula specific to a type of product, is used to score those products. The range of possible results for the EEI is then distributed along a scale of energy efficiency classes, for example from A to G, or from A+++ to D, which is common at present (see Figure 1).\(^10\)

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\(^7\) Or by instruments aiming at removing older products from use, for instance ‘scrapping premiums’ or deposits on products that use electricity. This type of approach cannot be implemented with the framework of the Ecodesign Directive, as it refers only to the point in time when new products are placed on the market.

\(^8\) 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 (recast)

\(^9\) Even if some of the requirements are not coordinated sufficiently with one another so that in some product groups, for example, the label shows energy classes that can no longer be marketed in the EU because of the corresponding ecodesign implementing measure.

\(^10\) The discussion about naming the energy classes (A+++ to D vs. A to G, etc.) is currently ongoing elsewhere (see Ecofys 2014) and is beyond the scope of this study.
Consumers are very familiar with the energy label, and it has contributed to making them more aware of products’ energy consumption. To date, however, the focus is above all on information about comparisons of energy efficiency between various products, and less on information about absolute consumption.

The ELD refers to the two terms ‘energy efficiency’ and ‘energy consumption’ in a manner similar to the Ecodesign Directive. The title of the ELD\(^{11}\), among other things, refers to energy consumption, but there are also numerous references to the goal of enhancing energy efficiency by implementing the directive.

The following problems result from the fact that the focus of the labels is on the labelled products’ energy efficiency rather than on their absolute energy consumption:

- In the case of some labels, for example for washing machines and television sets, it is easier for larger products with high absolute electricity consumption to achieve a good energy efficiency class than smaller ones whose absolute consumption is lower (see Figure 2, Figure 3, and Topten 2013a, VZ RLP 2013)\(^{12}\).

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\(^{11}\) ‘Directive … on the indication by labelling … of the consumption of energy and other resources by energy-related products …’

\(^{12}\) This is not the case for all products. For example, the efficiency classes are distributed fairly evenly across all sizes for refrigerating appliances. However, it can be observed that the proportion of refrigerator-freezers labelled ‘A+++’ is significantly higher than that of simple refrigerators, whereas the latter consume significantly less electricity (cf. VZ RIP 2013, p. 46 ff.).
In the case of washing machines, the trend towards larger appliances while household sizes are declining is problematic, as it must be assumed that the appliances are often run only partially full. After all, automatic load recognition reduces electricity consumption by only 20 percent on average when the machine is half full (VZ RLP 2013, p. 38, Topten 2013a). For this reason, the draft of the ongoing study on evaluating the ELD recommends that the classes indicated on the label should be designed in such a way that they reward low absolute consumption – that is, that they grant a good efficiency classification (Ecofys 2014, p. 6).

Many consumers do not understand the information usually provided on the label about (calculated) absolute energy consumption, which is normally given as a number with the unit ‘kWh/annum’ (see Figure 1). Studies have shown that consumers do not understand this value properly – although a majority does assume that it is about energy consumption over a certain time period, they cannot place the number in context or confuse kilowatt-hours with watts (see CLASP 2013, p. 97, Ecofys 2014, p. 75, VZ RLP 2013, p. 52). It is obviously necessary to present these units of measurement to consumers in a way that is easier to understand, potentially abandoning the principle of language neutrality on the label. After all, according to a recent consumer study, a majority of respondents consider energy consumption according to the energy scale or class to be the second-most important piece of information on the label (see CLASP 2013, p. 44). Manufacturers in competition with each other are another important target group for energy labelling. As long as the labelling scheme does not reward low absolute energy consumption, manufacturers have no incentive to take it into account when designing their products. On the contrary, if the formulas for calculation present ‘more efficient’ but larger products with higher absolute consumption as especially ‘green’, manufacturers may advertise those products more prominently.
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Figure 2: Television sets: Percentages of efficiency classes in relation to various sizes of television sets and their average electricity consumption (Source: VZ RLP 2013, p. 37)\textsuperscript{13}

Figure 3: Washing machines: percentages of efficiency classes in relation to various sizes of washing machines and their average electricity consumption (Source: VZ RLP 2013, p. 40)

\textsuperscript{13} Reproduction of this and the following figure with kind permission of Verbraucherzentrale Rheinland-Pfalz.
2.3 Other instruments – environmental labels

Besides the Ecodesign Directive and the ELD, there are a number of other product policy instruments aiming to reduce the negative environmental impacts of products. Environmental or energy labels which manufacturers can voluntarily use on their products, provided they fulfil the relevant criteria, merit special mention, for instance the European Eco-Label, the Blue Angel, Energy Star, the Nordic Swan, the TCO label.

These instruments specify criteria for the environmental characteristics of products, similar to the Ecodesign Directive. As voluntary environmental labels may employ more far-reaching and strict requirements than, for example, generally binding ecodesign requirements, it is worth examining to what extent such labels implement approaches that bring about absolute energy savings. For this reason, examples from this area will be mentioned in the following.

It is important to note that it is difficult at times to transfer environmental labelling approaches directly to the two directives, since systematic differences between the instruments exist. For example, environmental labels are granted to pioneering products on a voluntary basis, while a binding feature of the Ecodesign Directive is to exclude those products from the market that do not fulfil the requirements. In addition, energy labelling is a mandatory instrument, even if 'merely' informative in nature. Nonetheless, the approaches used for environmental labelling can provide important information for new approaches to ecodesign and labelling.

3 STARTING POINTS FOR ABSOLUTE ENERGY SAVINGS

3.1 The goals of the two directives

If the goal of achieving absolute energy savings is to be anchored more firmly in the Ecodesign and Energy Labelling Directives, this should also be reflected in the provisions of the directives. As described above, both directives do refer to (absolute) energy consumption in addition to energy efficiency, but the Ecodesign Directive in particular focusses more strongly on the concept of efficiency. During the next revision of the directives (presumably in the coming years), such changes should also be discussed.

In the following, various concrete starting points with regard to achieving more absolute savings through implementation of both instruments, ecodesign and energy labelling, will be described and discussed. Potential advantages and disadvantages as well as any possibly existing examples will be mentioned for each individual point. The question of applicability to various product groups will also be discussed.
3.2 Ecodesign

3.2.1 Progressive requirements

Typical energy efficiency requirements are linear (see Figure 4). For example, the energy consumption permissible for television sets in accordance with the Ecodesign Regulation 642/2009 is comprised of the size of the screen, multiplied by a certain factor, plus a basic amount that applies to all television sets. The smaller the factor, and thus the flatter the curve, the stricter the requirements. This kind of linear formula has been criticised for some product groups. As certain basic functions that consume energy (e.g. a network interface) are necessary regardless of the size of the television set, it is then relatively easy for larger TV sets or ones with more features to meet the requirements (see Ecofys 2014, p. 77).

![Figure 4: Linear requirements of the Ecodesign Regulation 642/2009 for television sets and fictitious, stricter linear requirements](image)

Another typical option for defining energy efficiency is setting non-continuous requirements (see Figure 5). They may also be linear with 'jumps' in the efficiency curve, or they may divide the products into categories and then define the permissible energy consumption or energy efficiency for a category of products (ecee 2010, p. 7 ff.) The latter was implemented in Ecodesign Regulation 617/2013 for computers in line with the corresponding Energy Star criteria. In this regulation, computers are assigned to categories A to D depending on their technical features (number of processors, among other things). Each of these categories is assigned a maximum limit for energy consumption. However, this limit may be surpassed by certain amounts if additional elements that use electricity are present, e.g. additional memory and graphics cards. This kind of requirements related to product categories has proven useful for certain products; on the other hand, they are not very transparent, and the boundaries between the categories allow for manipulations to fit the better category (ecee 2010, p. 7 ff.).

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14 Not to be confused with the energy efficiency classes on the energy label – to date, the EU does not require energy labelling for computers.
The idea to define ‘progressive’ energy efficiency requirements has been under discussion for quite some time (see, e.g., eceee 2010). Progressive requirements differ from linear ones in that their energy consumption curves become flatter, although they do slope upwards. This is the case, for example, for the Energy Star criteria for television sets (see Figure 6). Thus, larger products or products with more functions are permitted to use a larger amount of energy in absolute terms, but the additional increment becomes smaller and smaller. In the case of television sets, this means that the larger the screen becomes, the smaller the additional electricity consumption granted each additional ‘unit’ of screen area. As in the case of Energy Star for television sets, the curve may even become so flat that in the end, it actually has the effect of an absolute cap on energy consumption (see section 3.2.2).

The Blue Angel for television sets also includes energy efficiency requirements which are progressive to some extent. TVs with a screen size of up to 127 cm that are to be awarded the Blue Angel must fulfil the requirements for energy efficiency class ‘A’, larger ones ‘A+’. Similarly the Blue Angel for dishwashers requires larger appliances of more than 45 cm width to fulfil energy efficiency class ‘A+++’ and smaller ones only ‘A++’. There are similar examples in the US for energy efficiency certification of buildings, which results in smaller residential buildings receiving more positive evaluations than very large ones; or: large houses exceeding a given amount of floor space must fulfil additional efficiency measures to receive a corresponding label (eceee 2010, p. 25 f.).
No such examples exist to date in the field of ecodesign. The ecodesign Regulation 642/2009 for television sets is currently under revision. An EU Commission proposal for new energy efficiency requirements from 2012 provides for a combination of a linear and a progressive function (see Figure 7). However, detailed examination of the curve reveals that its effects tend to be the opposite, namely that it is relatively more difficult for small television sets to fulfill the requirements. In this case, the functions on which the curve is based need to be changed to achieve an ‘actually’ progressive curve.

One specific advantage of the approach based on progressive energy efficiency requirements is that it takes economies of scale into account. These occur if energy use does not rise with the

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17 The curves describing permissible energy consumption for non-directional and directional lamps (Regulations 244/2009 and 1194/2012) as well as for household tumble driers (Regulation 932/2012) are not quite linear, either, but cannot be considered particularly progressive in the sense described above. On the contrary: there is a jump in the curve for directional lamps at a particular amount of useful luminous flux, so the requirements end up being more anti-progressive.
increase of the service provided – for example because there is a certain amount of basic consumption that is independent of the size of the product.

This is the case especially for complex products consisting of a large number of components, of which only some use energy depending on performance, while others consume a certain basic amount of energy. This category tends to include free-standing products (e.g. large household appliances) rather than system components (e.g. motors). Especially if they are components used for industrial applications, the latter often require a certain power input to achieve the desired result. In addition, meaningful or prevailing clear upper size limits tend to exist less for industrial applications than for consumer products. For example, it is improbable that household cooling appliances will grow infinitely large, provided that it remains desirable that they can be transported through stairwells and doorways – but this is not the case for commercially used coolers.

For this reason, progressive standards tend to make more sense for household appliances and free-standing products than for industrial products and system components. It is surely also simpler to define progressive standards for products whose energy consumption is mainly dependent on a continuous variable (screen size, cooling capacity, washing machine drum size, luminous flux). In the case of products whose energy consumption is determined by a combination of numerous different components whose electricity consumption in turn depends on performance and functions (computers, set-top boxes, printers), a progressive standard is more difficult to define.

Overall, the experts surveyed for this study considered the idea of progressive standards positive, or at least believed that 'in any case, there will be no way round this discussion'.

### 3.2.2 Caps on consumption

So far, ecodesign requirements have focussed on requirements for minimum energy efficiency, which means that permissible energy consumption depends on certain characteristics of each product. For example, television sets with larger screen sizes are permitted to use more electricity than smaller ones, and cooling appliances with a larger cooling capacity and more functions may consume more power than smaller, simpler appliances. The idea of an upper limit on consumption aims to stem the trend towards ever-increasing electricity consumption by ever-larger products with more functions: an absolute limitation of electricity consumption which must be observed, regardless of a product's functionality. Manufacturers wishing to market larger products or ones with more functions must then do so while adhering to the set limit.

The regulation on the ecodesign of vacuum cleaners (Regulation 666/2013) combines a minimum efficiency requirement (permissible energy consumption dependent on dust pick-up ability) with a cap on power consumption across all such appliances designed for household use (max. 1,600 watts from September 2014, 900 watts from September 2017). Thus, vacuum cleaners are the first product group for which such a cap on consumption has been introduced within the framework of implementing the Ecodesign Directive. Measurements have shown that there is no clear link between power consumption and dust pick-up ability for the vacuum cleaners on the market (Topten 2013b). Most consumers, however, believe that higher power consumption (up to 3,000 watts) means better performance, so advertisers focus on wattage in a misleading way. For this reason, such a cap makes a lot of sense for the example of vacuum cleaners.
Further examples of absolute energy consumption caps are to be found in ecolabels. An earlier version of Energy Star for television sets included an absolute cap (see Figure 8) instead of the progressive requirements described above (see Figure 4). Television sets to be awarded the EU Ecolabel must not require more than 200 watts during operation. A current proposal for revision of the criteria even involves lowering the cap to 64 watts. The Blue Angel for television sets also requires that energy consumption does not exceed 100 watts (besides the progressive energy efficiency requirement, see above). The EU Ecolabel for computers defines an absolute cap of 100 watts for the energy consumption of monitors. The Blue Angel for refrigerators and freezers permits maximum electricity consumption of 230 kWh per year.

In the case of ecolabels, limiting energy consumption to prevent ‘greenwashing’ of products that are relatively harmful to the environment is reasonable.\textsuperscript{18} In the case of ecodesign, which is a generally binding instrument, one must carefully consider for which product groups and at which level a cap on energy consumption makes sense. After all, on the one hand, relevant energy savings are to be achieved, on the other, there is the danger of encroaching too strongly on consumers’ freedoms if caps are set in such a way that they result in products greater than a particular size or performance level disappearing from the market. A cap on energy consumption can even be ineffective in terms of the goal of achieving energy savings if it is too strict. This would be the case, for example, if a cap for refrigerators amounted to a ban on large, family-sized appliances, with the result that large households would purchase two small refrigerators that use more electricity than one large one.

Therefore, binding caps on consumption could often be politically more difficult to establish and/or would lead to resistance on the part of consumers and the general public\textsuperscript{19}. For this reason, such caps should be accompanied by more extensive communication by policy-makers and trade groups as well as environmental and consumer organisations as a matter of principle.

Also, absolute caps on energy consumption should always be linked to energy efficiency requirements. On its own, such a cap on energy consumption would otherwise waste significant

\textsuperscript{18} The same is true of the best, i.e. green classes on the energy label.

\textsuperscript{19} Even in the case of vacuum cleaners, where this cap makes sense from the perspective of consumers, there were negative media reports and criticism because of incorrect information.
savings potentials, as smaller/less powerful products would be allowed to be relatively inefficient.

The experts surveyed for this study tended to be sceptical about the approach of a cap on energy consumption, especially with regard to possible limitations on consumers’ freedom. However, they also mentioned that absolute caps may make sense for products such as vacuum cleaners, where consumers believe erroneously that higher power input entails a better result and advertising reinforces this belief. Various small household appliances, such as irons, food processors, hair dryers, and possibly also electric kettles come to mind. To date, ecodesign implementation measures have not been elaborated for these products, and there are no plans to do so in the near future because of their limited potential to save energy. Besides, applying the approach of a cap to industrial drives and the like would not make much sense, as is the case with progressive standards.

### 3.2.3 Mandatory use of energy-saving sensors or functions and requirements with regard to default settings

Sensors and special functions can contribute to reducing the energy consumption of energy-related products by automatically adapting to needs or by influencing user behaviour. Examples include motion sensors, monitors automatically adapting to ambient brightness, products automatically powering down or switching to sleep mode in the absence of user interaction, as well as acoustic warning signals, for example if the door of a cooling appliance is left open too long.

Such energy-saving functions are already required by ecodesign implementation measures for a number of product groups:

- The function of automatic sleep mode has become standard for many electric products and as a rule, it must be activated at delivery.
- Refrigerators and freezers: The fast freezing function, which lowers the temperature of the freezer compartment to enable faster freezing, must switch back to the previous normal storage temperature after at most 72 hours. Household cooling appliances with a storage capacity of less than 10 litres must automatically switch to an operating mode with 0.00 watts power consumption after at most one hour when empty.
- Duplex printing for imaging equipment must be activated on delivery (in accordance with the voluntary ecodesign agreement for imaging equipment, among other things).
- If household electric range hoods are set to a high air flow, they must switch back automatically to a lower one after a certain time.

Further examples implemented in ecolabels include:

- Automatic brightness control of monitors must be turned on on delivery (e.g. Blue Angel for television sets and monitors). The Blue Angel for television sets also requires manufacturers to provide information about additional energy use when the quick-start function is activated, and following activation of that function, the set must automatically switch back to standby mode after at most 4 hours.

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20 Cooling appliances with the Blue Angel must automatically switch off the fast freezing function when a temperature of -32°C. has been reached, at the latest after 65 hours.

21 To be precise, this is not an ecodesign implementation measure, but an alternative to such a mandatory regulation.
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• Blue Angel mobile phones (section on resources): When charging has been completed, the phone must inform the user in an easy-to-read way that the charger should be disconnected or that the computer is no longer needed for charging.

• Blue Angel washing machines: The washing machine must feature automatic load detection which automatically reduces water and energy consumption by a certain fraction when the machine is not fully loaded.

• Blue Angel tumble dryers: Tumble dryers must have a sensor drying feature, which automatically stops the drying process as soon as the moisture content of the clothing has reached the selected value.

• Blue Angel cooling appliances: The appliances must provide temperature settings and display the cooling temperature with one-degree accuracy. There must be separate temperature controls for cooling and freezing. A visual or acoustic signal must alert users when the door is open too long.

• Blue Angel range hoods: If the range hood is operated at the highest setting, it must automatically switch back to a lower one after a particular time period – and the factory setting must be a maximum of 10 minutes.

• Nordic Swan for ‘white goods’ (large household appliances such as refrigerators, washing machines, etc.): Possible requirements for automatic dispensing of laundry detergent or dishwashing detergent are to be considered in the next revision of the criteria.

The energy-saving functions mentioned on ecolabels could also be required in ecodesign implementing measures as a matter of principle. In addition, the examples from ecolabels provide suggestions for further similar functions: for example, humidity sensors could be used not only in tumble dryers, but also in drying cabinets and dehumidifiers; acoustic signals could also be required for further products, for instance to call the user’s attention to the fact that a washing or rinsing cycle has been completed and the machine can be turned off; sensors that turn off kitchen appliances when they are no longer needed are imaginable (besides range hoods, also for stoves, for example). A hard off-switch could be required for many products. It would make it possible to disconnect a product from the grid entirely and thus avoid electricity consumption in standby mode.

In combination with such energy-saving functions, information could also be provided to users about ways to save energy when using the products.

Discussions relating to increased automation are taking place especially concerning the energy efficiency of buildings. Here, examples can be found such as linking an open window to the heating system, which then turns itself off, automatic ventilation and air conditioning with heat recovery, etc. In particular when it comes to buildings, however, increasing automation is also being met with rejection, or the equipment, e.g. thermostats, is not used properly. In any case, because the approach of the Ecodesign Directive is geared towards individual products, it is difficult to apply it to requirements of building systems; other regulations, such as the Directive on the Energy Performance of Buildings and its implementation into national law are presumably better suited here.

The benefit of energy-saving functions or of making them mandatory in ecodesign measures should be assessed on a case-by-case basis. Such functions certainly can make a lot of sense and help achieve the goal of saving energy, especially in cases where consumers tend to leave

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22 See eceee (2014) and the contributions in that publication.
products switched on unnecessarily. However, one must take care that such functions are implemented in a way that users do not feel they are troublesome; otherwise, they might simply switch them off entirely. For example, suitable time periods after which products are switched to sleep mode in the absence of user interaction should also be discussed and determined on a case-by-case basis. Similarly, environmentally friendly settings that users can choose themselves should not be designed in such a way that they are unacceptable to users. A well-known example is ‘eco-programmes’ for washing machines, which do consume less energy, but take so long that they are probably hardly ever used.

The experts surveyed had a positive stance in principle about the possibility of making automatic energy-saving functions mandatory, but they did point out the limitations of this approach mentioned above. Several also mentioned that some of the additional functions consume energy themselves. In some cases, this can be a substantial amount, in others very little. Here, the costs and benefits need to be considered carefully. Such considerations should also include possible risks concerning personal data protection and privacy (e.g., carried to the extreme, with regard to the possibility to use cameras that monitor whether a television viewer has fallen asleep and then have the television turned off).

Besides energy-saving functions, there are also numerous additional product functions which themselves can result in higher energy consumption. These functions are not required to fulfil the basic function of a product (examples: additional hard drives in televisions sets, various kinds of additional cooling compartments in cooling appliances). In calculations of energy efficiency requirements, added functions are often taken into account in the form of additional permissible electricity consumption. This practice has recently come under increasing criticism (see Ecofys 2014, p. 77), since the additional permitted electricity consumption is at times quite generous. The argument has also been put forward that only the basic function should be taken into account when calculating energy efficiency and that products with more functions must then simply be comparatively efficient. Here, it should also be considered on a case-by-case basis whether it makes sense to have additional functions switched off automatically when not in use. This has been implemented in the relevant Ecodesign Regulation for the fast freezing function of cooling appliances and in the Blue Angel for the quick-start function of television sets (see above in this section).

From an environmental point of view, however, additional functions that use energy do not always involve negative effects. For example, integrated receivers in televisions can make other products which would otherwise serve these functions superfluous.

### 3.3 Energy labelling

#### 3.3.1 Progressive requirements

As a matter of principle, progressive requirements are possible also for energy labelling. Larger products, which generally consume more electricity in absolute terms because of their size, would then face more difficulties in achieving a good energy efficiency score (for further explanations, see section 3.2.1). The boundaries between classes on the labels for television sets, for example, are currently defined by a linear function (see Figure 9). The authors are not aware of any examples of progressively defined energy classes. In the case of energy efficiency classes for televisions, it is possible to change the curves, based on the Energy Star criteria, to make them progressive, i.e., the curve becomes flatter for larger screens (see Figure 10).
In the example of television sets shown here, the classes ‘A+++’ and ‘A++’ in the current energy labelling scheme are already characterised by a very flat linear curve, which means that a progressive curve, as shown in Figure 10, would have only a limited effect on these classes. However, it would be easier for smaller sets to reach a good efficiency class, as the curve is a bit more 'generous' there because of its curvature. As a matter of principle, the strength of a progressive curve's effects depends on its curvature. Generally speaking, such a progressive curve implies advantages for smaller products and disadvantages for larger ones or ones with more functions.

As the best efficiency classes are perceived by consumers as a kind of environmental label because of their green colour, it makes sense to define them in such a way that absolute energy consumption plays a role in the definition of the classes. Progressive curves are a possible step.

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23 Assumption of basic functions; potential additional consumption because of additional functions not taken into account.

24 This is merely a sample calculation; the precise curvatures can be shifted up or down.
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in this direction. It must be evaluated on a case-by-case basis how this can be implemented appropriately for each product group. In general, similar considerations as in the case of progressive ecodesign requirements apply, among others that it is presumably simplest to implement progressive curves for products whose energy consumption depends mainly on one continuous variable. In addition, one could introduce bonus systems in the calculations for efficiency classes that would reward e.g. the use of energy-saving functions (see section 3.2.3) (Ecofys 2014, p. 6 f.).

3.3.2 Caps on consumption for the best classes

A cap on consumption in the context of energy labelling would have to look like this: Classes A through G, or A+++ through D, would still be defined by a certain level of energy efficiency. However, the best classes, e.g. classes A, B and C, or A++, A+ and A, would also include an absolute cap on energy consumption. For example, a washing machine would have to attain at least a certain energy efficiency index and at the same time consume a maximum of 160 kWh per year to reach class A++. A larger machine with the same EEI, but exceeding this absolute limit, would then fall back into the next lower class, A++. This class could also have a defined cap, e.g. 180 kWh per year. If the machine in question remains below this limit, it could be granted class A++; otherwise, its classification would lower again – in a class for which no absolute cap on electricity consumption would be defined. The curves would look like those in Figure 11 (again for the example of television sets).

![Figure 11: Current boundaries of energy efficiency classes for television sets (in accordance with Regulation 1062/2010), combined with absolute caps on energy consumption for the best efficiency classes](image)

The authors are not aware of any such example in practice. In contrast to absolute caps in ecodesign, absolute caps on energy consumption for the best energy label classes would be relatively easy to implement and would not involve comparable potential for conflict as no

Assumption of basic functions; potential additional consumption because of additional functions not taken into account.
products would be banned from the market. Instead, products exceeding a certain absolute energy consumption would not be awarded one of the best, green efficiency classes. Therefore, these classes would become ‘something special’, similar to an ecolabel.

It must be determined for individual cases how many and which classes should be covered by such a cap. For some product groups, only products in a few efficiency classes are currently permissible on the market, for example, household cooling appliances must meet the standards of one of the classes A+ to A+++. Changes in the scale must also be taken into account, for example when new ecodesign requirements enter into force and remove another class at the bottom end of the scale. In this case, care must be taken to ensure sufficient differentiation, also in the case of larger products that tend to consume more energy. Similar considerations apply when the scale is expanded at the top to include an even better class.

Some of the experts interviewed for this study welcomed the idea, but others were of the opinion that an energy efficiency scale should represent efficiency and nothing else. On the other hand, the question is how efficiency is defined in the background calculations – in the end, progressive functions can also amount to a cap on consumption by products greater than a certain size (see Figure 6).

### 3.3.3 Stronger emphasis on absolute energy consumption

For some groups of products, indicating the energy efficiency class is losing relevance, at least in its current form, because of significant differences in the size of the products and therefore large differences in their absolute consumption. A small television in class D may consume the same amount of electricity as a very large one in class A++ (VZ RLP 2013, p. 35). It is questionable whether the extreme differences in energy efficiency communicated in this way (worst vs. second-best efficiency class) are justified in light of the fact that the two sets consume the same absolute amount of electricity. Similar statements are possible for washing machines. How the allocation to efficiency classes works precisely, that is, what the energy efficiency index actually measures, is very difficult for consumers to comprehend. People who are prepared to read the relevant regulation in detail and who also have the necessary technical background are the only ones able to understand the classification system – i.e., practically only experts dealing with the subject professionally.

As consumers have a significantly poorer understanding of the indication of absolute energy consumption on the energy label than of the efficiency class itself (see section 2.2), a different presentation that is easier to comprehend is recommended, one which emphasises absolute energy consumption more strongly and differentiates it from energy efficiency. This should be considered independently of the above-mentioned approaches for integrating absolute consumption more strongly in the definition of the energy labelling classes. Stronger emphasis of absolute electricity consumption could, as a matter of principle, be either a complement or an alternative.

It is questionable whether it would make sense to replace the efficiency scale used to date by one showing a product’s absolute energy consumption. The efficiency classes could continue to be noted on the labels as a letter, where absolute consumption has been indicated to date (Figure 12). The scale shown is continuous, which means that the products are not grouped into classes. Some countries are already using this kind of scale in their energy labelling (see Figure 13). Studies that have examined consumers’ understanding of such absolute scales in

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26 In some EU Member States, energy labelling of buildings is also supposed to focus on information with regard to absolute energy consumption.
comparison to scales that use categories (such as A through G) show mixed results (London Economics/Ipsos 2014, p. 4).²⁷

Figure 12: Example of an energy scale based on absolute electricity consumption (representation by authors)²⁸

²⁷ However, it has to be taken into account that one can expect consumers to have a better understanding of the kind of label they are familiar with. Completely new proposals therefore necessarily achieve worse results than well-known ones.

²⁸ An additional marker indicating the rating of the best product at a particular point in time is provided to help consumers rate the product in question.
Figure 13: Examples of the representation of absolute energy consumption as well as, in some cases, energy costs on different energy labels. From top left to bottom right: 'Energy Rating' label in Australia, Canadian 'Energy Guide' with a continuous scale, US 'Energy Guide' label with continuous scale referring to the costs (left, refrigerator-freezer) and energy consumption (right, washing machine).
Advantages of an absolute scale obviously include that the scale points out absolute consumption, which is relevant for electricity costs, more strongly to customers and also avoids benefitting large products by making it easier for them to reach higher energy labelling classes because of the method of calculation used for the energy efficiency index. In this case, the scenario that a super-sized television with an A+ label looks far more attractive to consumers than a small one with a B label that consumes only one-third as much electricity could no longer occur. In addition, reclassification would no longer be necessary when too many products reach the highest energy class.

One disadvantage would be that consumers are accustomed to the existing efficiency classes and would first have to learn about the new scale. As a result, there would likely be some confusion, at least at first. A current study refers to the value of the current combination of letters, colour code and arrows of varying lengths that conveys a simple message to consumers and should therefore not be abandoned lightly (see Ecofys 2014, p. 6). Since a relevant fraction of consumers apparently do not understand what ‘kWh/annum’ means, a purely absolute scale would also entail the risk that labelling would become completely useless if the unit is not given in the national languages. This, in turn, would involve abandoning the principle of language neutrality.

A further problem is that the absolute scale makes it more difficult to compare functionally equal products with each other and with other products of a similar size, whereas precisely this comparison has been possible with the current system. For example, without the energy efficiency scale, it would be more difficult for consumers to identify the most efficient product if they needed a large refrigerator for their large families and all products were labelled red, and electricity consumption were similar. Small appliances (e.g. a small refrigerator without a freezer), in contrast, would almost always be labelled ‘green’, even if they were less efficient compared with appliances with the same functions. The ‘Energy Guide’ used in the US solves this problem by only including similar products in the absolute scale (see Figure 13, bottom right: ‘Only standard size clothes washers are used in this scale.’)

In addition, it would not be easy to determine the lower end of the absolute scale for all products. The top, ‘green’ end could be indicated by a zero, the ‘red’ end, however, depends on the largest product with the most extra functions, and this can change frequently (provided no limit on absolute electricity consumption is mandated under ecodesign, see section 3.2.2). Comparing a product only with similar ones, as is the case in the US ‘Energy Guide’ and presumably also the Canadian ‘Energy Guide’ could solve part of the problem (see Figure 13). A direct link of the energy consumption scale to the respective ecodesign requirements for a product would, however, no longer be possible, since the latter are usually based on energy efficiency.

The efficiency scale seems to have certain advantages that should not be given up. Still, as an alternative to replacing the efficiency scale by an absolute one, one could place an additional scale on the label (see Figure 14).
Figure 14: Example of an additional absolute scale on the energy label (representation based on UBA/BAM 2014)

The benefit of such an additional absolute scale must be assessed individually for the various product groups. An absolute scale would hardly make sense for products such as heating systems, for example, where absolute energy consumption is intentionally not given on the label (but only the heat output of the system in kilowatts), as consumption depends on too many external influences (weather, room temperature, user behaviour, building, etc.). Placing stronger emphasis on absolute energy consumption can also become a problem when different energy sources are used, and this is true not only of heating systems, but also of stoves and tumble driers, as their energy consumption is not comparable due to the different energy sources. If absolute consumption is to be highlighted, then the energy source in question would also have to be given greater prominence.

In the case of products such as washing machines, televisions, refrigerators, etc., an absolute scale could, however, help customers get a feel for a product’s absolute energy consumption. This would be significant added value compared with the information given to date with regard to consumption, namely merely a number.

However, it should also be mentioned that consumer studies point out that labels should not be too overloaded with detail or too complex (Ecofys 2014, p. 88). This, too, should be examined for individual product groups; for example, an additional scale would likely be too much for labels that already include a large amount of information or display two scales (e.g. for some heaters and air conditioners).
Of course, other options for emphasising absolute consumption are imaginable in place of an absolute scale, for example by indicating the absolute value in a larger font or a different colour or by integrating it in the arrow next to the efficiency class. Another option would be to make this information more comprehensible by abandoning the principle of language neutrality on the label (‘kWh per year’ instead of ‘kWh/annum’; see section 2.2). The costs of energy consumption in the use phase could be provided as well, as in the US ‘Energy Guide’ for some products. However, energy costs are not stable, and they differ substantially between various EU Member States, which would make country-specific labelling necessary. Where the label is displayed in digital form (e.g. in e-commerce or digital displays in retail outlets), energy costs could be indicated relatively easily by multiplying expected electricity consumption by the average electricity price of the country in question.

Most of the experts interviewed for this study believed that it would make sense to give greater emphasis to absolute energy consumption on the label, in one way or another. However, one interviewee said that it would hardly be possible to make the number even bigger. Overall, they emphasised that it was important to assess the benefit of an additional absolute scale or other way of highlighting of a product’s energy consumption on a case-by-case basis.

### 3.4 Energy embedded in products

#### 3.4.1 Ecodesign requirements with regard to life time and repairability

All products contain ‘embedded energy’, i.e. energy used for their production. Thus, extending the use phase of a product has the effect of reducing the energy consumption required for manufacturing, provided it eliminates the purchase of a new product. One example: using a pair of shoes for two years instead of one avoids the entire energy consumption incurred for producing one pair of shoes; in other words, the amount of energy required is cut in half, based on a two-year use phase. A product’s durability is already affected in the product design and construction phases by the selection and interaction between the individual product components. Higher quality and longer technical product life time are not always solely a question of price. According to reports, using wear-resistant gears in handheld mixers costs only slightly more, but extends the product life time by about 10 years. The same is the case for the proper selection of electrolytic capacitors for televisions and other electronic consumer goods (Schridde/Kreiß 2013, pp. 28-30).

However, in the case of products that require energy during use or have an impact on energy consumption, one must take into account that it may sometimes not be worthwhile to continue using old, inefficient products because of their potentially high energy consumption during use. In such cases the impacts of the production and the use phase must be weighed carefully. As a matter of principle, however, energy consumption during the manufacturing phase becomes more important when energy efficiency in the use phase is increased.

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²⁹ It would also be possible to indicate the CO₂ emissions occurring during the use phase, i.e. the emissions due to a product’s energy consumption. The added value compared with indicating absolute electricity consumption (or consumption of other energy carriers) is limited, however. Many additional assumptions are involved here (e.g. concerning the electricity mix used); indicating energy consumption is more direct. Regarding labelling CO₂ emissions across the entire product life cycle see section 3.4.2.

³⁰ A project commissioned by the German Federal Environment Agency on the topic of ‘obsolescence’ is ongoing. Its goal is to establish an information base on the life time of products and to develop strategies to counter ‘obsolescence’. Interim reports or the like are not yet available.
As explained in section 2.1, ecodesign requirements with regard to durability, repairability and reusability may help extend a product’s life time\(^{31}\). Requirements for the products themselves and requirements regarding information for consumers must be differentiated here. Initial approaches for such requirements already exist in ecodesign implementation measures for some product groups:

- **Lamps**: Household lamps must fulfill certain life time requirements (premature failure rate, lumen maintenance, number of switching cycles before failure); information must be provided to consumers regarding the average life time and number of switching cycles before lamp failure.
- **Notebook computers**: Information must be provided to consumers about the minimum number of battery charge cycles attainable. For laptops whose battery cannot simply be exchanged by the user, that information must be displayed on the packaging and elsewhere. However, there is no requirement that the battery can indeed be exchanged.
- **Vacuum cleaners**: The hose (if any) and the motor must fulfill life time requirements – the hose shall be ‘durable so that it is still useable after 40 000 oscillations under strain’, the motor must last for at least 500 hours. In addition, information for professional users must be provided concerning non-destructive dismantling for maintenance.
- **For a number of products** (electric motors, pumps, fans, heaters, water heaters, vacuum cleaners, certain types of luminaires), information about dismantling, reuse and/or recycling must be provided. These are not requirements helping to extend the life time of products in the narrow sense of the term, but they may make it easier to reuse parts and therefore amortise the embedded energy to a greater extent.

Further examples are to be found in ecolabels:

- **Computers**: Personal and portable computers must provide certain technical expansion capabilities, e.g. for adding memory, and also feature interfaces if they are to be awarded the Blue Angel or the EU Ecolabel. The ongoing revision of the ecolabel criteria for computers has generated the proposal that users should also be informed about ways in which battery life can be extended for laptops and tablet computers. In addition, further criteria for repairability could be established requiring, among other things, that the costs of spare parts make up less than 20 percent of the costs of a new product. The criteria for the Nordic Swan for computers require that the batteries of certain, mostly battery-powered computers must be exchangeable.
- **Mobile phones**: If they are to be awarded the Blue Angel, mobile phones must be designed in such a way that users can completely and securely remove all personal data by themselves and without having to purchase software. This makes it easier to get the mobile ready for a second user. Users must be able to exchange batteries without special tools. Regardless of ecolabelling requirements, the ‘Fairphone’\(^{32}\) makes it easy to change the battery and also provides for using two SIM cards simultaneously so that users can use a single phone for both private and professional purposes rather than two.
- **Blue Angel for hair dryers**: Hair dryers must pass a 400-hour endurance test including 200 hours during which they are switched on (in a cycle alternating 15 minutes on and 15 minutes off).

\(^{31}\) See also the work of the Joint Research Centre (JRC) of the EU Commission (JRC 2011/2012).

• Vacuum cleaners: If vacuum cleaners are to be awarded the Blue Angel, they must fulfil life time requirements even today that will be required by the relevant ecodesign regulation beginning in 2017 (see above this section). In addition, vacuum cleaners must pass an impact test involving at least 500 impacts with doorsteps and pillars.

• Life time requirements may also refer to individual components: for example, projectors must use lamps with a certain minimum life time to earn the Blue Angel.

• In addition, a standard requirement of many ecolabels involves availability of spare parts for a certain period of time. As this is not a product characteristic, it is difficult to introduce such a requirement in the context of ecodesign. Ecolabels such as the Blue Angel also often require certain warranty periods. Whether or not legal requirements concerning warranties can be formulated Europe-wide cannot be evaluated in the present study.

As a matter of principle, life time and repairability requirements make sense from an environmental and consumer perspective, and it can be observed in the ongoing EU-level discussions that there is generally greater optimism than a few years ago concerning the feasibility of such requirements. Besides direct product requirements, information to be provided to consumers regarding the life time of products can also be useful – for lamps, for instance, a duty to provide such information is already contained in the ecodesign requirements (see above)\textsuperscript{33}.

Such requirements do not guarantee that purchases of new products are indeed avoided – consumers may nonetheless replace a product before the end of its technical life time because ‘better’ new products with additional functions are now on the market – but this should be less important in the case of mature products such as washing machines than for information technology. However, it is possible to provide for technical changes in products with a very dynamic development by designing them from the outset so they can be expanded and upgraded. In addition, functioning products no longer used by their original owners can subsequently be used by others.

In each case, it should also be evaluated whether the time and effort on the part of manufacturers and market surveillance for inspecting whether requirements are fulfilled is proportional to the environmental benefit.

### 3.4.2 Energy labelling: Indicating embedded energy on the label

One possible approach for taking the energy embedded in products into account in the context of energy labelling would be to include the relevant information on the label and thus make it visible to potential purchasers of products. At present, such information is not provided for on the label, which refers only to the consumption of energy and other resources during product use.\textsuperscript{34} If embedded energy is to be mentioned, the directive would first have to be amended.

In addition, it is currently (still) difficult to mandate such information requirements. After all, fulfilling them involves a considerable amount of time and effort, since manufacturers must assemble comprehensive data. It would be difficult for market surveillance to verify whether the information is correct, as embedded energy is not a product-related piece of information, but

\textsuperscript{33} Information on the life time could possibly also be shown on the energy label, i.e., in a place which is much more visible for customers. Potential advantages and disadvantages of such information cannot be discussed here in detail.

\textsuperscript{34} See Article 10, Para. 3a) of the ELD.
one related to the manufacturing chain. The same is true of potentially indicating CO₂ emissions in form of a footprint across the entire life of a product.

A practicable solution in the medium term would be to use average values for energy consumption and CO₂ emissions for the manufacture of certain materials and to apply them to the materials included in the product. In this way, the energy embedded in products could be calculated by approximation and provided to interested consumers. If specific data is available to manufacturers, they could use that data in place of averages.

A complete assessment of the costs, including possible risks due to manipulation, faulty information and the like, as well as the benefit of such additional information is beyond the scope of this study. An initial possible step would be to establish such information first in the context of ecolabels.

4 SUMMARY AND RECOMMENDATIONS

The present study discusses possible starting points for anchoring the goal of attaining absolute energy savings more firmly in the Ecodesign and Energy Labelling Directives and realising it in their implementation. To date, these two product-policy instruments focus on improving energy efficiency, which does not always result in a reduction of absolute energy consumption. In the final analysis, the purpose of the Ecodesign Directive is, besides other environmental aspects, to reduce greenhouse gas emissions caused by fuels as well as to improve the security of the energy supply. These two goals can be accomplished only by reducing energy consumption in absolute terms.

For each of the two instruments, three concrete starting points were discussed which can contribute to reducing the energy consumption of energy-related products during the use phase. In addition, possible approaches were presented that can help reduce the energy embedded in products during their manufacture.

On the basis of the preceding systematic discussion of the possible starting points, this study concludes with the following results and recommendations:

Both directives

During the next revision of the Ecodesign and Energy Labelling Directives, the question as to how the goal of attaining absolute energy savings can be reflected more strongly in the texts of the directives should be discussed. For example, some passages that so far refer to energy efficiency should be reconsidered, potentially replacing the term ‘energy efficiency’ by ‘absolute energy consumption’.

Implementation of the Ecodesign Directive

When formulating product group-specific energy efficiency requirements, one should examine on a case-by-case basis whether the requirements can be progressive. This should tend to be

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the case more for free-standing products whose electricity consumption depends above all on one continuous variable than for system components, for example.

Absolute caps on energy consumption may make sense under certain circumstances. This is true in particular of products where consumers erroneously believe that higher power input brings about a better result. As a matter of principle, care should be taken when applying this approach that it does not encroach too strongly on consumers’ freedom.

The use of sensors and functions resulting in energy savings as well as requirements with regard to the default setting should be mandated where reasonable. This has already been implemented in some cases. In individual cases, care should be taken that such functions are not rejected and switched off by consumers and that these functions do not require a disproportionate amount of electricity themselves. Also, it should be considered on a case-by-case basis whether the additionally permissible amounts of electricity for energy-consuming additional functions, which exist in practice in some cases, are necessary.

In addition, requirements that would help to indirectly reduce energy use in the manufacturing phase, e.g. by extending the use phase (durability and repairability), should be considered in a more systematic way than previously. The costs and benefits of such requirements should be considered on a case-by-case basis.

**Implementation of the ELD**

In particular when it comes to the more informational instrument of energy labelling, energy efficiency classes should be designed to be progressive for those products where this is reasonable. In order to ensure sufficient coherence with the requirements of the Ecodesign Directive, it would make sense to use the same formula for calculations for a product group, i.e. the requirements for the energy classes and for ecodesign would be uniform, either progressive or not progressive.

In combination with progressive requirements, or as an alternative to them, consumption caps could be introduced for the ‘green’ classes on the label. This would help these classes do justice to their green colour, similar to an ecolabel, better than in the past.

The benefit of an additional absolute consumption scale – besides the scale of the energy efficiency classes A to G, not replacing it – should be assessed on a case-by-case basis, or alternatively, other opportunities to emphasise absolute consumption more strongly should be considered. Consumer surveys would be useful here in order to test how well a product’s potential buyers understand such an additional scale or the information about absolute electricity consumption.

Mandating provision of information about the energy ‘embedded’ in products on the energy label would surely go too far at this point in time because of the effort involved and the existing gaps in information, not least because such information is not standard practice on ecolabels, either. But it would be reasonable to examine the feasibility of this approach, potentially in ecolabelling.
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