Introduction 1

1 INTRODUCTION

The objective of the First Findings Report is to present the initial analysis of the evidence collected during the field work conducted by CSES and its partners in the evaluation study of the Ecodesign Directive (2009/125/EC). It is also intended to serve as the reference document for the discussion during the second stakeholders' meeting that is planned to take place in October 2011.

The evidence collected so far has relied on stakeholder feedback through various mechanisms. This report sets out much of this feedback as the basis for further enquiry and discussion with view either to validating the views expressed and supporting them with further evidence or to qualifying or rejecting them, if they prove to have little foundation. The second stakeholders' meeting will play an important part in this process.

The report first presents a brief account of the methodological framework of the evaluation and then the analysis of the data and other information collected through desk research, an online survey of stakeholders and an interview programme that included Member States authorities, industry, environmental NGOs and experts.

The structure of the report is as follows:

Section 2 – Methodology: describes the key objectives of the evaluation and the tasks involved and presents the methodological framework that provides the basis for the evaluation.

Section 3 – Analysis of findings: analyses the initial findings, identifies issues and questions that should be examined further and proposes questions to be discussed with stakeholders during the Stakeholder Meeting.

Section 4 – Assessment of the extension of the Directive: describes the methodology that will be followed in assessing the scope for extending the Ecodesign Directive to cover non-energy related products and presents the work conducted so far in a series of case studies.

Section 5 - Present the initial emerging conclusions of the analysis conducted so far

Section 6 – Next steps: indicates the immediate steps to be taken, following the submission of the First Findings Report.

Methodology 2

In this section, we describe the key objectives of the study and present the methodological framework that we are going to use to evaluate the Directive and assess the feasibility of extending the Directive to cover non-energy related products.

2 METHODOLOGY

The aim of the study is to conduct a formal evaluation of the Ecodesign Directive, according to the normal practice of the European Commission, and to examine whether, and in what ways, the Directive might be extended to products that are not within the current scope of the Directive. The evaluation is in response to Article 21 of the 2009/125/EC Ecodesign Directive that requires the Commission to review the effectiveness of the Directive and of its Implementing Measures, with a view to further legislation, if necessary, that would amend the Directive's provisions and increase its effectiveness.

In view of the requirements of the Directive the study has a number of priorities that may be summarised as follows:

- assess whether the Directive is fulfilling its objectives in terms of reducing energy consumption and relevant environmental impacts for the products in its scope, including complex products and systems of products
- evaluate the Directive's effects on the market, on industry's competitiveness and on innovation in the sector concerned
- examine whether the criteria and procedures for defining and developing Implementing Measures as described in Article 15 and as implemented by the Commission, are effective and efficient, particularly taking account of the administrative costs involved
- examine the effectiveness of the application of the Directive in the EU and the Member States, including issues such as product conformity, the effectiveness of surveillance and the continuing existence of hidden barriers
- Examine the political, legal and (if appropriate) procedural relationships of the Directive with other EU policies and instruments - the SCP/SIP Communication, environmental legislation and health and safety legislation. The possible integration of product related instruments (Ecodesign, Energy label, Ecolabel and GPP) is of particular interest
- examine the appropriateness and implications of any extension of the Directive beyond its current scope to also cover non-energy related products

2.1 Analytical framework

The priorities of the study have helped to formulate a list of evaluation questions, covering the whole range of evaluation topics. These questions have been put within a conventional and well established evaluation framework that is used in standard evaluation methodology. These issues concern:

Relevance and coherence - the extent to which the given legislation is relevant to the identified needs and general EU policy objectives and coherent with other relevant policy tools.

Effectiveness - the extent to which the legislation is achieving its operational, specific and global objectives.

Efficiency – the relationship between financial and administrative inputs related to the implementation and enforcement of the legislation and the physical outcomes and how economically the various inputs have been converted into outputs and results. Linked to this is value for money – could more be achieved with the same level of financial inputs or, conversely, could the same outputs be achieved with reduced inputs?

Methodology 2

As far as the required exercise has the character of an Interim Evaluation, the question of efficiency also arises in relation to the processes and procedures through which the legislation is implemented.

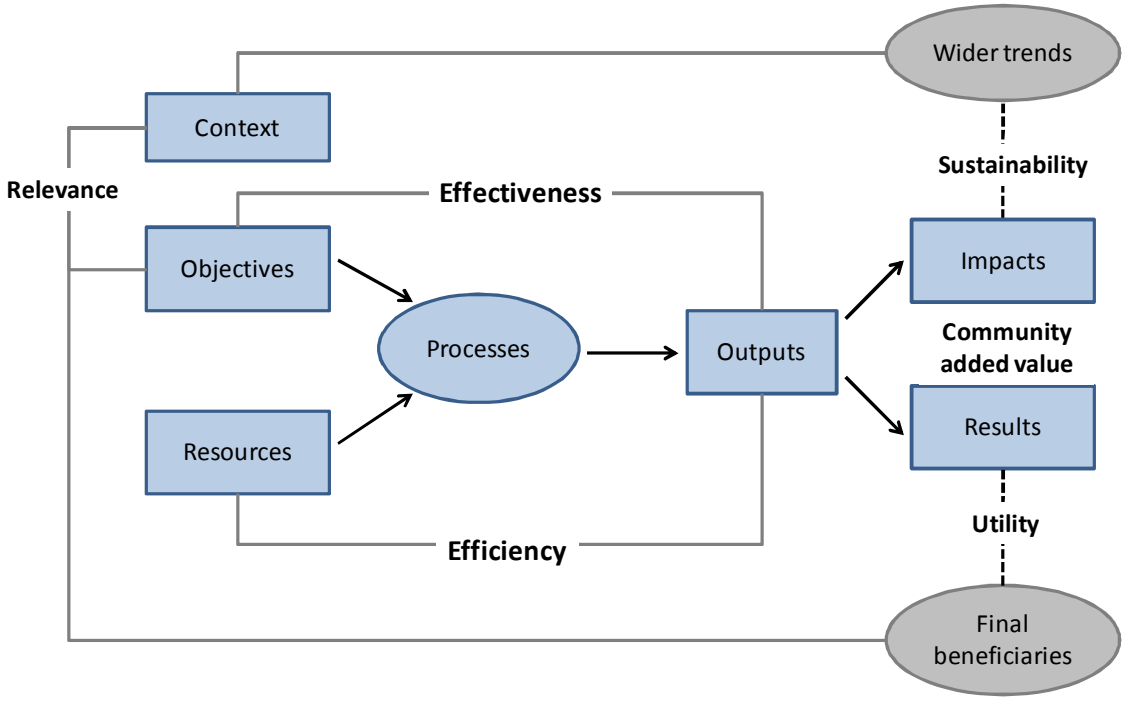
Utility – the extent to which the impacts of the legislation compare with the needs of the target population(s) – including industry, consumers and society more generally (including environmental concerns)

Sustainability - the extent to which positive changes attributable to the implementation of the legislation are expected to be sustainable in view of any additional compliance costs; More specifically in this specific case would it be practical and reasonable to extend the procedures (Implementing Measures, in particular) to cover a larger number of products?

European added value – the extent to which intervention or activities supported at an EU level brings about changes that would not have occurred through Member States acting on their own or cooperating bilaterally.

The differing issues can be thought of, as arising from a focus on particular aspects of a larger process, as is illustrated in the chart below:

Chart 2.1 – Evaluation framework



2.2 Intervention logic – key evaluation indicators

A key process in any evaluation of policy measures is the development of an account of the policy's intervention logic (see diagram in page 7). An intervention logic illustrates the expected linkages and causal relations between the identified needs the policy is addressing and the actions undertaken to address those needs. It shows the links between broader policy goals and the more specific operational objectives of the Directive, and how these are operationalised in the Implementing Measures and the actions of the key

actors involved (Commission, Member States authorities, industry and stakeholders). In addition, the intervention logic sets out the nature of the expected achievements of the policy, by setting out the relationship between the Directive's objectives, its specific short term outputs and the expected medium term results and longer term impacts of the actions undertaken. It is thus possible to see more clearly the mechanisms of the Directive, the key parameters of success or failure and the associated indicators at the different levels. The model set out in this way also provides the basis for investigation in the course of an evaluation since it suggests the points in the process that need examining and helps to show which are the critical indicators of success. In doing so, it highlights the process dimensions of the policy intervention and the efficiency with which they are carried out, as well as the expected market and industry outcomes and the ultimate environmental impacts.

The account of the Ecodesign Directive's intervention logic was developed on the basis of the analysis of the provisions of the Directive itself, a review of other significant policy documents (e.g. SCP/SIP action plan) and initial interviews with key stakeholders. It illustrates, in particular, the expected linkages between the identified needs and broader policy goals (reduction of greenhouse gas emission, security of supply, avoidance of fragmentation in the Internal Market) and the more specific operational objectives of the Directive (the methodology for setting requirements, the mechanisms for ensuring conformity) the Implementing Measures themselves and the actions on the ground of the key actors (Commission, Member States authorities, industry and stakeholders).

In turn these objectives are linked with expected short term outputs that are key elements in the implementation process and the anticipated outcomes in the medium term (results) and long term (impacts).

In the long term the key objective of the Ecodesign Directive is to reduce energy consumption and environmental impacts. Possible variables measuring impacts on the environment include:

- **Total $C0_2$ emission reductions**. A direct measure of the impact on the environment for a certain product group.
- **Total energy consumption by product group.** Total energy consumption is easier to assess and can be used as a proxy for impact on the environment.

The key medium term outcomes of the Directive are the expected changes in the markets of EuPs towards more energy efficient products. Possible indicators measuring impacts on market and industry include:

- **Composition of the market by class of products on the basis of the energy label or shifts in the market shares across the efficiency classes of products**
- **Average/aggregate efficiency gains achieved as a result of the changes in the market structure**

Furthermore, the Ecodesign Directive can have indirect effects on the market and industry which can affect energy consumption and CO2 emission:

- **Sales volumes and the prices of EuPs**
- **Product variety and consumer choice.** Ecodesign requirements can force certain types of product to be withdrawn or lead to suppliers of less efficient technologies leaving the market. If new products are not introduced in step with these changes, product variety and consumer choice will diminish.

Furthermore, it is important to assess additional market impacts, including:

- **Effects on trade patterns and the supply chain**: Shifts in trade or international competition, including the possibility of 'outsourcing' inefficient production activities.

- **Effects on competitiveness**: The reported or observed changes in the competitiveness of particular industries.
- **Impacts on third countries**: This could result from market changes or regulatory shifts due to the European policy initiatives.

The long terms outcomes stated earlier can normally only be observed some time after the intermediate outcomes and it is not necessarily the case that the intermediate outcomes will create the desired long term outcomes. Arguably, in the case of the Ecodesign Directive this linkage is more direct. Shifts in market and industry towards more energy efficient products should be expected to have an immediate effect on the product group's total energy consumption and CO2 emission.

A critical aspect as this stage is the actual compliance with the requirements set by the relevant Implementing Measures. If market surveillance and enforcement is effective a shift in the market and industry performance will indeed occur by definition and will help the transformation towards lower energy consumption for the targeted product group leading to the medium and longer term objectives. Furthermore, if market surveillance and enforcement are not equally effective across the Member States this will lead to uneven implementation of the Directive allowing for free riders in the market and providing entry points for non-compliant products, thus affecting the operation of the Single Market.

The indicators of the short term outputs can be quite extensive but the key indicators to be examined shall include:

- **Proportion of products identified in the Working Plan where Implementing Measure have been adopted**
- **Proportion of Preparatory Studies completed**
- **Proportion of products in compliance with requirements set under the Directive**
- **Quality of enforcement of the Directive across the EU (or level of variation in the level of enforcement across the EU).**
- **Gaps in the development of standards (share of products not covered)**

Rebound effect

One issue that can also question the linear connection between the medium term market effects and the long terms reduction in energy consumption saving is the possible presence of a **rebound effect. Direct rebound effect refers to** the increased level or frequency of use of products by consumers, as a result of their improved levels of energy efficiency and lower costs per use (fall in effective price). Furthermore, an **indirect rebound effect** may arise by the expenditure on additional energy using products due to the savings from efficiency costs.[3]

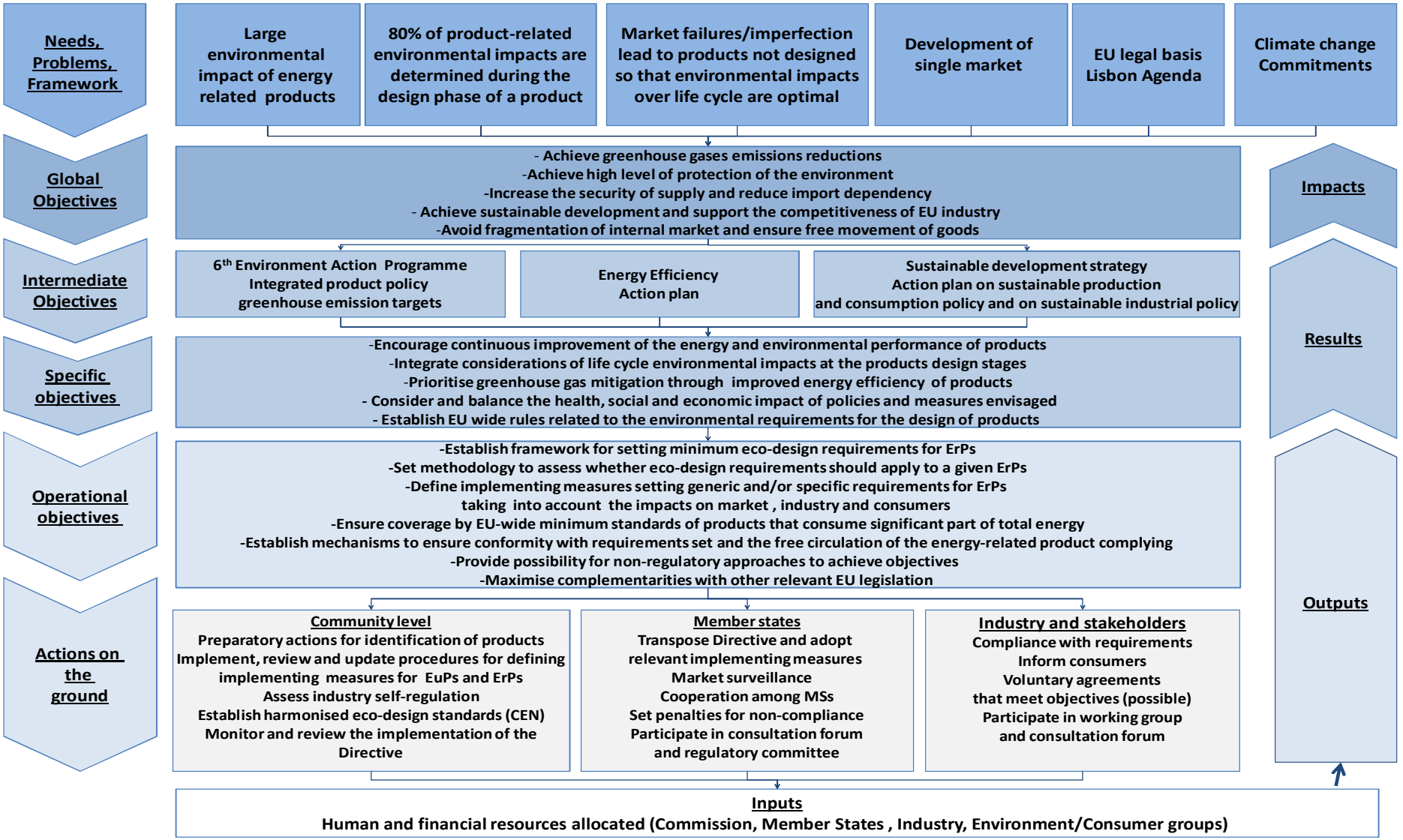
There are multiple ways that the rebound effect may take place in relation to the setting of Ecodesign requirements. One example is if light bulbs become more energy efficient, some consumers might not pay the same attention to turning the light off when leaving a room. Another example is if direct savings due to lower life cycle costs of products are spent on purchasing other goods that otherwise could not have been afforded. The effective fall in the price of a resource (the cost to produce one unit of output) can cause an increased consumption of the resource. Thus, while the products in the market become more efficient as a result of technological improvements and the minimum requirements set by the Implementing Measures, the initially expected reductions in total energy and the use of other resources use may not be achieved. A

[3] Information in this section is taken from the Interim Report of the project "Addressing the Rebound Effect" conducted on behalf of DG Environment, http://rebound.eu-smr.eu/documents/ReboundEffectInterimReportWEBGVSS03022011.pdf?attredirects=0&d=1

rebound effect may also arise from a "feel good perception of being green" that can encourage increased consumption for certain green products. For example, the use of recycled paper (Schneider, 2003) or energy-efficient lighting may lead some people to increase the level of consumption of such products.

It is rather difficult to identify a direct causal link between the introduction of Ecodesign based requirements and possible increases in the level of consumption of energy using products. Other factors, such as economic growth, overall consumption patterns, can have a much greater influence. Still, independent of its causes, the results of the rebound effect can be a reduced level of effectiveness of the introduced measures. According to the Ökopol study, rebound effect correction factors were not integrated in the calculations of expected savings in all preparatory studies. . Our study has not attempted to assess and measure the presence of a rebound effect but rather to identify evidence of its presence for the different energy using products. It was based on the analysis of the data available and **qualitative observations** through interviews with stakeholders who follow the markets and industry.

Methodology

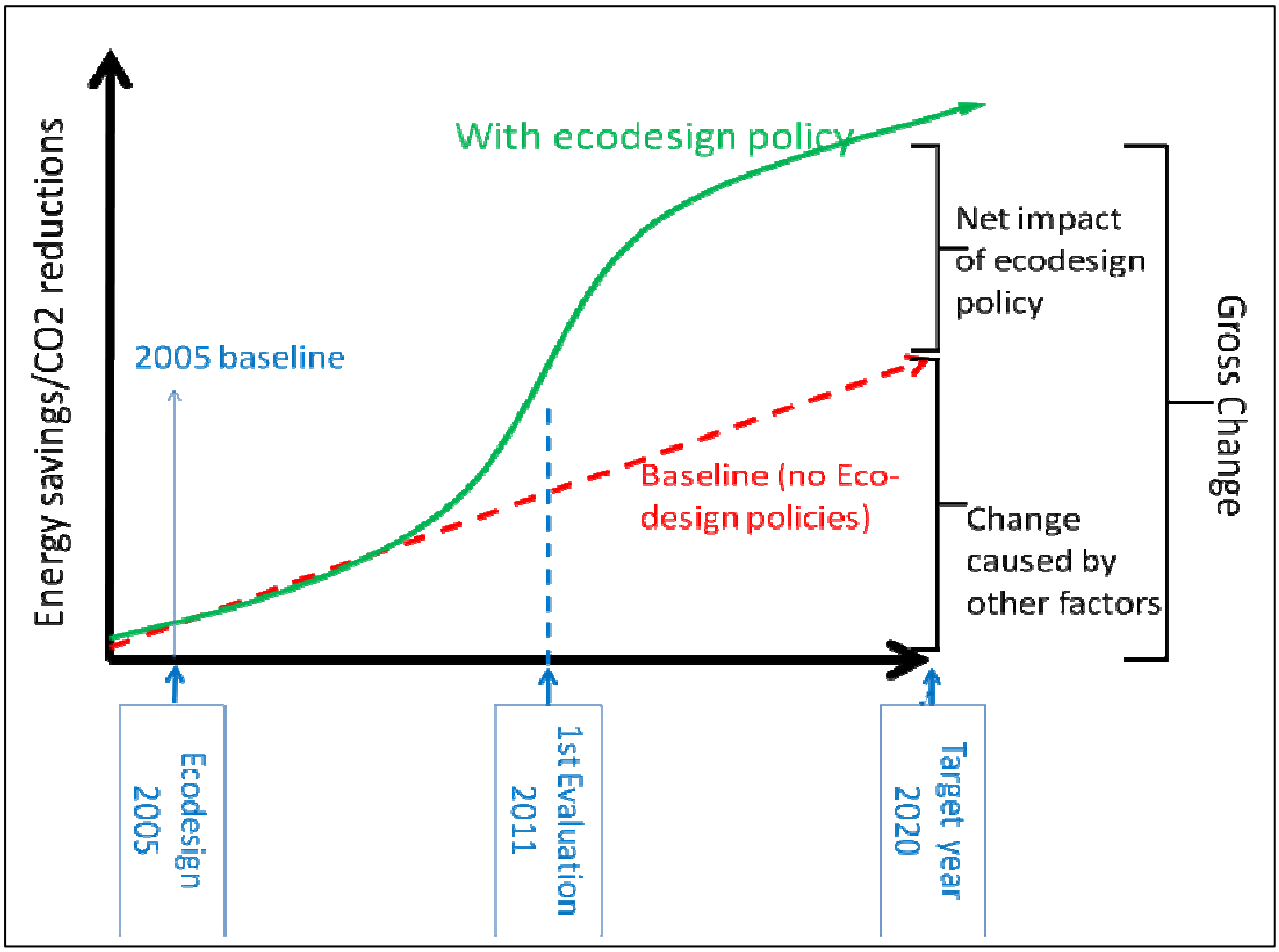


2.3 Development of the baseline for assessing effectiveness

In addition to defining which indicators to use, it is essential to establish when to measure impact and against which baseline. The baseline represents the starting point since it describes the status quo against which the effects of an intervention can be assessed. For the development of a baseline in the case of the Ecodesign Directive and the various respective Implementing Measures, the respective impact assessments of the energy-using products and the respective preparatory studies have been the point of reference.

Chart 2.2 below illustrates how the use of the baseline helps the assessment of the effectiveness of the Directive in relation to the longer term objective of reducing greenhouse gas emissions. By comparing an outcome indicator such as the overall energy savings of a specific product category over time against the baseline scenario provides an indication of the effects of the measure. Of course, the presence of a difference does not by itself substantiate a causal relation. Intermediate indicators can help assess whether the expected process (as described in the intervention logic) is taking place and the use of other sources such as interviews with stakeholders that throw further light on the nature of the change.

Chart 2.2. – Theoretical model for assessing the impact of the Ecodesign Directive

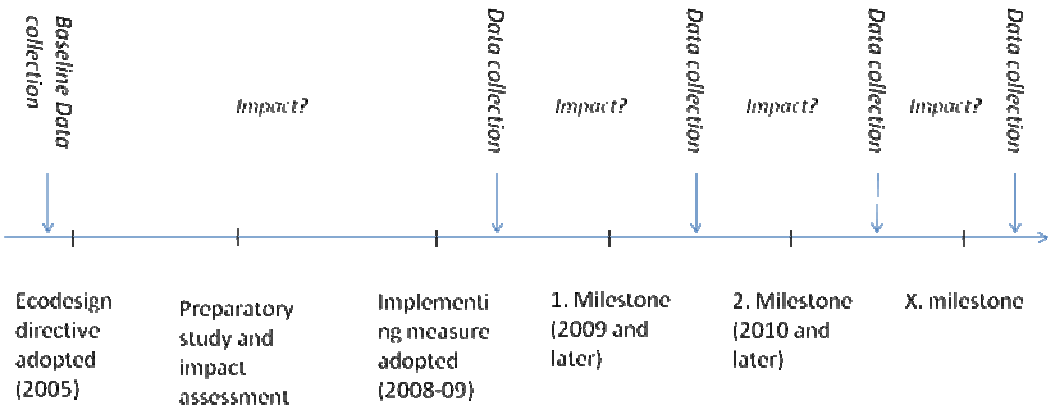


In an ideal scenario, the evaluation of the effectiveness would be based on:

- A first baseline measurement prior to the adoption of the Ecodesign Directive
- Several measurements after the requirements come into force

- A measurement at some point after the Implementing Measure is fully implemented and the desired effects have taken place. In the case of the Ecodesign Implementing Measures this refers to the entry into force of the most demanding requirements.

Chart 2.3: Ideal data collection to measure effectiveness



2.4 Limitations

In contrast to the ideal scenario described above there are a number of important limitations in the actual evaluation of the effectiveness of the Ecodesign Directive currently. Firstly, there is an issue of the **timing of the evaluation**. Implementing Measures for the 9 product groups were only brought into force towards the end of 2008 or in 2009, following a phased introduction of measures and a step-by-step strengthening of the minimum requirements. Only one product group has progressed beyond the first set of requirements. For three more products, the Implementing Measures came into force during the last year with no requirements yet applicable. Thus, the focus of the evaluation has to be on the individual products covered and effects that can be observed from the relevant Implementing Measures or voluntary agreements.

An additional complication is that the requirements set in Implementing Measures only apply to new products brought to the market and since most of the products covered have relatively **long life-cycles,** an important part of the total stock in the market will not yet be covered by the requirements. This naturally, limits the effect of the Directive.

Even more important are the **data constraints**. There is a lack of data covering the period after the requirements have entered into force. Data from official statistical sources are at least 2-3 years old and, as a result, they tend to be limited to the period before the Implementing Measures were adopted. Furthermore, for some of the nine product groups, it is a challenge to find data that cover the product groups as they are defined in the Implementing Measure. During the fieldwork period the evaluation team conducted an extensive review of available sources and requested stakeholders to come forward with any relevant data that would provide direct or indirect indications of changes in the market for EuPs. However, with very few exceptions, stakeholders representing associations have reported that they have no relevant information at this stage.

Beyond the practical aspects, there is also an **issue of causality**. The available data do not solely reflect the impact of the Ecodesign Directive. Other instruments – primarily the Energy Labelling Directive but also other policy tools at the European and Member State level –also play a role in the development of more energy efficient appliances. The way these different policies interact may vary among product categories. In theory the Energy Labelling Directive focuses on the provision of information to consumers on the quality of products and thus helps the operation of the market from the demand side, complementing the supply-

side changes brought about by the Ecodesign Directive. As a matter of fact Energy Labelling requirements are based on the benchmarks levels established under the Ecodesign Directive and preparatory studies under the Ecodesign Directive consider also labelling policies. However, the feedback received so far indicates that this is not as straightforward as it might appear and there are difficulties in discriminating between the two influences.

In addition, it is likely that the effects of the Directive or a particular Implementing Measure may have begun even before they formally entered into force. Interviews with stakeholders have confirmed that the prospective need to change in response to Ecodesign requirements, even at the stage that these are still under consideration, already focuses the attention of producers on improving energy efficiency. Thus, even though there were no legal requirements, changes may have started to happen prior to the implementation of the Directive. This anticipatory action is, in fact, a rather common phenomenon associated with the introduction of legislation that aims to set mandatory requirements. However, this **anticipatory effect** may have generated different reactions across the various industries depending on a number of framework conditions (e.g. market structures, availability of new technologies etc.). Some producers have reacted quickly and devoted significant resources to increasing energy efficiency. Others have reacted more slowly. The reaction from industry and the point in time at which changes start to happen will thus have to be discussed in more detail under each product group, but, in general, the effects we hope to measure will mainly be the anticipatory action of forward looking producers and, only to a limited degree, the effects of the entry of the Implementing Measures into force.

On the basis of the problems outlined, it is to be expected that the conclusions on the effectiveness of the Directive are likely to refer to only part of the relevant markets. Nevertheless, on the basis of indications from the information collected from various sources, it is possible to present a partial picture of the developments in the market and to make a first assessment of effectiveness of the Directive.

2.5 Assessment of the scope for a possible extension of the Directive to non-energy related products

A rather separate task of the evaluation is the assessment of the scope and feasibility for extending the Directive to non-energy related products. This is comprised of four sub-tasks that include:

- An identification of relevant non-energy related products and a selection of 5 products for in-depth case studies
- Case studies of representative products
- The use of the findings from the cases studies to derive conclusions on the feasibility of extending the Directive to take in broader product groups
- Assessing the appropriateness of an extension of the Directive to non-energy related products and making recommendations on how the Directive should be modified.

This part of the study is running in parallel to the work for the evaluation of the existing Directive (2009/125/EC). A detailed presentation of the work conducted so far is provided in section 4.

2.6 Presentation of the fieldwork and data collection mechanisms

The fieldwork completed during phase 2 of the evaluation has been based on three main instruments: a stakeholder survey, an interview programme and desk research. These are described briefly in the following paragraphs.

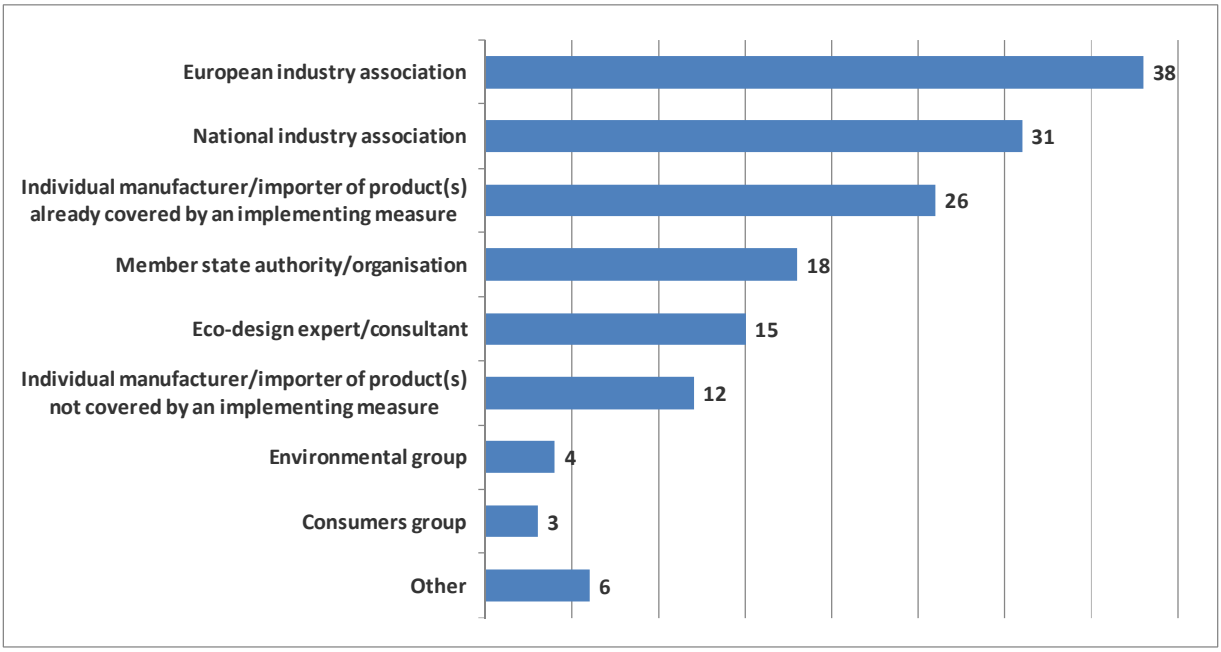
Methodology 2

Survey

A stakeholder survey was organised during the period of March to May 2011. Stakeholders representing different actors in the market (Member states authorities, industry associations, experts, environmental and consumer groups, individual companies) were asked to provide their feedback through both closed and open questions on almost all evaluation issues. The survey did not attempt to achieve any type of representative sample as the target population is rather difficult to define. The focus was rather on the collection of as much information as possible.

A total of 152 responses were received although not all questionnaires were fully completed. The following chart provides a breakdown of the respondents by role.

Chart 2.4 – Survey responses by type of stakeholder



The respondents were also asked to indicate their familiarity with the development of one or more existing or expected Implementing Measures. Among the products already covered, 78 indicated experience with one or more product and for all products listed there were at least 20 that have been or are currently involved. Clearly the level of focus on specific products is different in the case of industry associations that represent a specific sector and concentrate on one or a few products in contrast to Member State authorities or environmental groups that are usually involved in multiple products. Still, in all products a diversity of stakeholders has been achieved.

Interview programme

In parallel to the stakeholder survey a significant interview programme was completed. In some cases, this involved stakeholders that had not participated in the survey but in others it was possible to take up the comments and information provided in the survey and discussed the issues in further detail. Thus, the interview programme operated in a complementary way to the survey. It also covered Commission officials in the key Directorates General in order to provide information on their own experience of the implementation of the Directive so far and to clarify questions on the practical aspects of the legislation as well as on the broader policy framework.

Methodology 2

Table 2.1 – Interview programme

Row Labels	Completed	Declined
EU level		
Commission officials	6	
Consumer group	1	
Environmental group	3	
Expert/consultant	5	2
Industry association	15	
Standard body	2	1
National level		
Member states authorities	9	2
National industry association	2	1
Individual manufacturer/importer	4	
Interviews related to the extension case studies	9	2
Grand Total	**55**	**8**

Desk research

Finally the evaluation was based on extensive desk research that aimed to collect information on developments in the market for energy using products, market surveillance activities and compliance levels plus information on relevant policies in third countries. The list of survey sources is provided in Appendix A.

The different sources of information have provided distinctively different but highly complementary perspectives on the central issues of the evaluation.

Analysis 3

In this section we examine the key evaluation questions and present findings based on the analysis of the data and other information collected.

3 ANALYSIS OF THE KEY EVALUATION QUESTIONS

3.1 Introduction

The objective of this section is to present the analysis of the information collected and the emerging conclusions in relation to each of the key evaluation questions concerning the effectiveness, efficiency, relevance and sustainability of the Directive.

The objective of the report at this stage is to present the findings of the work conducted so far and for this to serve as a basis for discussion and feedback with stakeholders. The evidence that is to be presented relies to a large extent on information provided by stakeholders in response to a survey and in interviews and on comments made during the first stakeholder meeting. Comments are reported especially when they are derived from several sources or are consistent with other observations, but it is important now to seek to verify these comments, both by exposing them to contradiction and by seeking further substantiating evidence. The positions stated are therefore very much provisional and a number are likely to be modified or removed from later reports after further feedback from stakeholders. For this reason, none of the material presented should be cited as a conclusion of the evaluation. Currently that would be very premature. Rather, the evaluation team has sought to take advantage of the open spirit of Ecodesign procedures to test and challenge propositions that appear to be emerging from the analysis and to direct attention to areas where more evidence is required. It is for this reason that throughout this section, after each major sub-section, a series of questions are posed, with a view to prompting the provision of more information from stakeholders.

3.2 Relevance of the Directive

In this section we present the findings of the evaluation, first of all, in relation to the key question of the relevance of the Directive within the broader context of sustainable consumption and production policy. We also consider how the Directive operates -whether it is complementary or not - to other related policy instruments and if there are synergies or overlaps. In this, the evaluation aims to address the following set of questions:

- How does the Directive fulfil its role within the context of the SCP/SIP Communication? Do the other SCP/SIP instruments complement the Ecodesign Directive in terms of efficiently promoting public procurement, incentives, labelling, etc?
- How has the Directive complemented the other relevant policy instruments (Energy Label, Ecolabel and Green Public Procurement)? Is it possible to better integrate the product related policy instruments? (e.g. common preparatory studies, stakeholder forums and committees)?
- How do interfaces/borderlines with other relevant energy efficiency legislation (Energy Labelling Directive, the Energy Performance of Buildings, Energy Services Directives) function?
- How does the Directive interface/overlap with other relevant environmental and health and safety legislation? Are there any problematic areas?

Background

From its adoption in 2005, the Ecodesign Directive has been linked with a range of EU policies. The reduction of energy consumption was considered to be key for achieving the greenhouse gases emissions reduction targets set in the Sixth Community Environment Action Programme. Energy saving measures

were also seen as the most cost-effective way to increase the security of supply and reduce import dependency. Similarly, the Action Plan for Energy Efficiency[4] provided for the adoption of minimum ecodesign standards to improve the efficiency of energy-using products. In that context the Ecodesign measures were seen as part of a broader set of measures to improve energy performance that also included the Labelling Directive, the Energy end-use efficiency and Energy Services Directive and the Energy Performance of Buildings Directive.

The promotion of the eco-design of products is also a crucial element of the Community Integrated Product Policy. The aim has been to optimise the environmental performance of products in the most cost-effective way taking into account technical, functional and economic considerations. This approach should also provide genuine new opportunities for manufacturers, consumers and for society as a whole.

The extension of the EC Directive in 2009 to cover energy related products (ErPs) allows it to serve the broader objectives of the Action Plan on Sustainable Consumption and Production and on Sustainable Industrial Policy (SCP/SIP)[5] that implements the Commission Sustainable Development Strategy (SDS)[6].

According the Action Plan impact assessment[7] the key role of the Directive in that respect is to address the market failures and imperfections that prevent market mechanisms from reaching an optimum in terms of the balance of consumption and production and environmental impacts. These market failures result in products that are not designed so that the environmental impacts of products over their life cycle are optimal from a social point of view. The extension to energy related products was due to the fact that energy using products are responsible for only 31-36%[7] of total environmental impacts. The Commission considered that the limited scope of the Directive had previously represented an important restriction on the potential impact of the EU's Integrated Product Policy.

While key, the Ecodesign Directive is only one element in a broader range of policy measures that have been put in place to achieve the policy objectives aiming to promote sustainable growth. According to the SCP/SIP action plan the Directive is expected to be operate in synergy with a number of other tools. These include:

- **the Energy Labelling Directive (ELD)** – This mandatory Directive aims to provide consumers with information on the energy and environmental performance of household products helping them to identify the most energy efficient products and thus pull the market towards the best performers. The scope of the Energy Labelling Directive was extended in May 2010[8] to cover energy related products with significant impact on energy consumption during use. Furthermore the ELD harmonises performance levels for environmental requirements in public procurement and in Member States incentives in order to further increase the uptake of the best performing products. In combination with the Ecodesign Directive the ELD is expected to bring further energy savings and a reduction of environmental impacts through the combination of the push effect of the Ecodesign Directive and the pull effect of the ELD. Furthermore, practical synergies with the Ecodesign Directive include the use of the findings of the preparatory studies of the Ecodesign Directive for the update of the Energy Label requirements and classifications.
- **the European Ecolabel -** This voluntary approach applies to products and to services and sets rather demanding environmental criteria so that only a small share of the very best products available on the

[4] http://ec.europa.eu/energy/action_plan_energy_efficiency/doc/com_2006_0545_en.pdf
[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0397:FIN:EN:PDF
[6] adopted in 2001 and revised in 2006..
[7] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2008:2116:FIN:EN:PDF
[8] http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=COMfinal&an_doc=2008&nu_doc=778

market actually meets them. The European Union Eco-labelling Board (EUEB) is responsible for developing, publishing and promoting criteria for product groups. It is made up of the Competent Bodies from each Member State and other interested parties that form the Consultation Forum. There are a number of possible overlaps and synergies with the Ecodesign Directive including the process of determining relevant product categories, collecting information in the context of the preparatory studies and assessing the level of priority and establishing performance criteria[9].

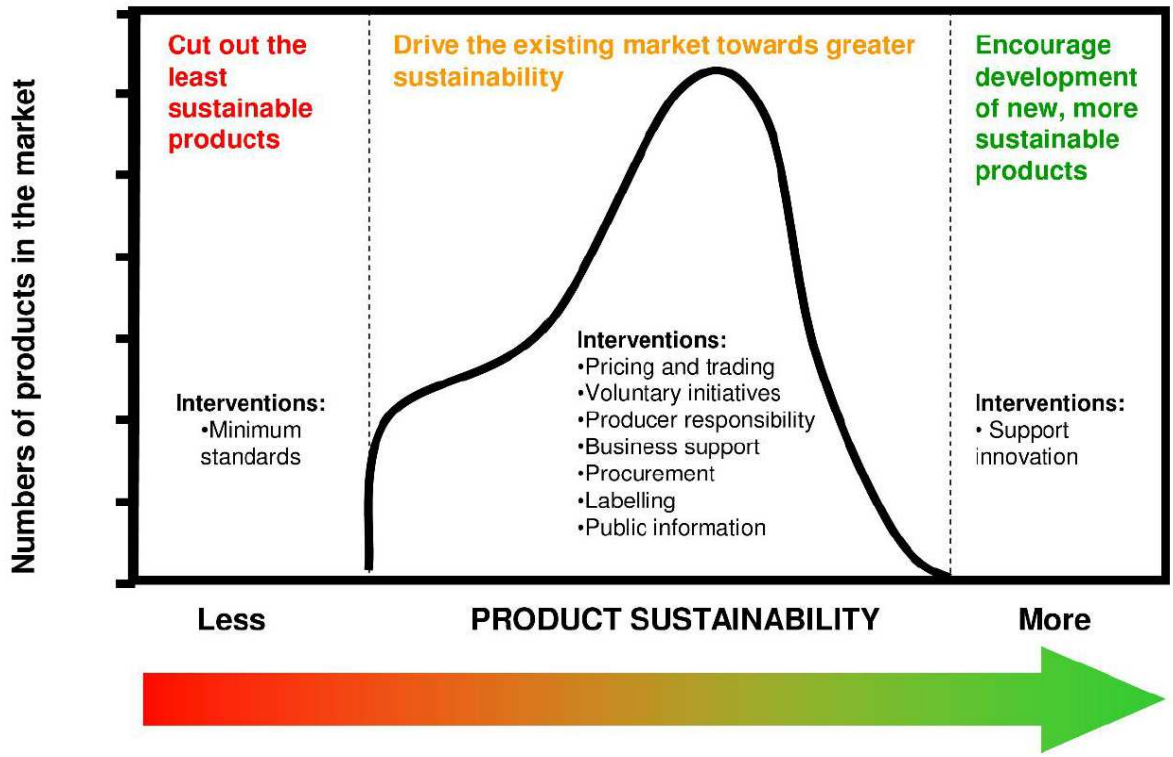
Besides the Ecolabel, there are a number of other product labelling schemes at national and international level[10] [11].

- **Energy Star** - The mandatory Energy Star is a global label that aims to facilitate trade in office equipment. Energy Star sets rather demanding efficiency standards that are continuously updated so that no more than 25% of the models in the market may quality. Furthermore, the Energy Star Regulation[12] obliges EU institutions and Member States to purchase office equipment to specific levels of energy efficiency.
- Green Public Procurement (GPP) is a voluntary scheme at EU level. Public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured. It promotes the application of life cycle costing (LCC) in public purchasing rather than looking only at initial purchase costs. Many Member States have adopted their own approaches at national level for supporting green procurement. There already are synergies between criteria development for Ecolabel and GPP and those could, if appropriate, be extended to Ecodesign and, to a certain extent, the Energy label, including the process of determining relevant product categories, collecting information for preparatory studies and assessing the level of priority and establishing performance criteria
- In addition to that a number of Member States have introduced financial and other incentives programmes (in the form of tax credits or subsidies) to encourage the uptake of energy and environmentally performing products.
- **Construction products legislation** - The extension of the Directive to energy-related products has also increased the potential overlap with other regulations, such as the **Energy Performance of Buildings Directive** (2002/91/EC) if Implementing Measures are introduced in the future concerning energy related products used in construction.

The chart below summarises the typical view of how the policy tools are expected to operate in a synergetic manner. The Ecodesign Directive is supposed to act on the red side of the diagram by setting minimum standards that should operate as a mechanism to eliminate the least sustainable products from the market while the other policy tools described aim to drive the market towards better performing products.

[9] http://ec.europa.eu/environment/Eco-label/Eco-labelled_products/categories/pdf/report.pdf
[10] The study for preparing the 1st working plan concerning energy-using products identified 22 such schemes at the European and international level.
[11] Extensive list: http://www.Eco-labelindex.com/Eco-labels/
[12] http://www.eu-energystar.org/downloads/legislation/20080213/l_03920080213en00010007.pdf

Chart 3.1 – Role of different policy tools towards product sustainability



Source: DEFRA

In addition to these tools, the life cycle approach of the Ecodesign Directive means that it interacts – and is expected to operate in a complementary manner - with other Community instruments including **the WEEE Directive** (2002/96/EC) concerning the management of waste of electrical and electronic equipment and the **RoHS Directive (**2002/95/EC) that regulates the presence of certain hazardous substances in products, including energy related products. The provisions from these Directives need to be taken into account in the preparatory studies for developing Implementing Measures. However, according to Article 15 of the Ecodesign Directive, any requirements set should not duplicate already existing EU legislation. There are also possible connections with the **REACH Regulation** concerning the registration, authorisation and evaluation of chemicals. They concern the requirements for information communication across the supply chain set by the two pieces of legislation. But there may also be issues related to the authorisation or restriction of chemicals the use of which may affect the energy efficiency of products. Finally, many categories of energy-related product fall under the scope of **Community legislation concerning safety** (e.g. Low Voltage Directive, Machinery Directive, Construction Products Directive). These set requirements in terms of content and format of conformity documentation to which the Ecodesign Directive adds the environmental aspects.

Analysis of evidence

The evidence collected in relation to the questions stated above is based primarily on the input of stakeholders through the survey and the interview programme.

Relevance

The main conclusion of the discussions is that the Ecodesign Directive does indeed play a key role and is well placed within the context of the SCP/SIP Action Plan. The main purpose of removing the worst

performing products from the market is considered as appropriate and this is a view shared by the great majority of stakeholders. Opinions diverge as to the extent that in its current form and implementation the Ecodesign Directive serves the whole range of objectives of the SCP/SIP. Some criticism, coming primarily from Member States and environmental groups, concerns the perceived focus of the Implementing Measures, on the energy use aspect of the products covered. Thus, while it is broadly recognised that the energy efficiency aspects of the SCP/SIP Action Plan can be served by the Ecodesign Directive and the Implementing Measures, it is also suggested that there are missed opportunities as a result of the limited coverage in Implementing Measures of other environmental aspects. Issues of material efficiency are most often proposed as an area where certain requirements should be set.

This is a key issue that needs to be addressed directly at the next stakeholders' meeting. On the one hand, there is clearly a widespread perception, on the part of environmental groups and some Member State officials, that the Ecodesign Directive, has focused primarily on energy use, to the neglect of other environmental factors. Some have even said that an opportunity has been missed to use the Directive to develop a significant and consistent product-based pillar for environmental policy. On the other hand, it is not clear if anything more is being said than the incontrovertible statement that the Ecodesign Directive has so far concentrated on energy-using or energy-related products. It is not clear, for instance, if there are grounds for believing that opportunities have been missed to include environmental considerations other than energy in the existing Implementing Measures. Regulations on light bulbs and washing machines, for instance, do have significant elements relating to non-energy issues. So, If it is the view of some stakeholders that there has been a failure to include other considerations, then it is necessary both to cite specific cases and also to explain why these were not raised during the consultation processes leading up to the adoption of the relevant Regulations. This represents a challenge to an important part of the stakeholder community that should be taken up, particularly during the course of the second stakeholder meeting.

There is also significant criticism from the representatives of the construction sector concerning the scope and relevance of the extension to energy related products. The Action Plan document indicated that EuPs represent 31-36% of energy use and that the extension was necessary to serve the SCP/SIP policy objectives. However, the construction sector stakeholders argue that the focus on the product level is not appropriate for products used in buildings where energy optimisation should be at the level of the whole building and where different climatic conditions mean that EU wide measures are not appropriate. Having said that, there is also the view that certain minimum standards at individual product level can indeed be relevant especially in view of the important variations in how the EPBD Directive is applied among Member States.

There is also the broader question of the relevance of the Directive in the case of complex products or systems of products. As explained later in the report, some stakeholders claim that overall optimisation in terms of energy efficiency is not best served by requirements set on components or individual products. At this stage it is difficult to make a judgement. On the one hand, it is clear that systems of products (buildings, traffic etc) do have important environmental aspects. On the other, to the best of our knowledge - there is no practical experience of the use of eco-design requirements in other regions that would provide possible indications. This is an aspect where further feedback from stakeholders is necessary.

Finally, there have been questions raised concerning the rather static nature of the requirements set and whether they can serve the purpose of promoting innovation in an environment of continuous technological change. Clearly, there are provisions in Implementing Measures for thresholds to be increased over an extended time period and also for a review of the Regulation after a certain period. It would be helpful to have further commentary from stakeholders on the question of how often in principle

reviews should be conducted, but this is also an area, where reference to specific cases where problems have been identified could be particularly helpful, in gauging the real extent of the perceived problem.

Coherence

The interaction with the Energy Labelling Directive is considered to be a key priority for the success of the SCP/SIP. Almost all stakeholders recognise the strong potential complementarities of the two pieces of legislation operating as push and pull mechanisms in the market. In practice, for most products these complementarities seem to work rather effectively since, whenever available, Ecodesign requirements refer to certain energy label levels set in the ELD. However, a few comments suggest there are still some practical problems. For some, the whole process should be unified under one instrument rather than having different procedures (Ecodesign Implementing Measures and Labelling Delegated Acts). One stakeholder suggested that it is still possible for the Energy Label to be based on entirely different metrics from those used in the Ecodesign studies although no specific instance of this was cited.

The adoption of Lisbon Treaty is also seen as posing challenges for the coordination and synchronisation of the Ecodesign and Energy Labelling Directives. In the case of the recently revised ELD that followed the adoption of the Lisbon Treaty the regulatory committee stage has been removed, in contrast to the Ecodesign Directive that still operates under the Nice Treaty framework. This has already led to the adoption of Delegated Acts for certain products (boilers and water heaters) before the adoption of the corresponding Ecodesign requirements.

Overall, we should say that the comments by stakeholders do not indicate important problems at this stage. They rather point to the fact that the Commission services need to ensure that the two processes are co-ordinated in terms of timing, use of the knowledge obtained through studies and requirements for input by stakeholders.

In relation to the other policy tools – the EU Ecolabel and the GPP – there is still some scope for greater coordination. One example cited is the case of TVs where the EU Ecolabel was provided to class B products because there was no effective sharing of information with the relevant preparatory study on market developments. Our understanding is that this was more a result in the development of the relevant energy label for TV rather than an issue of transparency and information exchange. At this point there is also no reference in GPP to the Ecodesign requirements (including the advanced benchmarks). A few stakeholders question the scope for closer co-ordination but the majority consider that there have been some missed opportunities. At a practical level studies and data should be shared, where appropriate, in order to avoid duplication of effort and conflicting conclusions.

We should note here that there are some questions raised on the possibility of a full adoption of the preparatory studies for the development of Ecolabel requirements. In its current form the MEEuP methodology and the Eco-report focus on priority aspects that could contradict with the need for identification of best performing products across the range of environmental aspects. Thus, further changes may be necessary, insofar that they conform to the requirements of the Directive and do not slow down or makes the procedure even more complicated. Still, the conclusions of preparatory studies could serve as a starting point as they have in the ongoing review of the MEEuP. In the case of energy efficiency, the use of Energy Labelling should be the basis for a clearer co-ordination between tools that aim to pull the market (such as the Ecolabel and the GPP) and the Ecodesign Directive.

On the issue of the synergies and overlap with other EU environmental or health and safety-related legislation, there are rather diverging views. A little less than half of the respondents to the survey (25 out of 59 who responded to the relevant question) said that there was neither conflict nor overlap between the Ecodesign Directive and other EU environmental legislation. Indeed, it was said that the Directive correctly spells out the hierarchical priority between the Ecodesign Directive and WEEE and RoHS.

However, a larger number (34 of the 59) suggest that there is a lack of consistency and significant overlaps. In general, the fact that the Ecodesign Directive concerns the **whole life cycle of a product** is considered as posing a continuous risk of double regulation or, at least, confusion among firms. The weak interface with, and mutual knowledge of, other product regulations was particularly seen to be a problem when dealing with interfaces between products that are used as part of systems (central heating, supermarket refrigeration, etc.) where, in the view of many stakeholders, the interface should be with 'system-orientated' regulations like the Energy Performance of Buildings Directive (EPBD), and not with 'product-orientated' rules that apply to appliances, like the Ecodesign Directive, WEEE and RoHS. Other stakeholders argue though that greater **interaction between** the **Ecodesign Directive and the EPBD** should be sought. A particular illustration is the case of boilers[13] where the Ecodesign Implementing Measures could help ensure that the products on the market give correct data for national calculations, a problematic area in the implementation of the EPBD.

On the issue of the use and emission of chemicals and the overlap with relevant regulations – Industrial emissions, ROHS and REACH – there seems to be agreement that a clearer interface with the Ecodesign Directive is necessary. The case of compact fluorescent lamps is one example of confusion to stakeholders in terms of which Directive - the Ecodesign or the ROHs - has priority. The Ecodesign measure for CFLs first included a recommendation on mercury, which was then removed, only to be added back at the last minute. It is considered important by some stakeholders that any restrictions on chemicals that come up in the Ecodesign Directive do not hinder attempts to restrict risks from the same chemicals through other pieces of EU legislation.

There were also concerns that the extension of the Directive to energy related products could lead to double regulation, especially concerning construction products covered by the Construction Products Directive.

From a different aspect, it is also suggested that interaction between the Ecodesign Directive and WEEE has led to a gap in the case of requirements for the end-of-life of products. It iss claimed, the WEEE Directive does not address the reuse and recyclability of products while relevant product design aspects cannot be set under the WEEE. However, a number of stakeholders suggest that no such requirements are set within the context of the Ecodesign Directive on the basis that these should be addressed under the WEEE. Any reference to design for recycling in Ecodesign measures tends to be criticised by industry that refers to a possible duplication with WEEE. In such a case, the Ecodesign Directive does not seem to serve **the new direction of European waste policy**. From the point of view of the Commission it is clear that it is under Ecodesign that such requirement may be set, provided there are significant environmental impacts. However, no such cases have been identified so far and no specific examples were indicated by any of the stakeholders. At a more practical level, there appears to be a lack of co-ordination in the Commission services that are responsible for the different regulations. A better use of expertise and better sharing of the results and conclusions from studies is considered necessary.

In relation to safety regulations, no particular issues or problems have been raised. It was only reiterated that in all cases the Ecodesign requirements should not imply a trade-off between environmental performance and safety.

Finally, reference was made to possible conflicts between the Ecodesign Directive and the NEC-Directive (2001/81/EC) and the Air quality Directive (2008/50/EC). The product-specific requirements of the Ecodesign Directive for EuPs with significant air emissions can potentially create difficulties for Member States in implementing additional measures at the national level to achieve the national targets set by the

[13] Because of old buildings the specific requirements for boilers are proposed at a non-ambitious level, a loophole which is not addressed by EPBD through a system approach (requiring best boiler technologies where compatible).

two Directives. Specific reference was made to the draft Regulation on boilers where the proposed limit values for NOx in stage 3 are rather moderate and can impede Member States from applying more stringent measures.

Questions to stakeholders

Important further clarifications and validation of issues raised by stakeholders are required to provide a more robust analysis. The following questions could usefully be addressed at the stakeholders' meeting :

- What is the nature of the claim that the Ecodesign Directive has failed to take into account environmental issues wider than energy-related matters? Are there examples in existing Implementing Measures where significant wider issues have not been addressed ?
- Is there any support for the view that Implementing Measures fail to encourage innovation, because of their relatively static provisions ?
- Are preparatory studies being used to best advantage ?
- In which areas specifically, could there be closer integration between the Ecodesign Directive and legislation such as the Energy Labelling Directive, WEEE and ROHS ?
- Are there other examples of a conflict between the Ecodesign Directive and the NEC and Air Quality Directives ?

3.3 Effectiveness of the Ecodesign Directive and Implementing Measures

3.3.1 Introduction

One of the key evaluation issues concerns the effectiveness of the Directive in achieving the expected energy consumption reduction targets and other environmental impact improvements. More specifically the evaluation examined the evidence available in relation to the following questions:

- What is the picture so far concerning the achievement of the objectives in reducing energy consumption and the relevant environmental impacts for those EuPs for which Implementing Measures have been adopted? What are the expectations in relation to the 2020 targets?
- To what extent can the results achieved in terms of environmental impacts be attributed to the Directive?
- How significant, if at all, is the rebound effect?
- How do the improvements compare to results from policies in third countries?

In parallel to that, the study examined the existing evidence on the impacts of the Directive on the operation of the market in relation to a number of key issues:

- Effects on the market as result of the Directive and the relevant Implementing Measure for each of the EuPs in terms of:
    - shifts in the market shares within different classes of product
    - changes in sales volumes, prices, product variety and consumer choice
    - shifts in levels of intra-EU27 and extra-EU imports and exports
- Effects on the competitiveness of the different market operators (EU industry, importers, large companies, SMEs), on domestic and international markets?
- Effects on the production costs and profit margins for regulated products?

- Effect of the Directive on the market structure (i.e. relations between actors in the supply chain, for example distribution channels; relationships between manufacturers and distributors, retailers or installers; competitive situations of the different market players; market shares of SMEs etc.)?

In the following section we present the evidence collected to this point. The first part focuses on the evidence in relation to the 11 Implementing Measures in force by the end of 2010. These are:

1. Stand by and off mode electric power consumption (horizontal measure)
2. Circulators in buildings
3. Televisions
4. Domestic refrigerators and freezers
5. Simple set-top boxes
6. Domestic lighting (general lighting equipment)
7. Battery charges and external power supplies
8. Tertiary lighting
9. Electric motors 1-150 kW
10. Domestic washing machines
11. Domestic dishwashers

Data available from the period up to know have been compared against the baseline and complemented with feedback from stakeholders to help us reach conclusions as onto the possible role of the Implementing Measures to this point.

The subsequent section looks into the overall evidence available on the effectiveness of the Directive in relation to the above questions.

3.3.2 Analysis of evidence in relation to individual Implementing measures

1. Standby and off-mode electric power consumption

Introduction

Standby energy is one of the largest individual end uses of electricity in the residential sector and accounts for approximately 10% of electricity use in Europe, Australia and in California and 1% to 2% of global electricity consumption. IEA expects the energy use from standby and off mode losses to increase to 15 % of energy consumption in the residential sector in 2030.

The Implementing Measures on the standby and off mode energy consumption is limited to products corresponding to household and office equipment intended for use in the domestic environment. As opposed to the other product groups covered in this evaluation, standby and off mode energy consumption is a horizontal measure not limited to one product group but cuts across a wide variety of different products such as mobile phones, ovens, TVs, electric toothbrushes, washing machines, PCs and printers. Furthermore, the product scope also covers equipment that is not yet available on the market but has similar functionalities to the products explicitly named in the Implementing Measure.[14] Additional

[14] A more detailed definition of the scope of the Implementing Measure and the terms for standby and off mode of EuPs can be found in the implementing measure: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:EN:PDF

requirements on standby and off mode may also be set out in product-specific Implementing Measures. If so, they should not be less ambitious than those set out in this Regulation.

Methodological limitations specific to standby and off mode power consumption

There are certain challenges specific to the assessment of the impact of the Implementing Measure on the standby and off mode energy consumption. Firstly, the impact of this Implementing measure for standby and off mode energy loss cannot be measured by looking at a particular product group. Data for several products have to be collected and combined. Furthermore, while there are market data on some products on the basis of the market share of products in different energy labels categories there is no similar labelling of standby and off mode energy consumption.

Furthermore, there are some attribution issues. Existing Community Programmes such as the Energy Star programme for office equipment, the Ecolabel and the Commission's Codes of Conduct also address standby and off-mode. This makes it more difficult to isolate the effect of the Ecodesign Directive. Furthermore, as mentioned, product specific measures often set requirements related to standby/off-mode for individual product groups.

The impact assessment states that monitoring of the impacts will mainly be done by market surveillance carried out by Member State authorities. Due to the many different product groups covered, the rapid market evolution, the shortage of ongoing market tracking data, and lack of common data collection, evidence on the evolution of the market is not available.

Baseline

In December 2008, standby and off-mode electric power consumption became the first Implementing Measure to be adopted under the Ecodesign Directive. The requirements were phased in over two stages. The timing of the stages is set to balance negative impacts related to the functionality of equipment and cost impacts for manufacturers with a timely achievement of policy objectives. The key dates with the respective requirements for the off mode and the stand-by mode are summarised in the table below.

Table 3.1 - Dates for implementing the Ecodesign Directive and the requirements set

Mode	Maximum power consumption from January 07, 2010	Maximum power consumption from January 07, 2013
Off-mode	1.00 W	0.50 W
Standby mode without display	1.00 W	0.50 W
Standby mode with display	2.00 W	1.00 W

The preparatory study states that standby functionalities and off-mode losses occur for the majority of electrical and electronic household and office equipment products sold in the EU. Annual electricity consumption related to standby functionalities and off-mode losses was estimated to be 47 TWh in 2005. Without taking any specific measures, the consumption was predicted to increase to 49 TWh by 2020 while the number of products having standby mode and off-mode was expected to increase to 4.6 billion in EU27.

Table 3.2 - Standby and off-mode losses - 2005 baseline

Number of products	Energy consumption in EU27	Electricity costs	CO_2 emission
3.7bln (2005)	47TWh (2005)	6.4 bln Euro (2005)	19 Mt

The application of cost effective existing technology, meeting the Ecodesign requirements for standby and off-mode losses should, according to the study, reduce energy consumption with an estimated energy savings of 35 TWh annually in 2020, compared to a business-as-usual scenario. Thus, total energy

consumption is expected to decrease from 47 TWh in 2005 to 13.6 TWh in 2020, a total improvement of 35TWh. Furthermore, under the baseline scenario, any changes are expected to happen only after the requirement has taken effect. The improvement in 2010 is therefore estimated to be zero.

Table 3.3 - Projected energy consumption and saving potential for standby and off mode energy consumption - Baseline scenario

	No Policy (in TWh)	**Policy*** (in TWh)	**Improvement Potential** (in TWh)
2010	49.9	49,9	0
2020	49	14	35

Table 3.4. Standby and off-mode losses projected impact until 2020

Accumulated electricity savings until 2020	**Accumulated electricity cost savings until 2020**	**Accumulated CO_2 emission savings until 2020**
194 TWh	€ 26.4 bln.	77.6 Mt

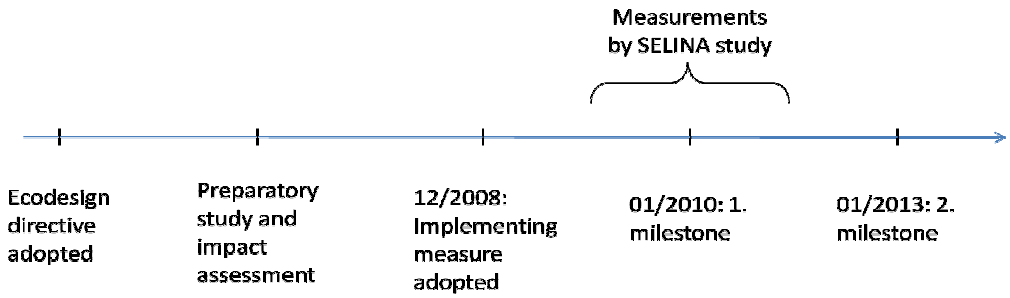
The preparatory study concluded that significant cost effective improvement potentials exist in the case of stand-by. According to the "base case" of the preparatory study, standby/off-mode power consumption levels of electric and electronic household and office equipment were typically several watts higher than would be the case if readily-available improved technologies were to be used (computer 3.6 Watt/2.2 Watt, DVD player 4.8 Watt/1.5 Watt, washing machine 5.7/1.2 Watt). It concluded that although the technologies for achieving the requirements are available, the majority of products on the market did not meet them because there was little or no incentive for manufacturers to make additional investments for technologies leading to low standby/off-mode electricity consumption for a single product. This barrier prevents market take-up of cost-effective technologies with improved environmental performance.[15]

Existing evidence on the effects of the Directive

At this stage, data on the effects of stand-by requirements are rather scarce. One relevant source is the SELINA project (Standby and Off-mode Energy Losses in New Appliances Measured in Shops) that measured the standby and off mode energy consumption of almost 6000 products in shops in 12 countries in 2009 and 2010, thus both before and after the requirements entered into force. This allows some assessment of the changes in the composition of new products placed on the market both in absolute numbers and in terms of market share.

[15] http://ec.europa.eu/energy/efficiency/Ecodesign/doc/legislation/sec_2008_3071_impact_assesment_en.pdf

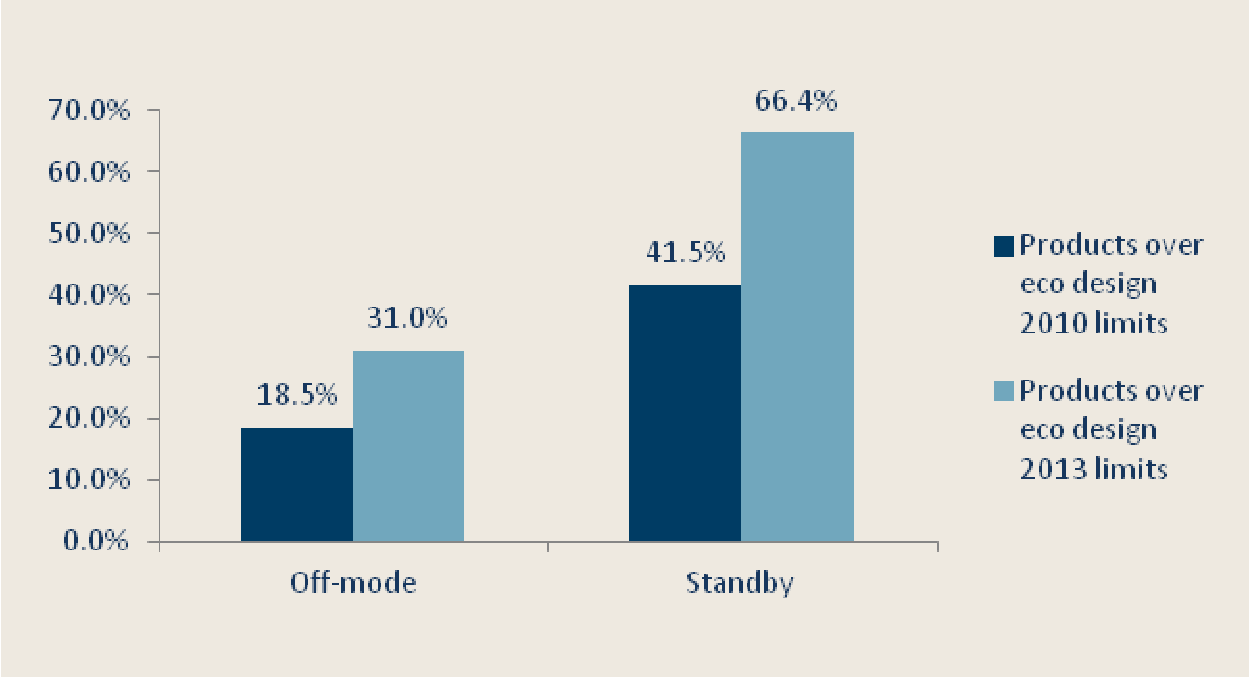
Chart 3.2. SELINA measurement period



It is important to note, however, that the products measured after the first set of requirements took effect in January 2010 could have been placed on the market before the requirements took effect. If so, they will be compliant with the Directive even though they might be sold to the customer after the requirements took effect and use more standby or off-mode energy than would otherwise be allowed as of January 2010.

According to the data collected, approximately 18 % of the off-mode and 29 % of the standby products did not live up to the requirements taking effect from 2010. Furthermore, in relation to the requirements which take effect from 2013, at this stage almost 40 % of the products do not fulfil the requirements in off-mode and almost 60 % percent in standby mode.

Chart 3.3. Comparison of the power consumption in standby and off-mode with the Ecodesign Directive



Source: Selina Project

Compared to the situation when the impact assessment was carried out - at which point the majority of products on the market did not meet the requirements – significant improvements seem to have taken place with 18% not meeting the off-mode requirements and 29% the standby requirements for 2010. In

relation to the 2013 limits, in 2010 around half of the products do not meet the requirements and will need to be improved to remain on the market.

The comparison between the 2009 and 2010 data also shows that the number of products found to be over the EU regulation threshold was almost unchanged from 2009 to 2010. For standby mode, an additional 2.8 % of products did not comply with the 2010 limits and an additional 2.3 % did not comply with the 2013 limits after the Implementing Measure entered into force. For off-mode an additional 4 % complied with the 2010 limits and 0.9 % fewer complied with the 2013 limits in 2010.

Table 3.5 Difference between products not performing to the Ecodesign Directive limits in 2010 and 2009

	Off-mode	Standby
Difference between 2010 and 2009 – products over Ecodesign 2010 limits	4.0 %	-2.8 %
Difference between 2010 and 2009 – products over Ecodesign 2013 limits	-0.9 %	-2.3 %

Source: Selina project

Note: The study does not control for the potential influence of difference in products tested in 2009 and 2010 and when products were placed on the market. Thus, if different types of products were tested in 2009 and 2010 this could influence the results. Also, potentially, products tested in 2009 could have been placed on the market before the products tested in 2009.

The SELINA project conclusions should only be seen as providing indications and need to be further tested as there are a number of limitations. Most tests were conducted before the requirements came into force and they included products to which standby and/or off mode requirements do not apply (e.g. imaging equipment). Furthermore the tests were not performed in laboratories and did not use the agreed testing methodologies but easier and less precise tools. However, another study carried out for the Danish Energy Agency, using a simplified method to measure standby energy consumption in 2009, also found similar results. Of 314 products measured in 6 shops, 35 % of the products did not comply with the 2010 limits.[16]

A continuation of the SELINA project is currently under consideration and could provide valuable input for assessing the future impact of the standby and off-mode requirements. An additional initiative is the Standby Power Annex under the international collaborative programme to promote wider use of more energy-efficient electrical equipment called Efficient Electrical End-Use Equipment (4E). One of the overall goals of the Standby Power Annex is to monitor and report on the extent of, and changes in, energy consumption by electrical appliances in low-power modes (standby power). A methodology for evaluation of standby power will be developed under the Standby Annex. The Standby Power Annex is expected to deliver important outputs which will be useful for future evaluations on the effect of the Implementing Measure on standby and off mode losses. However, data from this exercise are not yet available.

Summary

The requirements for standby and off-mode losses only entered into force for products "placed on the market" in January 2010 and will not be fully implemented until 2013. Partly as a result of this, common data collection efforts are not fully developed. Furthermore, standby and off-mode losses are a cross cutting issue covering many product groups, which in turn are characterised by rapid market evolution. The amount of data to assess the effect of the requirements for standby and off-mode losses is therefore rather restricted.

However, the data available does indicate that significant improvements in energy efficiency have taken place from the time of the impact assessment to the latest studies. Since around half of the products that

[16] Danish Energy Agency, Markedsscreeninger for: standbyforbrug, eksterne strømforsyninger, tv-apparater

were placed on the marked in 2009-2010 did not meet the 2013 requirements future products placed on the market should be even more energy efficient. Thus, further improvements can be expected.

Questions to stakeholders

- The SELINA study suffers - as mentioned - from a number of methodological limitations. Are stakeholders aware of similar studies from Market Surveillance Authorities or similar sources?
- Data indicate decreasing use of energy in standby and off-mode mode. Would stakeholders have any examples – quantitative or qualitative – of reduced standby or off-mode which can be linked to the Ecodesign Directive?

2. Circulators in buildings

Introduction

Circulators in buildings are used primarily for pumping water in central heating systems. Less than 4% of the total market output is used for applications other than pumping water, such as solar water heating or chilling systems. They range in size from 25W – 2500W, and are always sold as an integrated pump motor assembly. The circulator market is somewhat unusual compared to other product groups in that the primary market and production base of circulators is within Europe, since circulators are almost exclusively manufactured and sold within the EU. There are around 140 million circulators in the EU-25, with few used outside of Europe. Circulators are rarely used outside of Europe and all the major manufacturers are based in Europe, although there is some evidence of with limited imports and exports of circulators. Nonetheless, the primary market and production base of circulators remains Europe.

Circulators in buildings covered under the Directive are defined in the following way:

- 'Circulator' means a glandless impeller pump up to 2500 W used principally for central heating systems.
- 'Standalone' means a circulator separate from the boiler.
- 'Glandless' means a circulator having the shaft of the motor directly coupled to the impeller and the motor immersed in the pumped medium.

Circulators consume much of the energy used in heating systems in buildings. The energy used by circulator pumps is equal to about 2 % of the overall electricity consumption of the EU and causes CO2 emissions of more than 30 million tons per year, according to data from 2011.[17] A large fraction of the primary energy consumed in buildings is used for heating and cooling functions: for residential buildings, this fraction is 60-70%. When considering all kinds of buildings, on average this fraction is around 50-60%. This means that 20-30% of the total primary energy consumption in the EU-27 is used in the heating and cooling of buildings. This quantity is approximately equal in absolute terms to the total energy used for transport in the EU.[18]

The Lot 11 preparatory study showed that energy consumption in the use-phase dominates the life-cycle impact of circulators. Generally, there are three different technologies available to the industry to improve efficiency:

1. improved (standard) circulator
2. variable speed (induction motor)
3. variable speed (permanent magnet motor)

[17] http://www.topten.info/uploads/File/Recommendations%20Circulation%20Pumps%20March%2011.pdf
[18] 2010: http://susproc.jrc.ec.europa.eu/heating/docs/1%20IPTS%20Scope%20Draft%201%20-%20Heating&Cooling%20Systems.pdf

Prior to an initiative by the industry to improve performance, speed-controlled circulators sold in 2005 on the European market in 2005 represented no more than 20% of all circulators sold.[19] To improve efficiency, the industry needed to shift from the standard model of circulators to a variable speed motor. However, the market barriers hampering a larger market penetration of energy efficient circulators identified in the preparatory study are:

1. *Negative externality* - There is a price difference between the purchase of a high-efficiency pump and the established models.
2. *Split incentives*- Often the consumer of the product is not the one making the choice of which model to purchase, as many consumers leave the decision to trades people and equipment installers rather than taking part in the decisions themselves.
3. *Asymmetric information*- The purchase price is well visible and is typically higher for energy efficient circulators. On the other hand, information on running costs/cost savings is not explicit and can be obtained only with difficulty.

With the opportunity presented by a well-established and concentrated set of manufacturers, the industry, through its central organisation Europump, developed a voluntary classification and energy labelling scheme, which was implemented in 2005. The goal of the scheme was to support the uptake of variable speed motors, which constituted only 20% of the market in 2005. Seven companies with a total market share of more than 80% committed to the agreement. By 2011, 13 companies representing 95% of the market have committed to the voluntary measures.

In parallel to the voluntary agreement, the current Ecodesign requirements were developed for glandless standalone circulators and glandless circulators integrated in products (Implementing Directive 2005/32/EC) followed by the Implementing Measure (under Directives 2009/125/EC and 2010/30/EU). A key difference between the voluntary agreement and the Implementing Measure was that the regulations applied to Europe as a whole and a firmer timeline was set in place.

Class A* under the voluntary agreement was taken as a baseline for the new standards. Because Class B circulators use a different technology to Class A* or above circulators, they do not represent an incremental developmental step on the way to designing a Class A* circulator. It was therefore concluded that it would cause manufacturers considerable additional work for little gain if Class B was stipulated as being the interim minimum standard of circulator. Hence a direct move to Class A* has been seen as being the best option for manufacturers (and consumers) under the Directive[20]

Circulators not meeting the new standards were to be withdrawn from the market. As a result, the voluntary agreement will become obsolete once the provisions of the Ecodesign Directive are implemented in 2012.

Relevant factors affecting implementation

The average lifetime of the circulator is taken as being 10 years in the preparatory report. The impact of this is that stock and hence energy savings due based on the design options, and hence energy savings, will take longer some time to impact the market. It was also estimated in the preparatory studies that there would be few users preemptively replacing their circulator with an improved one.

[19] 2005 Europump plan "To improve the energy performance of Stand-Alone Circulators Through the setting-up of a Classification Scheme In relation to Energy Labelling"
http://work.sitedirect.se/sites/europump/europump/p4180/files/Industry_commitment_Circulators-no_annexIV_rev_July_2009_bis.pdf

[20] Preparatory Study. AEA Energy and Environment. Lot 11- Circulators in Buildings:
http://www.ebpg.bam.de/de/ebpg_medien/011_studyf_08-04_circulators_updated.pdf

About half of all circulators are sold from manufacturer to installer/builder in order to and integrated into the heating or warm water system. When circulators fail, they are replaced rather than repaired because of the relatively low cost of circulators[21].

It is not considered viable Small domestic circulators are not considered viable to repair small domestic circulators in Western European countries. However, there is a limited repair market for these types in Eastern Europe.[22] Thus, it is expected that the existing stock will gradually move to newer models of circulators as future production under the Ecodesign Directive will have a constant and gradual uptake in the market.

Methodological limitations specific to circulators

The extent to which the effectiveness of the Ecodesign Directive can be measured within the circulators market is limited by several factors, including:

Implementation schedule: The time schedule for the transition of the market from the existing stock of regular circulators to high-efficiency, variable speed circulators is designed to give the industry time to adjust to the changes. The first requirements will not take have effect until 2013, and the period of transition period will continue until 2020, when the significant cumulative effects of the change are will be realised. With this phased-in approach, the changes are not immediately visible in the market.

Product lifecycle and consumer behavior: Circulators are replaced on average every ten years although replacement rate varies significantly. Thus, any change in standards would take, on average, around the same time or even more to come into effect. Moreover, split incentives and asymmetric information affect the uptake of new models of circulators until the date that the new circulator requirements become mandatory. There is also the possibility of stockpiling inventories of non-compliant circulators, though there is little evidence to demonstrate this potential effect.

Lack of appropriate data: The data on the market shares of individual circulator classes is available and up-to-date. However, the analysis of available data will not be measuring the direct impact of the Ecodesign Directive but mainly exogenous factors and the 'policy signals' generated by the Commission's focus on the sector. Furthermore, the energy consumption levels associated with the current stock are difficult to measure, which makes it difficult to assess the longer terms impacts in the form of energy savings.

Attribution: It is difficult to attribute changes in the market to the Ecodesign Directive as there was a discernable change in response resulting fromto the voluntary initiative launched in 2005. The baseline for the product group has thus been affected, which will reduce the margin of impact linked to the Ecodesign Directive. This is clearly an example of an announcement effect, an indirect yet strong driver of change linked to the policy process that formed the Ecodesign Directive as well as other policy instruments. Technical change is an additional exogenous factor that is not taken into account, as the best available technology (BAT) was significantly more efficient than the industry standard. Improvement in the product group could equally in theory be attributed in part to industry convergence around a superior product due to market pressure.

Baseline

As of January 2013, the EEI limit value for glandless circulators that are installed externally to the heat generator (stand alone circulators) will be set as equal to or smaller than 0.27. This is equal to energy class A which is currently the highest energy class. This means that the energy efficiency class labels under the current voluntary agreement will become obsolete once the new standards are in place.

[21] http://www.eup-network.de/fileadmin/user_upload/Produktgruppen/Lots/Working_Documents/Lot11_Circulators_WD.pdf
[22] From the Preparatory study

As of August 2015, the EEI limit will be lowered again to 0.23, and then will also apply to glandless circulators which have been installed in newly installed heat generators or solar stations (integrated pumps). In the last implementation stage, the specifications applicable as of 2020 will also apply for the replacement of integrated pumps in existing heat generators and air-conditioning.

Table 3.6. Implementation schedule for circulators[23]

Date	Milestone
1 January 2013	The Energy Efficiency Index (EEI) of standalone glandless circulators must not exceed a value of 0.27 (except standalone glandless circulators designed especially for primary circuits of thermal solar systems and heat pumps).
1 August 2015	The Energy Efficiency Index of standalone glandless circulators and glandless circulators integrated into OEM products must not exceed a value of 0.23
1 January 2020	The Energy Efficiency Index of replacement pumps for glandless circulators integrated into OEM products must not exceed a value of 0.23.

The actions of the manufacturers to improve the efficiency of circulators pre-dated the setting of specific requirements under the Ecodesign Directive. Thus there has been a significant reaction prior to the mandated changes. Therefore, changes have occurred well in advance of 2013 when the first requirements take effect.

In the preparatory study and the impact assessment data from 2005 are used to establish the baseline. The number of circulators was estimated at 140 billion and the total energy consumption is estimated at 53.3 Twh for EU27. This leads to a total CO_2 emission of 80 Mt.

Table 3.7. Circulators in buildings – 2005 baseline

Number of products (2005)	Energy consumption in EU27 (2005)	Electricity costs	CO_2 emission (2005)
140 million	53.2 TWh	--	80 Mt

The Directive is expected to have significant market impacts. One of the intended effects of the Ecodesign requirements is to harmonise electricity consumption requirements for circulators throughout Europe, which will improve the functioning of the Internal Market while raising environmental standards. Energy savings of up to 80% are possible by using speed-controlled circulators rather than state-of-the-art, non-controlled circulators. Furthermore, over 90% of the glandless circulators for heating and air-conditioning available on the market in 2009 will soon be banned from the market as a result of the requirements for glandless circulators under the Ecodesign Directive.

In terms of long-term impacts on consumption of electricity, the preparatory study and the impact assessment estimate that the baseline 'no policy' scenario would lead to an overall energy consumption of circulators of 55.3 TWh (stand alone and boiler integrated circulators) in 2020. With the implementation of the Directive, energy consumption is expected be reduced to about 28.7 TWh (stand alone and boiler integrated circulators) representing a 42% reduction by 2020, compared to the baseline scenario[24].

[23] Timetable of ErP Directive in EU- The Future is High-efficiency: http://www.wilo.co.uk/cps/rde/xchg/gb-en/layout.xsl/1250.htm

[24] Circulator Regulation Impact Assessment, http://ec.europa.eu/energy/efficiency/Ecodesign/doc/legislation/sec_2009_1016_part1.pdf

Table 3.8 - Projected energy consumption and saving potential for circulators in buildings - Baseline scenario

	No Policy (in TWh)	Policy* (in TWh)	Improvement Potential (in TWh)
2010	52.2	51.2	1.0
2020	55.3	28.7	26.6

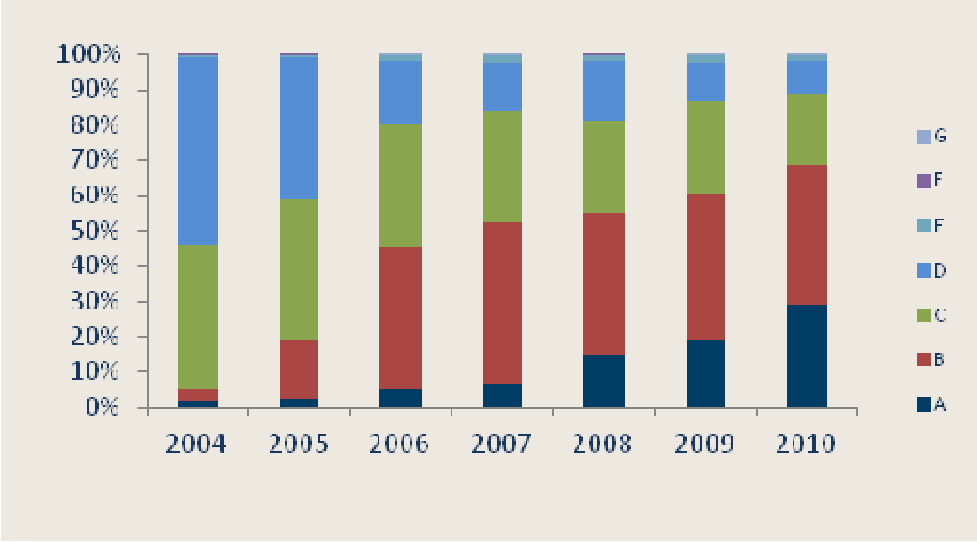
Because of the availability of market data, the difficulties of long-term attribution of impacts related to energy consumption, and the need to test empirically for energy consumption changes, the evaluation of the impacts will focus on market changes to the product group. However, an estimate for the change in energy consumption over the past size years is also provided.

Existing evidence on the effects of the Directive

As mentioned, there has been a significant shift in the composition of the circulators market that predates the implementation of the Ecodesign Directive. The dynamic market makes it difficult to isolate the direct effects of the Ecodesign Directive, though it is clear that anticipation effects have changed the composition of the market and pushed the industry toward greater energy efficiency.

The introduction of labelling saw an immediate rise in the B class, which more than doubled in the year following the voluntary agreement but this has since levelled off. The increase in the share of Class B pumps shifted from 3.3% in 2004 to over 40 percent in 2010. At the same time, the remainder of the market has been increasingly filled by the A class circulators, which moved from a small proportion of the market (<3 percent) to the current point where it is the second most common type of circulator, accounting for nearly 30 percent, an increase by a factor of 12.

Chart 3.4 - Market share of efficiency classes of circulators 2004-2010



Source: EUROPUMP

At the bottom end of the efficiency scale, the most significant change has been in the decline of the D class from 2004, when it accounted for over 50 percent of the market, to 2010 where it accounts for slightly less than 10 percent. The E and F class have remained steady, but with a very limited share of the market (<2 percent). Nonetheless, in the absence of requirements, this pattern appears to be consistent.

It thus appears that efficiency level of EEI ≤ 0.23 is an appropriate level of ambition for the circulator market. The technologies for achieving these efficiency levels are available, but the majority of products

currently on the market do not meet them. In the absence of specific requirements, there is a possibility that a portion of the market would still be composed of the least efficient circulator models of circulator.

Based on the projected energy consumption of each class, the impact of the change in market composition should translate into a relative decrease of the EEI of nearly 25%. Expressed in energy consumption terms, this 25% decrease results in a reduction of about 696 GWh.[25] However, in the absence of independent testing, this number remains only an estimate.[26]

Other expected effects

The impact assessment suggested that the implementation of the Ecodesign requirements would help create a level playing field and should ensure that there is easier access to the Single Market. Key stakeholders state that one of the most significant impacts has been a reduction in trade barriers and the opportunity for the most advanced companies to consolidate markets.

However, it does not appear that the regulations can be credited with driving competition to even higher standards. The voluntary approach of the energy label had already generated significant upward pressure at the higher-end efficiency classes. Furthermore, at the time of the adoption of the Regulation, the benchmark for the best available technology on the market for circulators was EEI ≤ 0.20. Achieving the targets would not require the development of new technology rather the adoption of existing technologies.

Replacement is cost-effective and is the current practice. The electricity cost reduction will only begin to compensate for the price difference within 3 to 15 years of operating.[27] The information asymmetry and split incentives identified could limit the effect of this offset, limiting the uptake of newer, more efficient pumps.

In terms of the impacts on the market, the proposed Ecodesign requirements will lead, de facto, to a technology shift from standard induction motor driven circulators to variable speed permanent magnet circulators. This will require some manufacturers to update production lines of less efficient circulators.[28] There are likely to be some very small manufacturers who are unable or unwilling to find the capital necessary in order to develop and launch class A* circulators. This could lead to some companies going out of business with subsequent loss of jobs locally.[29] However, this job loss is negligible and could be offset by a shift towards the production of new models of circulator.

In terms of the impacts outside Europe, the circulator market outside the EU is rather limited and as a result the measure cannot be expected to have a significant international impact.[30]

This is consistent with the findings of a British study related to circulators.[31] Various scenarios were compared, including a BAT scenario (Best Available Technology) and a 'policy' scenario on the basis of the implementation of the various regulations including the Ecodesign requirements. Based on an analysis of the market-driven changes in average efficiency levels, the policy scenarios outlined in the report project that there is little difference between the ultimate levels of efficiency achieved between the best case and

[25] Five-year briefing document of the Europump "Industry Commitment to improve the energy performance of stand-alone circulators through the setting-up of a classification scheme in relation to Energy Labelling"
[26] Europump is expected to undertake a study in 2012 to understand the change in energy consumption.
[27] http://www.topten.info/uploads/File/Recommendations%20Circulation%20Pumps%20March%2011.pdf
[28] http://www.eup-network.de/fileadmin/user_upload/Produktgruppen/Lots/Working_Documents/Lot11_Circulators_WD.pdf
[29] Topten
[30] http://www.eup-network.de/fileadmin/user_upload/Produktgruppen/Lots/Working_Documents/Lot11_Circulators_WD.pdf
[31] BNM C02: Circulators Government Standards Evidence Base 2009: Reference Scenario http://efficient-products.defra.gov.uk/spm/download/document/id/869

the use of regulations, and that it is possible that the industry would have been driven through market competition to have an even greater uptake of efficient classes of circulator.

Summary

Based on the projected energy use associated with each class, the change in composition that has already occurred is likely to have already reduced energy consumption by approximately 25% from the baseline of what would have occurred in the absence of a voluntary agreement. The voluntary agreement was created and implemented in the context of discussions related to Ecodesign regulations. Thus, although the formal requirements for building circulators have yet to generate clear evidence of effectiveness, the policy signals from the early rounds of consultation have had a significant impact on the sector. Further, as of 2010 around 30 % of the circulators met the requirements which will come into force in 2013. Thus, an additional 70 % of the circulators are expected to be improved between 2011 and 2013.

Possible changes in the wider system to which they are connected could have a much larger impact on EU circulator energy consumption than any further improvements in circulator technology itself.[32]

Questions to stakeholders

- Do stakeholders have any data (national or European) to supplement the data presented in the chapter for circulators?
- Do stakeholders agree with the conclusions presented in the chapter?

3. Televisions

Introduction

Television contributes significantly to the electricity use of European households. Studies have estimated this to be at least 10%.[33] Televisions are characterized by rapid technological and market change, including the development of new types of televisions. Traditional CRT televisions have been abandoned almost completely in the most advanced markets and LCD and Plasma televisions have been taken their place. LCD televisions are expected to be the dominant technology on most European markets in the future. LED backlight LCD televisions have proven to be energy efficient while plasma televisions have proven to be less energy efficient.[34]

The preparatory studies highlighted three main market failures where a significant potential for energy savings from televisions exists:

- the electricity consumption of televisions has not been a decisive factor for the purchasing decisions of consumers
- information on electricity consumption, running costs and potential electricity savings available has not been easily accessed and understood
- few incentives exist for manufacturers to optimise the electricity consumption.

Energy consumption among TV models varies significantly. A Swiss study of 8 televisions measured the average energy use by full HD ready televisions with screen sizes typically used in living rooms. Average

[32] Preparatory Study
[33] http://www.coolproducts.eu/product_tvs_3106.aspx
[34] See for example http://www.comparison.com.au for rating of energy efficiency which controls for screen size. The best plasma TVs score 5½ in energy efficiency. The best LED and LCD TVs score 8 and 7 respectively in energy efficiency. See also http://mappingandbenchmarking.iea-4e.org/shared_files/110/download

electricity costs over a 10 year period were € 230. For the best model electricity costs were € 146 and for the least energy efficient it was around € 346.[35]

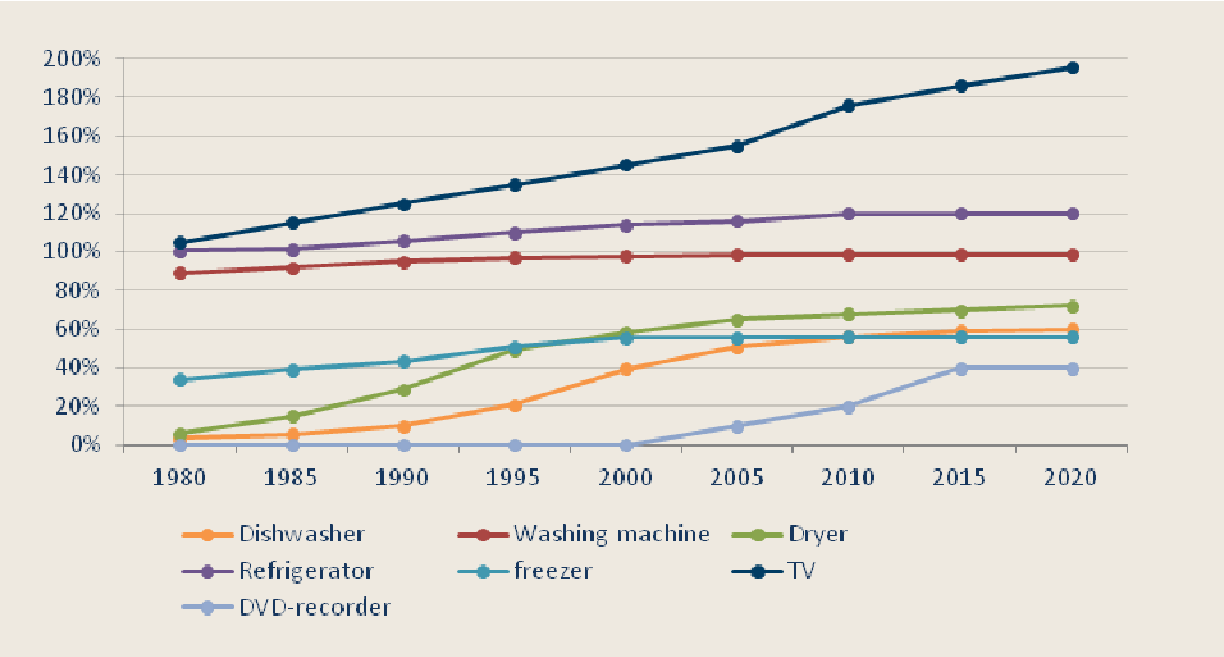
Likewise a study by GfK Retail and Technology shows that for 42 inch LCD TV on average almost one third of total life cycle costs for the consumer is caused by energy consumption. Out of total life cycle costs of €1198, the purchase price is on average € 828 and average energy costs are € 370.[36]

The total energy consumption of televisions has been affected negatively by:

- A growing number of televisions in EU households (higher penetration rates)
- Increased viewing time per day
- Increased average screen sizes

The chart below shows how the penetration rate of televisions have increased from index 100 in 1980 to around 175 in 2010 and is expected to rise further to around 200 by 2020. From the data, it is clear that televisions have exceeded all other home appliances in terms of market penetration, with nearly two for every household.

Chart 3.5 – Penetration rate of televisions and other household appliances



Source: Hans-Paul Siderius, Presentation at EEDAL Conference 2011

Methodological limitations specific for televisions

Televisions isare a well defined and fairly homogenous product group which have been around for a long time. This is an advantage for any data collection efforts. However, the key challenge in the case of televisions is to isolate the effect of the Ecodesign Directive since the market and technologies develop quickly, driven by market pressure rather than government regulation. This makes it difficult to establish a

[35] http://www.topten.info/uploads/File/S.A.L.T.%20TV%20study%202009%20EN.pdf
[36] Presentation by Thilo Heyder at the 2011 EEDAL conference. Assumption are: 4 hours per day ON MODE + 20 hours per day STANDBY, life cycle 7 years, costs per 1 KWh in Germany = Euro 0.253

causal relationship between the Ecodesign Directive and changes in the market, energy efficiency and especially in resulting total energy consumption.

Baseline

The Implementing Measure for televisions was adopted in July 2009 under Commission Regulation EC/642/2009. The requirements for televisions will be introduced in two steps starting from august 2010.

Table 3.9 Televisions: Implementing Measure requirements

Date	Target
From August 2010	The minimum energy performance requirements are set so that all TVs must be more efficient than the 2007 sector average.
From April 2012	Standard television sets must be 20% more efficient and full-HD sets to must be 30% more efficient than the 2007 sector average.

The exact limits for on-mode power consumption of televisions are dependent on the screen size of the televisions and are determined by a formula and not by a specific value.

In addition, in September 2010 an A-G energy labelling scheme for televisions was adopted and will be introduced in 2012. The labelling scheme aims to create market transparency for consumers and provide incentives for manufacturers for to innovate and make investments in energy efficiency.

The preparatory study states that 32 million televisions were sold in 2005 bringing the total number of installed televisions up to 303 million. This means an estimated annual energy consumption of 54 TWh in 2005 and 60 TWh in 2007.

Table 3.10 Televisions – 2005 Baseline

Number of products	Energy consumption in EU27	Electricity costs	CO_2 emission
303 mln. (2005)	54 TWh (2005)		24 Mt (2007)

Expected impact

Despite Ecodesign requirements and energy labelling being adopted to increase energy efficiency of televisions, a significant growth in energy consumption is expected. Without Ecodesign policies energy consumption is expected to reach 132 TWh in 2020. With Ecodesign requirements, growth in energy consumption is expected to be limited to 104 TWh in 2020 (28 TWh reduction).

Table 3.11. Televisions – expected impact of Ecodesign requirements

Year	No Policy (in TWh)	Policy* (in TWh)	Improvement Potential (in TWh)
2020	132	104	28

At the time of carrying out the preparatory study and the impact assessment LED-backlit LCD televisions were considered to be a niche market. The rapid development of this technology has led to improved energy efficiency which was not anticipated by the impact assessment. This is a major consideration.

The preparatory study predicts that the total stock of televisions, indicated by the *sales/installed base*, will increase from 35 million annual sales with a total of 303 million sets in 2005 to 47 million in annual sales with an accumulated total of 429 million television sets in households in 2020. Accumulated electricity

savings between 2005-2020 are estimated at 83 TWh, generating accumulated electricity cost savings of €12.5 billion.

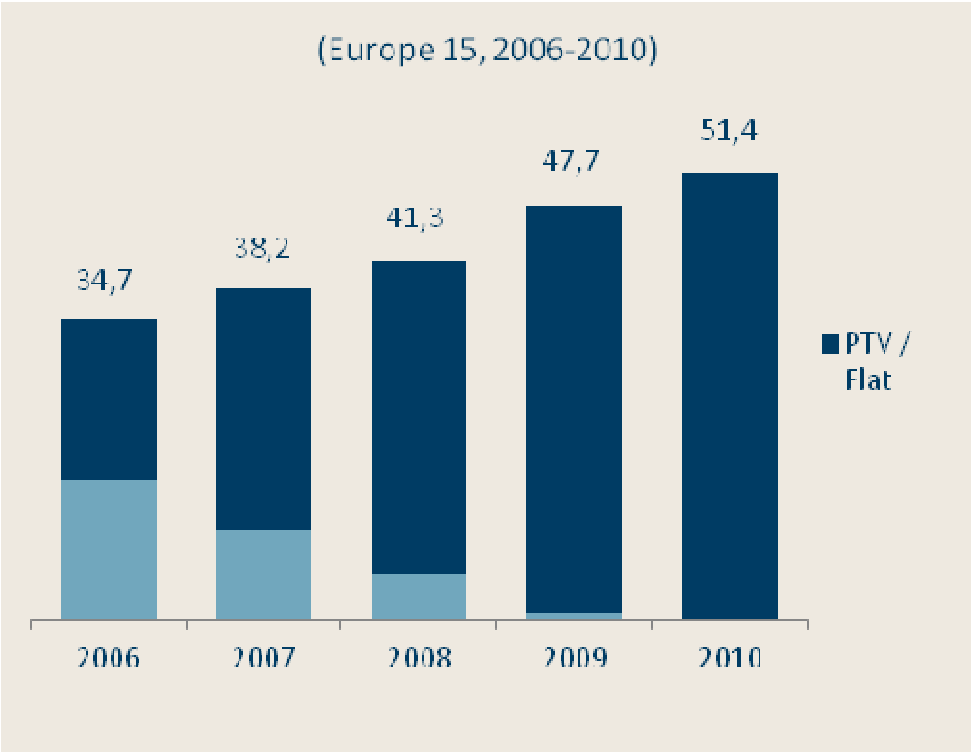
Table 3.12. Televisions – expected accumulated impact of Ecodesign requirements

Accumulated electricity savings until 2020	Accumulated electricity cost savings until 2020	Accumulated CO_2 emission savings until 2020
83 TWh	€ 12.5 bln.	34 Mt

Effects of the Directive

Available data from GfK Retail and Technology on the television market in 15 countries[37] shows that sales of televisions have increased by almost 50 % over the period from 2006 to 2010, reaching 51.4 million in 2010. CRT televisions accounted for around 40 % in 2006 but had a market share very close to zero in 2010.

Chart 3.6 Annual television sales in millions

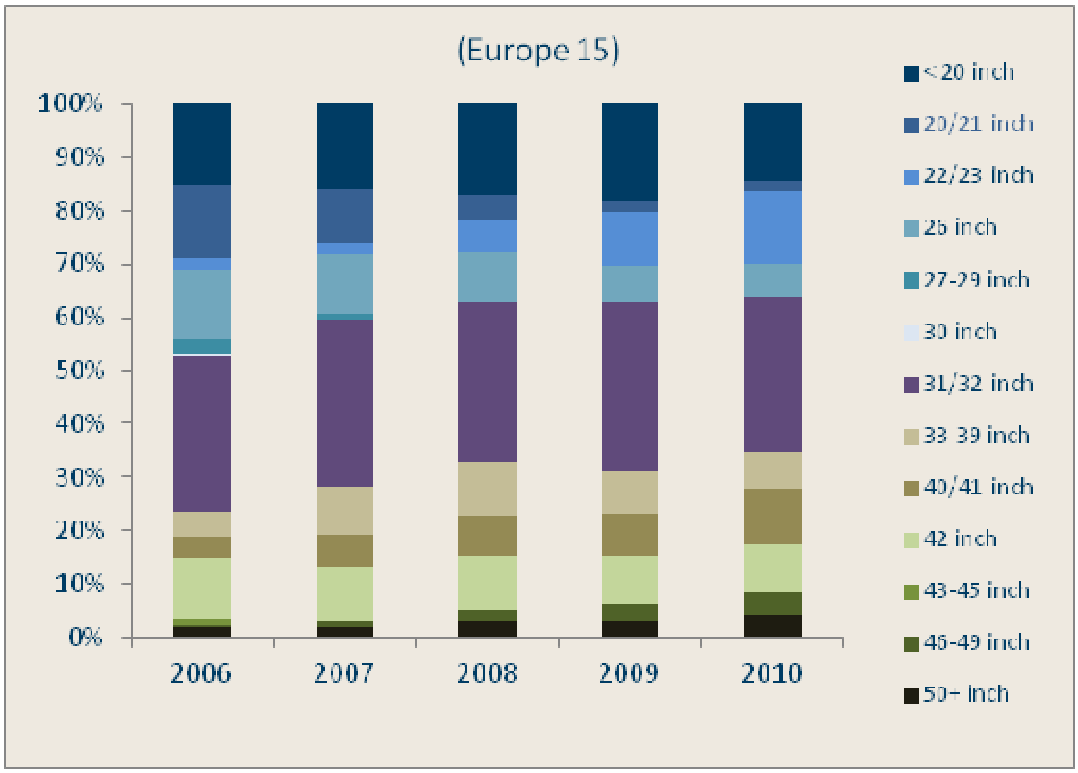


Source:: GFk Retail and Technology

Average screen size has increased as well. In 2006 screen sizes of 40 inches and bigger had a market share of 17 %. This had gone up to 27 % in 2010. Similarly, screen sizes of 30 inches and smaller have lost market shares and screen sizes between 32 and 39 have maintained a stable market share.

[37] Europe 15: DE, FR, GB, IT, NL, ES, AU, BE, SE, CH, DK, FI, IR, GR, PT

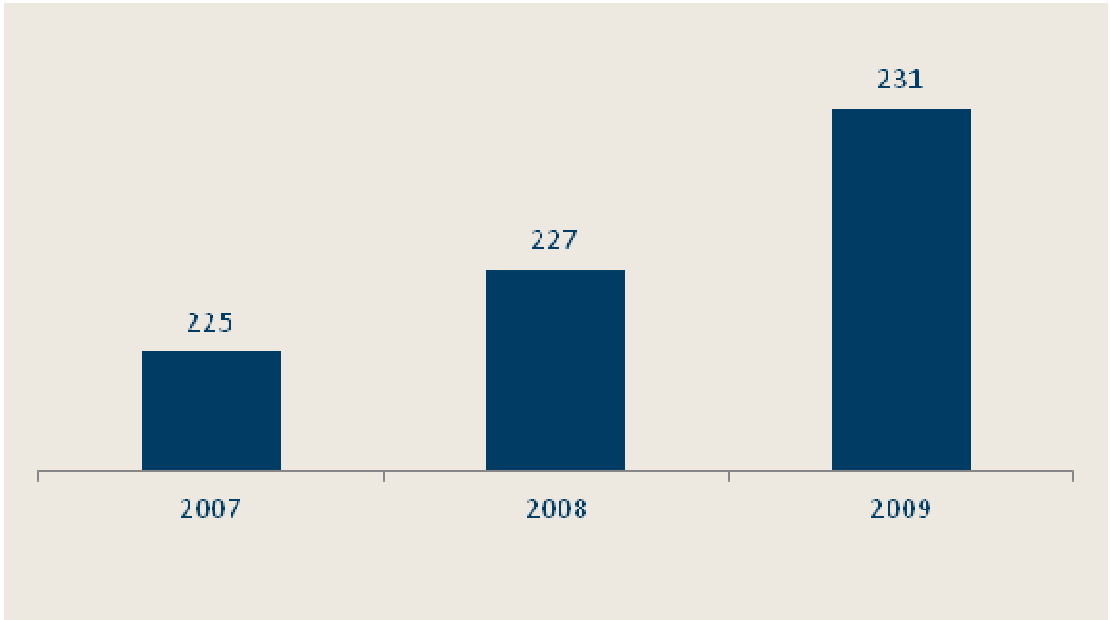
Chart 3.7 Development of screen size for new televisions



Source: GFk Retail and Technology

At the same time that new televisions have been introduced on to the market and screen sizes have consistently increased, consumer behaviour has also changed and people are watching television for longer periods of time each day.

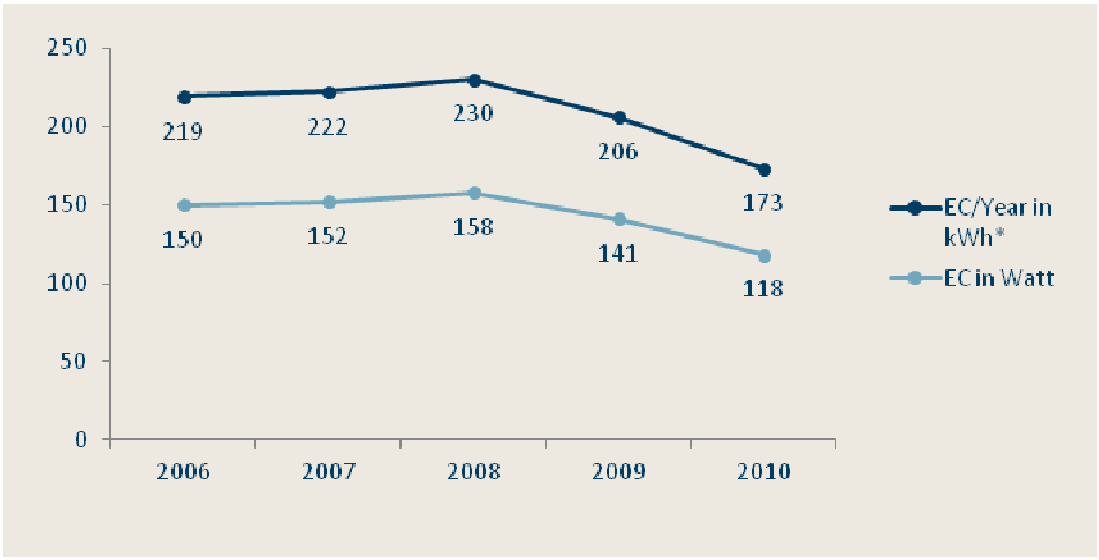
Chart 3.8 Average TV viewing time in minutes per person



Source: IP Network ; Note: EU-26, 2007-2009

At the same time though, efficiency of TV sets has increased and the average energy consumption per television set has decreased over the period 2008-2010 by around 25%. This was a reverse of a trend up to 2008 when energy consumption was increasing.

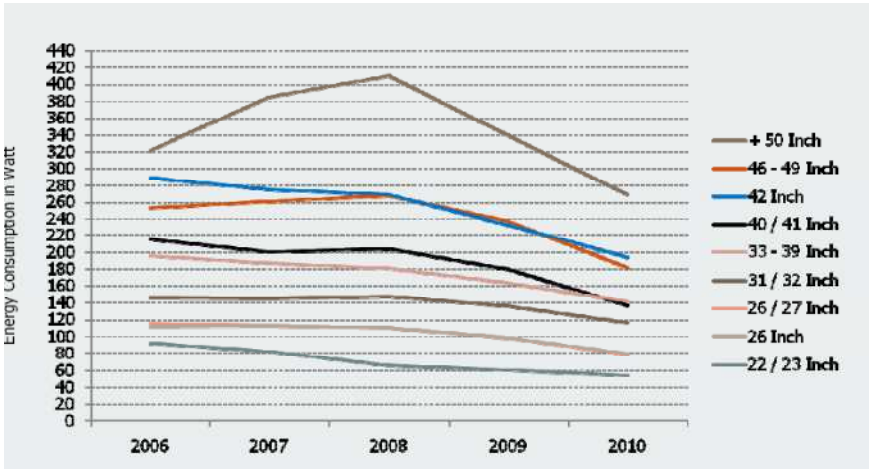
Chart 3.9 Energy consumption per television set



Source: GFk Retail and Technology, based on 4 hours on-mode and 20 hours standby per device and day.

The tendency towards increased energy efficiency is even more clearly indicated if we look at data for energy consumption for different screen sizes. Every screen size uses less energy in 2010 than in 2006.

Chart 3.10 Energy efficiency divided by screen size

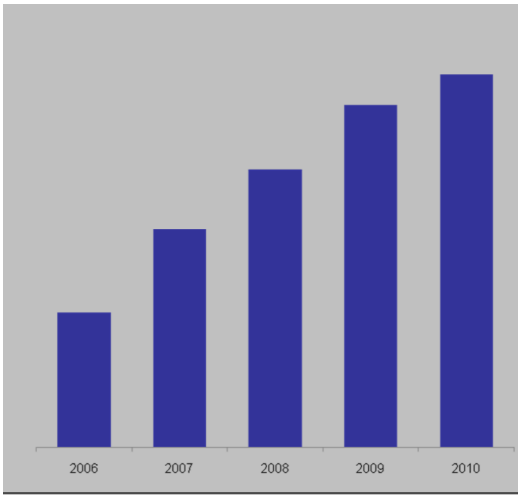
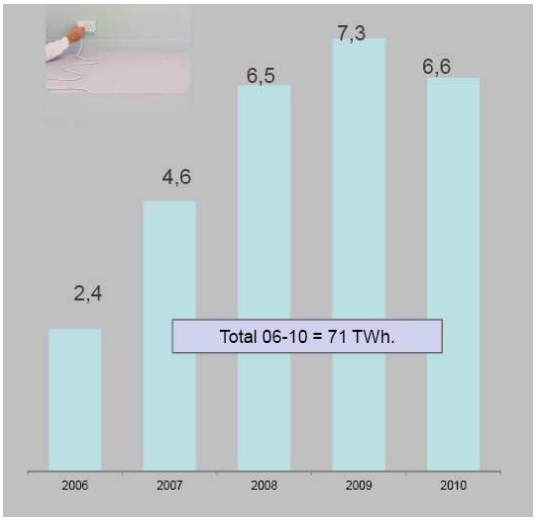


Source: GFk Retail and Technology

There is a clear improvement in the energy efficiency of televisions in 2008, which is offset by the increase in penetration and screen sizes in combination with an increase in average viewing time. However, it is unlikely that the increased consumer demand was a result of increased energy efficiency. Rather, the industry is responding to increased policy activity but the effect on total energy consumption is limited due to consumer behaviour. Since the development in screen size and viewing time happened independently of the Ecodesign requirements, this does not imply that the Ecodesign Directive has not been effective. The Regulation achieved its affect by reducing the absolute electricity consumption compared to a business-as-usual scenario.

The trends in Europe reflect broader world market trends. The data from the 4E mapping and benchmarking exercise under the International Energy Agency (IEA) indicate that for all countries examined, on mode consumption for LCD televisions dropped in 2009 by 8% in comparison to the year before (134W in 2009 in comparison to 146W in 2008). With the increasing average energy consumption per television experienced until 2008 and the increasing sales of televisions, the total energy consumption from televisions was increasing up to 2009. In 2010 total energy consumption decreased indicating that that the increasing energy efficiency of TV sets for the first time managed to offset the effect caused by higher sales, increased viewing and bigger screen sizes.

Chart 3.11 - Sales of televisions and energy consumption

Flat screen TV Sales Units in Mio	Flat screen TV Fleet Energy Consumption in TWh
	

Source: GFK Retail and technology, Presentation by Jürgen Boyny at IFA messe Berlin 2011.
Note: EU-15, 2006-2010

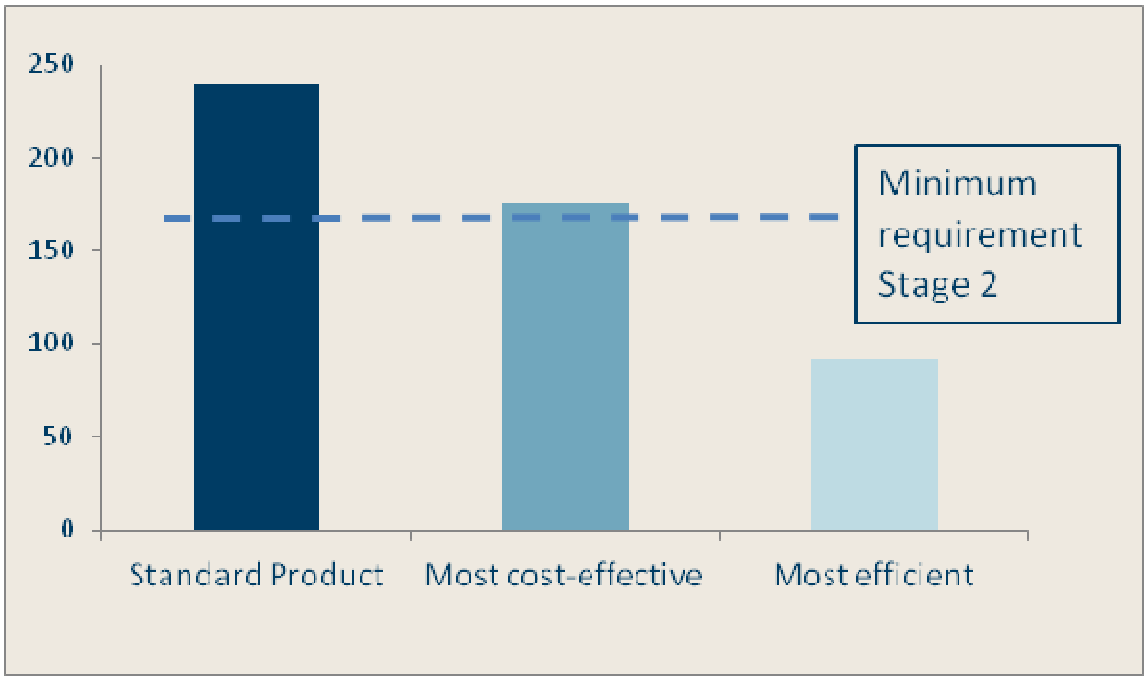
Another way of assessing the Ecodesign Directive is to look at whether the requirements have been set as intended or whether they are too strict. A study commissioned by the environmental NGOs SNM and BUND assess the level of ambition for the current Implementing Measures of the Ecodesign Directive.[38]

According to the study, in the case of Televisions the 1st stage requirements (maximum energy consumption of 141 W for a 32 inch LCD television) are more demanding than the average in the market in 2008 (152W for 32 inch television). However, the most cost efficient television already had much lower energy consumption levels in 2008 (117W). Furthermore, even the second tier requirements that will come into force in 2012 (117W) will be much higher than the most cost efficient television already in the market in 2009 (60W in on-mode).[39]

Based on the analysis the authors conclude that taking the development of technologies in the coming years into account the minimum requirements will not represent the most cost-effective solution by the time they enter into force and should have been more ambitious.

[38] The analysis is based on the analysis of the total energy and costs effects for a typical household and compares the results of the specific requirements against three possible scenario: base case of standard products available in the market, most energy efficient products and the most cost effective – least life cycle cost option.
http://www.coolproducts.eu/resources/documents/EnergySaving-in-Practice.pdf
[39] http://www.coolproducts.eu/resources/documents/EnergySaving-in-Practice.pdf

Chart 3.12 - Energy consumption of standard television, most cost effective and most efficient television seen in relation to the stage 2 requirements



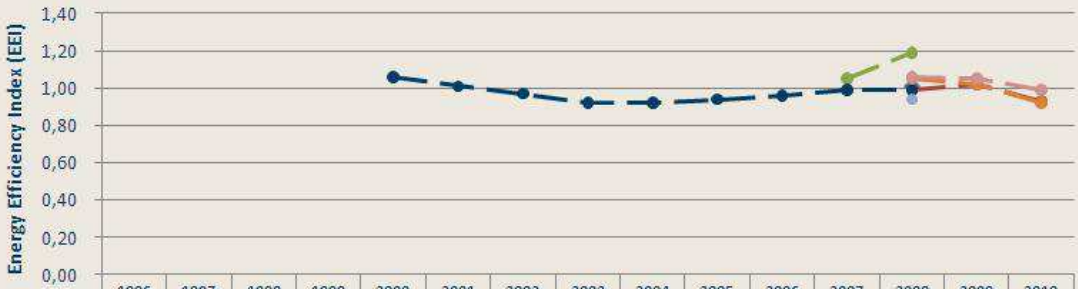
Source: Coolproduct (2010), Energy saving in practice

Comparing the development in the EU to other countries[40] suggests that in the cases of televisions the EU has achieved similar level of average energy efficiency levels. Data on the on power mode energy consumption and energy efficiency Index - in total and for different types of televisions - showed an average across three countries with data of 145W (illustrative) for new sales, varying from 132W for the US[41] over 141W (UK and EU-15) to 152W (Austria, 2009) (due to limited data availability the data should only be seen as illustrative).

It appears that there is already a tight band of average levels of efficiency, though the benchmarking study indicates that the most efficiently performing products are capable of a performance at around an index value of 0.3 and the poorest can reach as poor a value of 2.

[40] 4E Mapping and Benchmarking. http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=2
[41] Data for the US is based on Energy Star Data and therefore skewed towards more energy efficient products.

Chart 3.13 - Average Efficiency of all televisions sold



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Australia													1,01		
Austria													0,99	1,02	0,93
France												1,05	1,19		
Republic of Korea															
Switzerland					1,06	1,01	0,97	0,92	0,92	0,94	0,96	0,99	0,99		
United Kingdom													1,05	1,02	0,92
USA													0,94		
EU													1,06	1,05	0,99

Source: 4E Benchmarking Document, 2010

Both Australia and the US have - like the EU - focused on improving the energy efficiency of televisions.

In Australia all television models are required to be registered for import and meet mandatory Minimum Energy Performance Standards (MEPS) from 1 October 2009. In addition voluntary energy labelling of televisions was introduced in July 2008. The labelling scheme became mandatory on 1 October 2009.

In the US the Energy Star television specification was introduced in January 1998, covering standby consumption only. On Mode power consumption limits came into effect in October 2008. AtBy 2009, a large majority of televisions on the market met the revised Energy Star specification. Revised Energy Star television specifications were establishedin May 2010 and are intended to come into effect in May 2012.

As the 4E mapping and benchmark project gathers more data and produces more robust results it will be possible to compare improvements in energy efficiency among countries which could give an indication of the effectiveness of the different approaches taken.

Summary

Even with Ecodesign requirements energy consumption from televisions was expected to almost double from 54 TWh in 2005 to 104 TWh in 2020. Data presented here indicates some more positive developments than forecasted in the preparatory study and the impact assessment.

While sales of new televisions increased with by around 25 % over the period 2008-2010, energy consumption per television dropped with by around 25 % in the same period. Over 2006-2009 the total energy consumption from televisions increased, but in 2010 a remarkable shift occurred and total energy consumption dropped by close to 10 percent. If this development continues the total energy consumption in 2020 is likely to be lower than in 2005 and not double the size of 2005 as forecasted in the impact assessment. This is mainly due because ofto the introduction of televisions based on new technologies which werewas not anticipated at the time of writing the preparatory studies and the impact assessment.

As mentioned the rapid development of the market for televisions has also led to an increasing number of televisions per household, increasedlarger screen sizes and increased viewing time. These effects are not a direct consequence of the increased energy efficiency and are therefore not a direct rebound effect of the

Ecodesign requirements but they are related to the intense research and development leading to significant technological change, largely independently of the Ecodesign Directive.

The decrease in total energy consumption coincided with the introduction of the first Ecodesign requirements but it cannot - based on the data available - be concluded that there is a direct link between the two. However, the rapid development of more energy efficient televisions might have been accelerated by the focus on energy efficiency and the introduction of Ecodesign requirements.

A key question is to what extent the introduction of the Ecodesign requirements led manufacturers to push forward with the LED technology in order to comfortably comply with the requirements and to what extent the current rapid development will be sustained in the absence of more strict requirements. Due to this recent shift in the market, the evidence is not yet sufficient to estimate the effect of the Ecodesign Directive.

A further question is whether the Ecodesign requirements are appropriate in view of the developments in LED technology.

Questions to stakeholders

- The introduction of new types of televisions happened largely independently of the Ecodesign Directive. But it could be argues that the introduction of the Ecodesign requirements led manufacturers to push forward with the LED technology in order to comply with the requirements. Do stakeholders have evidence/examples of this?
- Do stakeholders have any other evidence (qualitative or quantitative) which can link the shift in the market to the introduction of Ecodesign requirements?

4. Domestic refrigerators and freezers

Introduction

Cold appliances (refrigerators & freezers - which are covered under the same Implementing Measure) account for around 15 % of residential electricity consumption and are the largest source of energy use together with heating systems/electric boilers.[42] In total Europeans use 122 TWh of electricity annually to power their fridges and freezers - equivalent to the total residential consumption of the UK.[43]

For a long time there has been a positive development in the energy efficiency of cold appliances entering the market. Due to early efforts at energy labelling, voluntary agreements and minimum efficiency requirements came into force in 1994 and 1996, respectively. Domestic refrigerators and freezers are seen as one of the success stories of EU energy efficiency policy. In the period 1959-1970, the average consumption of a refrigeration unit was 839 kWh/year, which was reduced to 292 kWh/year by 2005. As stated in the preparatory study[44] in 2005, these improvements occurred through product improvements and the introduction of new product lines.

However, the relevant Implementing Measures states that while the projected energy consumption of household refrigerating appliances will decrease by 2020, the rate of this reduction is expected to slow as a result of outdated requirements and energy labels. The cost-effective energy-savings potential would therefore not be achieved if no further measures are introduced to update the existing Ecodesign requirements.

[42] Presentation by Bettina Hirl, JRC, EEDAL Conference 2011.
43 http://www.coolproducts.eu/product_fridges_and_freezers_3164.aspx
44 ISIS. 2005. LOT 13: Domestic Refrigerators & Freezers Final Report [Preparatory Study]: http://www.ecocold-domestic.org/index.php?option=com_docman&task=doc_view&gid=125&Itemid=40

The energy efficiency of absorption-type refrigerators and thermoelectric cooling refrigerating appliances, such as mini drink chillers, can be significantly improved. Appliances that have consequently been included under the Regulations include:

(a) refrigerating appliances that are primarily powered by energy sources other than electricity, such as liquefied petroleum gas (LPG), kerosene and bio-diesel fuels;

(b) battery-operated refrigerating appliances that can be connected to the mains through an AC/DC converter, purchased separately;

(c) custom-made refrigerating appliances, made on a one-off basis and not equivalent to other refrigerating appliance models;

(d) refrigerating appliances for tertiary sector application where the removal of refrigerated foodstuffs is electronically sensed and so that information can be automatically transmitted through a network connection to a remote control system for accounting;

(e) appliances where the primary function is not the storage of foodstuffs through refrigeration, such as stand-alone ice-makers or chilled drinks dispensers.

Methodological limitations specific for refrigerators and freezers

As in the case of televisions, the market for domestic refrigerators and freezers has seen significant technological changes over the recent decades. The technological progress and the focus on energy efficiency in the sector make it difficult to isolate the effect generated by the Ecodesign Directive.

On the other hand, cold appliances are a well defined product group which has attracted significant attention for a considerable time. Market and industry data are thus available up until quite recently.

Baseline

The preparatory study suggests that the refrigerator industry had improved significantly in terms of electricity consumption in the 30 year period leading up to the introduction of the new regulations in 2009. Subsequent improvements may be more difficult to achieve because they would probably require the development of new technologies.

The Directive Regulation on cold appliances sets out a series of labelling and performance targets for the industry, outlined in the table below[45]

Table 3.13: Domestic refrigerators and freezers specific requirements - Energy Efficiency Index (EEI)

Category	Date	Absorption-type and other-type refrigerating appliances	Compression-type refrigerating appliances
	1 July 2010	EEI < 150	EEI < 55
	1 July 2012	EEI < 125	EEI < 44
	1 July 2014	EEI < 110	EEI < 42

The requirements that took effect in July 2010 state that the Energy Efficiency Index (EEI) for products must be smaller than 150 for absorption type and 55 for compression type appliances, equivalent to energy class A. The requirements that take effect in July 2012 will ban part of the class A products.

[45] Domestic refrigerators and freezers Implementing Measure, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009R0643:EN:NOT

In 2008, the EU-27 refrigerator stock in the residential sector was estimated to be 190,577 million units and the freezer stock stood at 84,292 million units. The combined annual electricity consumption was estimated to be 122 TWh in 2005, corresponding to 56 million tonnes of CO_2 equivalent.

Table 3.14 – Domestic refrigerators and freezers baseline

Number of products (2008)	Energy consumption in EU27 (2005)	Electricity costs	CO_2 emission (2005)
Refrigerators 190,577 million units Freezer 84,292 million units	122 TWh	--	56 million tonnes

Based on the targets set, it is estimated that by 2020, electricity consumption will fall to 79 TWh and CO_2 emissions will amount to 38 Mt from cold storage appliances, a decrease of 33 % in comparison to 2005. Moreover, the regulations are estimated to have significant implications for consumer spending to support the total stock of refrigeration in homes. The annual purchase and running costs of the EU-27 stock is expected to drop by around € 400 mln/year in 2025 compared to 2005. Compared to a scenario with no Ecodesign policy the expected savings in 2020 is 4 TWh and the accumulated savings until 2020 is 12 TWh.

Table 3.15 – expected impact of Ecodesign requirements

	No Policy (in TWh)	Policy* (in TWh)	Improvement Potential (in TWh)
2010	105	105	0
2020	83	79	4

Table 3.16 - Domestic refrigerators and freezers expected accumulated impact of Ecodesign requirements

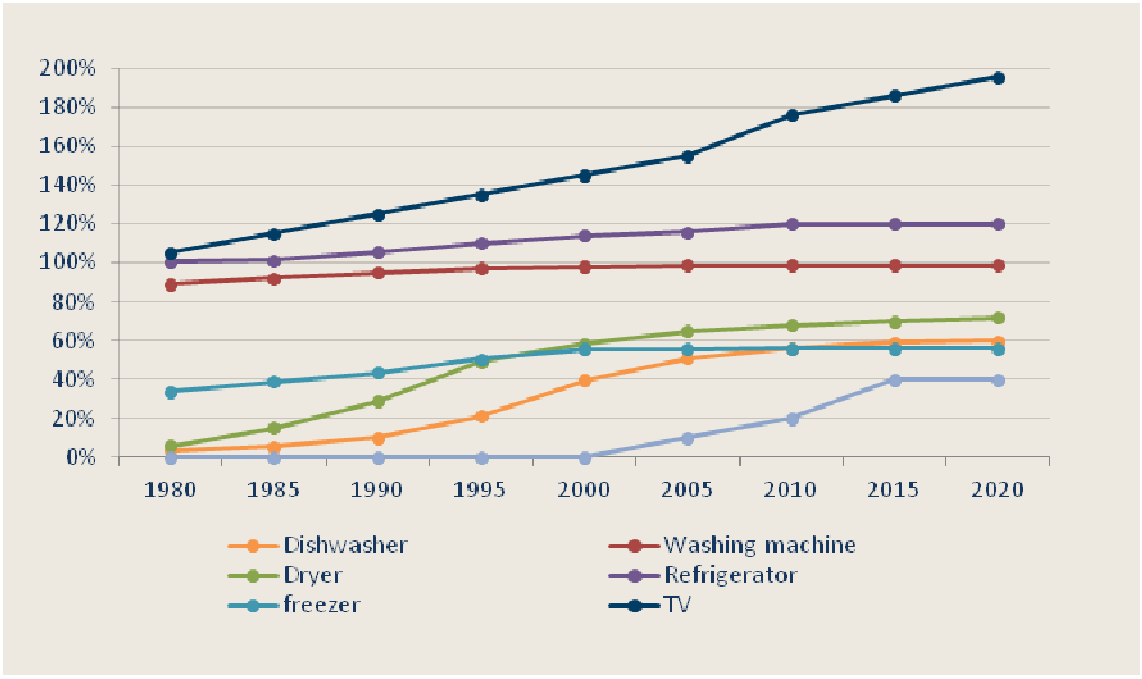
Accumulated electricity savings until 2020	Accumulated electricity cost savings until 2020	Accumulated CO_2 emission savings until 2020
12 TWh	€ 2 bln.	5 Mt

As will be explained below the drop in energy consumption in 2020 compared to 2010 even with no policy can be explained by market saturation and a long lasting trend towards increased energy efficiency.

Existing evidence on the effects of the Directive

In contrast to the case of televisions, refrigerators appear to have reached market saturation with a penetration rate of around 100% in the EU27. The freezer market has a lower penetration rate – around 60 % but has been rather stable since 2000. Lately freezers have even registered a decreasing tendency in the last years, due to the increased use of combined refrigerator/freezer appliances. Thus, energy consumption by this product group is not driven by a growth in the market.

Chart 3.14 - Penetration rates of refrigerators and freezers

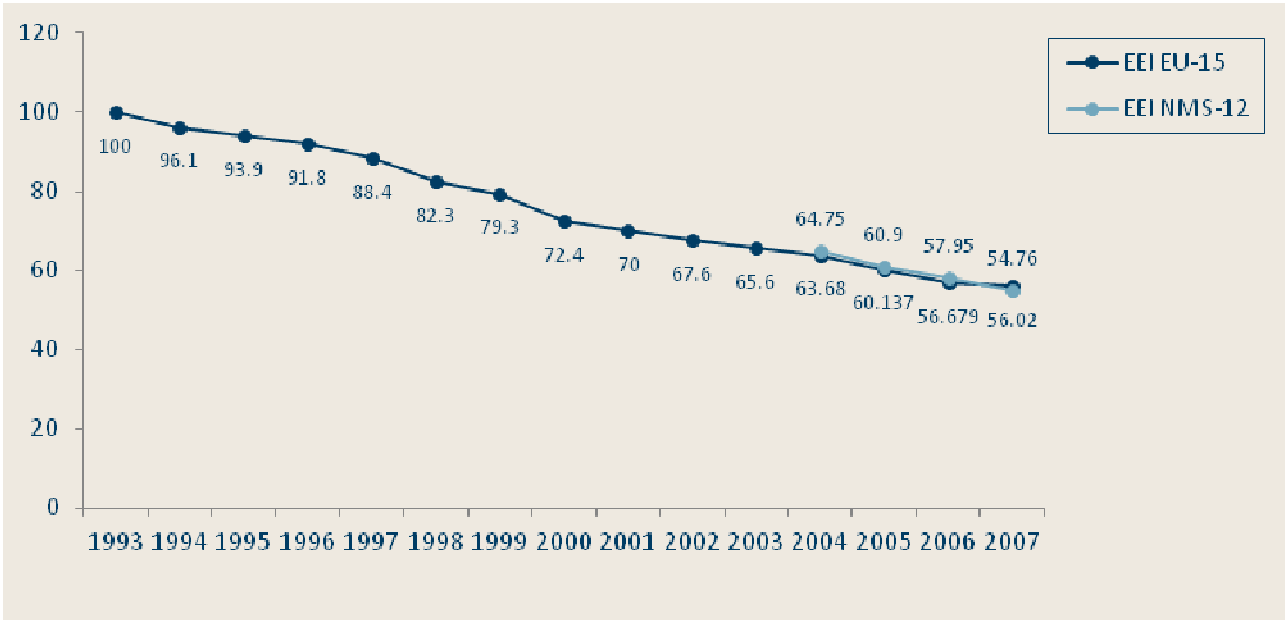


Source: Hans-Paul Siderius, Presentation at EEDAL Conference 2011

In contrast, the data going back to 1993 show that energy efficiency for EU-15 has almost doubled by 2007, meaning that energy consumption has almost been cut in half. This has been the trend in the absence of any additional energy efficiency policies.

Like for televisions one could have imagined that increasing average size of refrigerators and freezers would have fully or partly offset the efficiency improvements but this does not seem to be the case.

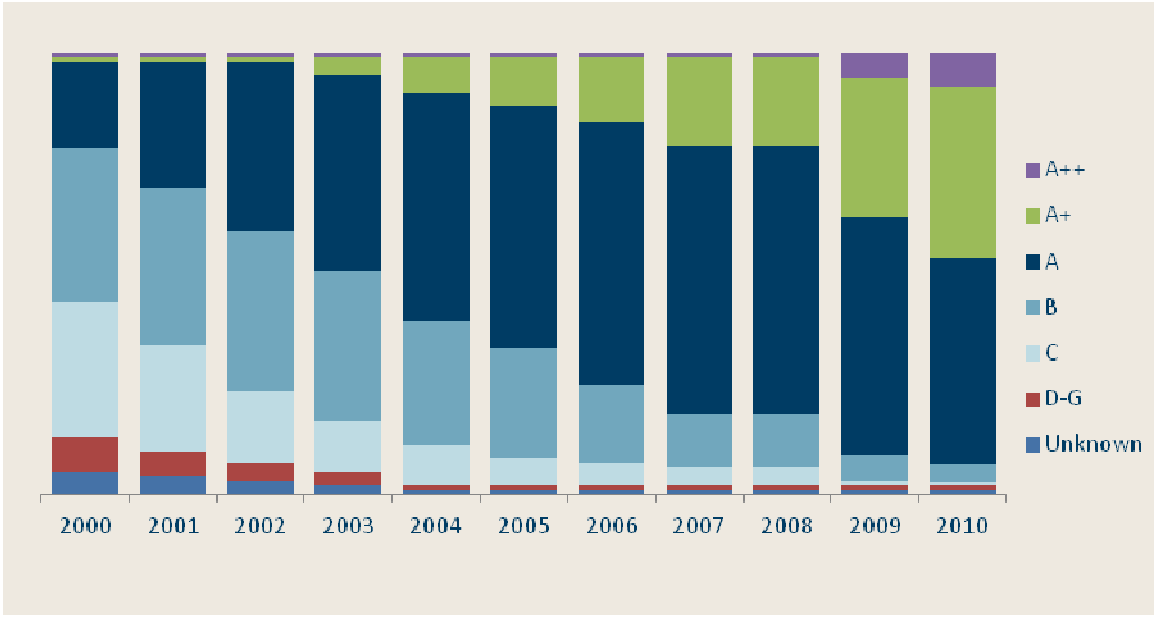
Chart 3.15 - Energy Efficiency Index (EEI) for cold appliances for EU-15



Source: Bettina Hirl, JRC, presentation at the 2011 EEDAL Conference

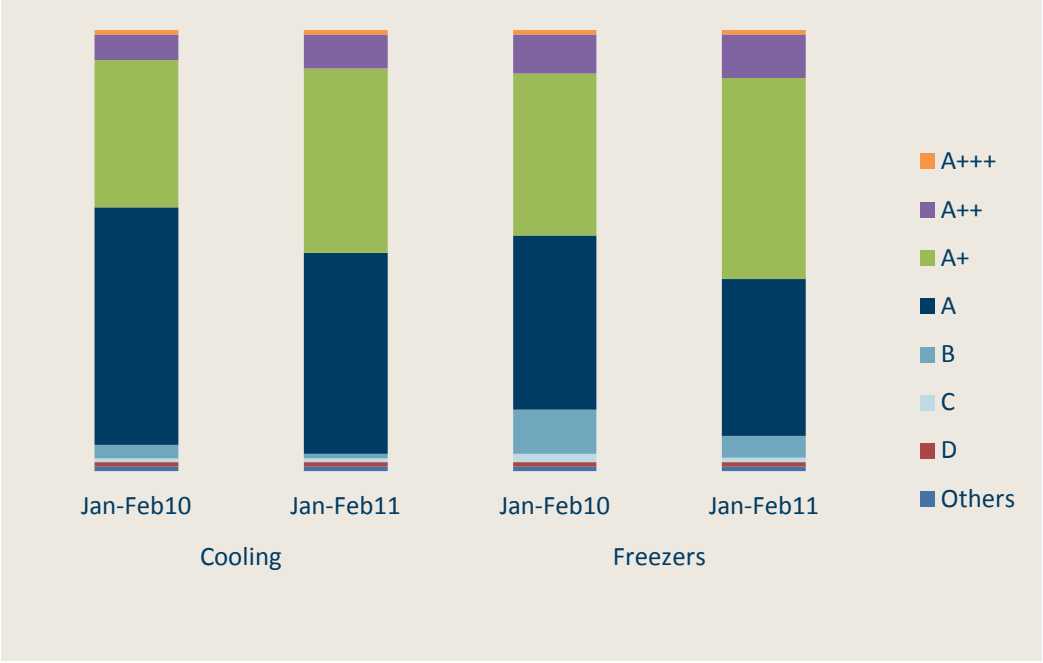
The increasing energy efficiency in the EU is also illustrated by the market shift towards cold appliances with higher energy efficiency labels. In 2000 products with label A or better represented around 20% of the market while B and C-labelled products were the most common. In 2010, A-labelled products or better made up around 96 percent of the market. A+ and A++ products had a market share of nearly 50 % and this trend continues further.

Chart 3.16 - Market share of cold appliances (refrigerators and freezers) by energy class (2000-2010)



Source: GfK, Presentation by Anton Eckl at the AtLETE workshop - Note: Data for EU-10, AT, BE,DE,ES,FR,GB,IT,NL,PT,SE.

Chart 3.17 - Market share of cold appliances divided by energy class (2010-1011)



Source: GfK, Presentation by Anton Eckl at the AtLETE workshop - Note: Data for EU-13, central and Western Europe.

As mentioned, the Ecodesign requirements banned all products below energy class A in July 2010. The decision was adopted in July 2009 but the preparatory studies were initiated already in 2006.

The table below illustrates the market share of products labelled A or better and the change in market share from previous year. The higher the market share the more difficult it will generally be to achieve a further significant increase in market share. This should be kept in mind when interpreting the data. Still, it is difficult to identify an accelerated movement towards more energy efficient appliances around the time of discussing minimum requirements (2006-2007) or introducing minimum requirements (2009-2010).

Table 3.17 Market share of product labeled A or better

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Marked share of Class A or better	21	30	40	48	59	67	76	83	88	93	96
Change from previous year		9	10	8	11	8	9	7	5	5	3

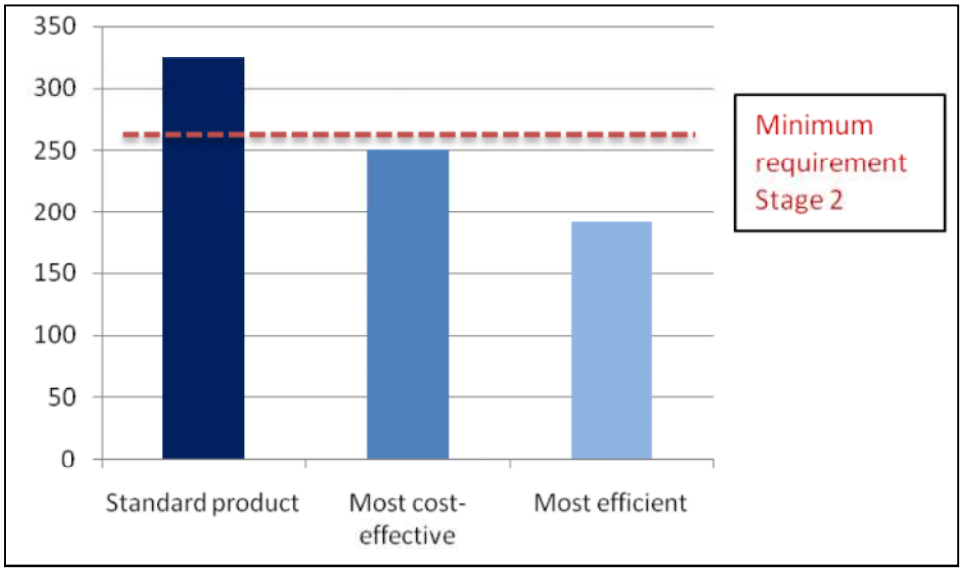
Source: GfK

It is worth noting that products below energy class A were still being sold in early 2011 despite the Ecodesign requirements banning them from the market.

Despite the positive development there is significant criticism that the requirements have not been ambitious enough.[46] The requirement set for July 2010 removed the products from the market that already had a declining market share as documented above. The second stage of implementation in July 2012 will ban a significant part of the A class but this is still below the energy efficiency of the product which in 2009 was the most cost-effective product (in the A+ class). There is thus criticism that most of the development would have happened in the absence of the Regulation and that the Ecodesign Directive therefore has only removed a small share of products from the market. Furthermore, it is suggested that in practice manufacturers had access to the necessary technologies before the introduction of the Implementing Measures, and that improvements have been designed to marginally surpass the minimum requirements.

[46] Cool Products for a Cool Planet.

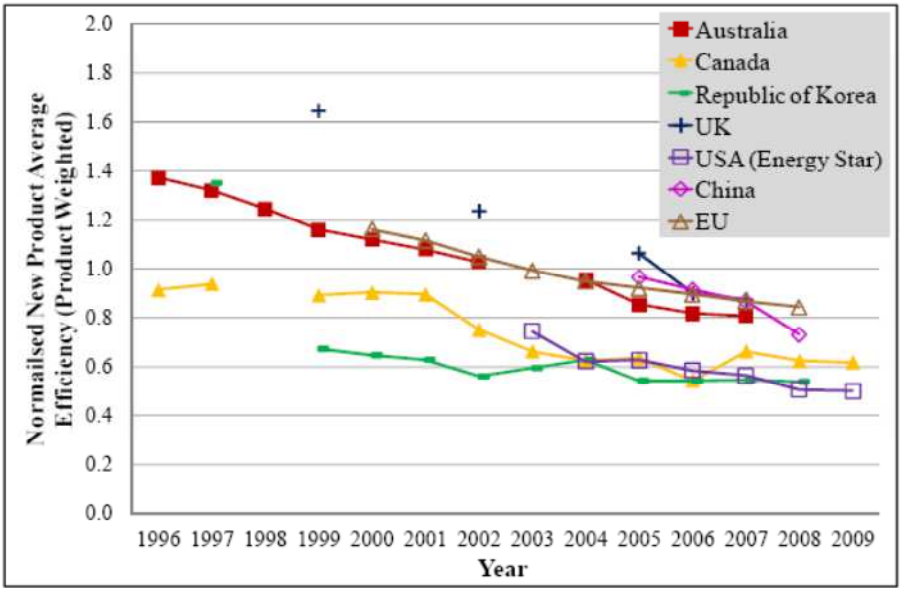
Chart 3.18 - Stage two requirements compared to a standard refrigerator, the most cost efficient refrigerator and the most energy efficient



Source: Coolproducts

The fact that the requirements are probably not as ambitious as they could be is also supported by the information from other countries. Countries outside the EU have already achieved greater energy efficiency levels. While there are issues of direct comparability, a first view of the data collected as part of the 4E Mapping and Benchmarking Annex shows higher efficiency levels in place in Australia, Canada, Korea, China and the US. In all these markets mandatory labelling and/or Minimum Energy Performance Standards (MEPS) have been introduced even earlier than in the EU and/or are revised regularly (Canada, Korea and the USA).

Chart 3.19 - Benchmarking electricity efficiency trends for cold appliances[47]



Source: Hans-Paul Siderius, presentation at the EEDAL conference.

[47] figures have been normalized to account for different volumes

Summary

Cold appliances, refrigerators and freezers, have seen significant improvement in energy efficiency in the last decade. Energy class A has become the dominant class and more and more products are moving up to even higher energy classes. As the size of the market has remained constant total energy consumption has gradually decreased.

However, it is difficult to attribute changes to the Ecodesign Directive as the development started long before the Directive was implemented and no additional change can be detected around the time when the relevant Implementing Measure was discussed or came into force. The previous positive development in energy efficiency have also been influenced by other minimum energy performance standards and labelling schemes so one could also draw the conclusion that the minimum requirements have helped sustain the fast paced market transformation.

There is evidence from data and reports cited above that the current requirements are not as demanding as they could be. On the other hand the requirements may have led to a faster removal from the market of the - small proportion of - less efficient products left on the market than what would otherwise have been the case.

Questions to stakeholders

- Do stakeholders have evidence (qualitative or quantitative) which can link the shift in the market to the introduction of Ecodesign requirements?
- Is it fair to conclude that a large part of the markets shift towards more energy efficient products would have happened in the absence of the Ecodesign requirements and that the requirements are not as ambitious as they could have been?

5. Simple set top boxes

Introduction

Simple set top boxes (hereafter SSTBs) have the primary function of converting digital input into analogue output signals. During the ongoing transition from analogue to digital broadcasting, TV sets not adapted to receive digital signals will need to be accompanied by SSTBs. Analogue broadcasting will be switched off in the EU in 2015, hence, the sales and aggregated energy consumption of SSTBs are expected to dramatically increase. In 2009, it was expected that a total European consumption of up to 10 TWh/yr could be attributed to SSTBs[48]. In order to minimize the environmental impact of SSTBs it was thus considered important that the electrical efficiency should be maximized within a short timeframe.

The Impact assessment report states that SSTBs have great improvement potential due to the fact that existing cost-effective technical solutions allow the electricity consumption of these devices to be reduced significantly. Moreover, it was suggested that there is no correlation between the prices of different SSBTs having with the same functionalities and their energy consumption.

At the level of individual households, SSTBs contribute only to a limited degree to the total energy consumption. For that reason consumers are focusing on the upfront price of SSTBs and do not take into account their energy consumption throughout the lifecycle. Consequently, over the past few years manufacturers have concentrated on driving down the cost of manufacturing, even though technical solutions to decrease the energy consumption of SSTBs could be applied at virtually no additional cost.

[48] Bertoldi, Paolo & Atanasiu, Bogdan 2009: *Electricity Consumption and Efficiency Trends in European Union,* Joint Research Centre Institute for Energy, European Commission, EUR 24005 EN

Additionally, as consumers are not aware of the power consumption of SSTBs, they tend to leave them permanently switched on which leads to a substantial energy waste.[49]

Voluntary agreements

Related voluntary initiatives both at the Community EU level and at the Member State level were taken into account in the preparatory phase of the implementation of the Ecodesign Directive. Two EU and national initiatives addressing the energy consumption of SSTBs were identified. At the Community level, the Joint Research Centre (IES) has been running a voluntary Code of Conduct which sets energy efficiency criteria. At the level of Member States, the UK has been running an endorsement label programme for SSBTs managed by the Energy Saving Trust.

However, the impacts of the voluntary initiatives were limited due to the lack of incentives for manufacturers to focus on decreasing the power consumption of SSTBs.[50] Furthermore, a study carried out by in 2007 by the Swiss Agency for Energy Efficiency found that the Code of Conduct was unambiguous[51]. The study found that existing technology should enable manufacturers to reduce the energy consumption well below the defined maximum levels in a cost effective manner[52].

Baseline

The Ecodesign Regulation on SSTBs was adopted in February 2010. The core element of the Ecodesign Directive is the introduction of minimum energy performance requirements. The requirements for simple set top boxes will be introduced in two steps. The timing of the stages took the product life cycle and availability of technology into consideration and attempted to find a balance between the expected environmental and consumer benefits and the possible negative impacts on affordability and functionality. In the case of the SSTBs there were limited options available and reinforced by the expectation that they would be made redundant through the growth of new TV sets capable of receiving digital signals. If the savings potential is to be captured, the Ecodesign requirements have to be implemented before the peak use of SSTBs.

Table 3.18 Simple set-top boxes: Implementing Measure requirements[53]

Date	Target
February 2010	The simple set top boxes on the market, excluding SSTB's with integrated hard disk and/or second tuner, should not exceed consumption limits of 1.00 W for standby mode and 5.00 W for active mode.
February 2012	Simple set top boxes on the market should not exceed 0.50 W for standby mode and 5.00 W for active mode.

The Regulation also stipulates that by February 2010 all the SSTBs must have a stand-by mode option and automatic power-down function set as default. According to the impact assessment report a total of 90 million set top boxes were estimated to be sold in 2010 using a combined 6 TWh of energy.

[49] http://www.iea.org/Textbase/npsum/Gigawatts2009SUM.pdf
[50] http://ec.europa.eu/energy/efficiency/ecodesign/doc/legislation/sec_2009_114_impact_assesment_en.pdf
[51] http://standby.iea-4e.org/files/otherfiles/0000/0021/Schlussbericht-Settop-Boxen-V14_EN2-total.pdf
[52] Out of 80 analysed products 68 % were already well below the defined maximum level.
[53] Simple set-top boxes implementing measure, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009R0107:EN:NOT

Table 3.19 – Simple set-top boxes - Baseline

Number of products (2010)	Energy consumption in EU27 (2010)	Electricity costs	Co2 emission
90 million	6 TWh	--	--

According to the impact assessment report, the number of SSTBs in EU households will rise from the 90 million in 2009 to 178 million in 2014. Savings in accumulated energy consumption are expected to peak in 2014 representing an expected reduction of 64% in terms of energy costs (€1.4 billion in today's electricity prices) and abatement of 4 Mt of CO_2. Approximately 6TWh out of a savings on 9TWh would come from reducing the power consumption in the standby mode.

From 2015 onwards, the electricity consumption is expected to decrease, as old TV sets will be replaced by new ones and SSTBs will be removed from the market. The total estimated savings in accumulated energy consumption would amount to approximately 47 TWh until 2020 compared to a no-action scenario. This amounts to a € 7.2 billion and a 17Mt CO2 reduction. Beyond 2020, the electricity consumption of SSTBs is expected to be negligible[54].

Table 3.20 – expected impact of Ecodesign requirements

	No Policy (in TWh)	Policy* (in TWh)	Improvement Potential (in TWh)
2010	6	5.5	0.5
2014	14	5	9

Table 3.21 – simple set top boxes – expected accumulated impact of Ecodesign requirements

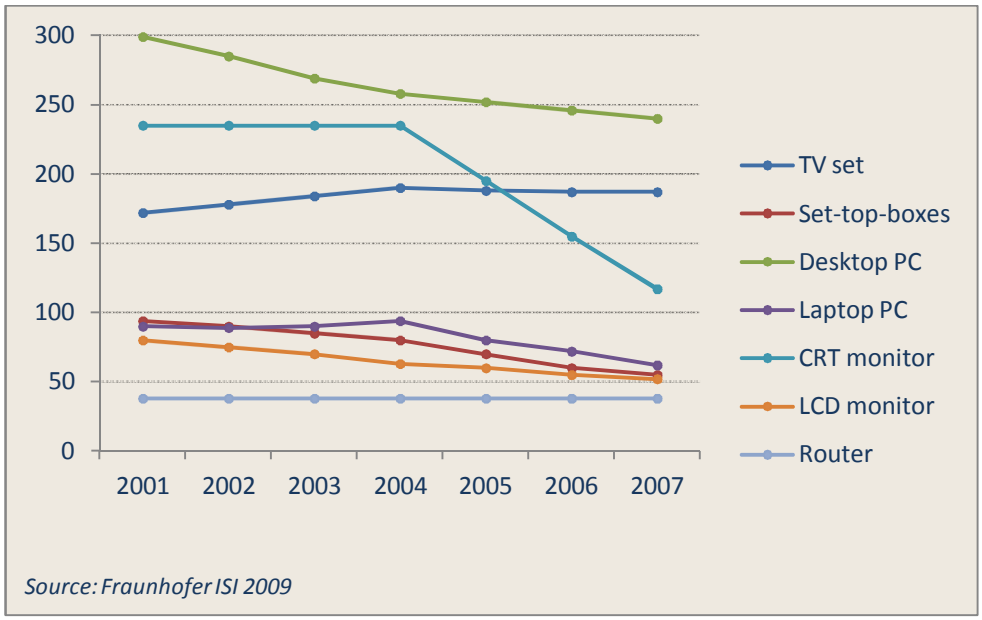
Accumulated electricity savings until 2020	Accumulated electricity cost savings until 2020	Accumulated CO_2 emission savings until 2020
47 TWh	€ 7.2 bln.	17 Mt

Effects of the Directive

Unfortunately, no data could be found to provide a direct assessment of the effects of the Implementing Measure in the case of SSTBs. Only some indirect indications could be found. Fraunhofer ISI has collected information on the development of total electricity consumption in EU 27, Norway and Croatia, in different operation modes (active, standby, off-mode). The study shows that total consumption for set-top-boxes has decreased steadily since 2001. However, the data series does not extend beyond 2007 and it is not possible to evaluate energy efficiency or identify any impact of the Ecodesign requirements.

[54] Simple set-top boxes impact assessment.
http://ec.europa.eu/energy/efficiency/Ecodesign/doc/legislation/sec_2009_114_impact_assesment_en.pdf

Chart 3.20 Total electricity consumption by appliance (all operation modes) 2001-2007



Source: Fraunhofer ISI 2009

The Joint Research Centre (JRC) report on Electricity Consumption and Efficiency Trends in the European Union contains data for the 2008 power consumption of the new Set-Top Boxes sold in 2008 within the EU. However, it is based only on data from companies that have signed the Voluntary Code of Conduct. It contains data for the power consumption for set-top boxes from 2001 to 2008, showing a decrease in consumption for set-top boxes for on-mode and a 2008 stand-by consumption level at almost the same level as in 2001. Such data can provide some indications on the developments in the market even though they are not representative of the whole market.

The impact assessment report for the SSTBs Regulation highlighted the positive effects of the required "automatic power down" function. As most consumers do not switch off the SSTBs, the mandatory power down function is a key element for reducing the power consumption of SSTBs. In 2007, a study made by NRDC in the US highlights the importance of an automatic power down function. The study showed that even though many SSTBs had a power button it often had minimal impact on the power consumption and may just amount to the difference of the display light. The introduction of an automatic power down function was expected to cut down the electricity consumption by 50 % or more when the box is not used by the costumer.[55] However, according to the campaign "Coolproducts" the automatic power down function is not sufficiently ambitious, since the Regulation only requires the SSTBs to shut down after 3 hours of no user interaction, and due to the fact that the user can disable the function.[56]

It should be noted that the standard set by European legislation will act as the de facto standard for the Australian and New Zealand voluntary code of conduct for the performance of set top box providers; specifically, the major carriers of pay television services have made explicit reference to the European standards, which are estimated to deliver energy savings of 1,124 GWh, avoid the emission of 948 Kt of CO2 emissions, and save households AUSD 168 million in lower energy bills.[57]

[55] http://www.efficientproducts.org/reports/stbs/NRDC_SetTopBoxes_Brochure_FINAL.pdf
[56] http://www.coolproducts.eu/product_settop_boxes_(tv_decoders)_4391.aspx
[57] http://www.energyrating.gov.au/library/pubs/201103-achievements.pdf

Summary

The Ecodesign requirements for SSTBs entered into force in February 2010 and are to be fully implemented in February 2013. The Ecodesign options available for policy makers were very limited due to the specificity of the market for SSTBs which is expected to peak between 2012 and 2016. A very important task for the Directive Regulation was a quick implementation. It had been signalled that in the absence of Community EU action, some Member States would want to take individual, non-harmonized action. For that reason the Directive Regulation had to ensure the free movement of affected products within the Internal Market.

There are no direct data available to assess the effectiveness of the Implementing Measures in relation to SSTBs. However, according to the information relating to a period prior to entry of the Implementing Measures into force, the impact assessment report indicates that significant relative environmental improvement can be expected to take place. This appears to be supported by some partial data that are available. It should also be noted that the standard set by European legislation will act as the de facto standard for the Australian and New Zealand voluntary code of conduct for the performance of set top box providers

Questions to stakeholders

- Do stakeholders have data that could be used for assessing the effectiveness of the Implementing Measure for simple set-top boxes (shift in market to more energy efficient SSTBs or similar)?

6. Domestic lighting (general lighting equipment)

Introduction

The EU residential energy consumption is estimated to account for emissions equivalent of 1 ton of CO_2 per person per year[58]. Lighting represents 10.5 % of residential electricity consumption in EU-27. It is the 3rd main electricity consumer after heating and cold appliances.[59] Residential lighting was expected to account for around 84 TWh/yr in 2007[60].

Besides consuming energy and thereby emitting CO_2, mercury emissions are likewise a consequence of using lamps. Mercury poses a risk to the consumer and the environment if not handled properly. However, it is estimated that a reduction of nearly 75% of the mercury currently emitted from the installed base of lamps is possible by 2020 when compared to a business-as-usual scenario.

Domestic lighting includes mainly traditional incandescent lamps (GLS), halogen lamps, self-ballasted compact fluorescent lamps (CFLs) but also double capped fluorescent lamps without integrated ballast, light emitting diodes (LEDs) and high intensity discharge lamps.

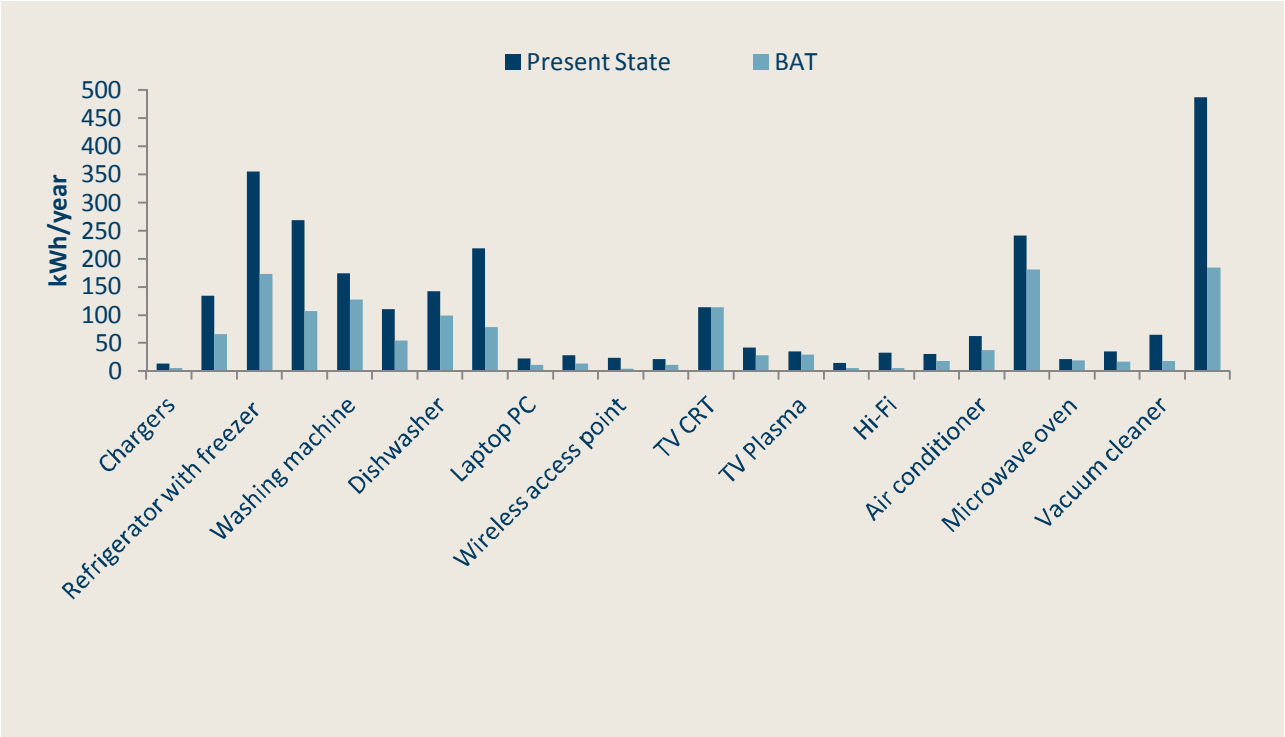
Incandescent lamps currently represent around 50% of residential lighting consumption[61].Compact Fluorescent Lamps (CFLs) represent one of the most efficient solutions available today for improving energy efficiency in residential lighting. The CFLs stock in residential sector has been growing and there has been a 340% increase in the apparent consumption of CFL in 2007 as compared to 2003.

The energy consumption in non-directional lamps can be reduced while providing the same functionality and reducing the life-cycle costs for the end-user[62]. As is shown in the following chart, the electricity savings potential for lighting in a typical European household are significant. Taking the Best Available Technology

[58] http://www.coolproducts.eu/resources/documents/EnergySaving-in-Practice.pdf
[59] Hirl, JRC, presentation at EEDAL conference.
[60] Hirl, JRC, presentation at EEDAL conference.
[61] Hirl, JRC, presentation at EEDAL conference.
[62] Impact assessment

and Best Practices into account it is shown how the energy savings potential is significant in both absolute and relative terms.

Chart 3.21 - Comparison of current regulations versus best available technology



Source: ECEEE 2009 Summer Study

Methodological limitations specific for to domestic lighting

There are a number of methodological factors in assessing the effectiveness of the Ecodesign Directive in relation to domestic lighting.

Lack of appropriate data: There is a very limited amount of updated data available on domestic lighting. Most available data refers to the period before the entry of the Regulation into force and much of the data is collected from a number of sources, so that and significant aggregations and assumptions have been made. Related conclusions should be treated with caution. The available data usually presents the average efficiencies for various lamps, neglecting the substantially different efficacies of individual lamps. Not only do the different lamp types have differing efficacies but also substantially different lifetimes. For this reason data on the sales and average efficacies of new lamps sold cannot be interpreted as an absolute measure and only provide an indication or illustration of the market direction in a period when the market is in transition[63].[64].

Implementing schedule: The implementation schedule is designed to give the industry time to adjust to the changes. The time for entry into force of the full Regulation is 7 years. With this phased-in approach, the changes are not immediately visible in the market.

[63] The market transition is caused by new regulation schemes but likewise due to the market entrance of new lamp types.
[64] For further explanation see http://mappingandbenchmarking.iea-4e.org/matrix

Baseline

In the impact assessment it is estimated that the total energy consumption from 4.3 billion lighting points equipped with incandescent lamps, halogens or CFLs account for 112 TWh in the EU at an annual cost of €15.3 billion. In December 2008, the Ecodesign Regulatory Committee and EU Member States experts endorsed the European Commission's draft regulation progressively phasing out incandescent bulbs by 2012, while also setting requirements for other types of lamp.[65]

The requirements set out in the Implementing Measure for domestic lighting (non-directional household lamps) sets a number of standards requirements for maximum energy use. As a result of these requirements inefficient lamps (incandescent bulbs and conventional halogen bulbs) will be phased out gradually starting in September 2009. The requirements are introduced in six stages that last one coming in 2016.

Table 3.22 Scheduled phase out of incandescent lamps

Step	Date
Stage 1	1 September 2009
Stage 2	1 September 2010
Stage 3	1 September 2011
Stage 4	1 September 2012
Stage 5	1 September 2013
Stage 6	1 September 2016

The requirements for the six phases are summarized in the table below which illustrates how the less efficient lamps are gradually phased out. Grey cells indicate that the technology in question is still available at the given time, white cells mean that the technology is phased out according to the provisions given in the "requirement" column.

[65] Hirl, JRC, presentation at EEDAL conference

Table 3.23 Detailed plan for phasing out less efficient lamps as a consequence of Ecodesign requirements

Date	Non-clear lamps				Clear lamps							
	Requirement	Incan-descent	All Hallogen	CFL / LED	Requirement	Incandescent/conventional halogen				Halogen C	Halogen B	LED [1]
						≥ 100 W	≥ 75 W	≥ 60 W	60 W >			
Today	None				None							
September 2009 [1]	A [2]				C for ≥ 100 W [3]		≥ E [3]	≥ E [3]	≥ E [3]			
September 2010	A [2]				C for ≥ 75 W [3]			≥ E [3]	≥ E [3]			
September 2011	A [2]				C for ≥ 60 W [3]				≥ E [3]			
September 2012	A [2]				C for all							
September 2013	Second level of functionality requirements [1]											
Review 2014	Review											
September 2016	A [2]				B / C [4]					[4]		

Source: http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/09/113 ; Note: 1 - First level of functionality requirements introduced in first stage. LEDs are exempted from all functionality requirements. 2 - Refers to lamp energy label class. Correction factors apply to certain lamps, allowing them to be B-class. 3 - Minimum requirement for all lamps: E class. F and G lamps phased out. 4 - Only special cap halogen lamps are allowed to be class C.

The table below sets out the baseline for the study as measured in 2007 as part of the impact assessment.

Table 3.22 – Domestic lighting 2007 baseline

Number of products	Energy consumption in EU27	Electricity costs	CO2 emission
Several hundred million (2007)	112 TWh (2007)	15.3 billion Euro (2007)[66]	45 mt (2007)

The requirements set out in the Implementing Measure for domestic lighting (non-directional household lamps) sets a number of standards for the maximum energy use of lamps. Inefficient lamps (incandescent bulbs and conventional halogen bulbs) started being phased out from September 2009. The requirements are introduced through six stages (Stage 1: 1 September 2009, Stage 2: 1 September 2010, Stage 3: 1 September 2011, Stage 4: 1 September 2012, Stage 5: 1 September 2013, Stage 6: 1 September 2016).

The impact assessment reviewed assessed the potential impact of the Regulation in 2020. Following a business-as-usual scenario where no specific measures are taken the energy consumption from domestic lighting was expected to increase to 135 TWh by 2020. This estimated increase is based on the assumption that the number of lamps in the domestic sector is expected to increase by 20% due as a result of economic growth.

By phasing out current high energy consuming lamp types and increasing the use of more effective alternatives, the preparatory study and impact assessment suggests that the energy consumption could be

[66] Based on average electricity price in the EU 2005 of 0.136 €/kWh

reduced from 135 TWh in 2007 to 48 TWh in 2020 and lead to accumulated electricity savings of 399 TWh until 2020. As an indirect consequence of this effect mercury emissions will also be reduced by 2.3 tons.

Table 3.24 – Expected impact of Ecodesign requirements

	No Policy (in TWh)	**Policy*** (in TWh)	**Improvement Potential** (in TWh)
2007	112	112	0
2020	135	48	87

Table 3.25 - Televisions – expected accumulated impact of Ecodesign requirements

Accumulated electricity savings until 2020	**Accumulated electricity cost savings until 2020**	**Accumulated CO_2 emission savings until 2020**
399 TWh	€ 54 bln.	160Mt

Considering the economic impacts in the preparatory study, it has been found that one main and positive effect of the requirements put forward in the Directive Regulation is the reduction in life cycle costs (10-30% with halogen technologies and 70% with compact fluorescent lamps) for consumers. With the requirements for lamps fulfilled the purchasing costs of the equipment will rise. This rise in costs will not have serious implications on households' consumption patterns as the prices will still be relatively low and are expected to decrease even more over time[67]. More importantly, the costs are expected to be more than offset by the savings in operating costs[6869]. However, a study by REMODECE in 2008[70] suggested that 40% of consumers never or rarely replace non-functional lamps with CLFs mainly due to the high purchasing price of these products. It should be noted that other life-cycle phases, such as production, distribution or raw material extraction are not included in the estimates as since these effects are too difficult to predict given the fact that they generally occur outside of the EU.

Effects of the Directive

The global lighting market is going through a period of transition as a result of a combination of regulations designed to phase-out inefficient lighting and to encourage the entrance of new products. The Joint Research Centre (JRC) Report on Electricity Consumption and Efficiency Trends in European Union provides some data on the composition of the market for lamps. In 2007, the incandescent lamps (GLS) in the EU-27 held the dominant position with 767 million units sold and 54% (2.6 billion units) of the existing stock. Halogen low-voltage lamps accounted for 18% of the existing stock and the halogen-mains voltage lamps around 5%.

According to an analysis carried out by "4E Mapping and Benchmarking" there is evidence that suggests that regulatory frameworks intended to remove less efficient lamps from the market have proved successful. They find that the average efficiency of lamps put on the market rose by up to 50 % in the period from 2008 to 2010. The percentage of all UK lamp sales that are incandescent has fallen from 65 % in 2008 to only 20 % in 2010. At the European level, 66 % of total lamp sales were incandescent in 2008 and 52 % in 2010. This 14 % reduction over 2 years is much larger than the 4 % reduction over the preceding 2

[67] Impact Assessment, Incandescent bulbs cost 60 cent whereas the price for new alternatives will be in the areas between € 2-10, and expected to lower over time
[68] Impact assessment pg. 39
[69] Due to the ineffectiveness of incandescent lamps they generate a certain amount of heating that will help keep buildings warm. Changing to more efficient alternatives this heat will be reduced and extra heating will have to be generated from other sources. This additional energy consumption should be considered when calculating exact costs and CO_2 emissions.
[70] http://www.isr.uc.pt/~remodece/downloads/REMODECE_PublishableReport_Nov2008_FINAL.pdf

years. The incandescent sales have gradually been replaced by CFL and halogen sales. The analysis concludes that there are indications of a positive market effect from the Directive in relation to the withdrawal of incandescent lamps leading to an improved average efficacy of sales from 17.4 lm/W in 2009 to 18.5 lm/W in 2010.

However, the report finds no substantive evidence that the regulatory policies are affecting the total market. This cannot be interpreted as a policy failures in many of the policies have yet to be fully implemented but it should be noted that in some countries (e.g. Austria) a consumer backlash has resulted in a doubling of incandescent lamp sales in the year prior to regulations taking effect.[71] We do not have similar evidence from other countries but such market reactions should be expected to postpone but not reduce the ultimate impact of the Directive since replacement lamps will enter the installed stock at a later date. [72]

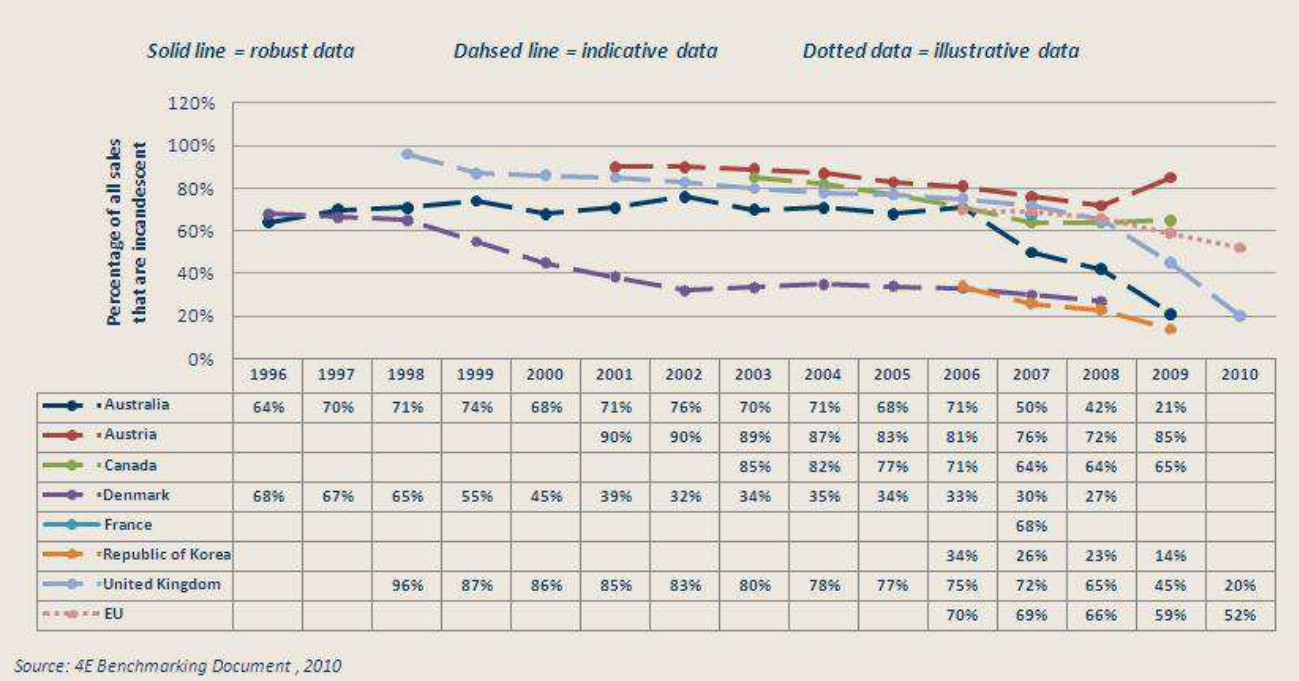
From a different perspective the Coolproducts study commissioned by the environmental NGOs SNM[73] concludes that the Ecodesign measures on for clear lamp domestic lighting for clear lamps for 2012 are not set at the most cost effective level. According to the study, a typical household[74] equipped mostly with products that conform to the 2012 standards – which will still include halogen lamps - will consume as much as 285 kWh/year. While this is better than the standard case by 25% it is still far from the most cost-effective option which would be 185kWh/year[75]. Thus, it is suggested, that the energy savings expected to be achieved are less than the potential ones under the scenario of the most cost-effective solution. However, the cost-effective scenario used as a benchmark in the study does not take into consideration other criteria used in the development of the Implementing Measures such as the costs for industry or specific consumer interests.

The comparison with policies in other countries[76] suggests that the use of regulatory frameworks to remove less efficient lamps from the market are in general successful. In Australia and Korea, the average efficiency of new lamps rose by up to 50% in 3 years. The indicative data from the UK and France suggest positive outcomes although, as suggested the picture is different in Austria.

On the other hand, the comparison suggests that a significant delay in the date that regulations come into force after the initial announcement can result in a market effect at odds with the intention of the policy action where the cost of the product is very low (it is difficult to imagine consumers stockpiling higher value larger goods such as washing machines or TVs in the same way). Another conclusion is that due with the longer lifecycles of more efficient lighting the total number of lighting products sold will fall dramatically upon implementation of new measures. The evidence from the UK leads to an estimated 75 percent reduction in the sales of lamps.

[71] 4E Mapping and Benchmarking: http://mappingandbenchmarking.iea-4e.org/matrix
[72] http://mappingandbenchmarking.iea-4e.org/matrix
[73] http://www.coolproducts.eu/resources/documents/EnergySaving-in-Practice.pdf
[74] In the case of domestic lighting the typical household was assumed to have 21 lighting points.
[75] The most cost-effective case is, according to the study, a house with 21 top efficient compact fluorescent lamps of various types.
[76] http://mappingandbenchmarking.iea-4e.org/shared_files/190/download

Chart 3.22 - Market share of domestic lamp sales that are incandescent in different countries



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Australia	64%	70%	71%	74%	68%	71%	76%	70%	71%	68%	71%	50%	42%	21%	
Austria						90%	90%	89%	87%	83%	81%	76%	72%	85%	
Canada								85%	82%	77%	71%	64%	64%	65%	
Denmark	68%	67%	65%	55%	45%	39%	32%	34%	35%	34%	33%	30%	27%		
France												68%			
Republic of Korea											34%	26%	23%	14%	
United Kingdom			96%	87%	86%	85%	83%	80%	78%	77%	75%	72%	65%	45%	20%
EU											70%	69%	66%	59%	52%

Source: 4E Benchmarking Document , 2010

Summary

The requirements for domestic lighting are taking effect in six stages running from 2009 to 2016. At the time of writing only the second phase has been completed. As most of the data assessed is from before 2009, prior to the requirements taking effect, it is difficult to conclude on the actual effects on energy consumption of the Ecodesign Directive so far.

The technology needed for achieving the desired impacts that the Directive aims for seems to be presently embodied in the more efficient CFL and halogen lamps and LEDs. The critical aspect is the extent that the less efficient incandescent lamps will be phased out. The data from a few Member States do indicate a positive result in that respect. Also, data for and stories about stockpiling of light bulbs which are about to be phased out shows that the Directive is pushing consumers towards more energy efficient light bulbs they would otherwise not have bought – if not immediately then at least once they run out of their stock of old light bulbs. Information on the penetration of more efficient lamps is however is not available.

Questions to stakeholders

- Do stakeholders have data on market share of different types of light bulbs at National or European level (or alternatively data from the large producers of light bulbs) which can document the shift in market toward more energy efficient light bulbs?
- In Austria significant stockpiling of light bulbs which were about to be phased out seemed to take place. Do stakeholders have similar experiences from other countries?

7. Battery chargers and external power supplies

Introduction

External power supply (EPS) and battery chargers (BC) are a cross-cutting issue, covering many product groups characterised by rapid market evolution. EPS and BC are often complementary to electronic devices that are introduced to the market e.g. mobile phones, MP3-players, notebooks, cordless phones, etc. EPS and BC have gained significance as they are necessary parts of portable appliances and according to the International Energy Agency the number of EPS on the global market now exceeds 5.5 billion[77]. The dramatic increase in the number of portable appliances in households and office environments means that the associated electricity consumption of portable appliances consumes an important portion of daily electricity consumption.

The main difference between BC and EPS is that the output of the BC connects physically directly to a removable battery which is not the case for EPS. The preparatory study under lot 7 found that the potential for improving the environmental impact of BC is minor and as a result BCs were left out of the Implementing Measure. It was concluded that, in particular, the potential for improving the use phase energy consumption of BC is not cost-effective, and the contribution to reductions of the life cycle energy consumption of the products analysed in the preparatory study is less than 5%. The focus is therefore on EPS.

There are several operating modes of an electric device that impact the power supply mode. These are:

- Active mode: Full operational state (usually not 100% of rated load, though).
- Sleep mode: A lower power state than active mode during which a product can respond to input or "wake up."
- Standby mode: The user thinks that the product is "off," but it may still be drawing some electrical power.
- Hard "off" mode: A switch allows power to be interrupted in front of power supply, causing zero power consumption.

There are two key environmental concerns connected to EPS. The first is the active average efficiency of EPS in the in- use-phase. The second is the electricity consumption due to conversion losses and no-load power consumption. The impact assessment report showed significant cost effective improvement potential of in the electricity consumption of EPS related both to the no-load electricity consumption and the in- use electricity consumption. The preparatory study concluded that the improvement potential was possible on the basis of existing technical solutions that could reduce the overall electricity consumption of EPS, while providing the same functionality and reducing the life cycle cost. However, cost effective improvement potentials of EPS are often not realized due because of market barriers. The market barriers are primary related to the fact that EPS are an accessory usually sold together with the primary load product. The impact assessment report identified three primary factors that lead to market barriers: Cost increments, lack of awareness, and un-harmonised EPS connectors.

The electronic market is very sensitive and even small additional costs can affect the competitive positions of the market actors. Moreover, consumers are often not aware of the electricity consumption of EPS and usually focus on the primary load product and not the EPS. This results in a lack of incentives for the manufacturers of the primary load products to demand for their products. Furthermore, the non-harmonised EPS connectors lead to a very short lifetime of EPS.

[77] http://www.greenbang.com/iea-gadgets-becoming-global-energy-hog_9408.html

Voluntary agreements

The European market for electrical devices seems to be governed by a paradox. On the one hand, the market is driven towards homogeneity where a few large manufacturers are present in all countries and are able to supply all countries. On the other hand, there are barriers (-e.g. important national differences in terms of market share and supply strategies and non-harmonized initiatives on at a Member State level) that prevent the creation of a harmonised European market of efficient electronic devices and together with the associated EPS. An example is the lack of standardization of EPS connectors, which in particular is in particular relevant to mobile phones, due because of the large sales volume. There are no technical barriers to such an interface and a voluntary initiative has been launched by the mobile operators. However, a large scale harmonization has not happened.

Several voluntary initiatives address the no-load and active average efficiency issues: these include the Commission's Code of Conduct for EPS[78], the Energy Star programme[79] for office equipment and the Ecolabel. However, according to the Impact Assessment, these programmes address only a limited subset of primary load products operated by EPS, and/or only a limited amount number of manufacturers takes part in them[80]. A status report from the European Commission found that the European Code of Conduct would increase the electricity efficiency of EPS in the standby mode, if it were widely adopted. Starting from 2010 the Code of Conduct could reduce the standby consumption by 5 TWH/year[81].

Several Member States have raised awareness of the standby and off mode electricity consumption of primary load products operated by EPS. However, it is questionable that awareness-raising can solve the problems leading to the market failure. As described, there are market barriers to a more widespread use of advanced EPS, such as low cost increments[82], lack of awareness and, non-harmonised EPS connectors. Further, legislative initiatives on at a Member State level will not ensure a fully harmonised European market. The Ecodesign Directive aims to at harmonise the legislative framework in the Community and set uniform and stringent standards.

Baseline

The Implementing Measure aims to improve the environmental impact of EPS by setting maximum levels for their no-load power consumption and average efficiency in the use-phase. The no-load power consumption of EPS accounts for a significant electricity waste since the EPS often remains connected to the main power source after the mobile primary load product is disconnected. The Ecodesign requirements are expected to come into force in two stages, one year (10/2009) and two years (10/2010) after entry into the adoption of the Regulation. The schedule is shown in Table 3.26 below.

[78] Code of Conduct: http://www.phihong.com/assets/pdf/Code_of_Conduct__EPS_Ver4__March_09.pdf
[79] EnergyStar Requirements: http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/eps_spec_v2.pdf
[80] Battery chargers and external power supplies Impact Assessment: http://ec.europa.eu/energy/efficiency/Ecodesign/doc/legislation/2009_fia.pdf
[81] Bertoldi, Paolo & Atanasiu, Bogdan 2009: *Electricity Consumption and Efficiency Trends in European Union,* Joint Research Centre Institute, European Commission, EUR 24005
[82] This cost increment is small in absolute terms (from EUR 3-20), but it can be a fairly high percentage premium, and even small cost factors can have a substantial impact on the net profit, in particular in the highly competitive markets for electronics products. The costs are distributed across many products and users, with the aggregate usage being significant.

Table 3.26: Battery chargers and external power supplies specific requirements

Date	Target
After one year (ca. 17 October 2009	The no-load condition power consumption shouldshall not exceed 0.50 W. The average active efficiency shouldshall be not less than: • 0,500 · PO, for PO < 1,0 W • 0,090 · ln (PO) + 0,500, for 1,0 W ≤ PO ≤ 51,0 W • 0,850, for PO > 51,0 W
After two years (ca. 17 October 2010)	The no-load condition power consumption shouldshall not exceed the following limits: • PO ≤ 51,0 W | 0,50 W | 0,30 W | 0,30 W • PO > 51,0 W | 0,50 W | 0,50 W | n/a The average active efficiency shouldshall be not less than the following limits: • PO ≤ 1,0 W | 0,480 · PO + 0,140 | 0,497 · PO + 0,067 • 1,0 W < PO ≤ 51,0 W | 0,063 · ln(PO) + 0,622 | 0,075 · ln(PO) + 0,561 • PO > 51,0 W | 0,870 | 0,860

The two stages are harmonised with the EU Code of Conduct for power supplies and the current US Energy Star requirements. The preparatory study showed that the Ecodesign requirements could be achieved with already available technology.

In 2005, the preparatory study estimated that the annual electricity consumption due resulting fromlosses for power conversion and 'no-load use amounted to 17 TWh, corresponding to 6.8 Mt of annual CO2 emissions. In the absence of measures this consumption is predicted to increase to 31 TWh in 2020, with a corresponding increase in CO_2 emissions.

Table 3.27 – Battery chargers and external power supplies 2005 baseline

Number of products	Energy consumption in EU27	Electricity costs	CO_2 emission
611 million units	17 TWh	--	6.8 Mt

In 2009, the a stock of 2 billion EPS units EPS implies a 17.3 TWh electricity consumption in the EU-27 in the use phase[83]. The DirectiveRegulation is expected to increase the market penetration of technologies that improve the lifecycle environmental impact of EPS, leading to estimated lifecycle energy savings of 118 PJ and electricity savings of 9 TWh/year by 2020, respectively, compared to the situation without taking any measures. The electricity savings correspond to 3.6 million tons of CO_2 emissions. The savings potential is estimated from taking into account the expected increase in annual sales. According the Impact Assessment, the annual sales and the EPS in use in the EU are expected to almost double. This implies use phase electricity consumption cost savings of € 1 billion by 2020.

[83] Bertoldi, Paolo & Atanasiu, Bogdan 2009: *Electricity Consumption and Efficiency Trends in European Union,* Joint Research Centre Institute, European Commission, EUR 24005

Table 3.28 – Expected impact of Ecodesign requirements

	No Policy (in TWh)	**Policy*** (in TWh)	**Improvement Potential** (in TWh)
2009	17		
2020	31	22	9

The primary environmental aspect is the electricity consumption of EPS in the use phase, i.e. the losses associated to with the conversion of mains power to power suitable for a particular primary load described by the "average active efficiency", and the no-load power consumption. Moreover, it is expected that the Regulation will have positive spill-over effects due to the in that technologies that reduce EPS electricity consumption of EPS in the use-phase also imply lead to also lower material content/weight. The expected additional impacts of the Ecodesign Directive thus include a reduction of waste by approximately 180 Ktonnes per year.

Effects of the Directive

Power supply and battery chargers are a cross-cutting issue, covering many product groups characterised by rapid market evolution. They are often complementary to other products that are introduced to the market. No updated data on the effect of the Directive are publicly available, mainly because of the recent application of the Directive. Indeed, the most ambitious aspects of the plan only came into effect less than a year ago. Some studies, however, estimate consumer demand for external power supply and chargers.

A report by Sullivan and Frost[84] analyses the worldwide markets for battery chargers with estimates and forecasts for the period from 2007 to 2015. A seven-year historic analysis is also provided for these markets. The report profiles 387 companies including many key and niche players. Unless more relevant data sources are identified in the subsequent stages of the evaluation, projections could be made on the basis of this study in combination with input from the stakeholders representing industries related to power supplies and battery chargers.

Summary

The Ecodesign requirements for battery chargers and external power supplies have already entered into force but the impact of the Directive is currently not clear. Not sufficient data have been identified to highlight changes in the energy efficiency of battery chargers and external power supplies before and after the Ecodesign requirements have entered into force.

Questions to stakeholders

- Unless more relevant data sources are identified in the subsequent stages, it will only be possible to draw very limited conclusions for battery charges and external power supplies. Do stakeholders have data on the market and energy efficiency of battery chargers and external power supplies?

[84] http://www.reportlinker.com/p092573/World-Battery-Chargers-Market.html#ixzz1Emb8C0hD. This report is available for a price of USD 4500.

8. Tertiary Lighting

'Tertiary sector lighting' is the common term used for the following product groups addressed by the requirements in the next Implementing Measure: fluorescent lighting products, high intensity discharge lighting products, public street lighting products and office lighting products. [85]

Two separate preparatory studies covering "public street lighting products" and "office lighting products" were carried out. After completion of the studies it was decided to integrate the work on public street lighting and high-intensity discharge lighting products and on fluorescent and office lighting products into a single piece of Regulation on "tertiary" sector lighting products.

The final electricity consumption in the tertiary sector of the EU-27 rose by 75.5 % over the period from 1990 to 2007. In 2007, office lightening was the largest electricity consumer in the tertiary sector with an estimated electricity end-use of 164 TWh. Although the electricity consumption of a single product is usually small, the large quantity of lighting products in the tertiary sector leads to significant overall electricity consumption. Office lighting accounted for more than 40 % of the total electricity used in non-residential buildings corresponding to 21.6 % of the overall tertiary sector electricity consumption. According to the preparatory study street lighting represents 4.7 %, representing 36 TWh/year. [86]

In 2009, The European GreenLight Programme stated that proven technology, products and services could reduce the lighting energy use by 30-50 %, earning internal rates of return above 20 %.[87] Correspondingly, the preparatory study concluded that existing technical solutions provided great improvement potential with regards to:

- Reducing the electricity consumption in tertiary sector lighting products, compared to the market average, while providing the same functionality;
- Reducing the lifecycle cost for the end users.

Several market barriers have hindered the achievement of the cost-effective potential of energy efficient lighting. Energy efficient lighting is usually higher in purchase price but lower in the overall lifecycle cost. Due As a result of budgeting concerns, consumers of tertiary lighting are often more concerned influenced by the purchase of tertiary lighting than the overall running cost over the product's lifecycle.[88]

Methodological limitations specific to tertiary lighting

The extent to which the effectiveness of the Ecodesign Directive can be measured within the tertiary lighting market is limited by several factors. The main one being is that there has been little focus on and interest in tertiary lighting. There is much less data available for individual electricity end-uses in the tertiary sector than for the residential sector, and only a few sources have attempted to divide distinguish between different end-uses in the data on total electricity consumption among different end-uses. The rapid changes in technology and prices enhance the challenge of to carrying out impact assessments for tertiary lighting.

Baseline

[85] http://ec.europa.eu/energy/efficiency/ecodesign/doc/legislation/sec_2009_324_impact_assesment_en.pdf. The exact definition is that tertiary lighting refers to fluorescent lamps without integrated ballast, high intensity discharge lamps, and ballasts and luminaires able to operate such lamps.

[86] Bertoldi, Paolo & Atanasiu, Bogdan 2009: *Electricity Consumption and Efficiency Trends in European Union,* Joint Research Centre Institute for Energy, European Commission, EUR 24005 EN

[87] The European GreenLight Programme Catalog 2005-2009.

[88] Industrial/commercial buildings are generally built by construction companies with the sole purpose to be lent or sold, i.e. the costs for operating the building, including the electricity costs for lighting, are not paid by the investor. Thus, there are classical principal-agents problems that hinder a energy-efficient market.

The European Commission adopted the Regulations EC No. 245/2009 for tertiary lighting products on 18 March 2009.This Ecodesign Regulation imposes minimum requirements on lamps, ballasts and luminaires, resulting in minimum efficiency and quality requirements on for the relevant lighting products.

The requirements for the energy efficiency of tertiary lightning which will be introduced in three stages - 1, 3 and 8 years after the Implementing Measure was adopted in March 2009. Among the requirements is one that T8 halo-phosphate lamps will be banned from 2010 and linear T12 and T10 halo-phosphate lamps will be banned from 2012. The exact requirements are multifaceted therefore and difficult to summarise, but t. The main requirements are listed below.

Table 3.29 - Tertiary lighting: Implementing Measure requirements

Date	Target
April 2010	Implementation of minimum requirements for performance for T8 and T5 linear lamps. The T8, U shaped and T9 circular halo-phosphate lamps as well as T4 linear lamps are no longer to be put on the EU 27 market anymore.
April 2012	New luminaires must be sold with electronic ballasts. Phase-out of the T12 and T10 type halophosphate lamps.
April 2017	Magnetic ballasts are banned. All fluorescent lamps must be designed to work with an electronic ballast

Source: European Commission and CELMA; Note: at the intermediate stage in 2015 High pressure mercury lamps and High Pressure Sodium-Plug-in/Retrofit lamps are not to be put on the EU 27 market anymore.

Establishment of the baseline

The annual electricity consumption relating to tertiary lighting in the EU has been estimated to have beenbe 200 TWh in 2005 amounting corresponding to emissions of 79,9 Mt of CO2[89] The baseline for the study as set out in the preparatory study is summarised below.

Table 3.30 – Tertiary lighting 2005 baseline

Number of products	Energy consumption in EU27	Electricity costs	Co2 emission
1.6 bln. (2005)	200 TWh (2005)	27,2 bln	79,9 Mt (2005)

Source: European Commission

Mercury content of lamps is another significant environmental aspect consideration identified. In 2005, the total mercury content of the lamps installed in the tertiary sector lighting amounted to approximately 12.6 tons. Without taking specific measures, the mercury content of the installed lamp base wasis predicted to increase to 18.6 tons in 2020. It has been demonstrated by the preparatory study and impact assessment that this can be “significantly reduced”.

On the As a resultbasis of the Ecodesign Directive it is estimated that about 1 billion lighting products will have been replaced by 2015, consisting of 100 million street lamps for street lightinglight and industry and 900 million neon lamps.[90]

According to the preparatory study, the quantity of lighting in the tertiary sector wasis expected to grow by 4.0 % per annum due to infrastructure developments and a greater demand for lighting in existing infrastructures. Based on these estimates the impact assessment estimated that the Ecodesign Directive

[89] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:076:0017:0044:EN:PDF
[90] http://www.ekobaseglobal.com/index.php?option=com_content&view=article&id=57

will lead to electricity savings of around 38 TWh/year. These savings correspond to savings ofcorrelates to € 5.2 billion[91] and 15.3 Mt CO_2 emissions and accumulated savings of 193 TWh until 2020.

Table 3.31 – Expected impact of Ecodesign requirements

	No Policy (in TWh/year)	**Policy*** (in TWh/year)	**Improvement Potential** (in TWh/year)
2020	260.3	217.9	38.1

Table 3.32 – tertiary lighting – expected accumulated impact of Ecodesign requirements

Accumulated electricity savings until 2020	**Accumulated electricity cost savings until 2020**	**Accumulated CO_2 emission savings until 2020**
193 TWh	€ 29 bln.	86 Mt

The expected accumulated reduction of electricity by 2020 is 193,2 TWh and 77.3 Mt of CO_2 by 2020. Moreover, the Ecodesign Directive is expected to have a positive spill-over effect related to the mercury content of lamps. It is estimated that the indirect effect of the Regulation Directive will reduce the mercury content of lamps by 14 tons resulting in a total mercury content of 4.6 tons compared to a business-as-usual scenario of 18.6 tons. In addition to the expected impact of the RegulationEcodesign Directive in Europe, it is worth noting that approximately 20 % of EU production is exported. Thus, the Ecodesign Directive is expected to have a positive environmental impact outside of Europe.

Effects of the Directive

The preparatory study has data for different types of lamps up to 2004.[92] In 2004, linear fluorescent lamps (LFLs) represented a market share of 16% of the total lamp sales and compact fluorescent lamps (CFLs) 6%. The annual increase anticipated in 2004 was 4.2% for LFLs and 8.3% for CFLs. However, there are no recent data to compare with the preparatory study and allow assessing the effect on the market composition to be assessedof the requirements set in the Implementing Measure.

A report prior to the Regulation Ecodesign Directive (2008) identified aidentifies huge savings potential by from utilisingutilizing available technology. The total energy consumption of street and road lighting wasis expected to be reduced by 60 % when applying available technology. By replacing the luminaires only, between 40-50% in energy reductions iswere expected.[93]

An indirect effect of the Regulation Directive is the fact that lamps that are more energy efficient lamps convert more energy to light, thus and releasereleasing less heat than the incandescent lamps. IThe incandescent lamps produce approximately 20 % lighting and up to 80 % heat with the energy they consume. This reduction in The energy-waste has a negative positive spill-over effect as in that the produced heating previously produced often interrupts requiredthe cooling systems, increasing the need involvingfor fans and or air conditioningconditions.[94]

Summary

The Ecodesign requirements within the tertiary lighting market only started coming into force in April 2010 and will not be fully implemented until 2017. Thus, the impact assessment of the Directive is currently not clear. Potentially large savings have been identified, but as yet it has not been possible to

[91] Average electricity price in 2005 in EU-25: 0,08 Cent/kWh for public street lighting, 13.6 Cent/kWh for other end uses. Because of this difference, the actual cost savings could be slightly lower in all suboptions.
[92] Tertiary lighting products preparatory study: http://www.eup4light.net/assets/pdffiles/Final/VITOEuPOfficeLightingFinal.pdf
[93] http://www.e-streetlight.com/Documents/Homepage/0_3%20Guide_For%20EE%20Street%20Lighting.pdf
[94] http://www.greenyour.com/office/office-space/office-lighting

identifyambiguous. Further, little relevant data have been identified to onhighlight changes in the energy efficiency of tertiary lighting before and after the Ecodesign requirements have entered into force.

Questions to stakeholders

- The preparatory study has data for different types of lamps up to 2004. However, so far no data have been found to compare to the preparatory study. Do stakeholders have data on the market size, market composition and/or energy efficiency of tertiary lighting?

9. Electric motors 1–150 kW

It has been estimated that electrical motors consume 30% of all electrical energy in the EU. Electrical motors are therefore the product group which has by far has the highest energy consumption of the product groups covered by the Ecodesign Directive.

An electric motor is defined as a product that converts electric energy into mechanic energy[95]. In this study, low voltage motors with a power range between 1-150 kW are considered[96]. Electric motors are the most important type of electric load in industries within the EU, where motors are used in production processes. The industrial instillations with motors account for about 70 % of the electricity consumed by the industry. There is a total potential for cost-effective improvement of in the energy efficiency of these motor systems by about 20% to 30%[97]. The impacts in efficiency and life-cycle costs are almost entirely captured in the use-phase[98] as most materials used in motors are recycled during the end-phase.

One important element of the Regulation is the focus on the Variable Speed Drive (VSD). Currently 90% of all motors are running at full speed no matter how much output is needed[99]. Mechanical brakes slow down the motor in where the fullcase output is not needed. This process is very inefficient as and much energy is wasted. By employing VSD technology, motors run with varying speedsvarious speed depending on the power needs and need for energy thereby using only as much electricity as is needed. It has been estimated that such a system could save 1,718 billion KWh globally[100] thereby presenting a significant improvement potential.

The motor market in Europe is relatively mature and the rising demand in Eastern Europe is responsible for the expected small increase in growth in the near future. The main electrical motor types are AC motors and DC motors. In the European market AC motors dominate the market with 96% of all motors sold. This amounts to around 9 million units. Sales of DC motors only account for 350,000 units. On top of that, the DC motor market is expected to decrease at a rate of 10-15% a year and some of the large manufacturersmanufactures have halted production. Most types of AC motors are expected to keep theirthe market share. However, a slight increase in the sales of three-phase induction motors is expected whilewhereas the sales of single-phase integral motors are expected to decline. The market for motors is largely a business-to-business market.

[95] Preparatory study
[96] However, to take into account standard power sizes a lower bound of 0.75 kW and an upper bound of 200 kW was considered
[97] Commission Regulation (EC) No 640/2009, implementing Directive 2005/32/EC with regard to eco-design requirements for electric motors Text with EEA relevance http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0026:01:EN:HTML
[98] Impact AssessmentIA
[99] http://cleantechnica.com/2011/06/16/electric-motors-consume-45-of-global-electricity-europe-responding-electric-motor-efficiency-infographic/
[100] http://cleantechnica.com/2011/06/16/electric-motors-consume-45-of-global-electricity-europe-responding-electric-motor-efficiency-infographic/

Based on technical specifications, in this study motors have been segmented into DC motors and AC motors, where. These two motor types differ in that the DC motors operate from a direct voltage source whereas and AC motors operate from an Alternating Current AC power source.

Prior to the initiation of the Ecodesign Regulation, various voluntary initiatives hadhave been introduced in order to set environmental requirements for motors. One of them is the CEMEP/EU agreement. This is a voluntary agreement developed in 1998 between the European Committee of Manufacturers of Electrical Machines and Power Electronics (CEMEP) and the European Commission. The agreement was signed by 36 motor manufactures representing 80% of the total production of standard motors within the EU. The agreement defined three categories of motors by reference referring to their energy efficiency. These categories are generally referred to in the studies as:

- EFF1 – High efficiency motors
- EFF2 – Medium efficiency motors
- EFF3 – Low efficiency motors

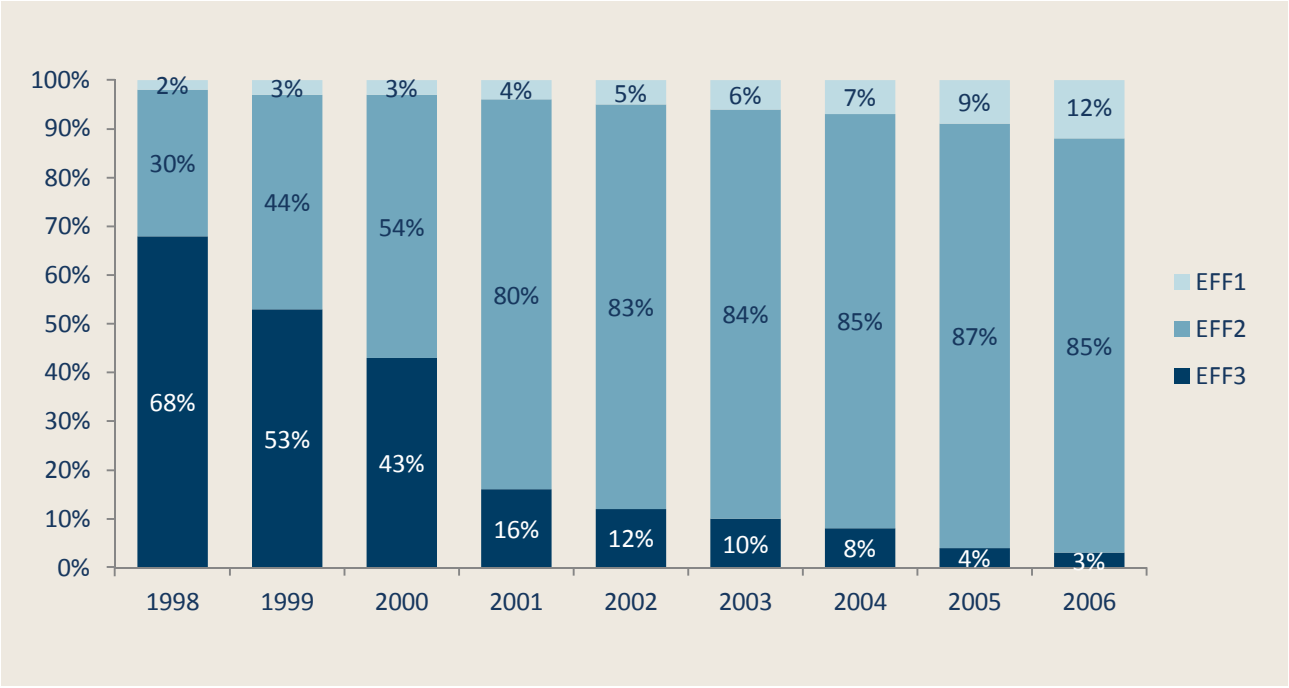
An aim of the agreement was to reduce the sales of EFF3 motors by 50%. This target was reached and surpassed since the sales of EFF3 motors declined from 68% to 45% in the period 1998-2005. However, the market penetration of the most efficient EFF1 motors has not increased significantly, largely due to its higher price. Whereas producers managed to produce EFF2 motors at comparable prices comparable to those ofto EFF3 motors, the price of EFF1 motors is currently 20-30% higher than the EFF2 segment.

The European Commission has also promoted the Motor Challenge Programme established in 2003. The aim of the programme is to encourage motor manufactures to improve the energy efficiency of their products. Participating companies will be aided in developing a plan to reduce the energy consumption while ensuring continuing highcontinued quality and reliability. In return they will receive public recognition for contributing towards reaching the objectives of EU's energy and environmental policies[101]. By 2009, 93 companies from 16 Member Statesmember states participated in the programme, accounting for an estimated savings of 185,000 MWh/year[102].

In the North American market, mandatory requirements for motors have been in place since 1997 and have led to an efficient market transformation from low efficiency to high efficiency motors. The challenge for EU legislation is to capture the benefits that can be reaped by replacing the inefficient motors with more efficient alternatives. Technical solutions already exist on the market but the penetration of the high efficiency EFF1EFF3 motors has remained relatively low.

[101] http://re.jrc.ec.europa.eu/energyefficiency/motorchallenge/index.htm
[102] http://re.jrc.ec.europa.eu/energyefficiency/motorchallenge/index.htm - REPORT

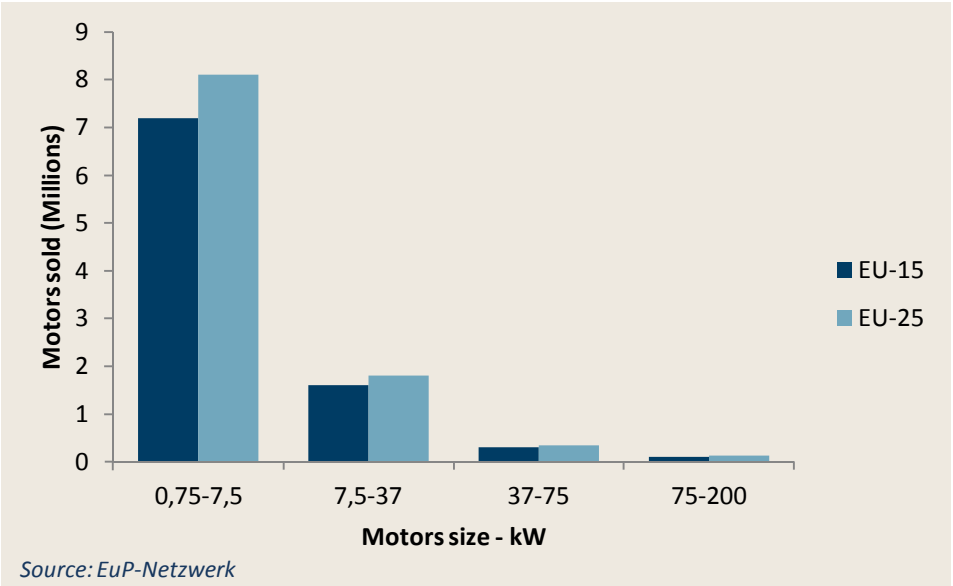
Chart 3.23 - European motor market — share of motors in different efficiency classesclass



Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for electric motors. FULL IMPACT ASSESSMENT

In terms of sales most of the motors sold are low power motors. As illustrated below, this motor type account for the vast majority of sales.

Chart 3.24 - Sales of different motors sizes for EU-15 and EU-25



Source: EuP-Netzwerk

Methodological limitations specific for to electric motors 1-150 kW

A motor is typically a component in a product and thereby part of a larger system. Since Ecodesign Implementing Measures on products (e.g. pumps, fans, compressors, air conditioning appliances) cannot address the improvement potential of all motors, specific requirements for motors have been set. Still, energy consumption should ideally be assessed in connection with the energy consumption of the entire system and should not be seen in isolation. However, this has not been possible since the data – to the extent they are available – address energy consumption by motors and not the motor and together with the wider systems.

Baseline

The requirements laid out in the Ecodesign Directive will be phased in over three stages. The first stage will take effect from June 2011. With no delay the second and third stagesstage will come into effect in the beginning of 2015 and 2017 respectively. This time frame will allow manufactures to adapt their production to the new requirements.

Table 3.33 – Implementing measure requirements for electric motors

Stage	Date	Target
Stage 1	June 2011	Motors shouldshall not be less efficient than the IE2 efficiency level
Stage 2	January 2015	Motors with a rated output of 7.5-375 kW shouldshall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level and be equipped with a variable speed drive.
Stage 3	January 2017	All motors with a rated output of 0.75-375 kW shouldshall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level, and be equipped with a variable speed drive.

Source: European Commission

Establishment of the baseline

The preparatory study shows that electric motors are placed on the EU market in large quantities, with the use-phase energy consumption being the most significant environmental aspect of all the life-cycle phases.

Analysis has shown that increased motor efficiency can only account for 10% of the improvement potential in the motor system. An additional 30% improvement can be obtained by an appropriate coupling between the motor and the drive[103].

The annual electricity consumption in 2010 from about 110 million motors amounted in 2010 to 1119 TWh corresponding to 523 Mt of CO_2 emissions at the cost of €97.2 billion.

Table 3.34 – Electric motors baseline

Number of products (2010)	Energy consumption in EU27 (2010)	Electricity costs (2010)	CO_2 emission (2010)
110 million	1119 TWh	97.2 bln Euro	513 Mt of CO_2

Source: Impact Assessment

Baseline studies have shown that motors should be a priority for energy-efficiency improvements due on account ofto the savings potential from implementing existing optimisationoptimization methods.[104] The

[103] http://ec.europa.eu/energy/efficiency/ecodesign/doc/legislation/sec_2009_1013.pdf

underlying problem can be summarisedsummarized in the following way: technical solutions leading to low energy consumption ofin motors do exist on the market. However, the market penetration of high efficiency motors is lower than expected. [105]

In 2010 approximately 110 million electrical motors existed in Europe and thatthe number is expected to reach 127 million by 2020.[106] These motors consumed 1119 TWh in 2010. Without the Implementing Measures the energy consumption is predicted to increase to 1252 TWh in 2020.[107]

Once fully implemented, the Regulation is expected to increase the market penetration of technologies that improve the environmental impact of electric motors, leading to estimated life-cycle energy savings of 5500 PJ and electricity savings of 135 TWh by 2020, compared to the situation if no measures are had been taken. This amounts to an annual reduction of 63 million tonnes of CO_2 emissions[108]. The electricity saving of 135 TWh is equivalent to the entire consumption of Germany[109] and accumulated electricity savings is expected to reach 657 TWh by 2020.

Table 3.35 – expected impact of Ecodesign requirements

	No Policy (in TWh)	**Policy*** (in TWh)	**Improvement Potential** (in TWh)
2010	1119	1119	0
2020	1252	1117	135

Source: European Commission

Table 3.36 – electric motors - expected accumulated impact of Ecodesign requirements

Accumulated electricity savings until 2020	**Accumulated electricity cost savings until 2020**	**Accumulated CO_2 emission savings until 2020**
657 TWh	€ 57 bln.	301 Mt

Effects of the Directive

Few data are available which can be used to assess the actual effect of the Implementing Measure for Electric motors. In assessing the effects of setting minimum requirements, various options have been developed regarding the final ultimate regulatoryregulation ofregime for motors. The preparatory study and stakeholder comments have formed the basis for these considerations. The options vary in terms of scope with option 1 being the least ambitious alternative and option 4 the most comprehensive alternative. Option four is similar to one that was eventually chosen.

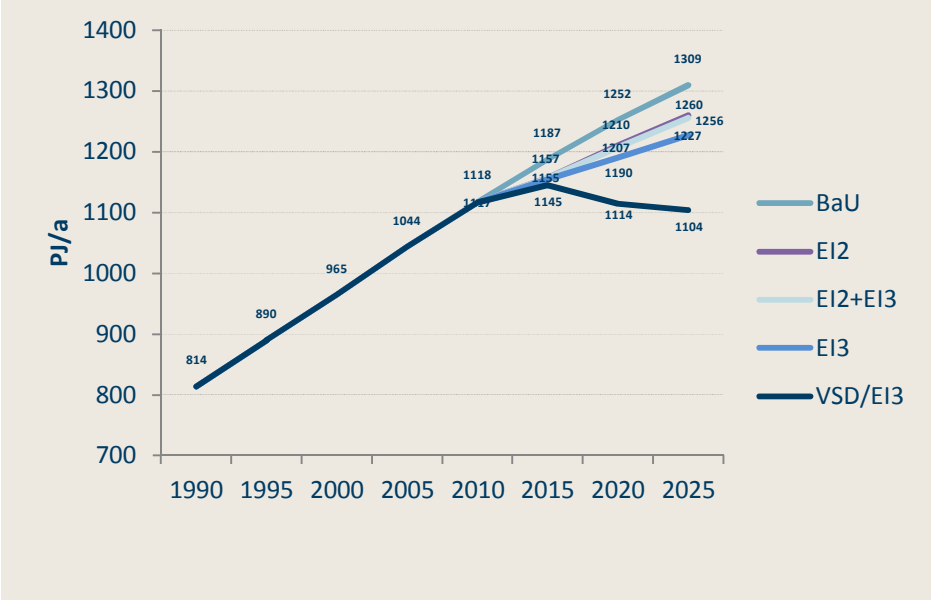
1. **IE2**: IE2 mandatory from 2011;
2. **IE2+IE3**: IE2 mandatory for all motors from 2011 and IE3 from 2015 for motors >7,5 kW;
3. **IE3**: IE2 mandatory for all motors from 2011 and IE3 from 2015 for all motors;

104 The European Copper Institute (ECI). 2004. "Energy Efficient Motor Driven Systems …can save Europe 200 billion kWh of electricity consumption and 100 million tonne of greenhouse gas emissions a year" http://www.eurocopper.org/doc/uploaded/File/Moteurs%20Press%20Kit%20April%2004%20EN%20finale1.pdf
105 Impact Assessment: http://ec.europa.eu/energy/efficiency/eco-design/doc/legislation/sec_2009_1013.pdf
106 Grundfos: http://www.resourceefficiency.aau.dk/UploadImages/Ecodesign_Nov-2010_2.pdf
107 Electric Motors Implementing Measure, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009R0640:EN:NOT
108 Grundfos. 2010. Workshop on Ecodesign and Resource Efficiency - A Case on Electrical Motors http://www.resourceefficiency.aau.dk/UploadImages/Ecodesign_Nov-2010_2.pdf
109 http://www.coolproducts.eu/product_electric_motors_3163.aspx

4. **VSD/IE3**: IE2 mandatory for all motors from 2011 and either IE2+VSD or IE3 for 0,75-7,5kW motors on 2015 and for all motors from 2017.

The chart below shows electricity consumption for the four options as compared to a business-as-usual scenario (BaU).

Chart 3.25 - Electricity consumption for the four options as compared to a Business-as-usual scenario (BaU) - EU27 Electricity Scenarios 1990-2025 in TWh/a (electric)



Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for electric motors FULL IMPACT ASSESSMENT

Table 3.37 (below) shows the accumulated impacts and savings for the period 2010-2020. When considering the accumulated savings of the requirements the timing of the stages is crucial. With no or little delay, savings will increase whereas a delay in implementing the Regulation will decrease the accumulated savings.

Table 3.37 Accumulative impacts and savings vs. Business as Usual for the period 2010-2020

Scenario	**Electricity**	**Savings**	**CO_2**	**Savings**	**Running costs**	**Savings**
	TWh	TWh	Mt	Mt	Bln. Euro	Bln. Euro
BaU	13088		5994		1141	
IE2	12827	261	5875	120	1118	23
IE2+IE3	12834	253	5878	116	1119	22
IE3	12743	345	5836	158	1111	30
VSD/IE3	12431	657	5693	301	1077	57

Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for electric motors. FULL IMPACT ASSESSMENT

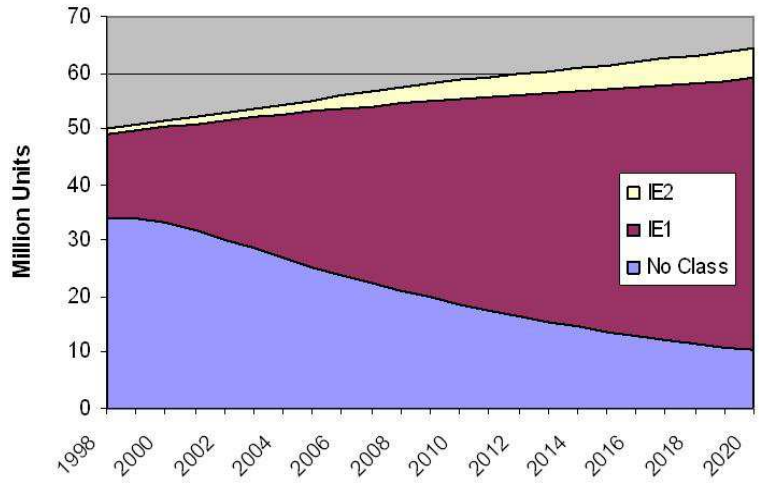
As the measure was only implemented in June 2011, it is not yet possible to identify any direct effect on the market. However, studies that measure market demand of for particular types of motor domotors exist and

may be able to provide some indications[110]. Furthermore, interviews with firms may be used to identify how the industry is reacting to the introduction of the measures (e.g. earlier introduction of more efficient products) or if there is any resistance to the uptake of efficient motors.

In the preparatory study a scenario analysis washas been conducted outlining the expected effects on the composition of the installed motor base. The various groups are defined by energy class and the scenarios are compared to a business-as-usual scenario.

The chart below shows the expected evolution of the composition of the installed motor base in the industry. In the BaU scenario a decreasing trend can be observed looking at the "no class" category which will is likely to have a positive effect on energy consumption. However, the IE1 category will increase significantly towards 2020 with only a small increase in the amount of IE2 products and no introduction of IE3 products in to the market.

Chart 3.26 - Expected evolution of the motor installed base by efficiency class



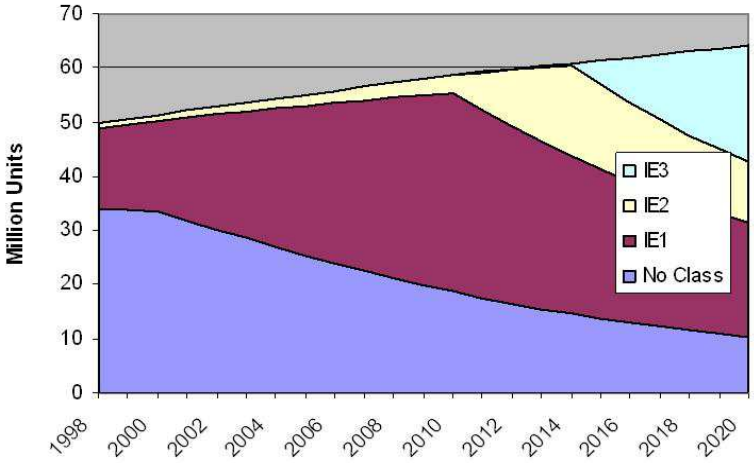
Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for electric motors. FULL IMPACT ASSESSMENT

Choosing the most ambitious scenario (scenario III) of the three developed scenarios in the preparatory study, the expected implications and effects of increasing regulation seems quite significant when compared to the BaU scenario. The share of IE1 class products will increase up until 2011. From 2011 the share of IE1 products will then decrease due to the introduction of products with higher efficiency classes. From 2015 products in energy class IE3 will be introduced.

[110] One econometric study based on latent demand provides a breakdown for more than 200 countries. For each year reported, estimates are given for the latent demand, or potential industry earnings (P.I.E.), for the country in question (in millions of U.S. dollars), the percent share the country is of each region and of the globe. But it is unclear if this study will be specific enough to account for changes in consumer preference and if it is aligned with European classification methods.

[110] Okopol. Wuppertal institute and RPA(2010), Outlook on the estimated GHG emissions reductions, Report for DG CLIMA, *ec.europa.eu/clima/studies/effort/docs/impact_ggas_en.pdf*

Chart 3.27 - Expected evolution of the motor stock, based on BaU scenario



Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for electric motors. FULL IMPACT ASSESSMENT

The table below summarises the expected savings comparing the use of best available technology against a base case scenario. It also shows the increased lossreduction in energy consumption and emissions when moving from IE2 to IE3 motors.

Table 3.38 Loss based environmental impact variation (BAT VS. base case)

Motor Rated Power						
	1.1 kW		**11 kW**		**110 kW**	
Main Indicators	**IE2**	**IE3**	**IE2**	**IE3**	**IE2**	**IE3**
Total Energy	-30.49%	-42.60%	-19.17%	-32.45%	-18.53	-31.88
Of which, electricity	-30.97%	-43.27%	-19.64%	-33.40%	-18.77%	-32.65%
Water (process)	-30.31%	-42.34%	-19.15%	-32.53%	-18.27%	31.65%
Waste, non-hazardous/landfill	-11.15%	-15.66%	2.06%	9.12%	-11.08%	-1.81%
Waste, hazardous/incinerated	-27.19%	-37.98%	-18.02%	-30.62%	-17.62%	-30.64%
Emissions to the air						
Greenhouse Gases in GWP 100	-30.19%	-42.18%	-18.92%	-31.95%	-18.34%	-31.39%
Acidification Agents, AP	-29.38%	-41.05%	-17.52%	-29.24%	-17.88%	-29.48%
Volatile Organic Compounds, VOC	-28.01%	-39.14%	-17.17%	-27.71%	-16.53%	-27.34%
Persistent Organic Pollutants	-12.42%	-17.41%%	-5.31%	-5.83%	-6.76%	-4.53%
Heavy Metals, HM	-21.40%	.29.93%	-10.58%	-15.87%	-13.03%	-16.87%
Polycyclic Aromatic Hydrocarbons, PAH	-21.85%	-30.55%	-12.63%	-17.25%	-27.89%	-34.60%
Particulate Matter, PM, dust	-17.98%	-25.14%	-12.87%	-10.34%	-10.89%	-13.31%

Motor Rated Power						
	1.1 kW		11 kW		110 kW	
Emissions to the water						
Heavy Metals, HM	-20.98%	-29.33%	-11.39%	-18.42%	-13.67%	-19.08%
Eutrophication, EP	-3.04%	-4.28%	0.09%	2.20%	-2.75%	2.91%

Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for electric motors. FULL IMPACT ASSESSMENT

Looking at the reductions over the entire life cycle (Best Available Technology vs. Base Case) it is worth noting that the largest reductions are achieved with the low power motors. Although most of the improvement occurs in the shift from IE1 to IE2, noticeable improvements can still be experienced in shifting from IE2 to IE3.

Table 3.39 – LCC reductions (BAT vs. Base case)

Table 7-12 LCC reductions (BAT vs. BaseCase						
	1,1 kW		11 kW		110 kW	
	IE2	IE3	IE2	IE3	IE2	IE3
LCC Reduction for 2000 hour/year	5,3 %	6,1 %	1,6 %	2,5 %	0,7 %	1,1 %
LCC Reduction for 4000 hour/year	6,5 %	8,3 %	2,0 %	3,3 %	1,0 %	1,7 %
LCC Reduction for 6000 hour/year	6,9 %	9,1 %	2,1 %	3,5 %	1,1 %	1,8 %
LCC Reduction for 8000 hour/year	7,1 %	9,5 %	2,2 %	3,7 %	1,1 %	1,9 %

Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for electric motors. FULL IMPACT ASSESSMENT

Motors as opposed to many other products have a long life-cycle of around 12-20 years. This means that the expected energy savings are likely to continue and even increase after 2020 since the more efficient products that will be sold after the requirements are introduced will be in use well beyond 2020.

Summary

Due to the extensive use of motors in industrial production and the large amount of energy they consume motors is an important product group to target in the Ecodesign Directive. The fact Sincethat available technology for improving the efficiency already exists, there seems to be huge possibilities for reducing energy consumption and benefitting the environment.

One of the obstacles to towards a shift totowards an installed base of products with a higher proportion of IE2 and IE1 products seems to be the higher purchasing price of the more efficient motors. Although much energy can be saved in the use phase of the products, thereby leading to a lower total life-cycle cost of the more efficient alternatives, the price issue still seems to complicate and stall the development.

Voluntary agreements between the industry and the EU have been implemented prior to the development of the Ecodesign Directive. These include the CEMEP/EU initiative and the Motor Challenges ProgrammeProgram. Both programmesprograms have pushed manufacturersmanufactures towards marketing more efficient motors. When trying to measure the effect of the Ecodesign Directive in relation to electrical motors it is therefore difficult to assess to what extent the effects have been due to already established voluntary agreements or whether the process of developing the mandatory Ecodesign

requirements, and the realization of future mandatory regulations, have pushed manufactures towards developing more efficient solutions. However, a change in the market towards more efficient alternatives is currently taking place.

Despite this change in the market structure within the EU, evidence from other non-EU markets showsshow that mandatory requirements and the introducing minimum efficiency levels, generally have had larger positive effects in moving the market towards higher efficiency motors than the voluntary initiatives within the EU[111].

Questions to stakeholders

- There seems to be huge possibilities for reducing energy consumption from electric motors. Do stakeholders have data which can illustrate whether a shift towards more energy efficient electric motors have taken place?
- The first set of requirements only took effect in June 2011. Do stakeholders have any evidence of an anticipatory effect for electric motors (quantitative or qualitative)?

10. Domestic washing machines

In the European Union, residential use of energy is responsible for the emissions of 1 ton of CO_2 equivalent per person and per year. Domestic appliances such as washing machines take up a large share of the residential energy consumption. In 2007, the EU-27 domestic washing machine stock was estimated to be around 172.85 million units - the sales for washing machines wereare at around 13.7 million units per year.

The electricity consumption of domestic washing machines was already in transition before the Ecodesign Implementing Measure was adopted, as a result of with a consumer move towards more efficient washing machines. The market of for domestic washing machines is characterised by a high level of substitution and the penetration of more efficient washing machines had already reduced the energy consumption by 24 % from over the period 1997 - 2005.

However, as approximately 90 % of washing machines at the time were in the highest energy class A (according the 97/17/EC labelling) consumers were left with uncertainty about the more efficient appliances in the energy group. Thus, the preparatory study found that the existing regulation and labelling scheme could not improve the industry any further. T as the regulation did not enhance technological development but rather clustered the products in the (currently) highest efficiency class.

This regulatoryThe regulation failure resulted in a strong market demand for a revision of the Labelling Directive and the adoption of Ecodesign requirements. The Ecodesign Regulation and labelling requirements entered into force in December 2010.

Methodological limitations specific forto washing machines

The extent to which the effectiveness of the Ecodesign Directive can be measured within the washing machine market is limited by several factors. The amount of energy used in real life washing machines depends on several individual factors in addition to the energy rating of the machine. These factors are related to how the machine is used and include:

- the wash temperature (typically 40, 60 or 90 degrees Celsius)
- whether a half-load programme is available and selected

[111] See preparatory study - http://ec.europa.eu/energy/efficiency/studies/doc/ecodesign/lot11_motors_1-8_final_28-04-08.zip

- whether it is used as hot-fill (and if so, whether the hot water is heated by gas or electricity) or cold-fill (when the machine will always use electricity to heat the water to the desired temperature).[112]

Further, the preparatory study illustrates that the household size and the corresponding number of washing cycles per week per person living in the households may be very different from country to country which to a high degree affects cross country analysis. The individual factors make aggregated analysis and cross country analysis dependent on strong assumptions. Thus, aggregated analysis of the energy consumption of domestic washing machines should only be used as an illustration or an indication of trends.

Baseline

As of December 2010, the Ecodesign requirements came into force. The specific objectives of the Ecodesign requirements are to:

- Remove least efficient products from the market
- Promote market take-up of more energy efficient washing machines
- Maintain and support the past market trend towards more energy efficient and environmentallyenvironmental friendly washing machinesmachine in addressing the regulatory failure (as described above).

The Implementing Measure contains both generic and specific eco-design requirements. The main elements are summarisedsummarized below.

Table 3.40 - Domestic washing machines: Implementing Measure requirements

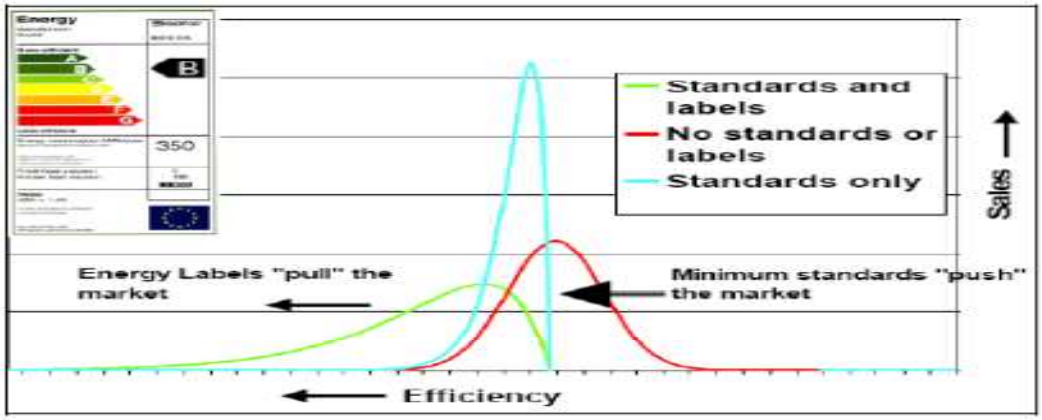
Date	Target
December 2011	• Limits for water consumption, standby and off modes. • Instruction manuals for energy use and water consumption. • Updated energy efficiency index to reflect the increasing use of 60° and 40° programmes and part load. • Prohibition of washing machines of current energy class A (the Energy Efficiency Index (EEI) shouldshall be less than 68). • A cold wash (20°) option
December 2013	• The Energy Efficiency Index (EEI) shouldshall be less than 59 (for washing machines with a rated capacity equal to or higher than 4 kg) • Further tightening of limits on water consumption

Source: European Commission

The Ecodesign requirements are harmonised with a labelling scheme. According to the impact assessment the harmonised approach is most effective, since the introduction of Ecodesign measures will remove the least effective models from the market and revised labelling will give producers and incentive to develop more energy efficient models.

[112] The preparatory study lot 14: http://www.landtechnik.uni-bonn.de/forschung/haushaltstechnik/publikationen/lot-14-domestic-washing-machines-dishwashers-ht-30

Chart 3.28 - Cumulative impact of Ecodesign and labelling.



Establishment of the baseline

Electrical energy is used mainly used for heating up the water in the washing machine to the desired temperature, for driving the drum motor and for the other electronic devices, including the user interface. But also in addition, after the end of the programme, electricity is used by many machines (to a very small extentextend) to keep some safety functions alive, like water protection sensor systems or remote control systems.

According to the preparatory study for wet appliances, the estimated energy consumption of the washing machine stock in 2005 was around 51 TWh/year, with 295 kWh average yearly energy consumption per appliance and a 90% penetration rate in the EU-27 households.

The total sale of domestic washing machines in the EU-27 is close to 14 million in 2005. The total trade represents a value of € 6.12 billion with water consumption of 2.2 billion m^3/year.[113]

Table 3.41 – Domestic washing machine - 2005 baseline

Number of products	Energy consumption in EU27	Electricity costs	Co2 emission
172,85 million	51 TWh/year	n.d.	18.2 mton/year

Source: European Commission

TakingTaken into consideration that the market has already reached a saturation level, as well as a growing penetration rate of by efficient washing machines due as a result of ato high substitution ratelevel, the energy consumption levels remained almost constant in 2007, at around 51 TWh.

According to the impact assessment the expected sales were assumed to be steady after 2005 in order to maintain a penetration rate of a maximum of 95% in by 2015. The installed base is some 167 million appliances and this is estimated to increase to 202 million by 2025 for the EU-27[114]. Even though the market of domestic washing machines has reached a high penetration rate indicating market saturation, the number of washes is expected to increase by 10%.[115]

[113] Impact assessment report:
http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2010/sec_2010_1354_en.pdf
[114] The impact assessment report:
http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2010/sec_2010_1354_en.pdf
115 http://www.smart-a.org/WP2_D_2_3_Synergy_Potential_of_Smart_Appliances.pdf

The preparatory study found a impact potential of 10 % energy savings to be cost effective in the short term, 14 % in medium term, and 20 % in long term when applying benchmark technology. The preparatory study concluded that this impact improvement could be realisedrealized without compromising overall product performance. The expected impact of the Ecodesign requirements is a reduction of CO_2 emissions by approximately 3 %, and a corresponding saving of around 0.6 Mt CO_2. In a business-as-usual scenario the electricity consumption will increases by 7 % from 2005 to 2020 resulting in increasing CO_2 emissions of around 37.7 mton/year. The slow increase is mainly due to growing stock.

Table 3.42 – Expected impact of Ecodesign requirements

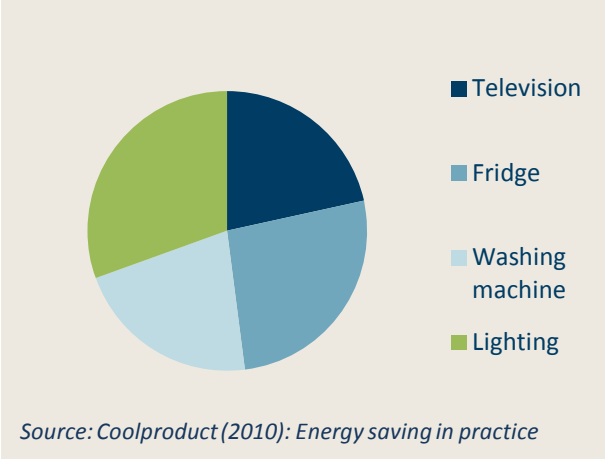
	No Policy (in TWh/year)	**Policy*** (in TWh/year)	**Improvement Potential** (in TWh/year)
2020	37.7	36.6	1.2

Source: European Commission

Effects of the Directive

Only limited data are available regarding the amounts of energy used for laundry washing in Europe. In 2010, a study from Coolproduct confirms the intuitive assumption that a European household can make substantial energy savings by choosing the most efficient products on the market. As shown in the following chart the total energy savings from more efficient electrical appliances is significant.

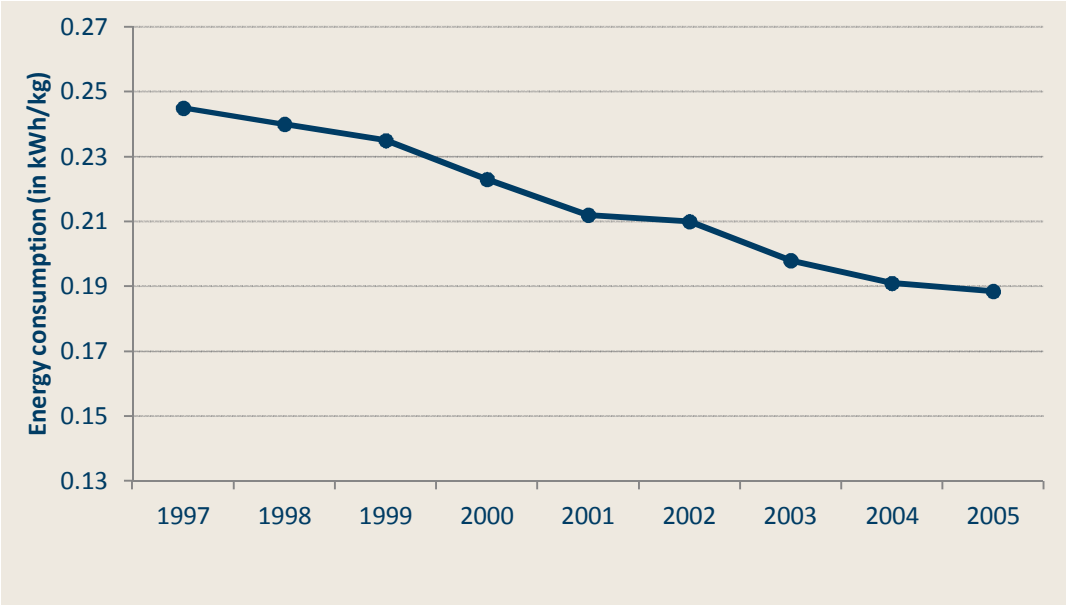
Chart 3.29 - Energy savings in the "most cost effective case"



Source: Coolproduct (2010): Energy saving in practice.

Data going back to 1997 shows that the average energy consumption per loading has decreased from approximately 0,24 KW/h/kg in 1997 to just under 0,19 KW/h/kg in 2005.

Chart 3.30 - Average energy consumption per loading

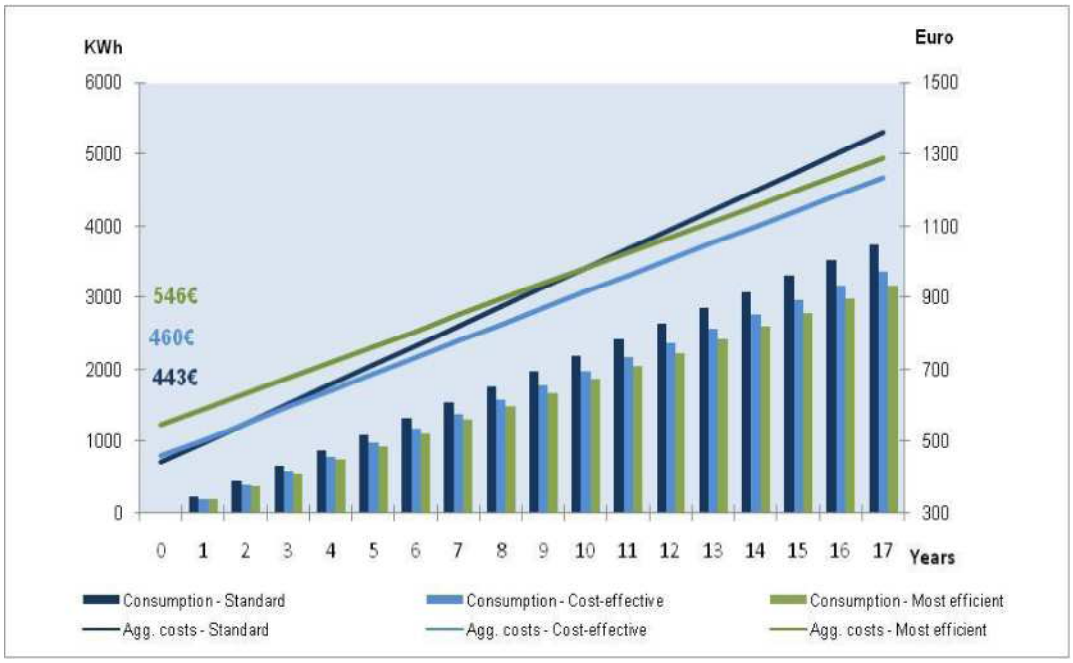


Source: Impact assessment report

As noted earlier, the market for domestic washing machines was already responsive to environmental concerns before the implementation of the Ecodesign Directive and was dominated by energy class A products. In 2007 With A and A+ classes together tooktaking in 2007 a share of 96,7 % and 95,3 % in EU-15 and NMS-12 respectively.

For washing machines, purchasing the most cost-efficient product generates net savings in only 2 to 3 years, while it takes around 10 years for the greenest option to become more profitable than the standard product.

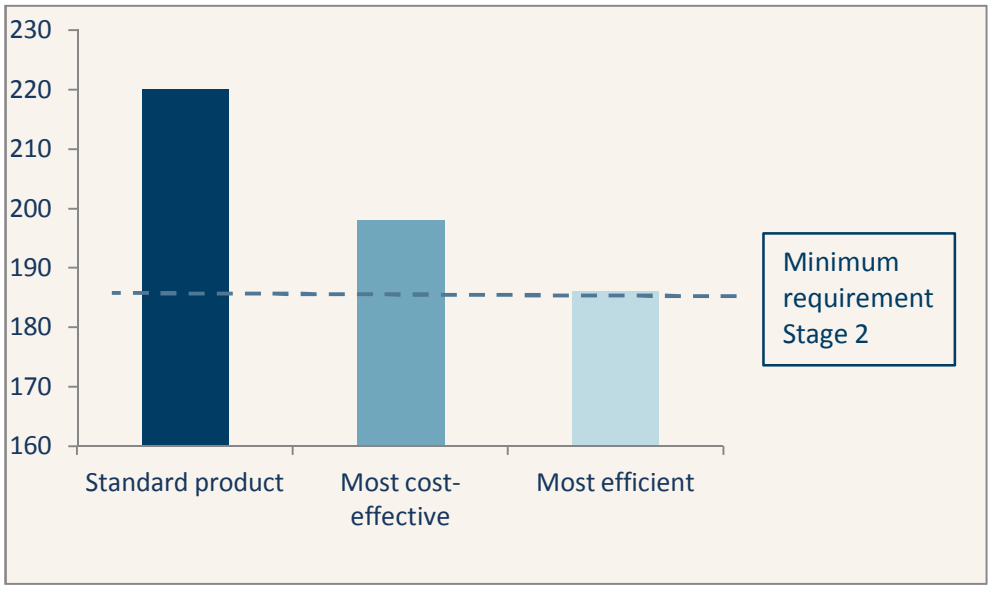
Chart 3.31 - Aggregate costs and energy consumption for the 3 different cases (washing machines)



Source: Coolproduct (2010): Energy saving in practice.

According to the study carried out by Coolproducts the first stage of minimum requirements for washing machines (to enter into force in December 2011) is estimated to correspond approximately to a yearly consumption of 210 kWh (for a 5.36 kg machine), close to the standard case and estimated to have limited market impact. The 2nd stage (in December 2013) is about 15% more ambitious, close to the most efficient product on the market in 2006. This can be considered an ambitious level, although it will be necessary first to assess the effect of the new way of measuring the energy consumption of washing machines introduced with this legislation.

Chart 3.32 - Indicative level of ambition of the 2nd stage of Ecodesign requirement



Source: Coolproducts (2010): Energy saving in practice.

The indicative level of ambition of the 2nd stage of the Ecodesign requirements is set at the currently most efficient products. Earlier studies found that the former labelling scheme had a huge impact on the sales of energy efficient washing machines, thus, it is reasonable to assert that the Ecodesign Directive has responded to the lack of incentives to further improvement. However, as with the earlier mentioned regulatory failure, the Ecodesign requirements may be in danger of locking in manufacturers rather than promoting further technological progress.

Summary

Domestic washing machines have improved the energy efficiency significantly during the last decade. Energy class A has become the dominant class and more and more products are moving up to even higher classes. As opposed to, for example, televisions, domestic washing machines seem to have reached market saturation (at 95 % penetration). Thus a growing market for this product group is not a significant cause of increasing, energy consumption by this product group does not increase significantly due to a growing market.

It is impossible to make draw final conclusions on the effects of the Ecodesign Directive as there are no available data on recent market trends. The recorded market changes cannot be attributed to the Ecodesign Directive, since as the development started long before the Directive was implemented and can be attributed to earlier minimum requirements.

Questions to stakeholders

- There was already a move towards more energy efficient washing machines before the Implementing Measure was adopted. Do stakeholders have data on recent market trends?

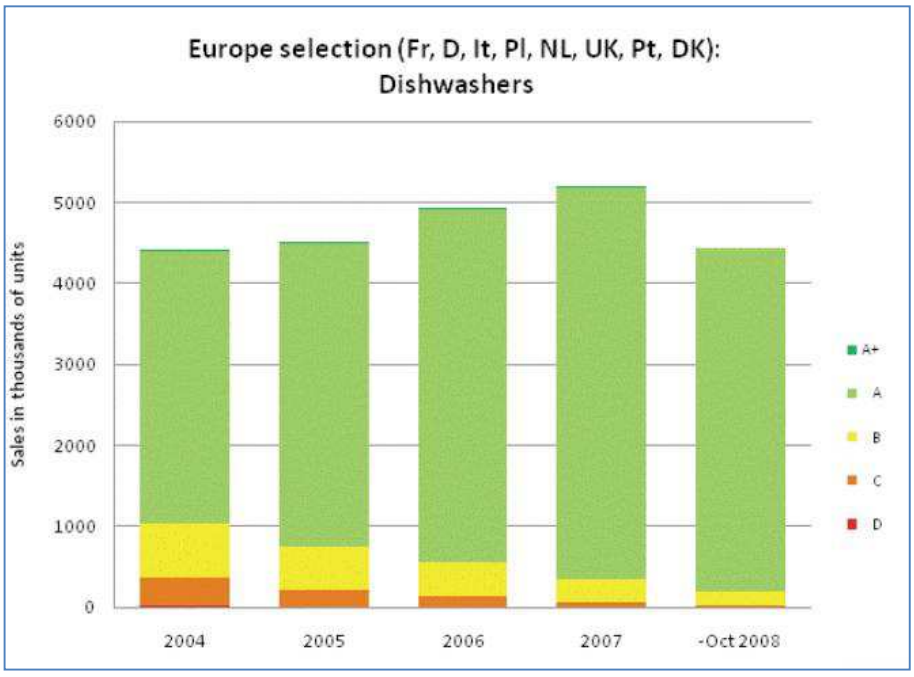
- Do stakeholders have data (quantitative or qualitative) which make it plausible that market changes can be linked to the Ecodesign Directive?

11. Domestic Dishwashers

The sales of dishwashers in recent years have been increasing with at a rate of around 10% in Western Europe and 50% in Eastern Europe over the last years. The Market saturation of dishwashers, however, is still lower than for other white appliances, such as refrigerators and washing machines, estimated at to be at around 50-60%. In the EU-27 around 69,000 units are installed yearly within the residential sector in EU-27.

Like other white appliances dishwashers are categorized into energy classes. This classification is based on the products' energy efficiency compared to other performance indicators. Energy class A by far dominates the total population of dishwashers with a still sharply declining amount number of products in energy class B. Despite, or perhaps because of, this there has been only a small little progress in terms of improvements in total energy efficiency between 2001 and-2005, while and even with current technology there is a limited potential for energy savings, which could can be further exploited with technical progress.

Chart 3.33 - Sales of dishwashers according to energy class in selected European countries



Source: GfK, Attali/Bush for Defra[116]

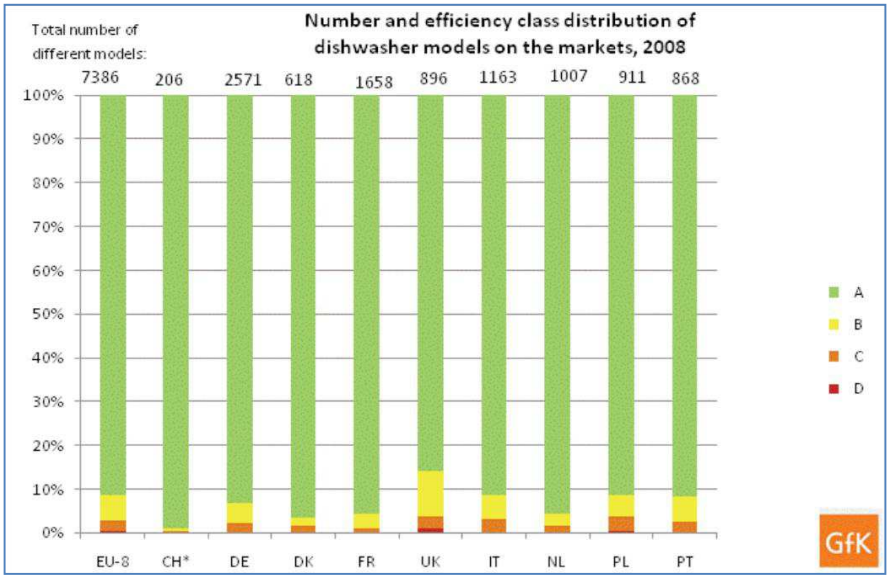
In 1999, the industry organisation for dishwasher manufacturers, the European Committee of Domestic Equipment Manufacturers, agreed on a Voluntary Commitment. The commitment, in which it was decided to remove all of the least efficient dishwashers from the market by 2004, appears to have been successful in enhancing the energy efficiency of dishwashers.

The Energy Label for automatic dishwashers, also introduced in 1999, focused on setting energy requirements, has prompted improvements in energy efficiency in the range of 37-44% depending on the type of machine[117]. These savings have been reinforced by other voluntary commitments by the industry. As a result of this development 90% of domestic dishwashers are now in the highest energy efficiency class.

[116] Attali, Bush & Michel (2009)
[117] Preparatory study – Task 2

As no further energy classes have been defined by the authorities, the industry has halted its voluntary processes leading towards increased energy efficiency[118].

Chart 3.34 - Distribution of dishwashers according to energy class divided by country



Source: GfK, Attali/Bush for Defra[119]

Looking at the life-cycle of dishwashers, the preparatory study shows that the environmental impact is clearly largest in the use-phase. Furthermore it has been shown in the preparatory that 38% of the total annual consumer expenditure comes from electricity consumption[120].

Baseline

In order to allow manufacturers a sufficient time frame for adaptation, the Implementing Measure suggests that the requirements for domestic dishwashers is introduced gradually. The aim is to avoid negative impacts on the functionalities and performance of the products should be avoided while simultaneously also considering the cost impact for consumers and in particular the cost implications for small and medium-sized manufacturers.

The measures consist of both generic and specific requirements and will apply from 1 December 2011. Step one will only cover specific requirements. In the second and third stages generic eco-design requirements will be introduced. In stages four and five, further specific eco-design requirements will be introduced.

[118] Impact assessment
[119] Attali, Bush & Michel (2009)
[120] These numbers are based on an average of the six base-case scenarios analyzed in the preparatory study

Table 3.43 – Implementing measure requirements

Step	Date	Target
Step 1	1 December 2011	(a) for all household dishwashers, except household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (*EEI*) shouldshall be less than 71; (b) for household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (*EEI*) shouldshall be less than 80; (c) for all household dishwashers, the Cleaning Efficiency Index (*I C*) shouldshall be greater than 1,12.
Step 2	1 December 2012	For the calculation of the energy consumption and other parameters for household dishwashers, the cycle which cleans normally soiled tableware (hereafter standard cleaning cycle) shouldshall be used. This cycle shouldshall be clearly identifiable on the programme selection device of the household dishwasher or the household dishwasher display, if any, or both, and named 'standard programme' and shouldshall be set as the default cycle for household dishwashers equipped with automatic programme selection or any function for automatically selecting a cleaning programme or maintaining the selection of a programme.
Step 3	1 June 2012	The booklet of instructions provided by the manufacturer shouldshall provide: (a) the standard cleaning cycle referred to as 'standard programme' and shouldand shall specify that it is suitable to clean normally soiled tableware and that it is the most efficient programme in terms of its combined energy and water consumption for that type of tableware; (b) the power consumption of the off-mode and of the left-on mode; (c) indicative information on the programme time, energy and water consumption for the main cleaning programmes.
Step 4	1 December 2013	(a) for all household dishwashers, except household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (EEI) shouldshall be less than 71; (b) for household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (EEI) shouldshall be less than 80; (c) for all household dishwashers, the Cleaning Efficiency Index (I C) shouldshall be greater than 1,12.
Step 5	1 December 2016	For household dishwashers with a rated capacity of 8 and 9 place settings and household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (EEI) shouldshall be less than 63.

Source: Implementing Measure

Establishment of the baseline

In 2005 the number of installed products in the residential sector within the EU 27 totalled 70 million. The total energy consumption for domestic dishwashers in the EU was estimated at 26 TWh which amounted to emissions corresponding to 13 Mt of CO_2.

Table 3.44 – Domestic dishwashers baseline

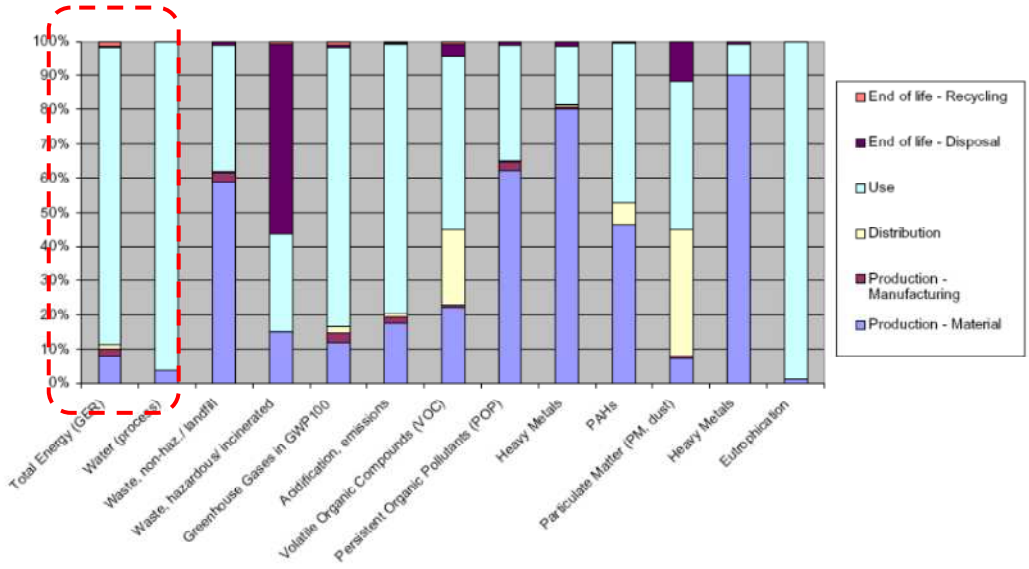
Number of products (2005)	Energy consumption in EU27 (2005)	Electricity costs (2009)	CO_2 emission (2005)
70 million	26 TWh	6.06 bln Euro	13 Mt of CO_2

Source: European Commission

The environmental impact of dishwashers is not only a result of electricity consumption but also of water consumption. According to the Impact Assessmentimpact assessment water consumption from dishwasher appliances amounted to 308 m3. In a BaU scenario the number is expected to increase to 389 m3 in 2020.

In terms of energy consumption, as well as water consumption the use phase is by far the most significant stage in the life cycle, as can be seen from the chart below. Furthermore, it should be noted that more than 95% of running costs are electricity costs.[121]

Chart 3.35 - Life cycle impacts of 12 place settings dishwasher



Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for Domestic Dishwashers Impact Assessment.

Although the more efficient alternatives are dominating the markets, the total energy consumption from dishwashers is still increasing. This is because the market is still unsaturated which and this leads to a continuing growth in sales, exceeding the savings by from greater energy efficiency[122]. It is estimated in the Impact Assessment that the installed base of dishwashers will increase to 115 million units in 2020.

Currently electricity consumption from domestic dishwashers amounts to 26 TWh. According to the Impact Assessment this number is expected to increase to 33.7 TWh by 2020 if no measures are taken. This will result in a CO_2 equivalent of 17.5 Mt. When the requirements have taken effect an annual saving in 2020 is expected to be around 1.7-2.0 depending on the selection of the sub-option. This number is expected to increase to 3.2-3.5 in 2025. Accumulated electricity savings until 2020 is expected to be 9 TWh.

[121] Impact assessment
[122] Impact assessment

Table 3.45 – expected impact of Ecodesign requirements

	No Policy (in TWh)	**Policy*** (in TWh)	**Improvement Potential** (in TWh)
2010	26	26	0
2020	33.7	32.0 - 31.7[123]	1.7 - 2.0

Source: European Commission

Table 3.46 – domestic dishwashers - expected accumulated impact of Ecodesign requirements

Accumulated electricity savings until 2020	**Accumulated electricity cost savings until 2020**	**Accumulated CO_2 emission savings until 2020**
9 TWh	€ 2 bln.	5 Mt

Besides the electricity savings, it is expected that somewhere between 56-64 m3 of water can be saved in the use phase by 2020[124].

Effects of the Directive

Some direct effects of the Directive will become apparent as the requirements come into effect. After December 2011 all dishwashers below energy class A will be prohibited. These requirements will be further strengthened for dishwashers above 10 place settings. Besides energy regulation the consumption of water will also be regulated and a 20 degree cold water option will be mandatory.

Manufactures will also have to comply with a range of requirements related to the actual features of the machines. According to the Implementing Measure a clearly identifiable "standard cleaning cycle" should be introduced on the selection device or display. This should be set as the default cycle on dishwashers with automatic programming selection. Furthermore a booklet should provide instructions that the "standard programme" is the most efficient in terms of combined energy and water consumption. Furthermore, the booklet should furthermore provide extended information on features such as programme time, energy consumption and water consumption of the main cleaning programmes. On top of these consumer-oriented requirements, the Implementing Measure sets more specific and technical requirements that follow the Energy Efficiency Index. These requirements are based on the size and performance of the machine. The various requirements will be phased in according to the timeline provided in the Implementing Measure.

In various consultations on the Ecodesign requirements for dishwashers an earlier implementation of the measures had been called for. An alternative option that pushed the second step from 2015 to 2013 was suggested in the Impact Assessment. The impact of the alternative option, however, does not differ much from the original option.

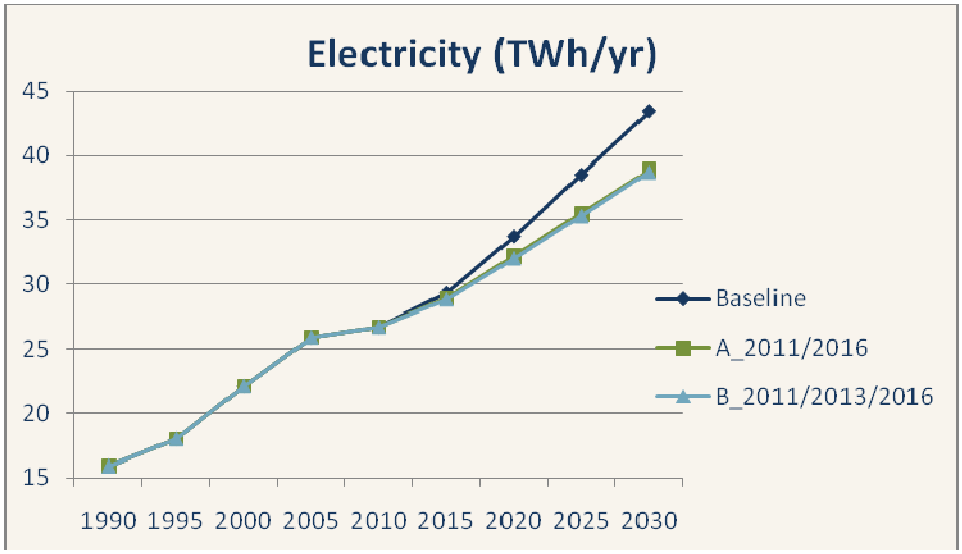
In the chart below the effects of the Ecodesign requirements are shown compared to a BaU scenario (baseline). The overall effect from 2005 to 2020 is rather small with only a 1.7 TWr/yr improvement compared to the baseline. This equals an improvement of around 5 %. Dishwashers generally have a life cycle of around 15 years and therefore it make sense also to consider the effects beyond 2020, given that as many products, especially due to the unsaturated market for dishwashers, many products will be sold in the period between 2005 and 2020. As shown below the effect of the measures is expected to increase at a constant pace and in 2030 savings (the difference between the Baseline and the introduced situation

[123] Depending on the sub-option
[124] Impact assesesmen

resulting from the Ecodesign requirements) is expected to reach 4.5 TWh/yr equal to a decrease in electricity consumption of a little more than 10%.

It is important to note that despite energy savings and the improvement of the products' energy efficiency, the total energy consumption from dishwashers is still expected to increase significantly due as a result of increased sales.

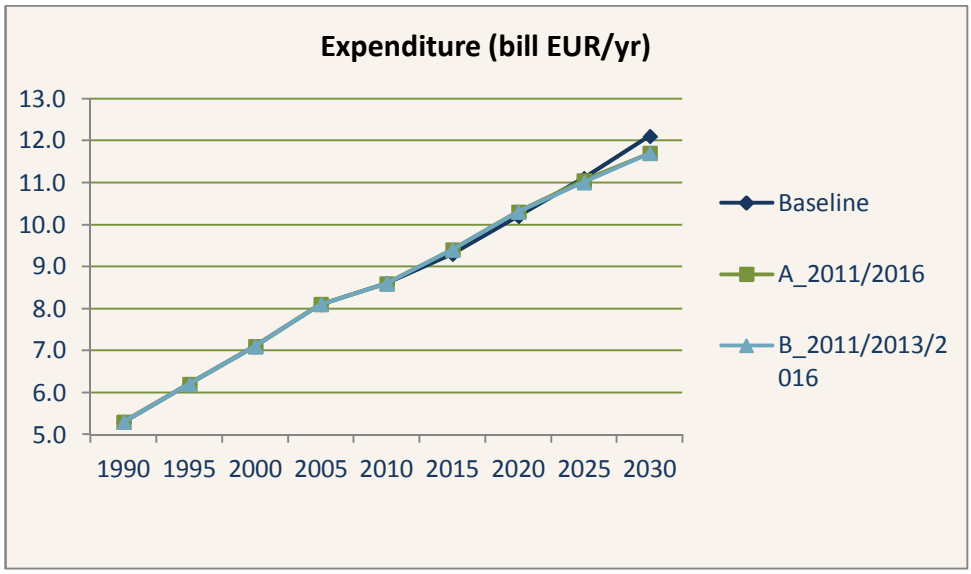
Chart 3.36 - Electricity consumption according to scenarios



Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for Domestic Dishwashers Impact Assessment.

When considering the costs for consumers, the relationship between the purchasing costs and running costs is important. With the Ecodesign Implementing Measures the purchase price will increase and the initial investment will be higher on the part of the consumer will be higher. However, considering the costs over the entire life-cycle of the products, the efficient solutions are more attractive. The chart below shows the total expenditure arising from dishwashers according to the three scenarios mentioned earlier. In the short run, expenditures will be higher due to the increased purchasing prices but in the longer run the analysis shows that the two alternative scenarios will prove to be less expensive than the baseline scenario.

Chart 3.37 – Expected total consumer expenditure for dishwashers according to the scenarios



Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for Domestic Dishwashers Impact Assessment.

When looking at the impact of the Directive on CO_2 emissions a similar pattern to that of electricity consumption can be seen. This is largely due to the fact becausethat electricity consumption is responsible for 98% of CO_2 emissions. If the most ambitious scenario is chosen an estimated 1 Mt of CO_2 equivalent can be saved in by 2025 compared to the baseline scenario.

Although regulatory requirements such as the Ecodesign Directive are sometimes accused of erecting unnecessary barriers to trade this seems not to be the case when considering dishwashers. Furthermore there are no signs that EU manufacturersmanufactures are placed at a comparative disadvantage vis-à-vis manufacturersmanufactures in third countries. Due time will be allowed for manufacturersmanufactures to effect a transition and adapt and. In fact it could be expected that EU manufacturersmanufactures will have an advantage due to their leadership in efficient solutions[125].

An analysis of the main annual impacts is provided in the Impact Assessmentimpact assessment. The baseline scenario is compared to the two sub-options. The table below summarises the savings between the baseline scenario and the A_2011/2016 scenario.

[125] Impact assessment

Table 3.47- Main annual impacts 2020

Environment		
	Electricity	2.0 TWh/a
	Energy	15 PJ/a
	GHG	0.4 Mt CO2 eq./a
	Water (use phase)	57 Million m3
Consumer		
EU totals	Expenditure	-0.1 € bln./a
	Purchase costs	-0.3 € bln./a
	Running costs	0.2 € bln./a
	Water costs (use phase)	0 € bln./a
Per Product	Product price	-31 €
	Install cost	0 €
	Energy costs	5 €/a
Business		
EU turnover	Manufacturing	1 € bln./a
	Whole-sale	0.1 € bln./a
	Install/retail/maintenance	0.1 € bln./a
Employment (jobs)		
	Industry EU (Incl. OEM)	800
	Industry Non-EU	300
	Whole-sale	100
	Installers	2100
	Total	3300
	Of which EU	3000
	Extra EU jobs	3010
	of which SME	2000

Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for Domestic Dishwashers Impact Assessment

The timing of the implementation of the requirements has been estimated ex ante as not having a large effect when looking at annual savings. However, when considering the accumulated savings, the difference becomes more significant. The table below shows the accumulated impacts (left) and savings (right) between 2005 and 2020.

Table 3.48 - Accumulative impacts 2010-2020

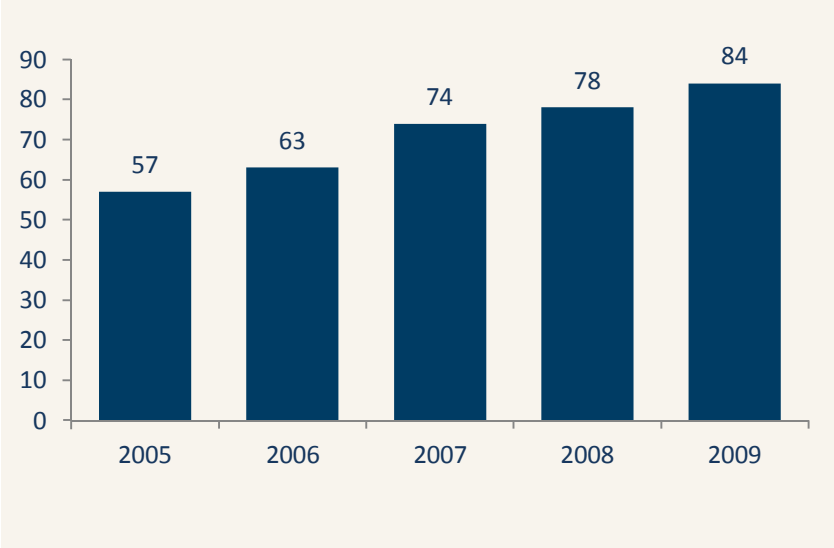
Totals			Scenario's 2020		
			1	2	3
IMPACTS (as Art. 15, sub. 4.e. of 2005/32/EC)			Baseline	A_2011/2016	B_2011/2013/2016
ENVIRONMENT					
	ELECTRICITY	TWh/a	326	319	317
	GHG	Mt CO2 eq./a	169	166	165
	WATER (use phase)	million m3	3786	3545	3492
CONSUMER					
EU totals	expenditure (excl.water)	€ bln./a***	102,5	103,5	103,5
	purchase costs	€ bln./a	41,1	43,1	43,5
	running costs (excl.water)	€ bln./a	61,3	60,4	60,0
	of which electricity	€ bln./a	55	54	54
	water costs (use phase)	€ mln./a	13	12	12
BUSINESS					
EU turnover	manuf	€ bln./a	13,8	14,5	14,6
	whole-sale	€ bln./a	3,6	3,8	3,8
	retail	€ bln./a	22,5	23,4	23,5

Savings vs. Baseline			Scenario's 2020		
			1	2	3
IMPACTS (as Art. 15, sub. 4.e. of 2005/32/EC)			Baseline	A_2011/2016	B_2011/2013/2016
ENVIRONMENT					
	ELECTRICITY	TWh/a	ref	7	9
	GHG	Mt CO2 eq./a	ref	4	5
	WATER (use phase)	million m3	ref	241	294
CONSUMER					
EU savings	expenditure	€ bln./a***	ref	-1	-1
	purchase costs	€ bln./a	ref	-2	-2
	running costs	€ bln./a	ref	1	1
	of which electricity	€ bln./a	ref	1	2
	water (use phase)	€ bln./a	ref	1	1
BUSINESS					
EU savings	manuf	€ bln./a	ref	-1	-1
	whole-sale	€ bln./a	ref	0	0
	retail	€ bln./a	ref	-1	-1
***=all money amounts in Euro 2005 (inflation corrected)					

Source: Source: Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to Ecodesign requirements for Domestic Dishwashers Impact Assessment.

Although the Ecodesign requirements for domestic dishwashers do not come into effect until late 2011 the trend towards more energy efficient machines has already started. Chart 3.38 shows the value share of triple A rated machines. The trend is evident with the share of triple A rated appliances moving from 57% in 2005 to 84% in 2009[126].

Chart 3.38 Value share of triple A rated appliances



Source: GfK Retail and technology, 2010

[126] http://www.gfkrt.com/uk/news_events/gfk_rt_uk_news/home_newsletter/single_sites/005163/index.en.html

Summary

The first measures regulating domestic dishwashers will not take effect until December 2011. After the requirements take effect dishwashers below energy class A will not be sold on the market. The process for implementing the requirements has been stalled several times and the agreed targets have been accused of not being ambitious enough[127]. The process however has been put back on track and although machines below energy class A are still allowed to be sold, manufactures and consumers already seem to be shifting away from the less energy efficient dishwashers. The fact that the market share of triple A-class products (an energy class well above the minimum requirement in the Ecodesign Directive) is increasing so significantly underpins the argument that the requirements have not been set at a sufficiently ambitious level. Also, since the industry seems to be moving already the transition phase for manufactures to adapt to the new requirements is not expected to cause major obstacles.

Besides energy requirements, water consumption, limits on standby and off mode losses and information requirements will also be introduced from December 2011. The reduced water consumption is also expected to reduce the running costs of the machines and contribute to decreased life-cycle costs for the consumer.

Comparing the domestic dishwasher product category to other product categories covered by the Ecodesign Directive, the saving potential is limited. The estimated annual savings by 2020 for dishwashers are around 2TWh which is well below the expected average of 34% for all the product categories[128]. Only domestic washing machines have a lower improvement potential. However, there is reason to believe that the improvement potential will rise in the future due to the continuous increase in the sales of dishwashers and also because these requirements could be a first step on the way to developing stricter requirements. Furthermore, although the overall effects are not as significant as for other product groups, the decrease in the life-cycle costs will have a positive impact for consumers.

Questions to stakeholders

- Do stakeholders have more recent data on the market composition of domestic dishwashers than the ones presented in this chapter?
- Do stakeholders have any data which underpins the argument that requirements have not been set at a sufficiently ambitious level?

12. Summing up for the 11 product groups

The table below sums up the main conclusions presented above for each of the 11 product groups. As highlighted thoughout the chapters a significant move towards more energy efficient products are occuring for most product groups but due to timing and lack of data it is difficult to refer the development back to the Ecodesign Directive.

[127] http://www.coolproducts.eu/cool_blog_archive_ecodesign_process_moves_forward_as_washing_machine_dishwasher_requirements_are_adopted_246.aspx

[128] http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/product-groups/index_en.htm

Table 3.44 - Summary table of evidence of the impact of Ecodesign Directive on individual products

Product group	Change in market	Change attributable to Ecodesign	Additional comments
Standby and off-mode losses of EuPs	Indications of improved energy efficiency	Indirect	Quantitative data indicate increased energy efficiency in standby and off mode but cannot document a direct link between the IM and energy efficiency improvements due to timing and availability of data. Interviewees have pointed out that the Ecodesign Directive has increased attention to energy loss from standby and off mode appliances which has accelerated efforts to increase energy efficiency.
Simple set-top boxes	Improved energy efficiency but no data after 2007	Uncertain due to limited data	Very limited data available.
Domestic lighting	Indications of improved energy efficiency	Direct effect	Indications of change which can be attributed to the IM. Inefficient incandescent lamps that until recently had a significant market share are being phased out. Not information on other groups
Tertiary Lighting	No data available to assess effectiveness	Uncertain due to limited data	-
Battery chargers and external power supplies	No data available to assess effectiveness	Uncertain due to limited data	-
Domestic refrigerators and freezers	Energy efficiency significantly improved	Indirect	Label A and A+ class products today dominate the market. Improvement of energy efficiency predates the Ecodesign and a direct effect is not clear. Move towards energy efficiency around the time of implementing the Ecodesign Directive cannot be observed. Requirements may help maintain trend towards higher levels of performance
Electric motors 1–150 kW	Energy efficiency improved but no data after 2006	Uncertain due to limited data	Very limited data available. Shift from fixed speed to variable speed motors will improve energy efficiency.
Televisions	Energy efficiency significantly improved	Indirect	Improvement of energy efficiency predates the Ecodesign Directive. Significant improvement in energy efficiency per TV set has been followed in 2010 by reduced total energy consumption. The Directive might have helped facilitate change but data do not provide evidence of a causal relation.
Circulators in buildings	Energy efficiency significantly improved	Strong indirect effect	Improvement of energy efficiency predates the IM. First requirement will not take effect until 2013. Stakeholders suggest that discussion of Ecodesign requirements led to a voluntary agreement that pushed energy efficiency. A strong shift from C and D labelled products to A and B labelled products has occurred. Planned shift from fixed speed to variable speed circulators will increase energy efficiency further.
Domestic washing machines	Energy efficiency significantly improved	Indirect	First requirement will not take effect until end of 2011. A shift from less energy efficient product groups to more efficient has occurred. Improvement of energy efficiency predates the IM. Move towards energy efficiency around the time of implementing the Directive cannot be detected but requirements may help maintain movement to higher levels of performance.
Domestic dishwashers	Energy efficiency significantly improved	Indirect	First requirement will not take effect until end of 2011. Improvement of energy efficiency predates the IM. Acceleration towards energy efficiency around the time of implementing the Ecodesign Directive cannot be detected but a shift from less energy efficient product groups to more efficient has occurred. Requirements may help maintain movement to higher levels of performance

3.3.3 Overall assessment of effectiveness of Directive

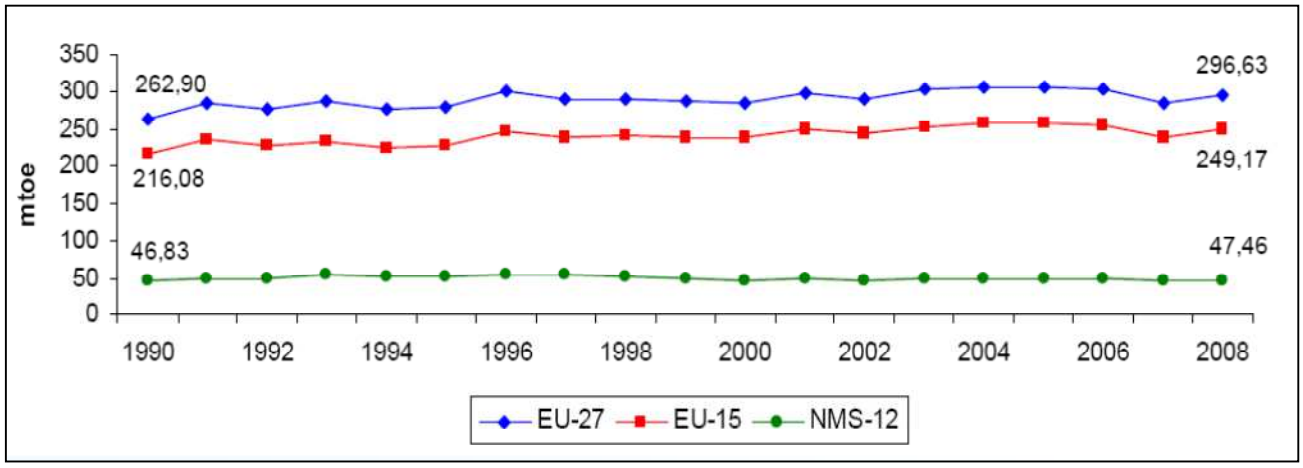
The lack of available data combined with the recent implementation of the Directive limits the strength of any conclusions and it is not possible to make general statements on the overall effectiveness of the Directive.

Progress towards 2020 targets

The report "Electricity Consumption and Efficiency Trends in European Union"[129] examined total energy consumption in the residential sector concluding that energy efficiency measures introduced across the European Union are contributing to stabilizing electricity consumption. A combination of labelling, minimum efficiency standards and voluntary agreements, together with national policies and incentives, have flattened the pattern of energy and electricity consumption in recent years. For the first time since 1990, final electricity consumption decreased in 2007 in EU households from 806.52 TWh in 2006 to 800.72 TWh.

In the last 4 years (2004-2008) final residential energy consumption has decreased by 2.88%. In the period between 1990 and 2008 final residential energy consumption grew by 12.83%.[130]

Chart 3.39 – Residential energy consumption in the EU (in mtoe)



Source: JRC

The JRC report concluded that "…the end-use electricity consumption in 2007 was below the 2006 level and close to the 2005 consumption. Even though it may be too early to have a clear conclusion due to a warmer climate in 2007, the drop in electricity consumption seems to indicate saturation and point at the effects of EU energy efficiency policies and measures".[131]

GFK also provides a positive outlook based on data from their retail panel.[132] The average energy consumption of new home appliances is decreasing (Washing Machines, Dishwashers, Cooling, Freezers – which account for more than half of the domestic energy consumption),) according to GFK data on new appliance's annual energy consumption in EU23. In a five-year comparison (2005-2010), the average consumption in Europe has fallen by 7%, despite the fact that there has been an increase in demand for even bigger appliances and advanced features, such as no-frost technology for fridges or larger television screens.

[129] http://ie.jrc.ec.europa.eu/publications/scientific_publications/2009/EnEff_Report_2009.pdf
[130] Bettina HIRL, JRC, presentation at the EEDAL Conference 2011 in Copenhagen.
[131] Bettina HIRL, JRC, presentation at the EEDAL Conference 2011 in Copenhagen.
[132] http://www.gfk.sk/imperia/md/content/gfkslovakia/pressrelease/2011/gfk_mda_energy_efficiency_en.pdf

Chart 3.40 - Shifts in consumption 2005 and 2010

	2005/kWh	2010/kWh	Growth_% 2005 → 2010
Average 23c EU	265	246	-7%
Germany	237	215	-9%
Great Britain	265	265	0%
France	261	255	-1%
Italy	282	256	-11%
Estonia	328	268	-18%
Poland	263	242	-8%
Netherlands	241	232	-4%
Belgium	243	236	-3%
Austria	252	225	-15%

Note: Some countries supported the market transformation with bonus systems: Estonia since 2006, Italy since 2007 and Austria since 2009/2010

* Washing machines, Dishwashers, Cooling, Freezers

** AT, BE, DE, DK, ES, FI, FR, GB, GR, IT, NL, PT, SE, BG, CZ, EE, HU, LT, LV, PL, RO, SI, SK

Source: GFK Retail and Technology and IFA 2011 Industry Power Briefing - Home Appliances, presentation by Anton Eckl

Furthermore, a forecast for Germany generated by GfK Retail and Technology predicts that the energy consumption of major domestic appliances will be considerably reduced further by 2020. On the assumption of a market growth of 0.5% annually and that appliances will be replaced when they are ten years old, energy savings of 10% in total are expected. This would mean that the electricity consumption of major domestic appliances in Germany will be reduced by a quarter between the year 2000 and 2020.

Other estimates provided suggest that while there will be energy savings in relation to the business as usual scenario of a total of 375 TWh, energy consumption is still expected to grow from 2151 TWh/ year to 2368 TWh/year. This is a positive outcome compared to the baseline scenario, under which energy consumption would have been expected to grow to 2742 TWh/ year. However, rather than reducing energy consumption by 20 percent below the levels of 2005, as per the 2020 goal, the existing measures are only expected to limit growth in energy consumption.[133]

3.3.4 Comparison with policies in third countries

The evaluation team has not conducted a thorough assessment of third country policies so far, but has received a fair amount of information on third country measures during the course of its interaction with stakeholders. . According to one interviewee, for instance, more than seventy-five countries now use

[133] Estimates provided by Hans-Paul Siderius. Energy Efficiency Expert at the Netherlands Agency for Energy and Climate Change.

various approaches to promoting energy efficiency, usually involving some form of standards and/or labelling programme to improve equipment efficiency outcomes.

On the basis of the an initial review the most relevant regulations on energy efficiency of products are is those regimes established set in Australia, the United States and Canada that also set Minimum Energy Performance Standards for a number of domestic and other energy using appliances. These regulations focus, in most respects, on the energy efficiency aspect and do not cover other the environmental issues as that feature in the Ecodesign Directive. The Japanese Top-Runner programme differs by using a dynamic approach in to setting the requirements. The scheme has a dynamic approach instituted with a continuous review of the setting of the average performance standards of all appliance models and gives flexibility to manufacturers by focusing on the average product.

The feedback from stakeholders on the structure and relative effectiveness of these tools varies. The input from one expert (Ökopol), on the basis of their own analysis, suggests that there are small differences in the overall institutional setting in the different countries. The main variation concerns – or is due to – arises from the different negotiation cultures among across countries. However, with limited data overall as proposed, it is difficult to assess the actual outcomes from the processes in the different areas due to limited overall data.

Comments made on other policies in third countries have focused mainly on the procedural structure rather than the actual effectiveness, although the two are possibly closely linked. In the case of the United States the main advantage is claimed to be the much clearer timetable and the legal deadlines for delivering and revising the relevant measures. This is seen as creating pressure to on the policy makers and providing certainty to industry and the other actors affected. In parallel, there seems to be a higher level of resources dedicated. On the other hand, the measures are seen as lacking in terms of ambition and in their focus only on energy issues.

In the case of the Australian MEPS, the main strength is considered to be the effective market surveillance that is seen as key for the success of the measures. In relation to that Market surveillance in Australia – as well as in Canada and the United States – is facilitated by the registration requirement to in a government database that makes market monitoring and surveillance easier. The result of such this approach is the high level of confidence from the side both of industry and of consumers that energy efficiency levels are met. As suggested by a number of interviewees such an approach is an important omission in the case of the European Ecodesign Directive.

Finally, in the case of the Japanese top-runner scheme a number of evaluation studies[134] [135] indicate rather high level of success in terms of achieving the energy efficiency targets set. However, according to CLASP, the structure of the scheme means that it is not possible to assess the compliance of individual products, since the scheme that is based on the average of for the total, making, enforcement problematic. According to CLASP, the scheme has delivered less than expected.

Questions to stakeholders

On the basis of the above analysis certain aspects still remain unclear and further input from stakeholders is necessary:

- Are there any other experiences from the policies in non-EU countries?
- Would a data provision requirement be possible to implement in the context of the Ecodesign? What, if any, are the possible issues?

134 Kimura,O.,(2010), Japanese Top Runner approach for energy efficiency standards, SERC Discussion paper , http://criepi.denken.or.jp/en/serc/research_re/download/09035dp.pdf

135 Nordqvist, J.,(2006), Evaluation of Japan's Top Runner programme - AID-EE project, www.aid-ee.org/documents/018TopRunner-Japan.PDF

3.3.5 **Evidence of rebound effect**

At a general level, a number of studies and report do indicate the presence of a rebound effect in relation to electrical appliances even if they do not provide evidence of causal linkage with Ecodesign. According to the reference scenario of the European Commission's PRIMES model (which includes the effect of existing energy efficiency policies and the anticipated effects of the climate and energy package adopted in 2009), final energy demand for electrical appliances and lighting in the residential sector is expected to grow by 2.2 % annually in the period 2010 to 2020 (EEA, 2010). In the past two decades changes to average household size, number of homes, and appliance and lighting energy use have led to a 20% increase in total residential energy consumption.[136]

In relation to specific products the estimates vary depended on the measurement method used. In relation to the Ecodesign Directive, a study of Ökopol, the Wuppertal Institute and RPA[137] estimated that the rebound effect for the different products ranged between 10 and 35% although there are studies indicated that the level of rebound effect for white goods is close to 0%, for lighting it can range between 5-12% and for air conditioning it may be up to 25%. The review of the EU SCP Action Plan and the EEA State of the Environment and Outlook Report[138] also refer to gains from energy efficiency that have been reduced by the rebound effect.

The analysis of the data available from the 11 products analysed do not allow for a proper assessment of the presence and extent of the rebound effect and to verify whether the estimates of 10-20% provided in the literature do apply in the case of the products covered by Implementing Measures. At this stage we can only refer to existing indications of the possible presence of a rebound effect. One such case concerns TV sets where, according to the data, there is an increase of the market share of larger television as well as of the level of average TV viewing per household. However, there is no evidence linking these changes to the increased energy efficiency. No data indicating greater intensity or frequency of use of appliances such as refrigerators, dishwashers or washing machines was identified during the course of the study.

Another form of rebound effect concerns the reaction of Austrian consumers to the announcement of the phasing out of incandescent light-bulbs. As has been reported, there was a surge in sales and stockpiling of incandescent bulbs which would probably lead to a delay in realising the energy saving expected. However, no evidence was provided that this was a more general reaction across the EU.

Beyond the rebound effect, energy savings may be less than what was initially expected as a result of the Heat Replacement Effect (HRE). The HRE concerns the fact that excess heat from inefficient light bulbs could account, in some cases, for a significant part of the heating in a given building. Reduction in this 'wasted' heat would need to be replaced by heating systems. Studies in the UK[139] indicate that the actual (net) energy savings from the replacement of incandescent light bulbs in a household that uses gas fuel can be as low as only 20% of the gross savings although still close to 70% for CO2 emissions and cost savings. For other appliances these numbers are around 35% and 80%. However, the level of the HRE can vary significantly depending on the climatic conditions and the types of fuel used.

Other than these examples, evidence of a rebound effect was not found, due in part to the limited time horizons upon which the study is based

[136] http://ec.europa.eu/environment/eussd/pdf/rebound_effect_report.pdf

[137] Okopol. Wuppertal institute and RPA(2010), Outlook on the estimated GHG emissions reductions, Report for DG CLIMA, ec.europa.eu/clima/studies/effort/docs/impact_ggas_en.pdf

[138] EEA (2010), The European environment — state and outlook 2010: consumption and the environment. European Environment Agency, Copenhagen, November 2010

[139] http://cdm.unfccc.int/filestorage/W/J/I/WJIGW6O5WYN3LWG6XGVCUNFVHLU477/Annex%20-%20Market%20transformation%20program%20reference.pdf?t=ZnF8bHI5NG9ifDDeOWni-NPUzxGxiueTy6Wb

Questions to stakeholders

On the basis of the above analysis certain aspects still remain unclear and further input from stakeholders is necessary:

- Are there any categories of EuP products where there has been an increase in the level of consumption or the frequency of use of EuPs or other indications of a rebound effect? Are there specific examples?

3.3.6 Impacts on the market and industry

The feedback from stakeholders indicates that it is still too early to assess the effect of the Directive on aspects such as production costs, prices or profit margins for firms. From the 152 survey participants none was able to produce any specific evidence that would help come up lead to meaningful conclusions. The information provided by some manufacturers is rather anecdotal and does not allow for clear conclusions. There was one reference to an overall increase of production cost increases of around 20% in the case of electric motors while one large manufacturer suggested that the total costs to the firm of the Regulation in the case of circulators was up to €100million (including necessary production changes, testing, personnel involved in various aspects to ensure compliance). The same manufacturer indicated that in the case of circulators the whole industry has invested over €400 million for changes in production. Only the administrative costs for a firm with 20 product families were estimated to be up to €520,000 annually, including costs for test laboratory and the personnel costs of around 5 full time equivalent for testing and ensuring compliance. On the other hand one manufacturer suggested that for products already covered by Implementing Measures the initial tier 1 requirements were not particularly challenging so did not affect production costs. Overall, the limited evidence available indicates that the experience of manufacturers varies. Any conclusions or estimation on the total costs to industry are difficult. In addition, a recent study of DEFRA in the UK[140] suggests that data from the literature support the presence of a learning effect that should gradually drive down the costs of production of new more efficient appliances.

On the issues of prices the necessary data were rather scarce. The survey responses – albeit only indicative – suggest that there have not been significant changes in the range and prices of products (see Table below). Only in the case of domestic lighting there were there some indications of an increase in overall prices. The only reference to hard data encountered is related to compact fluorescent lamps. We were informed that there are currently products that cost now below €1€ in contrast to assumption of a cost of € 7-10 € in studies a few years ago.

Table 3.45 - How have the Implementing Measures affected the availability and the price of products on the market? (Share of total respondents indicating – more than one response possible)

	Increased range of better performing products	Reduced range of better performing products	Reduction of functionalities of available products	No effect on range of products	Increase in the prices of products	Decrease in the prices of products
Standby and off-mode losses (N=23)	**48%**	9%	0%	30%	22%	4%
Simple set-top boxes (N=13)	38%	0%	0%	**46%**	8%	8%
Domestic lighting (N=32)	**34%**	6%	13%	19%	32%	9%
Tertiary Lighting	31%	13%	6%	31%	14%	6%

[140] Final Summary Report Impacts of Innovation on the Regulatory Costs of Energy-using Product Policy, Policy Studies Institute & BIO Intelligence Service - A research report completed for the Department for Environment, Food and Rural Affairs

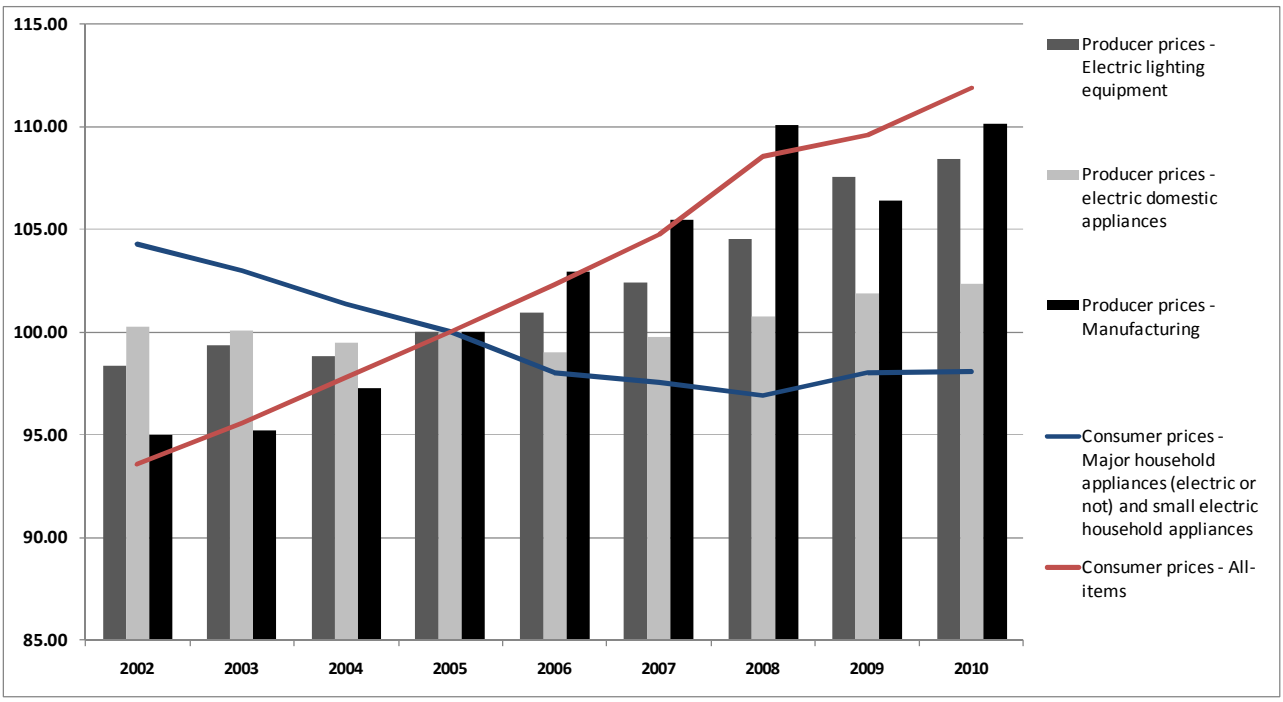
Analysis

	Increased range of better performing products	Reduced range of better performing products	Reduction of functionalities of available products	No effect on range of products	Increase in the prices of products	Decrease in the prices of products
(N=16)						
Battery chargers and external power supplies (N=17)	**59%**	12%	0%	24%	6%	0%
Domestic refrigerators and freezers (N=18)	39%	0%	0%	**50%**	6%	6%
Electric motors 1–150 kW (N=21)	29%	5%	5%	43%	22%	0%
Televisions (N=15)	**47%**	0%	0%	**47%**	0%	7%
Domestic dishwashers (N=14)	29%	0%	0%	**50%**	7%	14%
Domestic washing machines (N=13)	31%	0%	0%	**46%**	8%	15%

Source: CSES survey

Eurostat data on the evolution of the producer and consumer price indexes provide some additional support of the conclusion of a limited impact on prices. Over the period 2002-2010 there was a clear downward trend of in the total prices of household appliances (both electric or non-electric), in contrast to the evolution of the global prices index. At the same time, producer prices for electric domestic appliances and lighting equipment have increased at a rate that is lower than that of the manufacturing sector in total. The evolution of the above indexes is affected by a large number of factors and does not provide proof that the Directive did not have any negative effect. However, it does suggest that any impact on the actual price of household appliances has been rather minimal.

Chart 3.41 – Evolution of producer and consumer price indexes for selected product groups in EU27 (2005=100)



Source: Eurostat

Furthermore, a study conducted on behalf of the DEFRA[141] suggests that, all else being equal, the average price of the most energy efficient products at the time that they enter the market (i.e. when their ERI value is equal to one) has been declining over time.

This study suggests also that, based on the data available, policy interventions may push up average prices only in the short term. As time passes, manufacturers adjust their product ranges in response to a shift in demand and new (more efficient) products enter the market. Thus, the policy interventions only cause a short term disruption in a long-term downward trend in prices. We need to note though that the data used for this study relate to periods prior to the introduction of most of the Implementing Measures into force and do not provide direct evidence of the current developments in the European market for EuPs.

Impact on importers

On the question of the impact on importers, our research has not produced evidence of any adverse effects and most cases stakeholders consider that there have been no significant changes for importers. There are some indications that Importers, of course, have had to react to changes in increased demand for more efficient products, thus indicating a positive role. There have also been comments concerning the possible difficulty to in following the requirements and procedures of the Directive. Still, these are not seen as different from those applying to European firms, especially SMEs.

[141] Final Summary Report Impacts of Innovation on the Regulatory Costs of Energy-using Product Policy, Policy Studies Institute & BIO Intelligence Service - A research report completed for the Department for Environment, Food and Rural Affairs

Impact on innovation

Another key question for the evaluation is the role of the Directive and the requirements in the Implementing Measures as an incentive or obstacle to innovation.

We should note that for a number of stakeholders the promotion of innovation though performance requirements it is not considered as to be an objective of the Directive. The Directive is not expected to go beyond the adoption of already existing efficient technologies. From this point of view, it is the role of the Energy Labelling Directive the European and the national eco-labels and the other market-pull tools to promote innovation. Developments in product technologies are seen to be a result of energy labelling rather than the Ecodesign measures. Furthermore, the study of DEFRA cited earlier[141] concludes that mandatory standards are more effective than demand- based instruments such as energy labelling when it comes to stimulating improvements in the average energy efficiency levels of appliances. Innovation in that case does not refer to the development of new technologies but rather the adoption of better or the best technologies. Still, one can possibly claim and indirect mechanism since Energy Labelling standards are based on the benchmarks set by the Ecodesign. To the extent that these two are coordinated, there is clearly a possible mechanism that influences innovation.

Still, the analysis of the feedback provided so far does suggest a number of possible contributions- direct and indirect – of the Ecodesign Directive and the Implementing Measures but it also points to certain weaknesses or obstacles. The responses to the stakeholder survey suggest a generally positive role of for the Directive as an incentive for innovation. This is particularly the view of the Member States authorities but it is also shared by a significant number of industry representatives, particularly individual firms. Clearly our survey does not provide a representative sample of the whole industry and it should only be considered as indicative of how industry perceives the role of Directive. However, the review of all the comments provided and the additional interviews with experts that offer consulting services in the area of energy efficiency does support the conclusion that the Ecodesign Directive has a role as a promoter of an incentive for innovation beyond the simple removal of old products from the market.

Table 3. 46 - How important has been the implementation of the Directive and the respective Implementing Measures as an incentive for the development of innovation activities in firms?

	European/national industry association	Individual manufacturer	Member States	Environmental/ consumer groups	Experts	Total
Very/quite important	5 (21%)	8 (57%)	7 (64%)	-	2 (33%)	**22 (49%)**
Neither important nor unimportant	5 (21%)	1 (7%)	1 (9%)	1 (33%)	2 (33%)	**10 (22%)**
No/little important	6 (25%)	5 (36%)	1 (9%)	1 (33%)	-	**13 (29%)**
No opinion/Don't know	10 (42%)	-	2 (18%)	1 (33%)	2 (33%)	**15(25%)**
Total	24	14	12	3	8	**58**

Source: CSES survey

As a minimum, the Directive and the introduction of the Implementing Measure requirements are as seen as providing the necessary framework conditions, a clear timetable and legal certainty for the operation of a competitive market and the development of innovation. For this reason, for some, even longer term requirements would be welcome. Furthermore, the feedback provided suggests that in certain sectors the Implementing Measures seem to have challenged the industry. In the case of lighting, the industry representatives suggested that while new technologies – such as LED - were already developed prior to the introduction of the Directive, there is now a strong link between newer types of lighting and the requirements that have led to a more competitive industry. In the power supplies sector too, the industry representatives suggest, that the Directive has stimulated the tendency towards more energy efficient

products. In relation to SMEs, the feedback provided also indicates the Ecodesign Directive has led a large number of them to change practices and has driven the integration of life cycle thinking into firm culture in a significant number of them. In other sectors this does not appear to be the case. In the case of ICT products, for instance, for which an Implementing Measure is still not in force, industry representatives suggest that the Energy Star label and consumer preferences are driving innovation forward.

However, this positive message is qualified by feedback that indicates that in some cases the benefits are limited by operational and procedural weaknesses in the Directive. The long delays in the development of the requirements in a number of products can cause long periods of uncertainty and in certain cases delay investments in new technologies. The delays in the development of the Implementing Measures are also seen as the main reason that some of them have not been sufficiently ambitious. The fact that Implementing Measures may enter in force 2 or 3 years after the end of the preparatory study most often means that the requirements very often ignore recent developments. The most illustrative case is that of televisions when LED based displays were considered a niche product at the time of the study but since then have become dominant in the market during recent years.

Another factor that affects the ambition of the Implementing Measures is the use of the least life cycle cost (LLCC) principle[142]. For a number of stakeholders this leads to a selection of standards that can be far below that of the average product in the market. According to the Coolproducts study[143], in the case of televisions, fridges, washing machines, boilers and water heaters, the first tier requirements do not represent any push to the market beyond what would be considered to be the performance of a standard product. The second tier requirements are, according to the analysis, most often set somewhere between the "standard" and "most cost-effective" levels[144] of 2008 products which may, by 2012, already be rather standard. As is suggested by some experts, an alternative approach based on equal life cycle costs (i.e. no additional costs to consumers over the life cycle) would lead to more ambitious but equally feasible, targets. However, an approach that will set minimum standards at a level that would be less financially beneficial to consumers may be difficult to adopt due to political considerations.

What still remains to be seen is the extent that future revisions of the Implementing Measures of the Directive may lead to more demanding standards that will cater for technological progress, addressing existing limitations and weaknesses and introducing, to a certain extent, a dynamic element to the Ecodesign.

Finally, there were a few claims made by firms that the requirements do not always take into account the possible additional energy use needs from new functions, a key element of innovation. However, no concrete evidence has been provided so far to substantiate the assertion that requirements have created constraints in the introduction of new functions. The evidence from the survey, while only indicative, is that the survey responses concerning the range of products in the market (see Table 3.46 above) suggest that for all products there was either no impact from the new regulations on the range of products or a positive impact with an increased range of better products.

Role of advanced benchmarks

A separate question is the role, if any, of the advanced benchmarks proposed in the Implementing Measures. The advanced benchmarks are expected to provide information on best performing products

[142] Refer to the product configuration in which the overall costs of the product through its whole life cycle is reduced to a minimum, meaning that the additional investment costs are more than outweighed by reduced energy and water costs during the estimated product lifetime.

[143] Coolproducts(2011), Energy savings in practice - potential and delivery of EU Ecodesign measures, http://www.coolproducts.eu/resources/documents/EnergySaving-in-Practice.pdf

[144] According to the study the most cost-effective standards represent those product configurations that minimise the life-cycle cost for the consumer (including the purchase price and the costs over the theoretical lifetime of the product) but they may not be the most energy efficient.

already in the market and provide businesses with a long-term perspective of the future minimum requirements. According to the SCP/SIP Action Plan the Implementing Measures of the Energy Labelling Directive (ELD) are expected to set labelling categories for products that will also be used as a basis for setting minimum performance standards in public procurement or for Member States' incentives.

While the ELD categories are indeed based on these benchmarks the evidence suggests a limited use in the setting of public procurement standards. Only the Swedish authorities referred to the use advanced benchmarks to set public procurement requirements and contribute to innovation but this was the only example stated. More generally though, most stakeholders stated that benchmarks do not play any substantial role in the development of innovation. As suggested, the best available technologies they usually refer to are well known in the market but they are usually not accessible due to intellectual property constraints or high investment costs.

A separate question is the role, if any, of the advanced benchmarks proposed in the Implementing Measures. The advanced benchmarks are expected to provide information on best performing products already in the market and provide businesses with a long-term perspective of the future minimum requirements. In addition to that, according to the SCP/SIP Action Plan the Implementing Measures of the Energy Labelling Directive are expected to set labelling categories for products that will also be used as a basis for setting minimum performance standards in public procurement or in Member State incentives.

Questions to stakeholders

On the basis of the above analysis certain aspects still remain unclear and further input from stakeholders is necessary:

- Should the requirements in the Implementing Measures be more ambitious in order to push the market towards innovation? Would that be in accordance with the general policy objectives?
- Is there any concrete evidence that the introduction of specific requirements has hampered the introduction of new functionalities in products? Is there any evidence that it led to more energy efficient solutions?
- How do the requirements set in the Implementing Measures interact in practice with other policy tools in the promotion of innovation?
- Does the expected development of new Implementing Measures– as indicated by the inclusion in the Working Plan and the launch of preparatory studies - represent any incentive for firms to innovate? What has been the reaction of the manufacturers of those products to such developments?
- Does the use of least life cycle cost (LLCC) fail to promote innovation in practice?
- Are there other ways and mechanisms through which the Directive and the Implementing Measures support or obstruct the development of innovation in firms?
- How could the role of advanced benchmarks be improved?
- How extensive and effective has the use of the advanced benchmarks been for setting public procurement minimum standards or incentives through the Energy Labelling Directive?

Impact on the competitiveness of European industry

There are no data to support definite conclusions on the impact of the Directive and the Implementing Measures on the competitiveness of industry. The feedback in the discussions with stakeholders has provided no evidence of a clear impact to substantiate or challenge the argument that stricter standards in Europe will drive competitiveness within the Internal Market and globally.

The interviews with stakeholders, in fact, generated mixed findings. First, many of the industry associations pointed out that normal market pressure, especially in the product categories linked to professional or

industrial activities, were driving improvements in efficiency long before the Directive came into place. Moreover, there are greater pressures that come from the emergence of new technologies that affect competitiveness to a greater degree than the Directive. Separating the impact of each source of pressure is difficult.

3.3.7 **Global impacts**

Another issue of effectiveness examined concerns the possible global impacts of the Directive. More specifically the evaluation examined:

- the effect of the Directive on third countries including any possible effects on the performance of the products traded in third countries and the possible introduction of relevant regulations
- any impact on the global harmonisation of standards and products.

Analysis of findings

The market data from the different products does not allow assessing the effects on the markets of third countries. A number of manufacturers indicated their intention to "impose" European standards on other markets. However, no concrete evidence on how this has operated has been made available at this point.

However, statements from some stakeholders have pointed to a 'benchmarking' effect in terms of the wider adoption of the Ecodesign Directive approach and the potential for having a benchmarking effect driving standards up in other countries. There have been known instances of third countries adopting European legislation relating to product standards. Stakeholders pointed to Russia as a country that has effectively adopted European standards and others referring to Canada and Switzerland as examples where recently introduced regulation is closely related to the Ecodesign Directive. Moreover, the set-top boxes voluntary agreement under development in Australia explicitly refers to the European standards as the default global standards and has set the Ecodesign Directive as the baseline standard and there is also the stated intention to follow the EU 1watt (and 0.5watt) approach on stand-by. Such new developments come in parallel to existing regulations in a number of countries with established energy performance standards and energy labelling (e.g. United Stated, Australia, Korea, and China) or in the case of Japan the Top Runner regulation[145].

Still, the feedback provided suggests that we are still very far from any harmonisation standards or products, not to mention regulatory requirements. It is unclear whether a harmonisation of regulation this is necessarily desirable. What is more crucial is the absence of relevant harmonised standards and harmonised test procedures that would serve as the basis for more harmonised regulation. The study of CLASP[146] indicates that for products like refrigerators, clothes washers and dryers, water heating appliances, space heating appliances the degree of harmonisation of test procedures is relatively low while it is much higher in the case of electric motors and light bulbs. New IEC standards are expected to support in this direction. There are currently initiatives such as CLASP[147] and 4E[148] that aim to promote a more consistent approach to standards internationally but it is still work in progress. Furthermore, as suggested by a number of firms and industry associations, the coordination between the development of standards under IEC – as the international body for electrical appliances – and the relevant European bodies is not always effective and there is scope for improvement.

[145] EPTA, PE International and NTUA(2007), Study for preparing the first Working Plan of the Ecodesign Directive
[146] CLASP and Navigant Consultants, Opportunities for Success and CO2 Savings from Appliance Energy Efficiency Harmonization, http://www.clasponline.org/clasp.online.resource.php?disdoc=781#opportunities
[147] Collaborative Labelling and Appliance Standards Program, http://www.clasponline.org/index.php
[148] 4E - Efficient Electrical End-Use Equipment, http://www.iea-4e.org/

Analysis

Questions to stakeholders

- What is the practice of EU and non-EU manufacturers in terms of the energy efficiency of products marketed in third countries?
- Is there any evidence of shifts in the energy efficiency of products circulating in third countries?
- Is there any additional evidence of the adoption of regulation setting similar requirements to those of the Ecodesign Directive?
- What are the main obstacles for to the harmonisation of standards relating to the products covered by the Directive?