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CORRIGENDUM: Erreurs mineures corrigées dans le tableau du chapitre 6 et changement dans la disposition de l'annexe VIII pour rendre les tableaux plus lisibles.

COMMISSION STAFF WORKING DOCUMENT

accompanying the

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

establishing a framework for the setting of ecodesign requirements for energy related products

IMPACT ASSESSMENT

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SUMMARY

This Impact Assessment accompanies the proposal for the amendment of the Ecodesign Directive for Energy Using Products[1]. The amendment of the Ecodesign Directive is one of the elements of the Action Plan on Sustainable Consumption and Production and on Sustainable Industrial Policy (SCP/SIP) which is a joint initiative of DG ENTR, DG ENV and DG TREN. The main element of the SCP/SIP is an integrated product policy. The Ecodesign Directive is an important building block of the Action Plan.

The current Ecodesign Directive covers only energy using products (excluding means of transport). For these and under the condition that no self-regulatory mechanism is offering a valid alternative, the Directive allows the setting of mandatory minimum requirements corresponding to the performance of the product that has least life cycle cost. Also, the Directive specifies a number of criteria and safeguards such that minimum requirements take into account competitiveness and social issues. This guarantees that improvements in environmental performance are cost-effective. While the purchase prices of these products might rise in the short term, their superior performance more than offsets this over the life span of the product by lower usage costs.

However, the impact assessment of the Action Plan mentioned above has shown that the limited scope of the Ecodesign Directive represents an important restriction on the potential impact that the EU's Integrated Product Policy can have. This impact assessment report therefore analyses whether the scope of the Ecodesign Directive could be extended and what impacts the extension could have. The objective of the report is therefore to provide information to policy makers on the possible scope of such an extension.

Three options are considered:

(1) No extension of the scope, thus only energy using products can be covered,

(2) Extend the scope beyond energy using products maintaining the exclusion for means of transport, and

(3) Extend the scope beyond energy using products including means of transport

Changing the scope of the Ecodesign Directive would not have direct impacts on products, since the Ecodesign Directive is a framework Directive. The environmental, economic and social impacts are linked with the implementing measures for specific product groups. These implementing measures are adopted by the Commission under the regulatory comitology procedure. Before the implementing measures are adopted, stakeholders will be formally consulted and a specific impact assessment will be made by Commission services. All impacts mentioned in the report are illustrative examples of the impacts that could be reaped by having implementing measures for products of the different options. Moreover, the impacts would only be realised in the long run since the adoption of implementing measures is done product by product and after a thorough assessment process.

The analysis of the options takes into account a number of issues. First, the environmental impacts are discussed for broad product categories. Second, it is reviewed whether the Ecodesign Directive would overlap with existing legislation already addressing environmental impacts. Third the environmental improvement potential and the economic and social impacts of the options are assessed.

[1] Dir 2005/32/EC

The analysis of the available data indicates that significant reductions of environmental impacts are possible while at the same time also allowing economic savings for businesses and final consumers. Generally speaking, the potential benefits are larger the broader the scope of products that can be addressed through implementing measures.

Although the potential benefits would be highest in the case of covering all products (option 3) the report shows that the Ecodesign Directive does not appear to be complementary to the Type-Approval System since much of the potential benefits in the transport sector will already be reaped by forthcoming legislation such as the CO2 in cars legislation and the new Euro standards. Within the products screened in Option 2 a high environmental impact that can be reaped cost effectively would come from energy related products such as construction products and water using products. Furthermore, also a number of other product groups may offer significant potential for cost efficient improvements, as there is evidence that their impact is even more significant than both the Labouze 2003 and the EIPRO study have demonstrated when looking at products such as: detergent/cleaning products, footwear/leather products, other food products, print-media (books, journals, newspaper), hygiene paper, mattresses, batteries, and toys. Ongoing Commission studies will look further into the environmental impact and improvement potential of these products. Further research could also investigate the environmental and economic sustainability of the use of concrete/cement, steel, aluminium, plastics and other important materials. These product groups and materials are presented for illustrative purpose only.

The screening analysis of the cost and benefits of option 1 and 2 shows that the importance of the upfront costs is highly dependant on the nature of the products and even between sub-categories of the same product type. In the illustrative cases analysed, net benefits increase over time with an increased uptake of products responding to minimum requirements.

An extended scope will allow introducing implementing measures for those non energy using product categories that have the highest potential for improvement of environmental performance while also leading to the highest savings during the use phase. This would not necessarily be possible under the current Directive which is restricted to energy using products. More detailed analyses will be conducted for the impact assessments that need to be prepared for each implementing measure.

At this stage, it can be recommended based on the available evidence to widen the scope of the Directive to energy-related products. Extending the scope to means of transport would have limited benefits. While there are also strong indications that widening the Directive beyond those products could deliver significant benefits, it is recommended to carry out further investigations and further assess the option of including non-energy related products in the scope of the Directive following a future review.

1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

The Ecodesign Directive

This Impact Assessment accompanies the proposal for the amendment of the Ecodesign Directive for energy using products[2]. This framework directive provides harmonised EU-wide rules for ecodesign of products to improve their environmental performance and ensure their free movement in the EU. The product scope of the Directive is energy using products (EuPs) with the exclusion of means of transport. The Directive does not in itself introduce directly binding requirements for specific products, but defines conditions and criteria for setting, through subsequent implementing measures, minimum requirements regarding environmentally relevant product characteristics (including energy consumption) and allows to improve quickly and efficiently the performance of the products put on the market. Minimum requirements are set aiming at the life-cycle cost minimum to end-users, taking into account the consequences on other environmental aspects. Implementing measures are only considered for products with significant environmental impacts and a significant improvement potential through their design. The philosophy of the directive is to cover only a limited number of products with a significant contribution to environmental performance.

In Art 15 of the Directive the conditions and criteria for selecting products for which to set minimum requirements through subsequent implementing measures are explained. In Art 15.2 the necessary three criteria to be fulfilled by any product in order to be included in the working plan are presented. Satisfying these criteria is the first step in the procedure that could lead to an implementing measure:

(i) The product shall represent a significant volume of sales and trade, indicatively more than 200,000 units a year within the Community.

(ii) The product shall have a significant environmental impact within the Community.

(iii) The product shall present significant potential for improvement in terms of its environmental impact without entailing excessive costs, taking into account in particular:

- the absence of other relevant Community legislation or failure of market forces to address the issue properly.

- a wide disparity in the environmental performance of products available on the market with equivalent functionality.

These criteria can be applied to energy using products and non-energy using products

Moreover, art 15.4 of the Directive presents the criteria which the Commission needs to take into account in preparing a draft implementing measure:

(a) The life cycle of the products and its significant environmental impact

(b) The impact in terms of competitiveness, for manufacturers, including SMEs, including on markets outside the Community, innovation, market access and cost and benefits.

(c) Existing national environmental legislation.

(d) Consultation with stakeholders

(e) The setting of implementing dates, which could include staged or transitional measure or periods, taking into account in particular possible impacts on SMEs or on specific product

[2] Dir 92/75/EEC

groups manufactured primarily by SMEs. For example, the Commission is preparing implementing measures on set top boxes and standby/off mode of electric equipment. For both implementing measures, staged minimum requirements will be introduced to allow industry to adapt to the legislation.

These criteria can be applied to energy using products and non-energy using products

Finally, art 15.5 contains criteria that implementing measures need to satisfy:

(a) There shall be no significant negative impact on the functionality of the products

(b) Health, safety and the environment shall not be adversely affected

(c) There shall be no significant negative impact on consumers in particular as regards the affordability and the life-cycle cost of the product

(d) There shall be no significant negative impact on industry's competitiveness

(e) In principle, the setting of an ecodesign requirement shall not have the consequence of imposing proprietary technology on manufacturers

(f) No excessive administrative burden shall be imposed on manufacturers.

These criteria can be applied to energy using products and non-energy using products

Besides, Annex I and Annex II of the Eco-design Directive identify a wide list of environmental parameters must be considered when studying the setting of minimum requirements. The methodology used for developing implementing measures considers, (among others) the following environmental impacts: energy, water, waste, global warming potential, ozone depletion potential, acidification, the emission of volatile organic compounds, persistent organic pollutants, heavy metals and particulate matter into the air. The current methodology for setting implementing measures identifies the aspects of products having environmental impacts throughout their lifecycle, analyses the potential for improvement and identifies best available technology. On the basis of this information, minimum requirements are set to tackle the most relevant impacts. Typically, only 3-5 parameters would be identified because they account for a very high proportion of the total environmental impact of the product. The methodology for setting implementing measures does not weigh the environmental impacts. In practice, the European Commission decides, taking into account all evidence, what the most important environmental impacts of a product are. The list of environmental parameters can be used to reduce the environmental impacts of energy using and non-energy using products.

Procedural steps before any implementing measure is adopted

Before the Commission proposes an implementing measure, several steps have to be carried out.

First, there is a need to define a working plan with candidate products to be studied. The first batch of products was included in the Directive. Currently, the Commission is identifying product groups to be tackled in the following three years. The work plan is made after consultation of the stakeholders and analysing whether the products satisfy the requirements of art 15.2.

Second, it is necessary to launch preparatory studies for the products identified in the work plan to identify which eco-design requirements should be set for a particular product to improve the environmental performance of the product. The preparatory study provides the necessary information to prepare for the next phases to be carried out by the Commission.

Third, as requested by Art 18 of the Directive, a group of interested parties called "Consultation Forum" is set up to allow stakeholders to be informed and provide their positions on the possible measures. The task of the Forum is to contribute, in particular to the definition and review of the implementing measures, to monitoring the efficiency of the established market surveillance mechanisms and to the assessment of voluntary agreements and other self-regulatory measures taken in the context of the Directive. The Forum is also consulted by the Commission during the periodic modification of the working plan.

Fourth, an impact assessment is necessary for each proposal for an implementing measure. It will assess the environmental, economic and social impacts and submitted to the European Commission's impact assessment board.

Fifth, the Commission shall be assisted by a Committee operating under the regulatory procedure with scrutiny by the European Parliament.

Sixth, the Commission adopts a proposal for an implementing measure following the normal procedures, including interservice consultations.

In summary, the procedures that are specified in the Ecodesign Directive guarantee that all concerned parties are heard and all evidence is considered when setting implementing measures. Even if at the time of being developed, these provisions were drawn up to address mainly energy-using products, they can equally be applied to non-energy using products.

Regulatory Dialogue

It should be mentioned as well that the European Commission is involved in formal regulatory dialogues with its main trading partners and with international organisations on such issues as the harmonization of measurement methods/standards, benchmarking and other crucial elements directly linked to the setting of implementing measures of the Eco-design Directive. The draft measures are notified to the World Trade Organisation/Technical Barriers to Trade to ensure that no barriers to trade are introduced. Additionally the draft implementing measures are discussed with the relevant ministries from third countries in the frame of regulatory cooperation. Manufacturers from outside the EU are encouraged to actively provide input when implementing measures are developed and the all process is made extremely transparent from the outset.

Transposition

The Ecodesign Directive is being transposed into Member States legislation and there are currently 7 MS that are late in their transposition and confronted with infringement procedures. This is not an unusual situation for a new Directive. Furthermore the delays did not have yet any practical consequences, as there is no effective application of the Directive until Implementing Measures on specific products have been adopted and are applied. The development of such Implementing Measures is under way and the first ones could be adopted by the end of 2008.

Conclusion

The different criteria, procedures and other safeguards assure that economic and social issues are taken into account when setting minimum requirements. Therefore, the Directive is a good framework for reducing negative environmental externalities while taking into account potential negative economic or social impacts.

Since the same policy goal is aimed at for non-energy using products, the same criteria, procedures and other safeguards that already exist for energy using products should be in place to guarantee the policy goal.

The current impact assessment

The Action Plan on Sustainable Consumption and Production and on Sustainable Industrial Policy (SCP/SIP), a joint initiative of DG ENTR, DG ENV and DG TREN, will propose actions to solve market and regulatory failures which prevent improving the environmental performance of a large scope of products in Europe. The main element of the SCP/SIP is an integrated product policy. The Ecodesign Directive is an important building block thereof.

This impact assessment is one layer in the analytical framework of three levels of impact assessments related to product policy.

First, the impact assessment of the Action Plan focused on delimiting the problem definition and the remaining problems. In the Impact Assessment of the Action Plan it was clearly stated that the Action Plan would only look at existing policy instruments and how to coordinate them better. The Impact Assessment of the Action Plan discussed the options of business as usual, a voluntary approach or a mandatory approach. The main conclusion of the impact assessment of the action plan was that a mandatory approach could solve the identified market failures. Moreover, the impact assessment of the action plan concluded that a specific impact assessment was needed to look at the extension of the scope of the Ecodesign Directive.

Second, this impact assessment focuses on the identification of the need for and the most adequate extension of the scope of the Ecodesign Directive. It will start addressing the environmental, economic and social trends and impacts of the different options to the extent possible. The extension of the scope could be dealt with through a separate legal instrument, such as a sister directive that could contain similar provisions as the current eco-design directive but be applicable only to non-energy using products. This option has been discarded because two separate directives with exactly the same material content but different scope would not only pose an unnecessary burden for the Community legislator and the national Parliaments. It would also mean adding to the volume of the *acquis communautaire* and creating confusion for enterprises that have to understand which of the directives is actually relevant for them. This is fully in line with better regulation principles, in particular simplification.

Third, where an implementing measure will be proposed for a product, a specific impact assessment will identify the specific problems and analyse the specific environmental, economic and social impacts of setting minimum requirements. In the impact assessment for the specific product group, the Commission will set out how it respected the safeguards of Art 15.

The impact assessment principle of proportionality should be seen in light of these three layers of impact assessments and notably the guarantees and safeguards stipulated in the Ecodesign Directive for the implementing measure stage.

This document is prepared as a basis for comments and does not pre-judge the final form of any decision to be taken by the Commission. Moreover, all products categories mentioned in this document are only included for analytical purposes and do not prejudge any decision on the inclusion of products on the working plan for the Ecodesign Directive. Finally, all figures and numbers quoted in this Impact Assessment are of an indicative nature only.

1.1. Consultation and expertise

An inter-service steering group was consulted on the impact assessment. The meeting has taken place on 28 February 2008. ECFIN, ENV, ENTR, TREN, SG and RTD were present. After the meeting the DG's present have been informally consulted on a draft impact assessment. The suggestions of the different directorate generals have been taken into account in drafting this impact assessment.

1.1.1. Studies

The results of a number of studies have been considered. Some of the most important are: the EIPRO project[3], Labouze et al (2003)[4], McKinsey (2007)[5] and the preparatory studies on implementing measures. The results of the different studies are not necessarily consistent because of the very different methodologies used to evaluate the externalities and potential impacts. Yet, in general the results of the studies point out in the same direction.

1.1.2. Stakeholder Consultations

DG ENTR and DG TREN are in regular contact with their stakeholders.

Two consultations on the Action Plan were organised: The first one was business oriented: a questionnaire was sent to around 4000 companies participating in the European Business Test Panel. The consultation took place from the 15th of September to the 15th of October 2007. 354 companies responded. 69% of the businesses surveyed where in favour of applying minimum standards to improve energy and resource efficiency to a broad number of products. The second consultation was done jointly with DG ENV and concerned the Sustainable Consumption and Production and the Sustainable Industrial Policy Action Plan. The Internet consultation on the basis of the questionnaire and a 10 pages background document was launched on "Your voice in Europe" and took place between the 27th of July and the 23rd of September. It addressed both stakeholders (national ministries, industries, associations, NGOs) and the general public. Participants to the consultation were also invited to provide position papers. 479 answers were submitted. Enhanced use of eco-design instruments was generally recognised as the first best action (67.3%). 83% of the respondents strongly agreed with extending the product scope of the Ecodesign Directive. There was a slight preference for concentrating on products improving resource and energy efficiency (79.1%). A majority of the respondents (70%) indicated that actions need to tackle environmental problems in a cost-efficient way and need to minimise the social impacts. Eleven Member States, three Universities and forty-two associations and companies also provided position papers. See Annex I for a more detailed account of the stakeholder consultation.

Stakeholders have been generally very positive to the philosophy of the Directive and the possibilities it gives to manufacturers, in terms of self-regulation and cooperating on the development of implementing measures. However, some stakeholders[6] have recently raised

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3 http://ec.europa.eu/environment/ipp/identifying.htm

4 The full reference for Labouze et al (2003) is Labouze, E., V. Monier, Y. Le Guern and J.-B. Puyou. (2003), Study on external environmental effects related to the lifecycle of products and services – Final Report Version 2, European Commission, Directorate General Environment, Directorate A – Sustainable Development and Policy support, BIO Intelligence Service/O2 France, Paris, France. See Annex I for some detailed statistics from Labouze et al (2003).

5 http://www.mckinsey.com/clientservice/ccsi/pdf/costs_and_potentials_of_geenhouse_gas_full_report.pdf

6 Orgalime letter to Vice President Verheugen dated on the 11th of April. Also the position by Business Europe.

some concerns about the revision of the Ecodesign Directive. The main objections are the period of legal uncertainty for the mechanical engineering industry that would be induced by the revision as well as the strong resistance from other industries. The European Commission would take into account the comments of these industry associations by proposing only a limited recast to the Ecodesign Directive to modify only its scope without altering its other provisions. This should not raise legal uncertainty for the industries whose products currently fall under the scope of the Directive.

1.1.3. Academic expertise consulted

DG ENTR has drawn on the expertise of several academic institutions for the elaboration of this impact assessment. The Institute of Environmental Science of the University of Leiden has shared its expertise and databases for the life cycle assessment of the environmental impacts of products. The "Zentrum für Europäische Wirtschaftsforschung" (ZEW) assisted by providing input-output analysis on the environmental databases.

1.2. Opinion of the Impact Assessment Board

This impact assessment report was drafted following the remarks in the request for resubmission of the Impact Assessment Board of 21 April 2008 and the Final Opinion of the Board on the final draft issued on 6 May 2008. The following improvements have been made:

A comprehensive section on the current eco-design directive has been included. This section focuses on explaining that the provisions of the Eco-design Directive are suitable to cover non-energy using products. It sets out clearly that the goal of the Eco-design Directive is to reduce negative environmental externalities taking into consideration the social and competitiveness impacts. It is explained that the goal is realised by a list of criteria and procedures for setting implementing measures included in the Directive. Two examples (construction products and water using products) of the value added of an extended scope of the Directive are included. These two examples have an illustrative purpose and do not limit or prejudge any decision by the Commission.

This final draft makes clear that all products and impacts in this report are for illustrative purpose only. Moreover, it has been clarified to which extent specific product groups listed in the table could be potentially covered by the extension taking into account existing legislation and how existing voluntary measures and industry standards would be taken into account when designing implementing measures. Also, art 1.4 of the Directive has been taken into account when selecting products.

A number of methodological issues have been clarified. It has been clarified that the energy and climate package is not taken up in the baseline since this would require a complicated modelling exercise. Also, it is explained that some thresholds used in this impact assessment are purely for illustrative reasons and that for future implementing measures no such thresholds would be used. Also, it is clarified that the thresholds used could be higher or lower and that this would alter the environmental improvement potential but not the comparison of the three options. The text and Annex VII clarify the weightings used in this impact assessment. Moreover, it is clearly stated that the weightings are for illustrative purposes and that the European Commission does not use weightings to determine the most significant environmental impacts in the implementing measures.

This draft elaborates on the international context of the Eco-Design Directive. It clarifies the role of existing mechanisms on international standards and regulatory dialogues with main trading partners, and confirms that the impact on third countries will be addressed when designing implementing measures.

The Impact Assessment Board requested that net benefits would be disentangled into both costs and gross benefits. This has been done for illustrative purposes for water heaters and windows. The more aggregate analysis that was initially in the main body of the report has been explained more thoroughly in Annex II, explaining underlying assumptions more carefully.

2. PROBLEM DEFINITION:

2.1. Problem

As explained in the impact assessment of the SCP/SIP Action Plan, the way in which products are made, used, consumed and disposed of can have negative impacts on the environment. The aim of policy action is not to reduce pollution and CO2 emissions to zero. The aim is to have a socially desirable level of consumption and production on the one hand and environmental impacts on the other. The SCP/SIP impact assessment identified several market failures and imperfections that currently prevent society from reaching the social optimum[7]. The most important are:

- Environmental externalities that result from prices that do not reflect the negative environmental impacts of the production or consumption of products.
- Information asymmetries that result from high transaction costs for consumers to obtain relevant information on product characteristics. Consumers can often not tell whether a product is more resource efficient during its use phase than another.
- Bounded rationality that can explain why even well-informed consumers do not act rationally when making purchasing decisions. Even if consumers have sufficient information, they can be faced with high upfront costs when buying a more performing product, while the benefits accrue over a longer period of time (i.e. during its use-phase). Consumers may not take into account the use cost of a product but focus on the purchase price only.
- Principal-agent problems that occur where there is a misalignment of incentives of those purchasing the product (e.g. landlords) and those using it (e.g. tenants)
- The above market failures have negative effects on innovation of better performing products since they limit the demand for products with lower environmental impacts.

The market failures identified in the impact assessment of the SCP/SIP Action Plan result in products that are not designed such that environmental impacts of products over their life cycle are optimal from a social point of view.

This is confirmed in reality. Based on a comprehensive list of environmental impacts for the EU, Labouze et al (2003) calculated the total external cost of 25 products which are commonly seen as having a significant environmental impact over the life cycle. For each environmental impact Labouze et al report a minimum and maximum monetary value which corresponds to the cost of that environmental impact to society. The monetary values are based on the lower and higher estimates found in the literature and are reported in Annex VII. In Table1 below the monetary values for the environmental impacts are aggregated to one monetary value which represents the cost of all environmental impacts studied by Labouze et al for that product group. As the authors stress the given external cost figures are clearly

[7] Impact Assessment of the SCP/SIP Action Plan, EC (2008) forthcoming

conservative estimates as many mechanisms and impacts that result in external costs could not be included. The true impact and potential is hence clearly higher. Also, and as a found more below, the numbers for non-energy using products are a systematic underestimate, due to limitations in data, assumptions of the study and a certain focus on energy-related emissions in the inventory data and impact assessment. The aggregated monetary value is mainly used for presentational reasons. For setting implementing measures no aggregation of environmental impacts will be done and the European Commission can decide, taking into account all evidence, which environmental impacts it deems most important. These minimum and maximum environmental impacts are represented per capita, for the EU-27 and ranked per importance.

Table1 External costs of environmental impacts per year

	per capita (€)		EU-27 (bn €)		Rank	
Product	min	max	Min	max	min	max
Space heating	41.3	186	20.3	91.7	1	1
Personal cars	32.2	90	15.8	44.1	2	4
Goods transport[8]	20.4	100	10	49.2	3	3
EuP domestic appliances	15.6	101	7.7	49.5	4	2
Appliances and lights	12.7	58	6.2	28.4	5	6
Textiles	11.6	67	5.7	32.9	6	5
Building structure[12]	11	51	5.4	24.8	7	7
Water heating	8	38	3.9	18.9	10	10
Transport services	5.1	28	2.5	13.6	14	11
Water supply[12]	3.5	42	1.7	20.5	15	8
Cooking	3.5	16	1.7	7.6	16	16
Furniture	3.3	14	1.6	6.9	17	17
EuP IT	3.1	17	1.5	8.5	18	15
Non eco-designable products	47.7	138	22.4	68.8		
Total	**219**	**946**	**106.4**	**465.4**		

Source: Labouze et al (2003)

[8] Although these are not products, there are product design measures which can reduce the environmental impact of this category.

Products to which eco-design measures can be applied make up between 80 and 88% of environmental impacts studied by Labouze et al. Total externalities are in the range of €219-€946 per capita per year. For the EU-27 as a whole these externalities amount to between €106.4-465.4 billion per year. In relative terms, this is between 1.1% and 4.9% of EU GDP at the time of publishing the study, keeping in mind the already mentioned systematic underestimation of the real level of external costs. CO2 accounts for an important share of total externalities: in the minimum scenario CO2 accounts for 77% of the externalities, in the maximum scenario CO2 accounts for only 44%[9]. As CO2 related impacts are rather well covered in the external cost calculation while others are not, the true relevance of CO2 is however lower.

Remaining Problems, taking account of existing policies

The problem definition of the impact assessment of the Action Plan SCP/SIP demonstrated that a number of policies are already in place. It identified the climate package (Emission Trading Scheme (ETS), renewables, sectors not covered by ETS), the directive on industrial emissions, waste legislation, the directive on Ambient Air Quality and Cleaner Air for Europe, the eco-label, the energy action plan (energy performance of buildings directive, energy efficiency label and Ecodesign Directive), EMAS and ETAP. However, the impact assessment of the Action Plan already pointed out that:

- Internalisation policies such as ETS will not necessarily result in consumers buying more environmentally efficient products that are optimal from a social- or even consumer perspective. Information asymmetries, bounded rationality and principal-agent problems are not resolved by internalisation policies.
- The best way to foster environmentally efficient products is to complement price signals with an eco-design framework. The eco-design framework can assure that manufacturers produce products with environmental externalities that are optimal over the life cycle from a social perspective. Information asymmetries can be resolved by providing more information on the environmental performance of products. Yet, bounded rationality, principal agent problems and environmental externalities require a mandatory approach for product policy.
- Intervention on the environmental performance of products at Member State level might erect barriers for the free movement of products in the internal market. Therefore, public intervention at the EU level is justified for product policy.

Based on the definition of the problem and the results of the Impact Assessment of the SIP/SCP action plan, the Ecodesign Directive is identified as a useful mandatory tool to address environmental externalities of products.

However, currently the Ecodesign Directive covers only energy using products. But, energy using products are only responsible for 31-36% of the environmental impacts studied by Labouze et al (see Table 2). Thus the identified market failures are currently not necessarily adequately addressed for other products that cause the majority of environmental impacts.

[9] Based on Labouze et al (2003)

Table2 External costs of environmental impacts per year[10]

	per capita (€)		EU-27 (bn €)		% of total	
	min	max	min	max	Min	max
Energy using Products	69.6	341.6	33.2	167.9	31%	36%
Other products	149.3	604	73.7	297.9	69%	64%

Source: Labouze et al (2003)

2.2. EU's right to act

2.2.1. Treaty establishing the European Community

Article 94 & 95 of the EC Treaty state that the Council shall adopt the measures for the approximation of the provisions laid down by law, regulation or administrative action in Member States which have as their object the establishment and functioning of the internal market. This applies to all aspects of production, products and consumption in the EU.

2.2.2. Policy background

The possible amendment of the Ecodesign Directive is part of the SIP/SCP Action Plan.

2.2.3. Subsidiarity and EU added value

The subsidiarity principle applies insofar as the proposal does not fall under the exclusive competence of the Community.

The objectives of the proposal cannot be sufficiently achieved by the Member States for the following reason:

To leave the setting of ecodesign requirements for products to the Member States would lead to divergent national provisions and procedures having similar objectives that would generate undue costs for industry and constitute obstacles to the free movement of goods within the Community.

Community action will better achieve the objectives of the proposal for the following reasons:

Acting at the Community level is the only way to achieve the objective of the proposal while ensuring that the requirements for products placed on the market are equal in all Member States, thereby ensuring the free movement of goods in the Community.

The scope of the proposal is limited to new products placed for the first time on the Community market.

Action at the Member States level is unlikely to address environmental problems either efficiently or effectively. The impacts of climate change and air and water pollution are of a global or at least a cross border nature. Member States may fail to take into account the

[10] EuP are the grouping of space heating, EuP domestic appliances, appliances and lights, water heating, cooking and EuP IT. Since space heating impacts can be solved both by improving the energy efficiency of heaters and by improving the energy efficiency of the insulation, the environmental impacts of space heating have been divided in 60% for EuP and 40% for non-EuP. The division is based on the estimation that up to 40% of the heating requirements can be saved by installing better insulation source:Ecofys (2002)

effects of domestically generated pollution that creates impacts outside national borders and therefore carry out insufficient abatement.

3. OBJECTIVES:

The General objective of this proposal is the same as the overarching one for the SIP/SCP Action Plan: To allow industry to transform environmental challenges into economic opportunities by fostering sustainable production and consumption on the basis of a strong framework for product policy.

This proposal seeks to contribute to the general objective by aiming to reduce environmental externalities through broadening the scope of products covered by an integrated product policy (Specific objective).

As the impact assessment on the Action Plan on SCP/SIP has shown, the preferred way to implement an enhanced Integrated Product Policy is to extend the scope of the Ecodesign Directive to cover additional product groups. The operational objective is therefore to extend the Ecodesign Directive such that products can be included which present significant potential for improvement in terms of their environmental impact without entailing excessive costs (Based on the article 15 of Ecodesign Directive)

4. POLICY OPTIONS

The policy options analysed in this impact assessment only look into the most appropriate product scope for the Ecodesign Directive. The only amendment proposed to the directive will be related to the product scope. No changes are necessary for the procedures of the implementation of the Ecodesign Directive.

The impact assessment does not need to consider a voluntary approach or self-regulation as an option: Article 17 and annex VIII of the Ecodesign Directive obliges the Commission to look into the option of a voluntary approach or self-regulation in the process of the adoption of an implementing measure for a specific product. Indeed, annex VIII of the Ecodesign Directive sets out the criteria for the admissibility of self-regulatory initiatives as an alternative to implementing measures. Criteria are openness of participation, added value, representativeness, quantified and staged objectives, involvement of civil society, monitoring and reporting, cost-effectiveness of administering a self-regulatory initiative, sustainability and incentive compatibility. In general, the impact assessments of the implementing measures will also consider whether labelling the product category could be a valid alternative to minimum requirements.

Regardless of the option taken, the Directive, as do New Approach related Directives provides for the use of mandated harmonised standards giving presumption of conformity to requirements of the Directive. The EU encourages that standards are developed at global level (Vienna and Dresden agreements) and there is scope for making use of adequate international standards. However, the need for such standards is determined at the time of developing implementing measures for specific products.

The three options identified for extending the scope are:

Option 1: No Policy change (baseline)

Under this option, the scope of the Ecodesign Directive would remain as it is. The work to develop implementing measures for the priority products identified in the directive will be continued. For street lighting products, office lighting products, stand-by and off-mode losses, external power supplies and simple set top boxes implementing measures would be adopted in

2008. For the other priority products identified in the directive the technical studies preparing the implementing measures would be completed as planned.[11] The working plan that brings together and complements available information and arguments as to which products should be included among the indicative priorities would be adopted swiftly.

Option 2: Extend the Ecodesign Directive beyond energy using products but the exclusion for means of transport would be maintained (art. 1.3)

Under the second option, the scope of the Ecodesign Directive would be extended beyond energy using products but the current exclusion for means of transport, specified in art 1.3, would be maintained. This impact assessment presents the available evidence to inform policymakers on which product groups could be envisaged under such extension. As this is based on preliminary screening exercises, this must not exclude other product groups that need to be evaluated as well. As this is based on preliminary screening exercises, this does not exclude further product groups to be evaluated and to be considered under this, or a following, extension.

The implementing measures and the working plan of the baseline scenario would be implemented without delay.

After the adoption of the amended Ecodesign Directive by the EU the working plan would be updated or extended to cover products beyond energy using products while maintaining the exclusion of means of transport. Based on this working plan, technical studies for implementing measures per product group would be launched. Based on these technical studies the Commission would prepare implementing measures for specific products.

(4) **Option 3**: Extend the scope beyond energy using products including means of transport

The justification to include means of transport would be that means of transports have very significant environmental impacts.

Under this Option the scope of the Ecodesign Directive would be extended beyond energy using products and the exclusion of means of transport, currently specified in art 1.3, would be deleted.

The implementing measures and the working plan of the baseline scenario would be implemented without delay.

After the adoption of the amended Ecodesign Directive by the EU the working plan would be updated or extended to cover products beyond energy using products. Means of transport could also be taken up in the working plan. Based on this working plan, technical studies for implementing measures per product group would be launched. Based on these technical studies the Commission would prepare implementing measures for specific products.

5. ANALYSIS OF IMPACTS

To analyse the expected impacts of extending the scope of the EuP, first the environmental impacts of the options are identified based on available information. The analysis is carried out at the level of broad product categories for which ecodesign can be applicable. The aim is to identify whether an extension of the scope of the framework directive could be beneficial or not. Second, it is investigated whether the Ecodesign Directive could apply to the product category. This is done by looking at the complementarity of the Ecodesign Directive with

[11] http://ec.europa.eu/energy/demand/legislation/doc/planning.pdf

existing legislation and by looking at the applicability of the concepts of the Ecodesign Directive to the product group. Finally, indicative potentials in terms of environmental improvement and economic and social impacts are assessed for the 3 options.

Changing the scope of the Ecodesign Directive does not have direct impacts since the Ecodesign Directive is a framework Directive. The environmental, economic and social impacts are linked with the implementing measures for specific product groups. These implementing measures are adopted by the Commission in a comitology procedure. As the current Ecodesign Directive already mentions, before implementing measures are adopted stakeholders will be consulted and a specific impact assessment will be made by Commission services. All results presented in this document are illustrative of the impacts that could be reaped by having implementing measures for products of the different options.

Moreover, it is worth stressing that the impacts of the implementing measures would only be realised in the long run. It takes time to develop implementing measures because it is done product by product and are only adopted after a thorough policy making process.

Finally, it should be emphasised that for any implementing measures that could be adopted in the future, a much more detailed analysis will be carried out, as is already now the case for implementing measures under the Ecodesign Directive.

Option 1: No Policy change (baseline)

In this section evidence is presented on the environmental impacts of energy using products, then the potential of energy using products to reduce CO2 emissions is discussed, finally an assessment is given of the environmental impact of energy using products beyond CO2 emissions. The assessment of the environmental improvement potential and the economic and social impacts of the three options is undertaken in a later section and summarised in Table 8**.**

The baseline does not include the expected impact of the Energy and Climate change package on the improvement of the energy efficiency.

The Emission Trading Scheme (ETS) forces producers to buy emission rights for their production related CO2 emissions. It is likely that producers would at least pass through some of these costs to consumers. These increased costs will to some extent change the behaviour of consumers. To model these pass through effects and their impact on consumer behaviour requires very complicated modelling and is beyond the scope of this impact assessment. One of the most likely direct effects is a higher electricity price. This electricity price will make energy savings products even more beneficial. Consumers would rationally react to higher electricity prices by saving energy by for example buying more energy efficient appliances. However, as demonstrated in the problem section (and in the impact assessment accompanying the SCP/SIP action plan) and also recognised in, for example, the Stern Report, product policy can complement the ETS since it solves some market failures not directly addressed by ETS, in particular relating to information asymmetries, bounded rationality and principal agent problems. For the comparison of the different options it seems that not including ETS in the baseline does not change the comparison between Option 1 and Option 2. For both a higher electricity price seems the most significant impact of ETS. However, some means of transport under option 3 are not directly affected by the electricity price. Therefore, Option 3 seems less affected by ETS than option 1 and 2.

The renewable energy targets of the Energy and Climate Package will decrease the CO2 content of electricity production. This will make the CO2 savings of energy efficiency measures smaller. However, there seems again no difference for the comparison of option 1 and 2 concerning the impact of the renewable energy targets.

Based on Labouze et al (2003), the environmental impact of energy using products is between 31% and 36% of all impacts studied. See table 3. It is to be stressed that due to the pre-selection, as done by the Labouze study, of product groups that are commonly understood to have a high environmental impact, many of which are energy using products, these are overrepresented. Important meta groups of products including food are under-addressed. That means that the true contribution of EuPs to the overall environmental impact is lower than approximated, i.e. the importance for extending the EuP Directive to non EuP products is higher than found by that study. Furthermore, the study of Labouze does not differentiate between different production processes. This is obviously especially relevant for non-energy related products, which are dominated by the production phase. Considering this additional argument it can be concluded that the relative share of non energy using products among the overall impact is much higher than the stated ca. 66%.

Table 3 Environmental impacts of energy using products, yearly values

	per capita (€)		EU-27 (bn €)		% of total impact	
Product	Min	max	min	max	min	max
Space heating[12]	24.6	111.6	12.18	55.02	11%	12%
EuP domestic appliances	16	101	7.7	49.5	7%	11%
Appliances and lights	13	58	6.2	28.4	6%	6%
Water heating	8	38	3.9	18.9	4%	4%
Cooking	4	16	1.7	7.6	2%	2%
EuP IT	3	17	1.5	8.5	1%	2%
Total EuP	**68.6**	**341.6**	**33.18**	**167.92**	**31%**	**36%**

Source: Labouze et al (2003)

Energy using products are responsible for a substantial share of greenhouse gas emissions and have a demonstrated improvement potential. The preparatory studies for the implementing measures of specific products have largely confirmed the environmental savings potential and have demonstrated that the minimum requirements could lead to significant monetary savings. Indeed, the studies for the implementing measures of the Ecodesign Directive have shown that for boilers and water heaters a mix of ecodesign, installation and labelling requirements would result in yearly net savings of €45 billion as of 2020[13]. In addition, extrapolations based

[12] Since space heating impacts can be reduced both by the improving the energy efficiency of heaters and by improving the energy efficiency of the insulation, the environmental impacts of space heating have been divided in 60% for EuP and 40% for non-EuP. The division is based on the estimation that up to 40% of the heating requirements can be saved by installing better insulation source:Ecofys (2002).

[13] See p 32. of R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Boilers (2007), Task 7, p. 39 and R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Water Heaters (2007), Task 7. And see p 39 of R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Boilers (2007), Task 7, p. 39 and R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Boilers (2007), Task 7

on a recent study by McKinsey discussed in Annex II seem to confirm that significant amounts of CO2-equivalents can be saved while saving money to the consumer.

For other significant environmental parameters the reduction potential for energy using products is less significant. Table 4 below shows the share of CO2-equivalent related costs in the cost of total externalities for energy using products. The share of cost related to CO2-equivalents in total environmental cost is between 44% and 86%. It could reach 90% for specific energy using products such as space heating and water heating.

Table 4 Share of Greenhouse gases in environmental impacts for energy using products, yearly values

	Per capita (€)		% of total external costs for considered products[14]	
Product	Min	Max	min	max
Space heating	22.2	56.6	90%	51%
EuP domestic appliances	13	32.4	83%	32%
Appliances and lights	11	28.9	87%	50%
Water heating	8	19.5	99%	51%
Cooking	3	7.9	86%	51%
EuP IT	2	6.1	65%	35%
Total EuP	59.2	151.4	86%	44%
Total Products	169	416	77%	44%

Source: Labouze et al (2003)

Conclusion

The main conclusion of this section is that the current possible coverage of the Ecodesign Directive has a significant potential to reduce CO2 and other greenhouse gas emissions, by far the most significant environmental impacts of energy using products. In the section on environmental impacts below, summarized in Table 8, it will be demonstrated that the potential of ecodesign for energy using products to reduce other environmental impacts beyond CO2 is more limited.

[14] It is to be stressed that the calculation of external costs necessarily overestimates the relevance of CO2 as many other environmental impacts are not included, e.g. land use (e.g. for agriculture, mining, transport, housing) opposed to nature, which is in between understood to be of similar relevance as climate change.

Option 2: Extend the Ecodesign Directive beyond energy using but the exclusion of means of transport would be maintained (art. 1.3)

In this section evidence is presented on the applicability of the eco-design directive for non-EuP and the environmental impact of all products, except means of transport. The assessment of the environmental improvement potential and the economic and social impacts of the three options is undertaken in a later section and summarised in Table 8.

Table 5 shows the products that, based on a preliminary screening in Annex III, satisfy the requirements of art 15.2 of the Ecodesign Directive. These product groups are presented for illustrative purpose only and do not imply that the European Commission would take them up in the Working Plan. Indeed, the analysis done here is proportionate for this impact assessment. To select the products for the Working Plan the European Commission would consult stakeholders and check the requirements of art 15.2 in much more detail before taking a policy decision on which products to include in the Working Plan. For example, the product groups referred to in the below table are quite broad. For the working plan the product definition would be narrower such that a much more precise judgment could be made whether to include a product in the Working Plan or not. Moreover, the inclusion of a product in the Working Plan does not necessarily imply that an implementing measure would eventually be adopted for that product by the European Commission.

Based on a **preliminary screening**, the products that satisfy art 15.2 of the Ecodesign Directive would be construction products, textiles, water using products and furniture. These products account for 22-25% of the environmental impacts studied by Labouze et al (2003). As already discussed this is however underestimated (see in above section on Option 1).

Table 5 Environmental impacts of non-energy using products excluding means of transport, yearly values

	per capita (€)		EU-27 (bn €)		% of total impact	
Product[15]	Min	max	Min	max	min	Max
Space heating[16]	16.5	74.4	8.12	36.68	8%	8%
Textiles	11.6	67	5.7	32.9	5%	7%
Building structure	11	51	5.4	24.8	5%	5%
Water supply[17]	3.5	42	1.7	20.5	2%	4%
Furniture	3.3	14	1.6	6.9	2%	1%
Total	**45.9**	**248.4.**	**22.5**	**121.8**	**22%**	**25%**

Source: Labouze et al (2003)

15 To avoid double counting water heating has been omitted from this list although more resource efficient water using apparatus also impact on the water heating requirements.

16 See footnote above on how space heating has been divided in an EuP part and a construction part.

17 Although water supply is not a product, eco-design measures on water using products could reduce the demand for water and thus alleviate the environmental impact of water supply.

Important impacts can be expected from the inclusion of construction products such as windows and insulation for refurbishings not covered by the Energy Performance of Buildings Directive. For construction products, implementing measures could improve the insulation capacity for example by setting a maximum U-value according to the intended purposes. U-values summarise the capacity of a material to retain heat, the lower a U-value the better the insulation capacity.

Also other categories can have significant impacts. For water using products examples of eco-design measures are:

- Sensors such that the water stops flowing in the absence of movement.
- Infusion of air into water to decrease the water content per volume unit. Infusing air into water allows saving water without changing the functionality of water using products.
- Toilettes with a dual flush such that the consumer can choose to flush 4 or 6 liters of water.
- The main benefits of ecodesign for water using products would be a reduction in total water use of 5.2%. Moreover, less hot water spent by shower implies also less energy needed to heat it, which would save 0.20-0.23% of total final energy consumption in the EU-25 which corresponds to 18.2 - 21.7 Mt CO2 emissions saved per year. Reducing water use would also lead to the reduction of environmental impacts of water supply. This reduction potential would be reaped at a rate of 3% a year[18], at low or no extra costs.[19] See Annex IV for more details.

Unfortunately is the Labouze study is limited in scope; while more advanced studies such as EIPRO find other relevant non-energy related products with very high impacts . Some environmental impacts are not appropriately covered as the data used by Labouze et al (2003) was limited e.g. regarding a number of relevant emissions (e.g. human and ecotoxicity; as stated by the authors). As a result; products with a higher relevance in these areas are poorely represented in the overall results (e.g. paper products). Due to lack of data or incomplete data (especially for the production stages as can be seen in the annex of the study), the impact of non-energy using products is additionally underestimated.
Possible large improvement potentials in this area will require further investigation of these products.
The Ecodesign Directive encourages self regulation as an alternative to implementing measures (art 17). The indicative criteria for the admissibility of self-regulatory initiatives as an alternative to an implementing measure in the context of this Directive are: Openness of participation; Added Value; Representativeness; Quantified and staged objectives; Involvement of Civil Society; Monitoring and reporting; Cost-effectiveness of administering a self-regulatory initiative; sustainability and incentive compatibility. Several sectors could be interested in self-regulation.

Conclusion

In summary, this section shows that there are non-energy using products that would meet the requirements of art 15.2 of the Ecodesign Directive. Moreover, for many t of these products there is a clear potential for ecodesign measures that appear to be cost effective. Below, see Table 8, evidence will be presented that overall environmental improvements are substantial as well.

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[18] A replacement rate of 3% is the rate commonly used for construction products. This replacement rate assumes that all construction products have an average life time of 33 years.

[19] See annex IV and footnote 75.

(5) **Option 3:** Extend the scope beyond energy using products including means of transport

This section presents evidence on the environmental impact of means of transport. Then the potential of these products for reducing CO2 emissions is discussed. In addition, it is discussed whether the Ecodesign Directive is the appropriate framework to regulate the environmental impacts of means of transport. This exercise is done separately for road transport and other means of transport. The assessment of the environmental improvement potential and the economic and social impacts of the three options is undertaken in a later section and summarised in Table 8.

Table 6 shows that the environmental impact of means of transport is between 23% and 26% of all impacts studied.

Table 6 Environmental impacts of means of transport, yearly values

	per capita (€)		**EU-27 (bn €)**		**% of total impact**	
Product	**min**	**max**	**Min**	**max**	**min**	**max**
Personal cars	32	90	15.8	44.1	15%	9%
Goods transport	20	100	10.0	49.2	9%	11%
Transport services	5	28	2.5	13.6	2%	3%
Total means of transport	**58**	**217**	**28**	**107**	**26%**	**23%**

Source: Labouze et al (2003)

These figures show that the environmental impacts of means of transport are sizeable. Passenger cars account for most of the environmental impacts. Ecodesign measures can be taken for the overall vehicle or for the engine and transmissions. For the overall vehicle one can improve the aerodynamics, optimise the weight of the car or reduce the rolling resistance of the tyres. For the engine and transmissions improvements the most promising technologies that exist today reduce the internal friction in engines and improve thermal management. Goods transport also has an important share of environmental impacts. Ecodesign measures in light commercial trucks, reduction of internal engine friction and improved aerodynamics are the two most cost effective ones. For medium to heavy commercial vehicles (trucks and busses) the main design lever is improvements of the power train.For trains, measures to improve the energy recovery when breaking, lightweight modular construction and two-level carriages are available design improvements that would abate CO2. In air transportation one needs to further optimise the construction of planes as regards materials application and engine efficiency. To improve the environmental performance of existing planes one can retrofit them with winglets or reduce the weight of the seats used. Finally, transport services have a small contribution to environmental impacts.

In the next stage it is investigated whether the cost effective level of abatement will be reached by forthcoming legislation and whether the Ecodesign Directive is the appropriate legislative tool for means of transport. This is done for vehicles first and then for the other means of transport.

Vehicles

Road transport accounts for 73% of total energy demand for means of transport[20].

The proper functioning of the Internal Market for vehicles is based on the EC Type-Approval System. This system provides for market access throughout the EU for new vehicles complying with technical requirements relating to health, safety and environmental protection provided by a wide range of Directives and Regulations. Compliance with the legislation is assessed before the vehicles are placed on the market.

With regard to the environmental performance of motor vehicles existing Community policies largely address two main issues:

- *Pollutant emissions from vehicles* (including Nitrogen Oxides, Particulate Matter, Carbon Monoxide, etc) are regulated through the so-called Euro standards, providing limit values for the emission of these pollutants from new vehicles. The Euro standards are becoming more stringent over time to reflect the increasing need for environmental protection and to adapt to technical progress. The latest adopted standards are the Euro 5 and 6 standards[21] for light duty vehicles and the Euro V standards[22] for heavy duty vehicles. The present Euro standard for mopeds and motor bikes[23] is currently reviewed and the Commission is preparing more stringent limit values for these vehicles.
- *CO_2 emissions from cars* are addressed in an integrated approach. A proposal for the main regulation of that approach was adopted in December 2007 and is currently being discussed in Council and Parliament. The regulation would introduce CO_2 emission limits for manufacturers of 120 g CO2 per km for the average new passenger car fleet in 2012. Several other proposals further contributing to reduced CO_2 emissions are in preparation. One example is the upcoming proposal on rolling resistance of tyres and tyre pressure monitoring systems, expected to be adopted by the Commission during the second quarter of 2008.[24] Other types of vehicles (such as light commercial vehicles, trucks and busses and motorbikes) do not have binding CO2 targets yet. The Commission is in the process of evaluating suitable measures and test methods but no decisions on the principles have been taken so far. In principle, the Ecodesign Directive could regulate this.

In addition to these two major groupings, there are several other community policies addressing the environmental impact of motor vehicles. These include the Directives on end-of-life-vehicles (recycling)[25] and the use of certain refrigerants in air-conditioning systems[26].

With regards to pollutant emissions, existing type approval legislation is already forcing manufacturers to take environmental impacts into consideration when designing the vehicles. With regard to CO2 emissions, manufacturers already take this aspect into consideration when designing the vehicles, and will give it even more attention in the future following the

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20 IEA (2006) Energy Technology Perspectives.

21 Regulation (EC) No 715/2007

22 Directive 2005/55/EC. The Commission adopted a proposal for the Euro VI standards in December 2007, currently discussed in Council and Parliament.

23 Provided for by Directive 97/24/EC

24 These two tyre related aspects of CO2 emissions from cars will be included in a wider proposal also covering safety aspects of motor vehicles.

25 Directive 2000/53/EC

26 Directive 2006/40/EC

adoption of the legislative proposals under discussion in Council and Parliament. For example, the impact assessment for a regulation to reduce CO2 emissions from passenger cars specified that 600 M/tonne CO2 emissions would be saved by the regulation between 2010 and 2020[27]. The regulation would also reduce fine particulate matter (PM) by at least 3%, SO2 by at least 14% and NOX by at least 4%. Moreover, the Euro 5 and Euro 6 standards will substantially reduce the quantity of PM in the EU.

In summary, given i) the existing regulatory requirements, ii) the measures proposed by the Commission but not yet adopted and iii) the balance between environmental and safety criteria that are inherent to the Type-Approval System it seems that including motor vehicles under the Ecodesign Directive would have a somewhat limited complementary abatement potential. Due to the complexity of existing legislation related to environmental performance mentioned above it was not possible to determine further improvement potential resulting from applying ecodesign principles to road transport vehicles.

Other means of transport

The potential benefits of covering other means of transport are smaller compared to road transport but still significant. Air transport accounts for 11% of total energy demand for means of transport, water transport for 9% and rail for 3%.[28]

There is however a number of reasons why it will be difficult to apply the Ecodesign Directive to means of air-, water- and rail transport. The volumes sold in EU-27 for these products are below the threshold of 200,000 specified in art 15.2 (a) of the Ecodesign Directive[29]. Moreover, airplanes and ships are continuously entering and exiting the EU. The international nature of these products makes it difficult to regulate the design in a European legislation. . In addition, in Air Transport the main operational cost is and will increasingly be fuel consumption. Thus, less fuel - and hence less CO_2 emissions - is already the main market driver for aircraft design. Finally, for all other means of transport design is often customer specific which also renders the applicability of the eco-design approach difficult.

Conclusion

In summary, this section shows that means of transport have a sizeable impact on the environment and that there is a potential to reduce CO2 emissions. However, the potential abatement in the transport sector seems to be largely addressed and the limited potential benefits of applying the ecodesign approach to regulate means of transport seems not to be proportionate in view of the difficulties that that would engender.

Analysis of environmental, economic and social trends and impacts of the three options

In this section the environmental, economic and social impacts of the three options are further assessed.

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27 Table 5 on p 85 of SEC(2007) 1723

28 IEA (2006) Energy Technology Perspectives.

29 See annex IV for the statistics. However, this threshold is only indicative.

Environmental impacts

To assess the potential of the options to improve on the significant environmental parameters, a simulation has been undertaken based on the EIPRO database for the EU-25[30]. The EIPRO database contains information on the environmental impact of 480 sectors that span the total economy in the EU-25. The EIPRO database considers the environmental impact parameters of abiotic depletion, global warming, ozone layer depletion, human toxicity, freshwater aquatic ecotoxicity, marine aquatic ecotoxicity, terrestrial ecotoxicity, photochemical oxidation, acidification and eutrophication. Finally, these impacts are weighed and condensed by EIPRO into one environmental impact parameter. The weighted cumulative environmental impact is primarily for presentational purpose and for easy comparison of the options. As already mentioned, the methodology for setting implementing measures allows the European Commission to decide which environmental impacts it deems important and it is by no means bound to the analytical approach taken here.

The simulation imposes an exogenous improvement in the environmental performance of 10% or 15%. The 10% or 15% appear conservative based on the efficiency improvement potential between average product performance and suggested minimum requirements in the preparatory studies currently undertaken for the Ecodesign Directive. For the worst performing products in a product range the improvement potential will off course be much higher. Nonetheless, this simulation should be seen as illustrative. For some products, the 10% or 15% can be assumed to be too low or too high.

In the Directive, implementing measures are only considered for products with significant environmental impacts. Therefore, for the purpose of the example, the simulation considered improvement only in the cases of products whose environmental impact are higher than 0.5% of the total environmental impacts in Europe. This is an arbitrary cut-off used for illustrative purposes for this impact assessment.[31] Another illustrative threshold, e.g. 1% or 2.5%, could have been used. Other thresholds would alter the environmental improvement potential but it would not have significantly altered the comparison of the three options. For the purpose of selecting the products for which implementing measures are considered the European Commission does not intend to use this kind of quantitative threshold.

Since the environmental impact of the agricultural phase of the life cycle of food is already covered by the principle of cross compliance under the Common Agricultural Policy, this stage has been excluded from the analysis.

Based on these selection criteria, there are 7 product categories that qualify under option 1 (Table 7). These product categories represent 12.6% of weighted cumulative environmental impacts. There are 11 additional product categories under option 2 that represent an additional 15.0% of weighted cumulative environmental impacts. As argued above this is an underestimation. ,. Finally, one product category under option 3 represents an additional 18.8% of weighted cumulative environmental impacts. The weights used for the aggregation are the ones utilised in the EIPRO study, which were reviewed by the JRC.

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30 The EIPRO database is probably the most comprehensive IO-table of environmental impacts of sectors in Europe. It contains 480 sectors and 283 consumption sectors. It was built up by adapting US data to EU's context and production structure and was calibrated to ensure that the sum of the individual impacts sum up to EU-25 estimated total environmental impacts, in particular in terms of CO2 emissions. For each broad product category, the whole life-cycle costs are included. The EIPRO data is an approximation to the quantification of the environmental impacts, which can be useful to identify major trends due to policy changes. The reference year is 2000

31 Since this simulation is for illustrative purposes, no information is given on which product groups are included and which are not.

Table 7 Summary statistics for the products used in the simulation

	Option 1	Option 2	Option 3
% of total current environmental impacts covered	12.6%	27.6% (+15%)	46.4% (+33.8%)
Number of product categories	7	18(11)	19(12)

In brackets the differences to the baseline option are represented.

The results of the simulation are shown in Table 8 below. These results are illustrative.

Table 8 Annual environmental effect of improving the environmental impact of selected products by 10% in 2020[32] [33] relative to current products

Category	Option 1	Option 2	Option 3
Abiotic depletion	0.0%	-9.5%	-9.9%
global warming	-2.5%	-5.5%	-7.4%
ozone layer depletion	-0.1%	-2.4%	-2.5%
Human toxicity	-0.3%	-2.5%	-5.4%
Freshwater aquatic ecotoxicity	-0.1%	-0.6%	-0.8%
Marine aquatic ecotoxicity	-0.1%	-3.8%	-4.0%
Terrestrial ecotoxicity	-0.2%	-0.8%	-1.1%
photochemical oxidation	-0.4%	-3.0%	-5.5%
acidification	-4.2%	-5.2%	-6.3%
eutrophication	-1.2%	-2.1%	-3.7%
Weighted sum	-1.5%	-4.0%	-5.8%

As can be deducted from Table 8 above, and under the mentioned restrictions of an underestimation for non energy-using products, Option 1 reduces the weighted cumulative environmental impact of the economy by 1.5% compared to the status quo today. The main impacts are on global warming (-2.5% of total) and acidification (-4.2%). For other environmental parameters, the impacts of option 1 are smaller. Option 2 reduces the weighted cumulative environmental impact by at least 4.0% compared to the status quo. Compared to

[32] Since the use phase of products is also assumed to be improved by 10 or 15%, the results implicitly assume that all products are new products. Therefore, the results need to be interpreted as annual environmental improvements in 2020. The forecast do not take into account changes in economic structure or the climate change package.

[33] See Annex V for a definition of technical terms used in this table.

Option 1 the additional improvement potential of Option 2 is at least 2.5%. The main additional impacts are on abiotic depletion, global warming and marine depletion. Option 3 reduces the weighted cumulative environmental impact of the economy by 5.8% compared to the status quo. The additional improvement potential of Option 3 over option 1 is -4.3% and the main additional impacts compared to Option 1 are on abiotic depletion, global warming, human toxicity, marine aquatic ecotoxicity and photochemical oxidation.

The environmental improvement potential of the products, regardless of the option, will be realised over the life cycle of the product. This implies that this improvement potential is gradual and for durable products will only be reaped over the somewhat longer term.

The conclusion of this section is that Option 3 could have the biggest environmental improvement potential. However, since most of the additional improvement potential of Option 3 compared to option 2 is already addressed by forthcoming legislation, Option 2 and Option 3 would have similar environmental improvement potential.

Competitiveness

This section looks into the competitiveness aspect of extending the Ecodesign Directive. A general discussion is followed by a discussion of the internal competitiveness aspects and the competitiveness impacts for SMEs.

Art 15.5 (d) imposes on the European Commission that implementing measures for products cannot have a significant negative impact on industry's competitiveness. This implies that the European Commission needs to assure that implementing measures are only set such that this condition is respected. Art 15.4 (b) clarifies that the following dimensions of "competitiveness" need to be looked at: SMEs, innovation, market access and other international competitiveness aspects, and cost and benefits.

Cost and benefits

It is not straightforward to conduct an analysis of the cost and benefits of potential implementing measures without knowing in detail which products would be covered and how minimum requirements would be set. Besides, the portion of the impacts of ecodesign in option 3 (transportation means) not covered by existing or planned legislation are not differentiable in the current datasets[34].

However, to provide some indication of the nature of the costs and benefits over time of options 1 and 2, the same case studies (water heaters, windows) used in the SCP/SIP Impact Assessment, using the same sources of information, were analysed in greater detail. The results are presented in Tables 9, 10 and 11[35] below. This analysis is illustrative only, but deemed appropriate for the purpose of the current impact assessment. Full blown analysis of the costs and benefits of all potential implementing measures is neither proportionate nor feasible at this stage. A more detailed analysis will be done when identifying the minimum requirements for the product groups .

To analyse potential impacts in the two case studies, the period between 2010 and 2019 was selected. For this period of time, discounted upfront costs of least life-cycle costs products were compared with the discounted upfront cost of products considered to be the "baseline". In the simulation, it was estimated that water heaters are replaced every ten years and that

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[34] For example, the case of more performing tyres, a product that could be covered by Ecodesign, is already considered in the Proposal for a Council and Parliament Regulation on Advanced Vehicle Safety and Tyres.

[35] For a detailed presentation of the analysis, see Annex VIII

windows[36] are replaced every 25 years. This implies that 4% of all windows are replaced in a given year. These payment flows and the benefits (differences in energy consumption) over time were discounted at a rate of 4%. The results are presented in terms of net flows (cost-benefits) (Table 9). The detailed flow of potential cost and benefits is presented in Annex VIII.

Table 9 Present value of net benefits from the inclusion of minimum performance for one example of products in options 1 and 2 (in 2007 Euros)

	Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	**Total**
Option 1 Products	Water heaters "extra small"	-195	-99	-18	49	104	148	184	211	233	248	**865**
	Water heaters "extra large"	684	1563	2277	2848	3297	3640	3894	4072	4185	4244	**30704**
Option 2 Products	Windows (50% double glazing)	-1,020	- 708	- 418	- 150	98	327	539	734	913	1,077	**1392**
	Windows (only double glazing)	-2040	-1416	-837	-300	196	655	1078	1468	1826	2154	**2784**

Source: own estimations from the same sources used in the SCP/SIP Impact Assessment

In the case of water heaters, it appears that there are already appliances in the market that are not only more attractive from a life-cycle perspective but also from the up-front costs (the "extra-large" case). This implies that benefits would be derived from the beginning of the application of the implementing measure. In the other case (extra small water heaters and windows with different proportions of double glazing in the refurbishment) the up-front costs are higher than the ones of less efficient products, implying that the aggregate investment would pay-off only in the longer term.

In terms of energy savings, the penetration of more performing products would induce important savings in all the cases (Table 10).

[36] It is estimated that half of the existing windows have already been replaced by more performing ones. Therefore the analysis concentrates only on the proportion still to be refurbished. This analysis is done only for illustrative purposes. In order to simplify the analysis, only double glazed windows are associated with more efficient insulation performance. However, the Commission is aware that double glazed windows are not needed for every intended purpose in the EU for the purpose of improving insulation. Single glazed windows have also improvement potential in terms of insulation, which can contribute to energy savings. The estimates presented consider two replacement shares with double glazed windows: 50% and 100% of yearly refurbishment.

Table 10 Energy savings per year in GWh

	Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	**Total**
Option 1 products	Water heaters "extra small"	891	1782	2673	3564	4455	5346	6236	7127	8018	8909	**49001**
	Water heaters "extra large"	4007	8014	12022	16029	20036	24043	28050	32058	36065	40072	**220396**
Option 2 products	Windows (50% double glazing)	1669	3337	5006	6674	8343	10011	11680	13348	15017	16685	**91769**
	Windows (only double glazing)	3337	6674	10011	13348	16685	20022	23359	26696	30034	33371	**183538**

Source: own estimations from the same sources used in the SCP/SIP Impact Assessment

In terms of CO2 emissions, each of these products would increasingly reduce the emissions associated with their use (Table 11).

Table 11 emissions savings per year (M t of CO2)

	Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	**Total**
Option 1 Products	Water heaters "extra small"	1	1	2	2	3	4	4	5	5	6	**33**
	Water heaters "extra large"	3	5	8	11	14	16	19	22	25	27	**150**
Option 2 Products	Windows (50% double glazing)	1	2	3	5	6	7	8	9	10	11	**63**
	Windows (only double glazing)	2	5	7	9	11	14	16	18	21	23	**126**

Source: own estimations from the same sources used in the SCP/SIP Impact Assessment

It is clear that addressing both energy-using and non-energy using products could improve their performance and would complement the Climate and Energy package adopted by the

Commission in January 2008. As mentioned above, these are only examples[37] of the potential direction of the impacts and do not imply any commitment to introduce implementing measures for these products. A more thorough analysis would be undertaken in the impact assessment of each implementing measure.

In addition, it needs to be reminded that the provisions of Art 15.5 (d) require such analysis by the European Commission in the Impact Assessment of the implementing measures. The kind of analysis that would be undertaken at the product level:

- The Commission will look at how costly it is to redesign the manufacturing process for those producers whose products would not meet the minimum requirements. Based on this information it will take a decision on the timing of the phasing in of the minimum requirements.
- The Commission will look at the variable cost of adjusting the product in question when determining the level of the minimum requirements.
- The Commission will look at the amount of existing stock of products. This information will be taken into account when deciding the timing of the phasing in of the minimum requirements.

Some general competitiveness aspects of the options

The extension of the Ecodesign Directive should allow the introduction of implementing measures for products with significant environmental impact and significant potential for the improvement of that environmental impact at the lowest economic cost to society. By maintaining the product scope of Option 1, the full reduction potential which can be reaped at no extra cost or even at a gain to private individuals, is not reached. If one would try to reduce certain environmental impacts with the current product scope nothing guarantees that this happens in a cost effective way. For example, water efficient appliances such as showers, taps, washing machines and dish washers all offer households possibilities for water saving[38], equally diminishing the energy required to heat the water. Installing water efficient appliances, e.g. by eco-design, for all of them can reduce the use of a household from 280 l/day today to 167 l/day, representing total savings of 41% of household water use. Yet, under the current scope of the eco-design directive, only the water use of washing machines and dish washers can be regulated. Installing water efficient appliances for energy using products only has a potential to reduce the water use of a household by 12 l/day, representing total savings of 4% of household water use. If one would need to go beyond 4% savings for households and the scope of the Ecodesign Directive would be only energy using products, the current technology would not suffice and it would be very costly to reach this higher target. On the other hand, with an extended scope one can go beyond 4% reduction with existing technologies at lower additional cost.

International Competitiveness

As already stated before, a regulatory dialogue with the main trading partners is ongoing on the implementing measures of the Eco-design Directive. Moreover, manufacturers and countries from outside the EU can participate in the consultation forum for implementing measures of specific product groups.

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[37] Another examples can be found in Annex II, in which a rough extrapolation of the results of a study prepared by McKinsey for BDI is presented.

[38] Numbers based on DG ENV (2007) EU Water saving potential study done by ecologic

The Ecodesign Directive is an Internal Market Directive and will only apply to products placed on the market in Europe. Regardless of which options are taken, imported products would need to comply with the minimum requirements, while exported products would not need to comply with the minimum requirements. Thus, minimum requirements guarantee a level playing field both within and outside Europe. It should be noted that if these two level playing fields are sufficiently different it might be necessary for manufacturers to have two separate production lines, one for products complying with minimum requirements in the EU and one for the rest of the world. This creates additional costs. However, all manufacturers willing to be present on both markets will incur these costs no matter where they are located. Therefore there should be no competitive disadvantage for EU producers on export markets unless foreign producers decide to only serve the rest of the world and thus to save costs for a second production line. Given the substantial size of the EU market this is not particularly likely. It has to be pointed out that if tighter standards in the EU are considered desirable and the rest of the world does not adopt them, this additional cost is unavoidable.

Art 15 requires the European Commission to look into the international competitiveness issue when considering implementing measures. In designing the implementing measures carefully taking into account international competitiveness, the European Commission can avoid a distortion of the international competitive balance. To achieve this it would need to take into account whether manufacturers are active on the domestic market versus internationally, fixed versus variable adjustment cost for manufacturers and access to technology. For the different options it seems that all goods in option 1 and 3 are traded internationally. Some products in option 2 such as textiles are internationally traded goods whereas other products such as windows are not traded internationally to a large extent. Therefore, for products of option 2, it will be important to assess on a case by case basis whether international competitiveness is an issue.

To the extent that demand for environmental products is on the rise globally[39], new export opportunities might arise for European and foreign products that comply with the minimum requirements.

Competitiveness of SMEs

It is also worthwhile to look into the impacts that the Ecodesign Directive will have on SMEs. The Ecodesign Directive can have important benefits for SMEs. For all SMEs, office machinery and equipment will become cheaper because of option 1 and heating costs for offices will be reduced because of option 1 and option 2.

Only 12% of all SMEs are in the manufacturing sector. Those SMEs are responsible for 26% of all turnover for SMEs. Also for SMEs in the manufacturing sector there are important benefits. All motors purchased by SMEs will be cheapest over the life cycle under option 1. This implies that manufacturing SMEs will have a lower energy bill.

For SMEs in the services sector there will only be benefits in terms of cheaper products over the life cycle. SMEs in this sector make up 88% of all SMEs and are responsible for 74% of all turnover of SMEs in 2005 for EU-27. Therefore, for most SMEs there is no downside to the Ecodesign Directive under either option. Moreover, for some there is a considerable upside. For example, small retailers will have commercial refrigerators that are more energy efficient.

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[39] See Roland Berger (2007) Elements of a European Ecological Industrial Policy Working Paper to the Informal Meeting of Environment Ministers in Essen, Prepared for the German Presidency of the EU in 2007.

However, some SMEs will need to demonstrate that their products satisfy the minimum requirements.

The above shows that one cannot make a general statement of the impact of the Ecodesign Directive on the competitiveness of SMEs. Therefore, the Ecodesign Directive contains safeguards such that implementing measures will take into account the competitiveness of SMEs:

- Art 15.4 (b) requires the Commission to look into the issue of competitiveness for SMEs when preparing an implementing measure. Together with Art 15.5 (d) this implies that the Commission will consider, if the competitiveness of SMEs requires it, a transitional period or a stage approach when setting minimum requirements and/or set the minimum requirements taking into account SMEs.
- Art 13.1 imposes an obligation on the Commission to take into account initiatives to help SMEs with ecodesign in the context of programmes from which SMEs can benefit. This is for example done via the Enterprise Europe Network. The Enterprise Europe Network and other dissemination channels will encourage SMEs to adopt environmentally friendly and energy efficient solutions. The Enterprise Europe support centres will consult and advise SMEs. Moreover, the action will aim at developing content for training and dissemination of tailor made information on the subject of energy saving and environmental compliance in SMEs.[40]
- Art 13.2 obliges Member States to ensure, in particular by strengthening support network and structures, that they encourage SMEs to adopt ecodesign principles.

In summary, the implementing measures will need to take into account the competitiveness of SMEs when setting the level and timing of minimum requirements.

Conclusion

This section has shown that limiting the product scope to Energy Using Products (Option 1), does not allow reaping the full reduction potential of environmental impacts that can be attained in a cost effective way. There are no indications that any of the three options would harm the competitive position of European manufacturers in the world. Also for the competitiveness of SMEs there is no indication that one particular option would be more or less harmful for the competitiveness of SMEs. The impact assessments of the implementing measures will need to look into the competitiveness aspects in detail for a specific product.

Social dimension

This section looks into the social dimension of the different options. First, it discusses the social implications of lower environmental impacts. Second, it discusses the short term and long term implications of the Ecodesign Directive. Finally, the employment effects of the different options are discussed.

An extension of the Ecodesign Directive will allow setting minimum requirements such that products' environmental impacts are optimal over the life cycle. Each implementing measure will need to weigh the gains from reducing the environmental impact against the abatement cost. The abatement cost includes effects on jobs, competitiveness and affordability.

Based on the simulations presented above one can give an illustrative indication of the social gains due to the avoidance of externalities of option 1, 2 and 3. This can be done by

[40] Announced in the forthcoming SIP/SCP action plan

multiplying the environmental reduction potential by the cost of externalities.[41] The gains of option 1 would minimally be €3 per year per capita. For option 2 and 3 the minimal gains would be respectively €9 and €13 per capita per year.

Table 12 Cost avoided per capita per year

€	option 1	option 2	Option 3
min	3	9	13
max	14	38	55

For the EU-27 as a whole this corresponds to minimal savings of between €1.6 billion for option 1, €4.3 billion for option 2 and €6.2 billion for option 3.

Table 13 Cost avoided for the EU-27

€	option 1	option 2	option 3
min	1.6	4.3	6.2
max	7.0	18.6	27.0

In a number of cases, the reduction of externalities also generates savings, notably for products whose highest environmental impact occurs during the use phase.

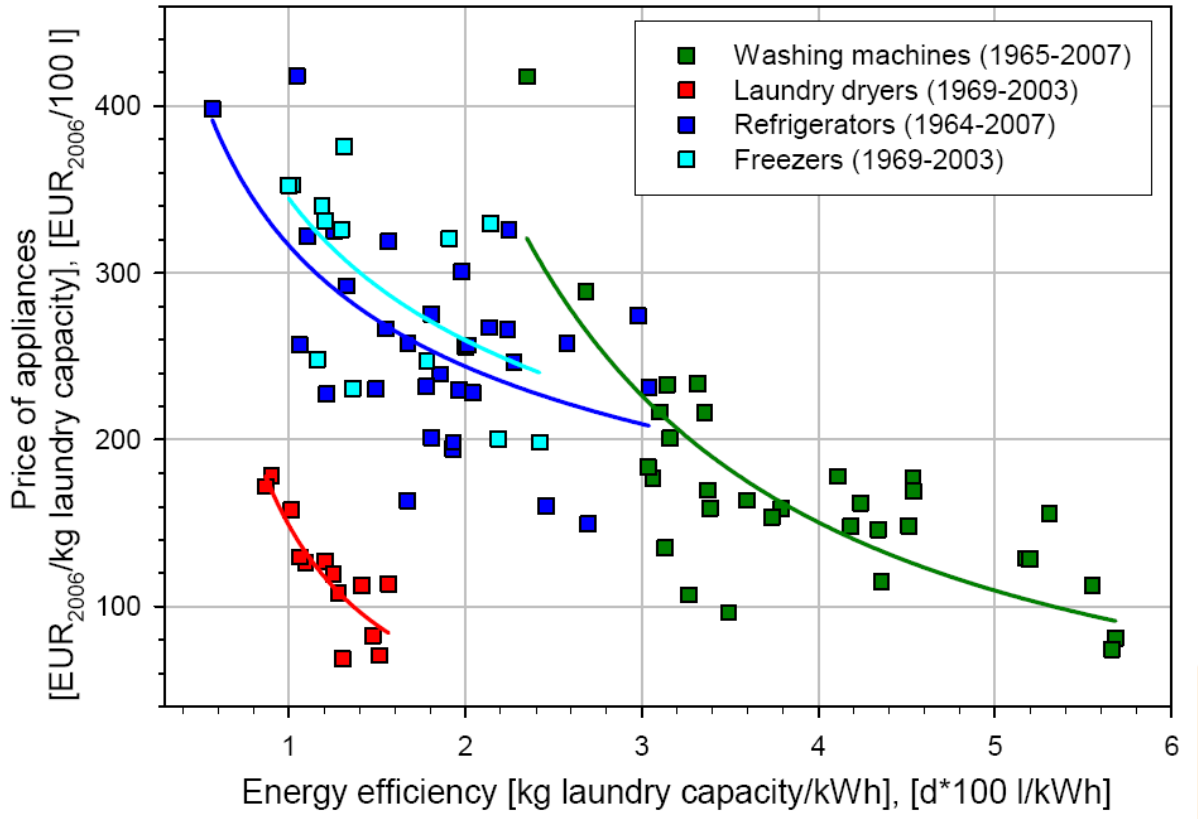
From a social point of view, any extension of the scope of the Ecodesign Directive might create difficulties for low income households in the short term since it is expected that those products that will be removed from the market because they do not fulfil the minimum requirements are the cheapest ones and thus most easily affordable. However, these products also have higher life cycle costs and thus permanently expose low income households to budget pressure, particularly with respect to energy expenditures. The Ecodesign Directive would instead allow a long term budgetary improvement for all households. Nonetheless, art 15.5 (c) obliges the European Commission to set implementing measures such that there shall be no significant negative impact on consumers in particular as regards the affordability and the life-cycle cost of the product. Therefore, the European Commission will consider when setting implementing measures foreseeing transitional periods or a staged approach for the introduction of minimum requirements and will set minimum requirements to balance affordability and the life-cycle cost of the product. Furthermore, short-term adjustment difficulties for low income households could be alleviated by financial measures by the Member States.

Moreover, the impacts on competitiveness and the social dimension of introducing minimum requirements are likely to be limited over the long run. This is due to the tendency for appliances to become cheaper the more appliances are produced (economies of scale). A shift in demand towards higher energy efficient appliances will imply that over time the cost of these appliances will go down. The figure below indicates that from the 1960's until now real

[41] Note that this is not entirely accurate since the calculations are done on the weighted impacts. A correct calculation would be based on the individual improvements of the environmental impacts. This is not straightforward since the cost factors for environmental impacts of Labouze et al (2003) do not correspond to the environmental impacts of EIPRO.

prices of energy efficient energy using products have fallen on average. In Annex III more detailed figures are shown disaggregating the price and resource efficiency effects over time.

Figure 1 Relation between energy efficiency and prices for energy using products over time



Source: Weiss, Junginger and Patel (2008) unpublished

The Ecodesign Directive and employment

Finally, one should also assess the employment effects of extending the scope of the Ecodesign Directive.

The academic literature does not provide conclusive evidence on the relationship between the environment and jobs. Studies by Morgenstern et al. (2002) and Berman and Bui (2001), for the case of US, find no evidence that environmental regulations have adversely affected industrial employment. Other studies for the US indicate that industries located in counties with stringent regulations have experienced job losses, or at the very least lower employment growth rates, relative to industries in less regulated counties[42]. Cole and Elliott (2007) examine the impact of environmental regulations on employment for the UK[43]. No significant

[42] Henderson, V. (1996). Effects of Air Quality Regulation. American Economic Review, 86: 789-813. Kahn, M.E. (1997). Particulate Pollution Trends in the United States. Journal of Regional Science and Urban Economics, 27: 87-107. Greenstone, M. (2002). The Impact of Environmental Regulations on Industrial Activity: Evidence from 1970 and 1977 Clean Air Act Amendments and the Census of Manufacturers. Journal of Political Economy, 110 (6): 1175-1219.

[43] Matthew A. Cole and Rob J. Elliott (2007) "Do Environmental Regulations Cost Jobs? An Industry-Level Analysis of the UK," *The B.E. Journal of Economic Analysis & Policy*: Vol. 7: Iss. 1 (Topics), Article 28.

trade-off between employment and the environment is found. The preferred option of the climate package is projected to have a +0.05% effect on employment in the EU-27[44].

Since, the Ecodesign Directive is an Internal Market Directive it will apply to any product placed on the EU market regardless of the place where the goods are produced. Therefore, it is unlikely that delocalisation and the resulting job losses would occur as a consequence of the enlargement of the scope of the Ecodesign Directive.

However, although the effect on the total economy might be non-negative, some industries can be negatively affected by environmental legislation. Yet, there is evidence that those effects are sometimes overstated initially. The effects of the US Acid Rain Programme on coal mining employment had originally been estimated at 13000-16000 by the year 2010. Current estimates are in the range of 4100 net jobs lost.[45]

Finally, there is some evidence that energy efficiency measures lead to job creation in Europe. One study determined the employment effects of energy conservation schemes for France, Germany, The Netherlands, Spain and the United Kingdom[46]. In all countries, the energy conservation schemes, both for EuP and energy saving appliances such as insulation or windows have been found to create employment. France has since 1974 a programme of tax incentives in place to favour energy saving investments for residential space heating. Over the lifetime of the Income Tax Incentive scheme 71,000 labour years have been created. For Germany, the employment impact of the Thermal Insulation programme, which imposes insulation requirements for new buildings, is 40,100 labour years for the period up to 2010. The condensing boiler programme in the Netherlands, which promotes the uptake of energy efficient boilers, induces a total cumulative employment effect of 3,800 labour years over the period 1995-2010.

The main driving force behind the positive employment effect of investment in energy efficiency in the residential sector is the fact that the energy sector has rather low labor intensity. The resulting shift of expenditures from the energy sector to other sectors with higher labor intensity leads to increased employment. Labor intensity is higher in the construction sector which needs to install energy efficient appliances than in the EuP producing goods or the transport manufacturing sector. This would imply that the products of option 2 would be the most positive for employment.

Conclusion

In summary, this section discussed the social impacts of the different options. The main conclusions are that option 2 and 3 result in lower environmental impacts which have a sizeable social value compared to option 1. Regardless of the option, minimum requirements for products can result in short term negative income effects for poor income households but these are offset by positive income effects over the longer term. This is because minimum requirements are set such that products have the lowest life cycle cost. These long term benefits are general since higher volumes for products with lower environmental impacts will result in price declines for these products. Finally, there is no evidence that either of the options will result in job losses. However, it will be necessary that social impacts are carefully scrutinised in the impact assessments of the implementing measures.

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44 See Table III of Annex I of SEC(2008) 85/3.

45 http://www.epa.gov/airmarkt/resource/docs/coalemployment.pdf

46 H. Jeeninga, C. Weber, I. Mäenpää, F. Rivero García, V. Wiltshire, J. Wade (1999). Employment Impacts of Energy Conservation Schemes in the Residential Sector, project for DG TREN.

6. COMPARISON OF THE OPTIONS

As already indicated above, the possible extension of the scope of the Ecodesign Directive does not trigger any direct cost or benefits. The cost and benefits of the Ecodesign Directive will only arise when an implementing measure will be set for a specific product category.

The analysis in the previous section can be summarised in a decision table:

Option	Disadvantages for covering/limiting under eco-design	Advantages for covering/limiting under eco-design
Not extending beyond EuPs	1) short run negative income effect on low-income households for some products 2) Adjustment cost for those manufacturers which products initially do not meet minimum requirements. 3) Limited environmental improve-ment potential even if relevant cost benefits exist.	1) Significant abatement potential in terms of CO2 2) The Potential for other environmental savings is somewhat limited: Improving the environmental impact of EuP by 10% will lead to improvements of 1.5% of the total environmental impacts. Most of these benefits are however reaped by reducing CO2 and acidification. 3) long run positive income effect on low income households
Extend scope beyond EuP except means of transport	1) Potential short run negative income effect on low-income households for some products 2) Adjustment cost for those manufacturers which products initially do not meet minimum requirements	1) Significant additional abatement potential at low cost per tonne of CO2. 2) complementary to construction products directive and energy performance of buildings directive 3) Potential for other environmental savings is important: Improving the environmental impact of products covered by option 2 by 10% results in additional improvements of at least 2.5% of the total environmental impacts compared to option 1. 4) Compared to option 1, the same environmental impact could be realised more efficiently if the products with the highest savings potential can be covered, regardless of the product category. 5) long run positive income effect on low income households 6) Employment effects could be more positive than for option 1 or option 3
Extend the scope beyond energy using products including means of transport	1) Potential short run negative income effect on low-income households for some products 2) Adjustment cost for those manufacturers which products initially do not meet minimum requirements 3) Type-approval legislation for motor vehicles already provides for stringent requirements on environ-mental performance and an application of the Ecodesign Directive would not provide additional benefits. 4) Current and foreseen legislation already covers the CO2 abatement potential for motor vehicles. The CO2 and cars proposal will save 600 Mt CO2 equivalents between 2010 and 2020. The recently adopted Euro-standards for light and heavy vehicles will also significantly	1) long run positive income effect on low income households 2) Potential for other environmental savings is important: Improving the environmental impact of products covered by option 3 by 10% results in improvements of an additional 4.3% compared to option 1 and an additional 1.8% of the total environmental impacts compared to option 2. But, see point 2 of disadvantages.

	reduce other environmental impacts. Light commercial vehicles, trucks and busses, and motorbikes remain outside the framework. 3) Non-road means of transport are produced in very low volumes making the application of the eco-design framework difficult.

At this stage, it can be recommended based on the available evidence to widen the scope of the Directive to energy-related products. While there are also strong indications that widening the Directive beyond those products could deliver significant benefits, it is recommended to carry out further investigations and further assess the option of including non-energy related products in the scope of the Directive following a future review.

7. ADMINISTRATIVE COSTS

7.1. For Member States and the Commission

It appears that there are two areas in which the actions might generate administrative costs for Members States and the Commission. These are:

(a) Work for defining implementing measures of the Ecodesign Directive. The extension of the product scope of the Ecodesign Directive will broaden the choice of product groups for which implementing measures can be adopted. Among those the products that have a significant environmental impact and potential for improvement will be identified and listed in the Working Plan referred to in Article 16 of the Ecodesign Directive. The eventual additional budgetary needs, resulting from the extension of the product scope will be determined by the Working Plan. The potential allocation of additional resources must be compatible with existing financial programming and will be subject to the current financial and budgetary rules and procedures. The expected integration of the decision structures of the Ecodesign Directive and the Energy Labelling Directive and the informative role of the eco-label suggested in the SCP/SIP Action Plan will provide synergies which guarantee that resources are used such that implementing measures have the biggest environmental impacts at the lowest cost for the economy.

(b) The time and costs involved cannot be quantified precisely but as a guideline it has been assumed that the implementation of the amended Ecodesign Directive would require six full time equivalent work from Commission staff and equivalent amounts of time from officials in at least 10 Member States (it is unlikely that all Member States would be involved in the detailed discussions). Given the average annual cost of a Commission official (€ 117.000/year) this would cost the Commission € 702 ,000. This does not include any add on for overhead costs. The assignment of staff for these particular tasks from existing or additional resources remains subject to resources availability and will be decided in the framework of the annual resources allocation procedure.

7.2. For Manufacturers

Extending the scope of the Ecodesign Directive means that a greater number of products can potentially fall under ecodesign requirements. The total administrative burden impact depends on the number and nature of any self-regulatory standards or minimum requirements imposed by the Commission and the number of products affected by each standard. Therefore it is here only possible to provide a general indication of the possible impacts on administrative burden. For any new minimum requirement, an assessment of the implications on administrative burdens will be carried out. It should also be recalled that Article 15 para 4f of the Ecodesign

Directive requires that an implementing measure does not lead to excessive administrative burden on manufacturers.

The Ecodesign Directive foresees procedures that generate administrative costs for producers. They comprise the following elements:

1. A CE conformity marking needs to be affixed to the product (or the packaging and the documentation) and a declaration of conformity needs to be provided by the manufacturer. Where information on how to install or use the product is provided to the end user, Member States can require this to be in their official language(s). (Art. 5)

2. A conformity assessment needs to be carried out by the manufacturer (or an authorized representative) that establishes that a product fulfills the criteria laid down in a minimum requirement. How this assessment needs to be carried out is specified by the implementing measure. The documentation relating to the conformity assessment needs to be kept for 10 years for inspection and need to be in an official language of the EU. (Art. 8) Details on what documentation needs to be kept are laid down in annex IV to the Ecodesign Directive.

3. Where a product is an input for the manufacturing of a product covered by a minimum requirement, the producer of the input can be required by the implementing measure to provide relevant information regarding the characteristics of his product to the manufacturer of the final product (Article 11). The need to use Article 11 will be assessed by the implementing measures. In principle Article 11 will only be used if the inputs provided are essential to meet the minimum requirements for the end product.

4. The implementing measure can require the producer to provide the consumer with information regarding the ecological profile of the product and the benefits of ecodesign. (Article 14). Article 14 would normally not be used since the Energy Efficiency Labeling Directive will normally be used to provide such information. See forthcoming SCP/SIP action plan.

However, those producers that already have obtained an Eco-label and/or an EMAS certification benefit from the presumption of conformity stated in the current Ecodesign Directive if the criteria of the product are assessed and the relevant standard also complies with the criteria set out in the relevant minimum requirement. Thus, if an assessment of the product design has been carried out already, duplication of costs is avoided.

Administrative costs on a producer level:

Since most products under the Ecodesign Directive fall also under other Single Market Directives, e.g. Machinery Directive, affixing the CE marking to the product or the packaging and documentation should not entail any additional cost.

Most manufacturers also already have a mandatory declaration of conformity and need to add some information specific to this Directive.

The costs of information storage are also deemed minimal. What is costly is the *generation* of the documentation of the conformity assessment. The required information comprises:

(a) a general description of the product and of its intended use;

(b) the results of relevant environmental assessment studies carried out by the manufacturer, and/or references to environmental assessment literature or case studies, which are used by the manufacturer in evaluating, documenting and determining product design solutions;

(c) the ecological profile, if required by the implementing measure;

(d) elements of the product design specification relating to environmental design aspects of the product;

(e) a list of the appropriate standards referred to in Article 10, applied in full or in part, and a description of the solutions adopted to meet the requirements of the applicable implementing measure where the standards referred to in Article 10 have not been applied or where these standards do not cover entirely the requirements of the applicable implementing measure;

(f) a copy of the information concerning the environmental design aspects of the product provided in accordance with the requirements specified in Annex I, Part 2;

(g) the results of measurements on the ecodesign requirements carried out, including details of the conformity of these measurements as compared with the ecodesign requirements set out in the applicable implementing measure.

The most costly elements of this assessment are likely to be related to the environmental assessment studies and the results of measurements on the ecodesign requirements. No empirical data regarding the costs of an assessment is available; however the cost for compliance with Eco-label can serve as a benchmark. According to the impact assessment for the Eco-label Regulation, they vary between 1 000 and 10 000 Euros per product. The costs are believed to be closer to the lower end, or even lower, of the above range for the Ecodesign Directive: Eco-label looks at all environmental parameters and can regulate as much as 25 different environmental parameters. As explained above, the Ecodesign Directive would only impose minimum requirements for the most significant environmental parameters of a product. This would normally imply covering on average 3 and up to 5 parameters. Moreover, the Eco-label Regulation requires third party verification whereas under the Ecodesign Directive self assessment is the default option. Self assessment would be typically cheaper.

Total administrative costs:

The total administrative costs of a minimum requirement consist of the individual producer cost multiplied by the number of products falling under the minimum requirements. This in turn depends largely on the product definition and on the market structure. A narrow market with a limited number of products and few criteria that need to be met will lead to a relatively low total administrative burden. Conversely, a broad product definition, complex criteria and a high number of different products in the market will lead to a significantly higher administrative burden.

Extending the scope of products that can be covered by the Ecodesign Directive in itself does not necessarily entail that the administrative burden will be increased. From an efficiency perspective, reaching certain environmental benefits will be cheaper if the products causing the most significant impact can be addressed rather than to cover a larger number of products that each of them have a minor impact. Overall, the impact on administrative burden is therefore dependent on a number of factors and it cannot be said that extending the scope of the Directive will lead to an increase or a decrease in administrative burden.

8. COST-EFFECTIVENESS

As already explained before, the extension of scope of the Ecodesign Directive has very little impact beyond making it possible to launch new implementing measures. The cost-effectiveness of implementing measures will be addressed in detail per specific product group. This will be done by preparatory technical studies, the stakeholder consultation forum (art 18) and the impact assessments for the implementing measures.

Based on the analysis provided in this impact assessment option 2 is the most cost effective option. Within the products screened in Option 2 a high environmental impact that can be reaped cost effectively would come from energy related products such as construction products and water using products. Furthermore, also a number of other product groups may offer significant potential for cost efficient improvements, as there is evidence that their impact is even more significant than both the Labouze 2003 and the EIPRO study have demonstrated when looking at products such as: detergent/cleaning products, footwear/leather products, other food products, print-media (books, journals, newspaper), hygiene paper, mattresses, batteries, and toys. Ongoing Commission studies will look further into the environmental impact and improvement potential of these products. Further research could also investigate on the environmental and economic sustainability of the use of concrete/cement, steel, aluminium, plastics and other important materials. These product groups and materials are presented for illustrative purpose only

There seems to be little potential for additional environmental improvement in the transport sector beyond current and planned EU legislation. Therefore, option 3 is not withheld.

9. MONITORING AND EVALUATION

The Action Plan foresees regular reporting to the European Parliament. Monitoring on the Ecodesign Directive could provide information on the various stages of the implementation process of the Ecodesign Directive such as:

- number of preparatory studies launched

- number of preparatory studies finished

- number of implementing measures adopted

Moreover, collaboration with the working group of Eurostat on Sustainable Development indicators is envisaged to assess the possibility to include statistics on the resource efficiency of products for which implementing measures are developed. Eurostat could for example report the market share of resource efficient products per labelling category.

The Commission plans to collect further information and evidence as regards the potential benefits of including non-energy related products in the scope of this Directive.

Based on this further assessment; and other relevant information, the effects of the presently recommended widening of the scope and options for a further widening to non-energy related products should be reviewed. To this end; it is recommended to foresee a review of the Directive in 2012.

ANNEX I

Analysis of the Consultation on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plans.

The European Commission undertook two public consultations on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plans.

The first one was targeted to companies. The European Business Test Panel scheme was built up to consult businesses in the different Member States on specific topics of their interest. The companies that have signed up to participate at the Panel are duly informed of the launching of the consultations, which are carried out in all the official languages of the European Union.

In the case of the consultation on SCP/SIP, 354 responded to the survey, of which 66% are SMEs. Companies of all Member States of the European Union, except Bulgaria, Luxembourg and Cyprus, responded to the survey.

In the following table, it can be seen that a majority of the respondents supported the extension of minimum standards to a broad number of products.

Table 1 Business Response to extending environmental minimum standard to a broad number of products

Minimum standards to improve energy and resource efficiency applied to a broad number of products		
Yes	214	(69.3%)
No	65	(21%)
Don't know	30	(9.7%)

Source: SCP/SIP consultation in EBTP

The second public consultation on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plans took place between July 27th and September 23rd, 2007. This consultation was a joint undertaking by DG Environment and DG Enterprise and Industries.

The purpose of the consultation was to gather public and stakeholder's opinions on the different areas of action, on the barriers to improve the situation in these areas and on the options for action. A Background document explaining the issues at stake and the options being under consideration was also available for the respondents. Participants were also invited to provide position papers on the different topic at stake.

The survey was accessed by 658 participants. 479 of them provided their affiliation: 277 were individuals and 202 stakeholders. The industrial sector and the environmental constituency presented both around 30% of total answers. In both groups stakeholders constituted around half of the participants. First, participants were asked what the best options are to promote better products. The results for stakeholders are shown in

Figure **1**. Broadening the scope of products to which environmental minimum requirements apply was seen as the first best option. The combination of dynamically setting minimum requirements for products and setting advanced performance benchmarks for best performing products also received strong report.

Figure 1 opinion of the stakeholders on the options to promote better products

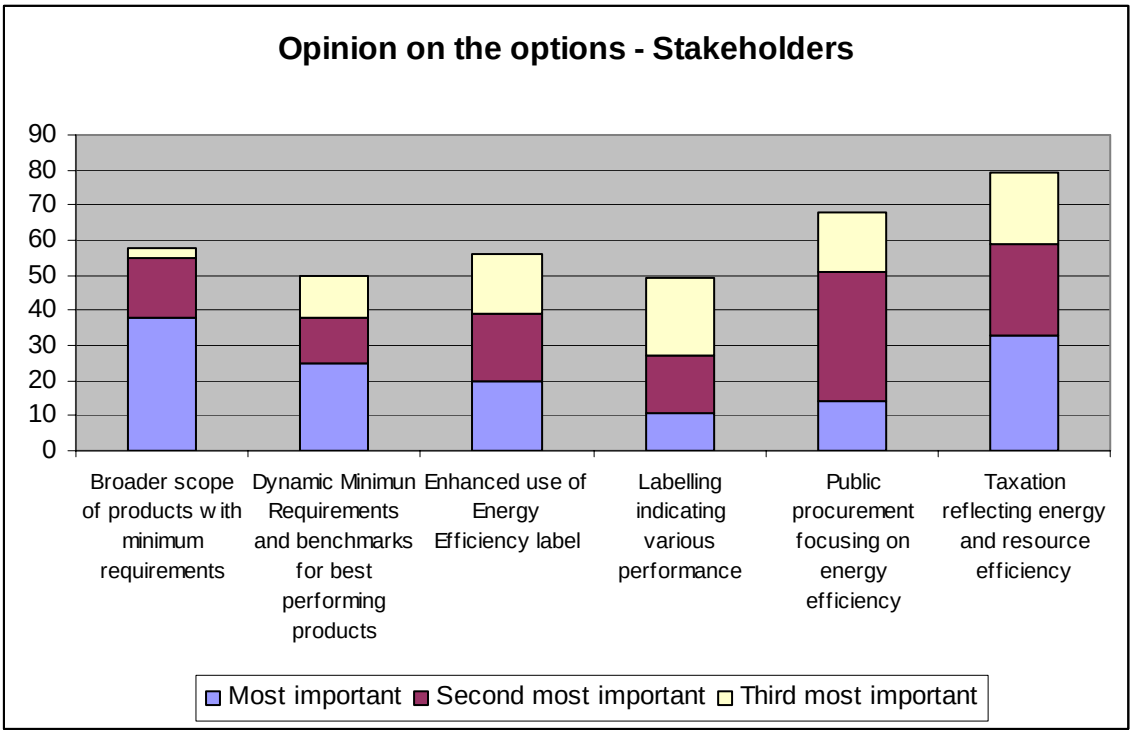
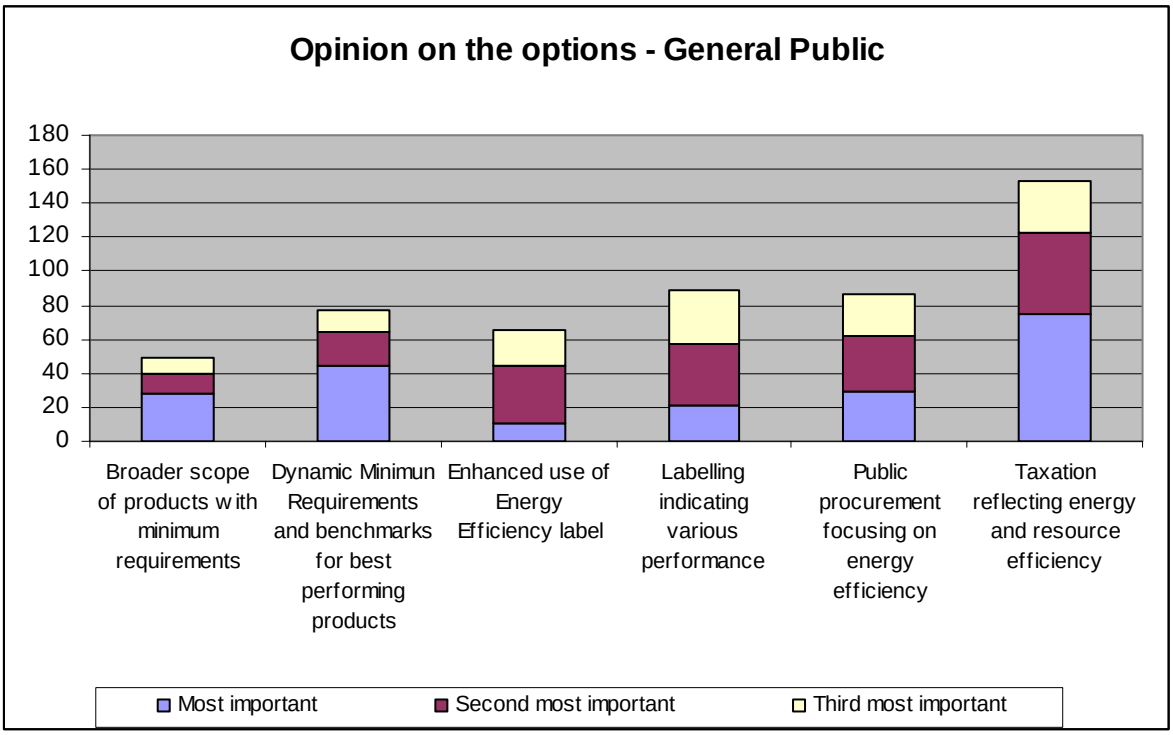


Figure 2 shows the general public's opinion on the best options to promote better products. A taxation reflecting energy and resource efficiency is the most advocated one. The combination of dynamically setting minimum requirements for products and setting advanced performance benchmarks for best performing products also received strong support..

Figure 2 opinion of the general public on the options to promote better products



Finally a strong majority, in particular among stakeholders, agrees that environmental problems need to be tackled in a cost-efficient way while minimizing the social impact (Table 2).

Table 2: Focus of the actions

Focus	General Public / Consumer	Stakeholder/Organisation	Grand Total
Actions need to be cost-efficient even if the positive environmental impacts are not maximised	5.3%	8.8%	6.7%
Actions need to prioritize social viability over environmental impacts	5.3%	2.7%	4.3%
Actions need to tackle environmental problems in a cost-efficient way while minimizing the social impacts	62.9%	80.2%	70.0%
Actions should mainly concentrate on solving environmental problems, regardless of their costs or social impacts	26.5%	8.2%	19.1%

ANNEX II

Study by Mckinsey for the BDI

This annex discusses the results of a study by McKinsey undertaken for the initiative "Business for climate protection" of the BDI Bundesverband der Deutschen Industrie. The study builds on a methodology for a global cost curve developed by McKinsey. McKinsey cooperated with Professors R Socolow; S Pacala, R Williams (Princeton University) and D Anderson (Imperial College London). The methodology for Germany was further discussed with Professors Hellwig (MPI Bonn), Strobele (University of Munster) and Von Weizsacker (University of Cologne).

In this annex the assumptions made by McKinsey; the assumptions made for extrapolation of results from Germany to the EU and the results of the extrapolation are discussed. The information in this annex has not been used in the revised version of the impact assessment report but it is consistent with the arguments brought forward and provides additional insights concerning the economic and environmental benefits that could result from extending the scope of the Ecodesign Directive.

Assumptions made by McKinsey

To calculate the abatement cost per tonne of CO2 for a product it seems that the life cycle cost for the users of the product and the energy consumption over the life cycle are compared for energy efficient and current products. The time period over which the abatement cost is calculated is therefore the life cycle of the product which is different from product to product. For example for vehicles a 4.5 years first ownership for private owned cars was assumed.

The following discount rates to calculate the NPV of the life cycle cost of products have been used:

Table 1: discount rates used in the McKinsey study

Decision maker	Discount factor
Individuals	4.5%
Industry	9.5%
Commercial	9%
Energy sector	7%

The choice of a discount rate influences how future benefits and costs are translated into current benefits and costs. For energy efficiency, cost are immediate whereas benefits accrue over time. The higher the discount factor the lower the future benefits are in net present value. The lower the discount factor the higher the future benefits are in net present value.

Discount factors in the range of 4.5-9.5% are reasonable. Therefore, the discount factors have not been used to overstate the benefits of the energy efficient investments.

However, using different discount factors for decision makers influences the most cost effective measures. The discount factors chosen by McKinsey make energy efficient investments by individuals more cost effective than those by industry.

The annual oil price is assumed to be $57 in 2010 and $52 in 2020. The reference for the oil price is the Annual Energy Outlook 2007. The exchange rate assumed was 1 euro would cost 1.2 dollar. A higher oil price would inflate for example the benefits of alternative energies and more fuel efficient cars.

Finally, McKinsey assumes that the demand of consumers does not change as a result of climate change measures and also that the industrial structure would not change. These assumptions are unrealistic but adding more realism would require significantly more complex models.

Assumptions made for extrapolation of results from Germany

The assumptions for the extrapolation of results from Germany to the EU-27 are presented and evaluated in this section. In general the extrapolation of the results gives illustrative indications of the likely effect at the EU level.

For the own calculations based on McKinsey (2007) the results for Germany have been multiplied by the inverse of German's share in EU-GDP to obtain the EU results. In the aggregate this assumption seems to be justified for the purpose of providing an indication of potential impacts: Germany is slightly more CO2 intensive per toe than the EU-27 as a whole. Germany's production of electricity emits more CO2 since it is relatively reliant on coal and less reliant on nuclear and renewables.

Table 2: Source of electricity generation as % of total

2004	EU27	Germany
Coal	29.9%	48.6%
Oil	4.4%	1.6%
Gas	19.7%	11.4%
Nuclear	30.7%	27.1%
Renewables (*)	13.9%	9.5%
Other (***)	1.4%	1.8%

Source: Energy & Transport in figures Statistical pocketbook 2007

Table 3 provides some comparative figures for Germany and EU27. In terms of emissions intensity, the distortion is factor 2.4 tCO2/toe / 2.2 tCO2/toe =1.09. So, extrapolating the results to EU 27 would be overestimated by 9%. Yet Germany is less energy intense –due to structure of industry; existing levels of insulation; efficiency of car park- than EU27. Factor 164 toe/MEUR / 185 toe/MEUR=0.88. So, in terms of energy intensity, the results of the extrapolation would be underestimated by 12%. Combining the two, Germany emits slightly less CO2 per Euro (per Million Euro of GDP (393.6 tCO2/MEUR / 407 tCO2/MEUR=0.967076). Therefore; using GDP to extrapolate abatement costs potential appears to be a reasonable approximation.

Table 3: Key indicators for Germany and EU-27 used to estimate the potential errors of the extrapolation of Germany's results in McKinsey (2007) to EU-27

Key Indicators (2004)

	GERMANY	EU-27
Energy per capita (kgoe/cap)	4 215	3 689
Energy intensity (toe/MEUR '00)	164	185
Energy import dependency %	61.3	50.1
CO_2 Emissions (Mt)	840	4 004
CO_2 intensity (tCO_2/toe)	2.4	2.2
CO_2 per capita (kg/cap)	10 187	8 180

Source: factsheet DG TREN 2007

The study of McKinsey uses a conversion factor of 0.72 Tonne CO2 equivalent per Mwh in 2004 which declines to 0.64 Tonne CO2 equivalent per MwH in 2020 as a result of the changes in the energy production sector[47].

Also, distortions at sectoral level could invalidate extrapolation of Germany's results to the EU-27.

Buildings: Ecofys estimates that the abatement potential of state of the art insulation is 67% reduction in heat loss in Germany compared to an average reduction of 56% in EU-12[48]. Therefore, extrapolation of Germany's result could be a 67/56 (19%) overstatement for the EU-27. However, Germany is fairly advanced in replacing single glass for double glassed windows. In Germany only 27% of the window surface is single glassed compared to 45.4% being single glassed in the rest of Europe.[49] Based on the windows surface being single glass the result could be an understatement of the savings potential for the EU-27. Although, climatologic conditions do play a role, the savings potential is there. In the Netherlands, single glassed windows are 40% of the total window surface, in France 44% and in Belgium 46%.

Transport: Germany's new cars emit more CO2 than the average in EU-27. The factor is approximately 172/158=1.09.[50] So, extrapolating Germany's result on cars seems to be a slight over-estimation. On the other hand; the car stock in Germany is probably somewhat more often replaced than in EU-27 which could counterbalance the over-estimation.

Energy production: as shown above, Germany's production of electricity emits more CO2 since it is relatively reliant on coal and less reliant on nuclear and renewables.

Energy Using appliances: Since all other sectors are more energy intensive than the EU-27 while Germany's total economy is less energy intensive than the EU-27, it must be that other household use of energy and industry's use of energy in Germany is less energy intensive than the EU-27. This implies that the savings for energy using appliances (corresponding to household use of energy and industry) are starting from a relatively high level of energy efficiency. Since the EU-27 starts from a lower level of energy efficiency the extrapolations for energy using products could well be an underestimation of the EU-27 savings potential.

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47 See footnote 58 of McKinsey (2007).

48 Austria, Belgium, Denmark, Finland, France, Germany, Ireland, UK, Spain, Sweden, Netherlands, Italy.

49 Based on GEPVP the association of glass manufacturers.

50 Impact Assessment CO2 in cars.

Based on economic theory, one could claim that Germany's energy efficiency should already be higher than the EU-27. Indeed, electricity prices for industry are on average 15% higher and for households more than 20% higher than in EU-27. These higher prices should induce more energy efficient purchases.

Table 4: Average electricity prices

Industry	2005	2006	2007
EU-27	0.0672	0.0752	0.082
Germany	0.078	0.0871	0.0946
Difference	16%	16%	15%
households	2005	2006	2007
EU-27	0.1013	0.1068	0.1173
Germany	0.1334	0.1374	0.1433
Difference	31.7%	28.7%	22.2%

In sum, to a first approximation the extrapolation from Germany to the EU seems not totally unreasonable and can give a ballpark estimate of the likely impacts at the EU level.

Discussion of the results of the extrapolation

The important environmental impacts of energy using products include direct and indirect greenhouse gas emissions. Significant evidence exists that the energy use and the related greenhouse gas emissions of energy using products can be significantly reduced. Only those product design policies that are abating CO2 emissions and that would pay back over the amortisation period of the users are included in the analysis. So, all abatement potential that costs more than €0 per tonne CO2 are not taken up. The table below shows the yearly CO2 emission reduction potential by ecodesign measures in 2020 for energy using products. The second column presents the CO2 reductions which can be achieved with existing technology if the market failures identified above are resolved[51]. The yearly CO2 reduction potential of energy using products is considerable with 287 million tonnes of CO2[52]. This is equivalent to a reduction of 7.2% of current emissions[53]. The third column presents the costs per tonne CO2 of undertaking these measures keeping into account initial investment and savings during the use phase. On average €124 will be saved per tonne of CO2. The fourth column presents the total net savings. Total net savings equal the abatement cost per tonne CO2 multiplied by the CO2 reduction potential. In total, € 35.7 billion can be saved.

51 See p 5 of McKinsey (2007)

52 The original communication on the EuP directive estimated the potential benefits at 200 million tonne of CO2 per year by the year 2020

53 Source for current emissions is CAIT 2007.

Table 5: Cost-benefit of yearly CO2 emissions reduction potential by eco-design measures for energy using products in 2020[54]

Sector	CO2 reductions which have negative abatement costs (Mt CO2 equivalent)	Abatement cost per t CO2 equivalent	Net savings (billion €)
Household sector	157.3	-130	20,5
Industrial sector	129.9	-117	15,2
TOTAL	287	-124	35,7

Source: own calculations based on McKinsey (2007)

Table 5 shows that investing in more energy efficient products will not only lead to lower emissions but lead to considerable savings for households and industry. These estimates are conservative. Indeed, the studies for the implementing measures of the Ecodesign Directive have shown that for boilers and water heaters a mix of ecodesign, installation and labelling requirements would result in yearly net savings of €45 billion as of 2020[55] On the basis of the EuP preparatory studies it is estimated that a comprehensive set of ecodesign requirements for the remaining major energy-using products would bring another € 30 billion of saving per annum as of 2020.[56]

Table 6 shows the CO2 abatement potential for innovative detergents and construction products. Only those investments that pay off are analysed. For example, 2L-renovation, which is more energy efficient that the other options, comes at cost of over €100 per tonne CO2 and is not analysed.

54 For a discussion of the assumptions made see Annex II.

55 See p 32. of R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Boilers (2007), Task 7, p. 39 and R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Water Heaters (2007), Task 7. And see p 39 of R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Boilers (2007), Task 7, p. 39 and R. Kemna, M. van Elburg, W. Li, R. van Holseijn. Preparatory study on the Ecodesign of Boilers (2007), Task 7

56 http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm#consultation_forum

Table 6: Cost-benefit of yearly CO2 emission reduction potential by ecodesign measures for option 2 in 2020

	Cumulative abatement potential (Mt CO2 equivalent)	Abatement cost per t CO2 equivalent	Net savings (million €)
Innovative detergents	4.7	-336	1600
7L-renovation[57] (multi-family house)	19	-135	2559
7L-renovation (3-6-family house)	18	-60	1052
7L-renovation (1-2 family house)	60	-49	2949
Office building insulation	12	-26	320
School building insulation	2	-15	36
TOTAL	115.7	-65	8516

Source: own calculations based on Mckinsey (2007)

The huge and very cost efficient potential of innovative (ambient temperature washing) detergents is due to the caused cost savings, as another recent and independently reviewed study from Procter and Gamble confirms (Procter&Gamble 2006). The total CO2 emission savings potential sum up to about 5 M t / year in the EU, assuming a replacement of 2001 market leading detergents by cold-wash detergents, of which the first products now enter the market. Of the reduction potential in the construction sector, 78 Mt of CO2 would be due to the use of construction products. The other reductions in the construction sector would be due to the combination of the product specific approach of the Ecodesign directive and the whole building approach of the Energy Performance of Buildings Directive.

The table below shows the yearly CO2 emission reduction potential for means of transport in 2020. Only those policies that are abating CO2 emissions and represent cost savings are shown[58]. For example, hybrid cars have an additional cost of over €1000 per tonne CO2 abated. Moreover, only those policies that are related to ecodesign improvements are withheld. Changes in consumption behaviour and other measures unrelated to ecodesign are not taken up. The cost effective saving potential of product design for means of transport is largely due to cars (37.4 Mt CO2 e), other vehicles (8.5 Mt CO2 e) and trains (8.5 Mt CO2 e). The potential of ecodesign for airplanes (2.3 Mt CO2) seems to be less important.

[57] 7L renovation is a renovation which reduces the heating needs of a house to 7 liters of heating oil per square meter every year

[58] Own calculations based on McKinsey (2007). Note that ships are not discussed by this study.

Table 7: Cost-benefit of yearly CO2 emission reduction potential by ecodesign measures for means of transport in 2020

Sector	CO2 reductions which have negative abatement costs (Mt CO2 equivalent)	Abatement cost per t CO2 equivalent (averages)	Net savings (€ million)
Cars	37.4	-139	5213
Light, medium and heavy vehicles (trucks and buses)	8.5	-167	1422
Train	8.5	0	0
Air	2.3	0	0
TOTAL	56.8	-117	6635

Source: own calculations based on McKinsey (2007)

As shown in Table 8 below, products of Option 1 have a savings potential of 287 Mt CO2 and could save €35.5 billion for consumers and companies. Products of option 2 have an additional savings potential of 122 Mt CO2 and could save €8.5 billion for households and consumers. Products of option 3 have a savings potential of 57 Mt CO2, and could save €6.6 billion for households and consumers. However, the saving potential for means of transport is already addressed by forthcoming legislation.

Table 8: Cost-benefit of yearly CO2 emission reduction potential by ecodesign measures for selected products of the three options in 2020

Sector	CO2 reductions which have negative abatement costs (Mt CO2 equivalent)	Abatement cost per t CO2 equivalent (averages)	Net savings (€ billion)
Option 1 Energy using products	287	-124	35,7
Option 2 All products except means of transport	122	-65	8,5
Option 3 Means of transport	56.8	-117	6,6

Source: own calculations based on McKinsey

ANNEX III

Illustration of learning curves and the fall in prices and rise in energy and resource efficiency for energy using products[59]

This annex illustrates learning curves and the fall in prices and rise in energy and resource efficiency for energy using products.

For washing machines, laundry dryers and refrigerators the stylised facts seem to be: declining prices and declining energy (and water) consumption.

Figure 1 Price and resource developments of washing machines

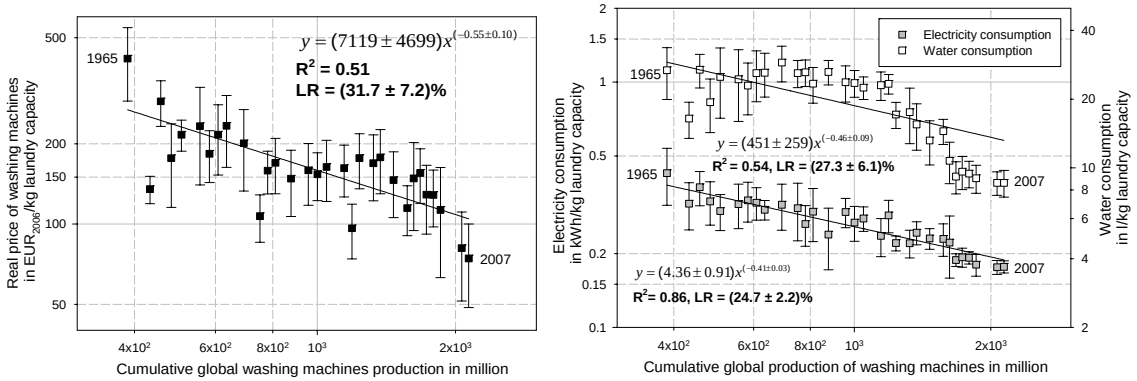


Figure 2 Price and energy efficiency of laundry dryers

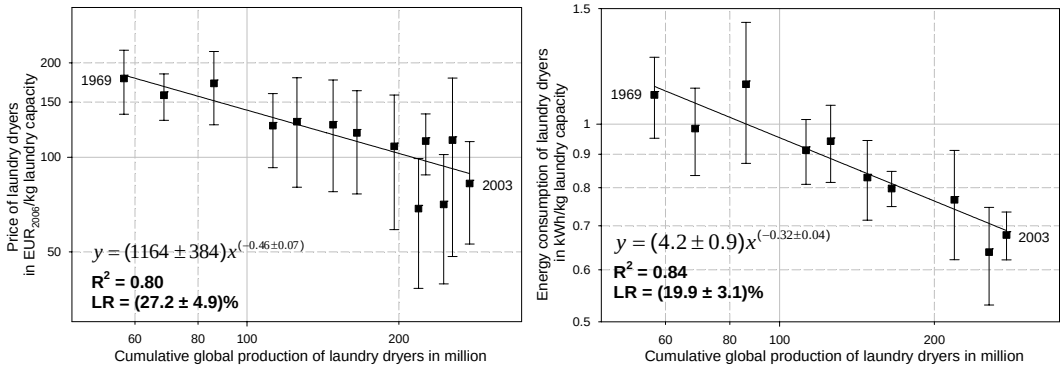
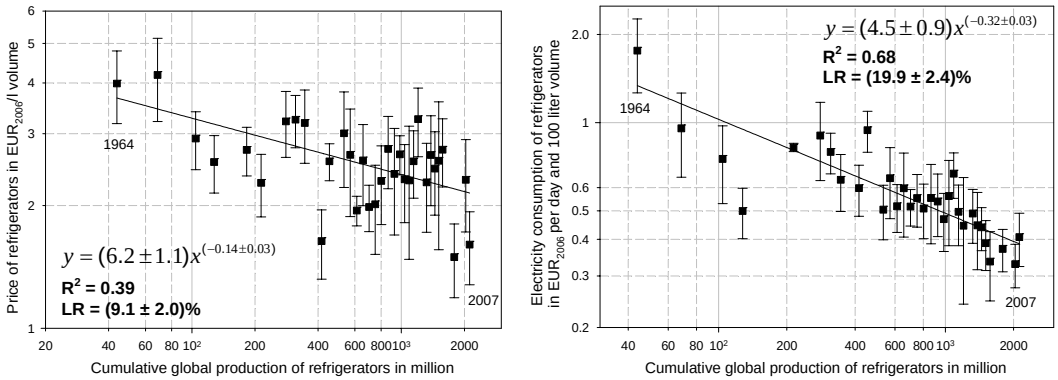


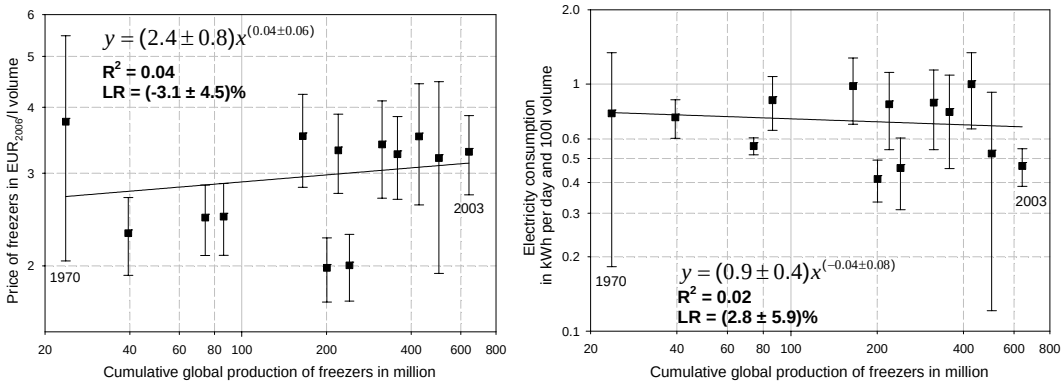
Figure 3 Price and energy efficiency of refrigerators



For freezers both prices and energy efficiency have remained relatively constant over time for the studied sample. Given the limited number of observations, one should be cautious about inferring general statements on price and energy efficiency of freezers.

59 This section is based on Weiss, Junginger and Patel (2008) unpublished.

Figure 4 Price and energy efficiency of freezers



ANNEX IV

Detailed discussion of applicability of eco-design to option 2 products

This annex contains a more detailed discussion on the applicability of the eco-design Directive to option 2 products.

Construction products

a) The extension of the Ecodesign Directive to construction products can be complementary to current policies relating to the energy performance of buildings:

The construction products directive (Directive 89/106/EEC) sets measurement standards for the technical performance of construction products. It assures that requirements set by Member States on buildings (or building elements), notably as regards the environment and the energy economy and heat retention, are consistent with these measurement standards.

The Energy Performance of Buildings Directive (Directive 2002/91/EC) only covers new buildings and major renovations – representing 25% of the building value- for existing buildings above 1000 square meters. However, existing buildings below 1000 square meters account for around 70% of the overall building stock and more than 70% of the energy consumption related to buildings. Besides, "minor" renovations, such as replacing single glassed windows by single glassed with better insulation capacity and/or double glassed windows, also have a significant environmental potential. For this type of small, product specific improvements, principal-agent problems are precisely the biggest. In addition, there is a need to deal with significant environmental impacts of construction other than the energy performance. For civil work and the building structure, the energy related externalities – CO2 emissions - are only 25-35% of all environmental externalities[60]. Setting minimum requirements for the most significant environmental impacts of construction products could contribute considerably to enhance the overall environmental performance of buildings.

Eco-design requirements for energy saving products could be complementary to the EPBD. The eco-design requirements would, for instance, set minimum requirements for important energy saving products. By doing so:

- Internal market problems in relation to Member State specific performance requirements on products are solved.
- The potential of small product specific improvements can be reaped.

b) Based on Labouze et al (2003), the total environmental impact of construction is between 15% and 16% of all environmental impacts studied.

[60] Labouze et al (2003).

Table 1: environmental impact of construction

	per capita (€)		EU-27 (bn €)		% of total impact	
Product	min	max	min	max	min	max
Space heating[61]	16.5	74	8.1	36.6	8%	8%
Building structure	11	51	5.4	24.8	5%	5%
Civil construction work	6	20	3.0	9.7	3%	2%
Total construction	33.5	145	16.5	71.1	16%	15%

In the table below the yearly CO2 emission reduction potential in 2020 that are also beneficial for the economy are demonstrated for the construction sector[62]:

Table 2: Cost-benefit of yearly CO2 emission reduction potential in 2020

	Cumulative abatement potential (Mt CO2 equivalent)	Abatement cost per t CO2 equivalent	Net savings (million €)
7L-renovation[63] (multi-family house)	19	-135	2559
7L-renovation (3-6-family house)	18	-60	1052
7L-renovation (1-2 family house)	60	-49	2949
Office building insulation	12	-26	320
School building insulation	2	-15	36
TOTAL	**111**	**-62**	**6916**

For the renovation of family houses, 1-2 and 3-6 households whose surface is lower than 1000 m2, the EPBD is currently not applicable and some of the abatement potential mentioned above could be realized through renovations with better performing products that could eventually be considered in the Ecodesign Directive. For the insulation in office and school

61 Note that space heating is both under energy using products and construction products. On the one hand, one can improve the efficiency of boilers. The current minimum requirements considered would improve boilers with 17% (source: preparatory study for implementing measures). On the other hand, one can improve the insulation of buildings such that heating requirements go down. Heating insulation can reduce the heating requirements of buildings substantially. EURIMA, a sector association claims that insulation can reduce energy requirements by more than 40% Ecofys I (2002).

62 Own calculations based on McKinsey (2007). McKinsey made the assumption that 3% of buildings would be renovated annually.

63 7L renovation is a renovation which reduces the heating needs of a house to 7 liters of heating oil per square meter every year.

buildings and the 7L-renovation in multi-family houses, it is likely that the 1000 square meter threshold is attained.

The approach followed does make the trade-off between affordability for households and environmental savings. More stringent requirements on insulation material, windows and other construction products could result in even bigger CO2 savings. Yet, the costs of such an approach would not justify such requirements. Table 5 presents cost-benefit of the additional yearly emission reduction potential of shifting from 7L-renovation to 2L-renovation[64]. Compared to 7L-renovation an additional 15 M Tonnes of CO2, 13.5% extra, can be saved. Yet, this will cost €12 billion extra. Abatement costs per extra tonne would be on average 828 €/T CO2 compared to an ETS price per ton CO2 of 20-30 Euro. Based on this evidence 2L-renovation standards seem not cost effective for the time being.

Table 3: Cost-benefit of additional yearly CO2 emission reduction potential in 2020 of going from 7L-renovation to 2L-renovation

	CO2 reductions (Mt CO2 equivalent)	cost per tonne CO2 equivalent	Costs (million €)
2L-renovation (multi-family house	4	660	2502
2L-renovation (3-6 family house)	3	714	2030
2L-renovation (1-2 family house)	8	947	7629
TOTAL	**15**	**828**	**12162**

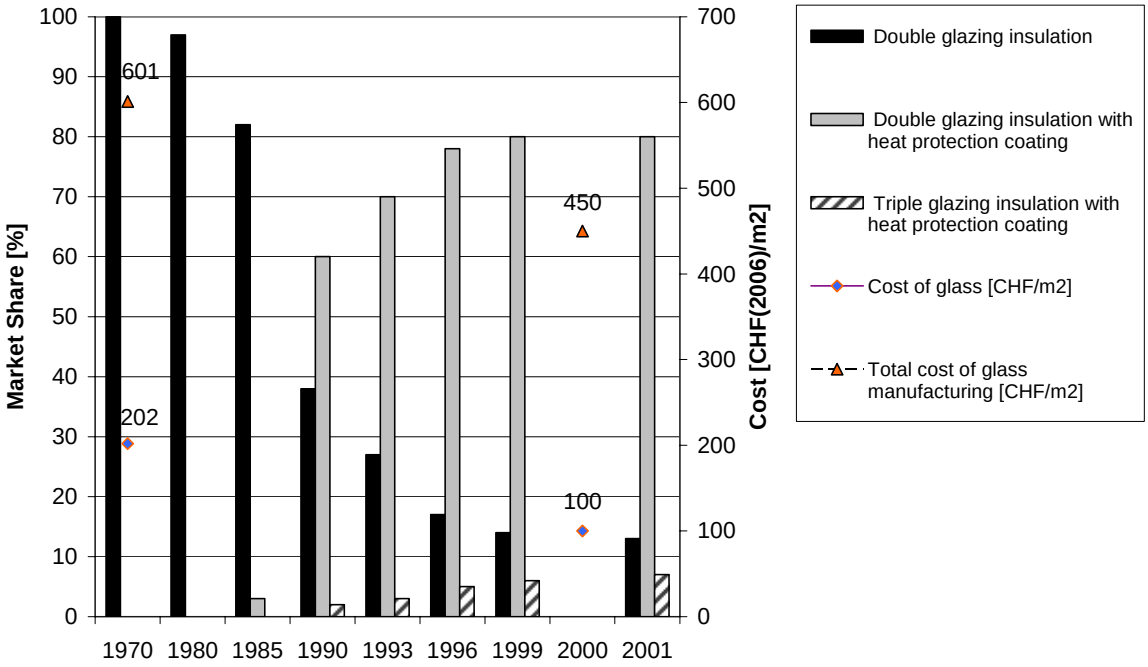
Product specific improvements are important. For example, replacing the current stock of single glazed windows by low-energy glazing at a rate of 3% per annum and the current stock of double glazed windows by low-energy glazing at a rate of 1% per annum saves 22.9 Mt CO2 equivalents in 2019.[65] This will result in discounted energy savings of €5.6 billion in 2019 using 2007 electricity prices.

In Switzerland, general building codes and specific building codes have been complementary over the last thirty year. Moreover, the policy succeeded in increasing the uptake of more energy efficient construction products at decreasing costs for these products. For insulation and glazing, Jakob (2007) and Jakob and Madlener (2004) show a continuing trend of cost reduction and a successful market penetration of more advanced windows (with lower heat transmissivity, see figure 5. In particular the shift towards more stringent energy standards in 1988 can be clearly distinguished in figure 5.

64 2L renovation is a renovation which reduces the heating needs of a house to 2 liters of heating oil per square meter every year.

65 Own calculations based on GEPVP.

Figure 1: Penetration rate and price developments of energy efficient glass[66]



Source: DG ENTR, based on data from: Jakob and Madlener 2004, p.16 and 17

Also for insulation material there is an important potential for improvement. Insulating the total stock of houses built before 1974, which have not been insulated yet, to the currently recommended standards is said to reduce energy consumption by 42%[67]. Moreover, this would result in savings of 353 Mt CO2 per year which is above 5% of total CO2 emissions in the EU. It is estimated that the refurbishment takes place at a rate of 4% so this potential can be reaped over the next 25 years.

Table 4 Reduction potential of energy consumption and CO_2 emissions for building heating through future insulation retrofit of buildings set up before 1974

Energy consumption and CO_2 emissions for building heating	Energy consumption 2002 of Building stock in Eurima countries	Consumption reduction through retrofitted insulation	CO_2 emissions 2002 of Building stock in Eurima countries	Emission reduction through retrofitted insulation	Resulting reduction through retrofitted insulation
	[TWh/a]	[TWh/a]	[Mt CO_2/a]	[Mt CO_2/a]	[%]
Total	2,843	1,192	839	353	42

The below table discusses the different materials of insulation and their respective cost-benefits. In the last column information is given on the amortisation rate. It appears that insulation pays off rather quickly.[68]

66 Development of the relative production output (quantity-based) for double and triple glazing in Switzerland, 1970–2001 (%) and the price difference for glass manufacturing between 1970 and 2006 (CHF (2006)/m2).

67 Based on studies done by ecofys covering Austria, Belgium, Denmark, Finland, France, Germany, Ireland, UK, Spain, Sweden, Netherlands, Italy, Norway, Switzerland and Turkey.

68 The numbers do not include the fixed costs of refurbishment. This is a valid assumption since there are two decisions. One is the decision to refurbish or not. This decision affects the refurbishment rate which is assumed fixed at 3% in the calculations. The other decision is, once one has chosen for refurbishment, whether or not to install insulation.

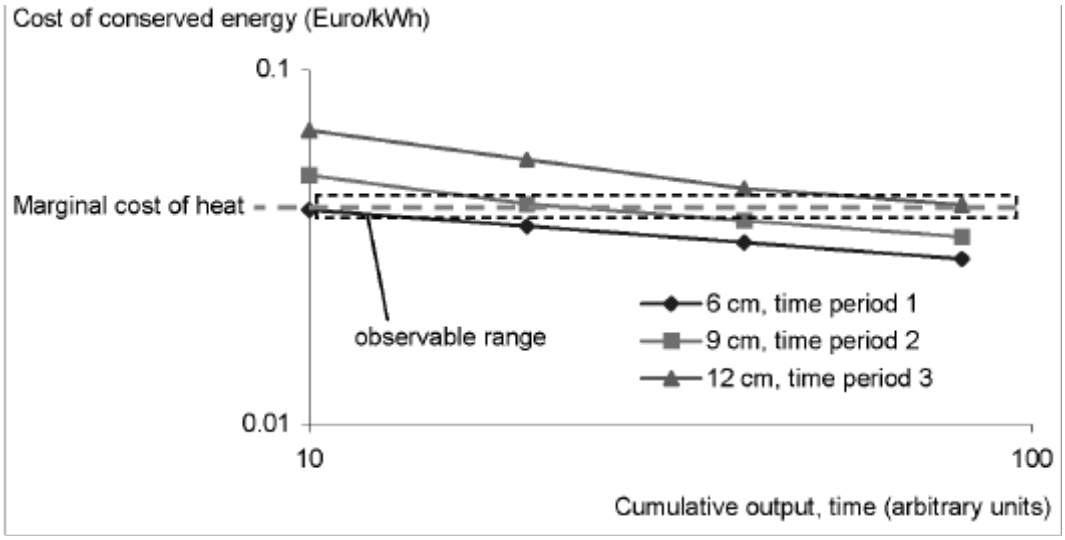
Table 10: Amortisation of different insulation material

Material	Density	Thermal conductivity	Non renewable primary energy demand production	Amortisation moderate climatic zone
	[kg/m³]	[W/mK]	[kWh/m³]	[months]
Polystyrene	15-30	0.035-0.040	530-1050	7-20
Polyurethane	30-35	0.020-0.035	1140-1330	9-23
Mineral wool	20-140	0.035-0.045	100-700	1.5-13
Fibreboard	190-240	0.045-0.053	590-785	8-16
Cellulose	40-70	0.045	10-17	0.1-0.3

(source: [UBA 1998])

Also for insulation, the Ecodesign Directive could result in an acceleration of learning curves.

Figure 2



Textiles

Textile products such as clothing and footwear do have relevant environmental impacts (EIPRO 2006), even though not all studies investigated in the EIPRO project agree on the relevance of the product category. There is an agreement that clothing and footwear contributes significantly to water use and acidification, whereas a relevant contribution to land use, eutrophication, greenhouse gases, photochemical ozone and waste is agreed by Nijdam and Wilting (2003) and partly by Labouze et al. (2003) and Dall et al. (2002).

Criteria for textile products have been developed by main eco-labels, which prove the environmental relevance and eco-design improvement potential of this product group. Some non-exhaustive examples are given in the following table:

Table 6: different requirements for textiles

Eco-Label	Type of Textiles	Requirements regarding
EU Eco-label (www.ec.europa.eu/environment/ecolabel)	Textiles	Textile fibre: type of fibre, limitation of toxic residues in fibres, reduction of air and water pollution during fibre process; processes and chemicals: limitation of harmful substances, fitness for use: performance and durability
EU Eco-label (www.ec.europa.eu/environment/ecolabel)	Shoes	Residues in the final product, emissions from the production of material (tannery), harmful substances, VOC, PVC, energy consumption, electrical components, packaging, durability
Nordic Swan (www.svanen.nu)	Textiles, skins and leather	Natural vegetable fibres, skins and leather – tanning, skins and leather - treatment with chemical products, energy and water consumption, recycling systems
Japanese Eco-Label (www.ecomark.jp)	Clothes, Household Textile Products, Textile Products for Industrial Use	Type of fibres, chemical substances, resins, packaging, replacement
Japanese Eco-Label (www.ecomark.jp)	Bags and Suitcases (Leather Bags, Fabric Bags, Synthetic/Artificial Leather Bags, Other Bags, Suitcases)	For example for Leather Bags: formaldehyde content, PCP, heavy metals, dyestuff fastness, plastics, metals, durability, information consumer
Australian Eco-label (www.aela.org.au)	Textiles (Clothing and Bedding Products, Interior Textile Applications, Yarns and Fabrics, Textile Bags, Outdoor Textile Applications)	Fitness for purpose, materials (fibres, plastics), hazardous materials, packaging

Moreover, Labouze et al. (2003) rank the external costs of environmental impacts of textiles on the 6th position, behind EuP products (space heating, EuP domestic appliances, appliances and lights) and transport (personal cars and good transports).

Detergents

Innovative detergents are projected to save 4.7 Mt CO2 equivalents yearly in 2020 at a negative cost of -336 Euro/t CO2 avoided. In other words, the CO2 reduction can be achieved without additional expenses but instead leads to large economic savings. Overall savings of households would amount to €1.6 billion.[69] Based on the environmental parameters described in the eco-labels for detergents a simulation was conducted that 25% of the worst environmental performing products would be banned from the market[70]:

Table 8

Product	**Environmental impact**	**savings as % of total impact of product category**	**absolute savings**	**unit/yr**
Cleaners for sanitary facilities	CDV	22%	29,812,757	Mlitres
	Total Phosphorus	17%	149	tonne
	Biodegradability of chemicals	33%	15	tonne
	VOCs	17%	1,490	tonne
All-purpose Cleaners	CDV	20%	22,361,482	Mlitres
	Total Phosphorus	17%	15	tonne
	Biodegradability of chemicals	5%	597	tonne
	VOCs	17%	746	tonne
Detergents for Dishwashers	CDV	17%	991,159	Mlitres
	Total Phosphorus	12%	29,736	tonne
	Total Chemicals	14%	86,727	tonne
	Hazardous Ingredients	26%	3,963	tonne

69 Own calculations based on McKinsey (2007).

70 Own calculations based on AEAT in Confidence (2004) The Direct and Indirect Benefits of the European Ecolabel – Final Report. The main assumptions made are 1) the eco-label corresponds to the 10% best environmental performing products on the market 2) environmental performance of products follows a standard normal distribution 3) the 25% worst performing products are replaced according to a normal distribution of the 75% best performing products.

	Biodegradability of chemicals	17%	5,949	tonne
Hand Dishwashing Detergents	CDV	11%	8,246,593	Mlitres
	Total Chemicals	12%	72,110	tonne
	Hazardous ingredients	11%	20,693	tonne
Laundry Detergents	CDV	8%	19,890,591	Mlitres
	Total Phosphorus	11%	165,233	tonne
	Total Chemicals	11%	660,858	tonne
	Hazardous ingredients	17%	6,609	tonne
	Biodegradability of chemicals	32%	114,733,010	tonne

An older analysis done by P&G demonstrates how the environmental performance for laundry detergents can be improved. The analysis –summarised in the below table- represents a 'cradle-to-grave' LCA for 1 wash under UK conditions for wash habits and infrastructure. Under the study's conditions, it is concluded that compact detergents (both powder & liquid) are environmentally preferable detergent formulations, mainly due to the lower use of chemicals, resulting in benefits on aquatic toxicity, eutrophication, ozone depletion and photochemical smog[71]. This study does not include the newer cold-wash detergents that have the much larger potential and via a different mechanism of saving energy for water heating, as detailed more above and as found by both McKinsey 2007 and P&G 2006.

Table 9

		Powder			Liquid	
	Unit	Regular	Compact	Tablet	Compact	Tablet
Acidification	g SO_2eq	0.19	0.16	0.16	0.14	0.15
Aquatic toxicity	m^3 PW	33	24	29	26	36
Eutrophication	g PO_4eq	0.66	0.67	0.85	0.92	1.08
Human toxicity	g BW	7.6	6.5	6.6	5.8	6.4
Climate change	g CO_2eq	1053	978	1018	933	994
Ozone depletion	ug CFC-11eq	53	36	43	24	29
Photochemical smog	g C_2H_4eq	0.75	0.83	1.18	0.41	0.50

Lice cycle energy consumption and emissions for 1 wash under UK conditions with year 2001 P&G laundry formulations

While there is already legislation that covers the environmental performance of chemicals, this does not cover the cold-wash effect with the huge and very cost-efficient savings potential of 5 M t / CO2 per year. REACH regulates chemicals in general and there is also the Detergents Directive which regulates detergents specifically, but again both have no effect on

[71] G. Van Hoof, D. Schowanek, TCJ Feijtel (2003). Comparative Life Cycle Assessment of laundry detergent formulations in the UK. Part I: Environmental fingerprint of five detergent formulations in 2001. Tenside (in press).

cold-wash detergents, hence the extended Eco-design legislation is fully complementary. Therefore, detergents are fully meeting the art 15.2 of the Eco-design Directive .

Water using products

24.4% of all water is consumed by the domestic sector. More resource efficient use and improving the technical performance of showers, baths, taps, washing machines, dish washers and toilet flushes could lead to water savings for households of between 29-41%. Improving the technical performance could lead to water savings for households of 25%.[72]

Table 10

	Standard New		Water Efficient		% reduction
	litre/use	*litre/household/day* [(a)]	*litre /use*	*litre/household/day* [(a)]	
Toilet flush	9	87[(b)]	4	39[(b)]	55
	6	57 [(b)]			32
Shower	54[(c)(d)]	77 [(f1)]	30[(g)]	43 [(f1)]	44
	45[(c)(e)]	64 [(f1)]			33
Bath	88	71 [(f2)]	65 [(h)]	53 [(f2)]	26
Taps	0.6 [(i)]	10 [(j)]	0.5 [(k)]	8.5	15
Washing machine	60	26 [(l)]	40	17.4	33
			45	19.6	25
Dish Washer	20	8.7 [(l)]	12	5.2 [(l)]	40
			14	6.1 [(l)]	30
Total		**237 - 280**		**167-169**	**29-41**

Note:
(a) Assuming 2.38 persons/household
(b) Assuming 4 full flushes per person per day
(c) Assuming 5 minute shower
(d) Assuming 10.8 lt/min
(e) Assuming 9 lt/min (use of restrictor)
(f1) Assuming 1.43 showers per household per day
(f2) Assuming 0.34 bath per person per day
(g) Assuming a 6 lt/min "water saver" showerhead
(h) Assuming an undersized or corner bath
(i) Assuming 6.5 lt/min and an average 6 sec use
(j) Assuming 7.1 tap uses / day / person
(k) Assuming 5 lt/min flow
(l) Assuming 1 full load per day

Source: study on water by DG ENV

The below table provides examples of such improvements in the technical performance of household devices.

[72] Eco-logic (2007) EU Water saving potential (Part 1 –Report) prepared for DG ENV.

Table 11: Typical water saving devices

Equipment	Description	Water Saving
	TAPS	
Taps with air devices	Introduction of air bubbles into the water, increasing its volume Less flow and same effect	Flow reduction of around 50%
Taps with thermostats	They keep the selected temperature	Reduction of around 50% of water and energy
Taps with infrared sensors	Water is available when an object is underneath	Reduction of between 70 and 80%
Electronic taps, or taps with buttons for a timed length of flow	Water running for a limited time	-
	TOILETS	
Toilets	command for 6 l/flush	
Double-command toilets	command for 3 l/flush	
Waterless or vacuum toilets	No water used	Reduction of water use by 50l/cap/day
	WATER-SAVING DEVICES FOR OLD EQUIPMENT	
Device to mix water and air for taps	Increases the volume of water	Reduction of around 40%
Button to interrupt toilet flush	(reduction of flow)	Reduction of around 70%
Device to limit shower flow	(reduction of flow)	Reduction of between 10 and 40%
Dishwasher	Decreases the volume of water used from 20 lt per use to 15 lt per use	Reduction around 25%
	WASHING MASHINES	
Washing Machines (~7kg load)	Decreases the volume of water used from 80 lt per use to 45 lt per use	Reduction about 44%

Source: study on water by DG ENV

This corresponds to savings of 6.1% of total water use. Disregarding washing and laundry machines, which are already regulated under the Ecodesign Directive, the savings potential is 15% smaller corresponding to savings of 5.2% of total water use.

More water efficiency also means higher energy efficiency. For example for baths, showers and taps less water use means less hot water use, which implies less water heating by boilers which in turn results in electricity savings. The water saving potential for these products is 28-34%, which is also the assumed water heating need saving for a household[73].

Water heaters currently use 92 Twh/year of primary energy[74]. Reducing heating needs by 28-34% should lead to a reduction in energy use of 26-31 Twh/year**.** This represents savings of 0.20-0.23% of total final energy consumption in the EU-25. Reducing energy use would in turn result in 18.2 - 21.7 Mt CO2 emissions saved per year. By 2020, roughly 40% of that potential could be saved assuming a replacement rate of 3% per annum. This would correspond to CO2 savings in the magnitude of 7.5 Mt CO2 per year.

Water efficiency of appliances seems not to be reflected in prices as available evidence for the UK indicates[75]. Another study finds payback times for water efficient showers to be 3.5 years and for water efficient toilet flush to be 6-11 years.[76]

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73 This assumption is underbuild by technical arguments. The main technical improvement to get more water efficient taps, showers and baths for the same level of quality is to infuse more air into the water. This technique will apply to water regardless of it being hot or cold.

74 Task 7 on water heaters of the preparatory studies for eco-design.

75 Pricing in the longer term should not be a barrier to uptake for more efficient showers as currently available water efficient showers tend not to be priced higher then the market average. The long-term decline in the price of baseline (inefficient) water using equipment is expected to be 2.45%. Reductions

There seems to be scope for improving the water efficiency of apparatus in agriculture and industry as well e.g. irrigation equipment.

Furniture

The EIPRO project investigated furniture only in the broader category "Housing, furniture, equipment and utility use", with some underlying studies confirming the relevance of furniture for eutrophication (Labouze *et al.* (2003)), resource depletion and waste (Dall et al. 2002 and Moll et al. 2004).

Criteria for furniture have been developed by several main eco-labels, which prove the environmental relevance and eco-design improvement potential of this product group. Some non-exhaustive examples are given in the following table:

Table 12

Eco-Label	Type of Furniture	Requirements regarding
EU Eco-label (www.ec.europa.eu/environment/ecolabel/index_en.htm)	Furniture	No agreed requirements so far
Nordic Swan (www.svanen.nu)	Furniture and fitments	Wood, wood based panels, surface treatment of wood, metals, plastics, padding materials, fabrics, glass, adhesives, waste, packaging
Nordic Swan (www.svanen.nu)	Outdoor Furniture and Playground Equipment	Solid wood, wood-based panels and high pressure laminate, wood preservation, surface treatment of wood, maintenance products for wood, metals, plastics, adhesive
German Blue Angel (www.blauer-engel.de)	Furniture	Manufacturing: origin of the wood, formaldehyde in wood-based materials, coating systems; use: indoor air quality, packaging, wearing parts; recycling and disposal; consumer information, advertising statements
Japanese Eco-Label (www.ecomark.jp)	Furniture	Wood origin, CFC, BTX, polymers, coatings, paint, adhesives, repair system, packaging, information,
Australian Eco-label (www.aela.org.au)	Furniture and Fittings (Office/ Domestic Chairs, Office/ Domestic Desks & Tables, Bedroom Furniture, White Furniture, Fittings)	Fitness for purpose, materials (timber and other natural materials, plastics, fabrics, glass, rubber, adhesives, metals, coatings), hazardous materials, post consumption recycling and labelling

in the price of water efficient equipment of between 5% and 15% are expected. Current example prices for showers are about £142 for 7.5 kW electric shower (3.46 l/min), £184 for a 10.8 kW electric shower (4.99 l min) and £184 for a standard mixer shower (8 l min). Current example prices for WCs are about £163 for a 6/4-litre, dual-flush WC, £275 for a 4.5-litre WC but, surprisingly, only £120 for a 4.5/3-litre, dual flush WC. Current examples of the prices of baths are £455 for a 140-litre bath, £198 for a 160-litre bath, £118 for a 200-litre bath and £171 for a 290-litre bath. As these figures show, bath volume is not an indicator of price UK's Market Transformation Programme and Assessing the cost of compliance with the Code for Sustainable homes, Environment Agency, 2007 (available from www.environment-agency.gov.uk).

[76] Eco-logic (2007) EU Water saving potential (Part 1 –Report) prepared for DG ENV.

Australian Eco-label (www.aela.org.au)	Outdoor Furniture (Commercial and Public Use Outdoor furniture, Domestic Recreational Outdoor Furniture, Roadside Furniture, Outdoor Fittings and Ornaments)	Fitness for purpose, materials (timber and other natural materials, plastics, fabrics, glass, rubber, adhesives, metals, coatings), hazardous materials, post consumption recycling and labelling

For furniture there are a lot of company specific success stories of improvements over the life cycle. Successful examples include the eco-design of office furniture[77] or wooden furniture[78].

[77] http://www.steelcase.com/uk/office_furniture_steelcase_index.aspx

[78] Klostermann and Tukker (Eds.) (1998) Product innovation and eco-efficiency, Kluwer Acedemic Publishers.

ANNEX V

Volumes sold for other means of transportation

This annex assesses whether the whether the threshold of article 15 2 (a) is met for other means of transport. In this article it is stated that products shall represent a significant volume of sales and trade, indicitavely more than 200000 units a year within the Community.

The data is based on the available information in PRODCOM for the year 2006. For transport by water only floating structures are sold over 200,000 units. Yet, no significant environmental impacts can be expected from them.

Table 1

transportation by water	Sold Volume EU27
Non-sea going ferry boats, cruise ships, excursion boats and similar vessels	455
Tugs	114
Sea-going dredgers	51
Floating cranes, floating docks, and other vessels, the navigability of which is subsidiary to their main function (excl. dredgers, floating or submersible drilling or production platforms; fishing vessels and warships), sea-going	57
Dredgers, and other vessels, the navigability of which is subsidiary to their main function (excl. floating or submersible drilling or production platforms; fishing vessels and warships), not sea-going	31
Other vessels (including lifeboats) other than rowing boats, sea-going	1731
Other vessels (including lifeboats other than rowing boats) not sea-going	2478
Floating structures (including rafts, tanks, coffer-dams, landing-stages, buoys and beacons)	622050
Non sea-going sailboats, for pleasure or sports, of a length < 7.5 m	20189
Non sea-going sailboats for pleasure or sports, > 100 kg in weight and 7.5 m in length	5112
Inflatable vessels for pleasure or sports, of a weight < 100 kg	50332
Inflatable vessels for pleasure or sports, of a weight > 100 kg	20741
Non sea-going motorboats for pleasure or sports, < 7.5 m in length (excluding outboard motorboats)	12777
Rigid boats- 100 kg in weight (including outboard motorboats, rowing boats and canoes)	94069

Rigid boats > 100 kg in weight and < 7.5 m in length (including outboard motorboats, rowing boats and canoes)	42931
Rigid boats > 100 kg in weight and 7.5 m in length (including outboard motorboats, rowing boats and canoes)	6321

For rail transport no product category has sales above 10,000 units a year. Combined the volumes are below 15,000 units.

Table 2

rail transport	**Sold volume EU27**
Rail locomotives powered from an external source of electricity	566
Diesel-electric locomotives	323
Self-propelled railway or tramway coaches, vans and trucks powered from an external source of electricity (excluding railway or tramway maintenance or service vehicles)	1629
Self-propelled railway or tramway coaches, vans and trucks (excluding those powered by electricity, railway and tramway maintenance or service vehicles)	511
Railway or tramway maintenance or service vehicles (including workshops, cranes, ballast tampers, track-liners, testing coaches and track inspection vehicles)	1193
Rail/tramway passenger coaches; luggage vans, post office coaches and other special purpose rail/tramway coaches excluding rail/tramway maintenance/service vehicles, self-propelled	991
Tank wagons and the like, insulated, refrigerated or covered and closed vans and wagons for railway or tramway use (excluding self-propelled)	3743
Rail/tramway goods vans/wagons including self-discharging vans/ wagons, open with non-removable sides 60cm, tank wagons etc., insulated, refrigerated/covered, closed vans/wagons	5848

For air transport no product category has sales above 2,000 a year. Combined the volumes are lower than 10,000 a year.

Table 3

air transport	**Sold volume EU27**
Turbojets or turbofans of a dry thrust > 25 kN, for civil use	1574
Turboprops of a power < 1100 kW, for civil use	982
Gliders and hang gliders, for civil use	509
Helicopters of an unladen weight < 2000 kg, for civil use	182
Helicopters of an unladen weight > 2000 kg, for civil use	383
Aeroplanes and other aircraft of an unladen weight < 2000 kg, for civil use	1333
Aeroplanes and other aircraft of an unladen weight > 2000 kg, but < 15000 kg for civil use	230
Aeroplanes and other aircraft of an unladen weight > 15 000 kg, for civil use	434

In the category other, bicycles and parts, invalid carriages and vehicles not mechanically propelled. The 200,000 sold criteria excludes “Invalid carriages motorized or mechanically propelled”. Other categories such as bicycles and parts or vehicles not mechanically propelled seem not to have a very big environmental impact.

Table 4

Other	**Sold volume EU27**
Non-motorized bicycles and other cycles, without ball bearings (including delivery tricycles)	1876540
Non-motorized bicycles and other cycles with ball bearings (including delivery tricycles)	10413953
Frames for bicycles, other non-motorized cycles and side-cars (excluding parts of frames)	2244108
Front forks for bicycles, other non-motorized cycles and side-cars (excluding parts of front forks)	1103244
Wheel rims for bicycles other non-motorized cycles and side-cars	19314277
Wheel spokes for bicycles, other non-motorized cycles and side-cars	6335948
Hubs without free-wheel or braking device for bicycles, other non-motorized cycles and side-cars	3877819

Coaster braking hubs and hub brakes for bicycles and other non-motorized cycles	2723865
Brakes for bicycles and other non-motorized cycles (excluding coaster braking hubs and hub brakes)	7895581
Pedals for bicycles and other non-motorized cycles	662357
Crank-gear for bicycles and other non-motorized cycles	1215878
Luggage-carriers for bicycles and other non-motorized cycles	2696298
Invalid carriages not mechanically propelled	861633
Invalid carriages motorized or mechanically propelled	134871
Vehicles not mechanically propelled including industry trolleys, barrows, luggage trucks, hopper-trucks, hand pulled golf trolleys excluding shopping trolleys	9306570

ANNEX VI

Definition of technical terms

This annex defines the definition of technical terms[79]

- Abiotic depletion refers to the exhaustion of natural resources such as iron ore or copper, which are regarded as non-living. Impacts considered are those derived from the extraction of minerals and fossil fuels.
- Global warming is the impact of greenhouse gases emissions on the radiative forcing of the atmosphere. These emissions have negative impacts on human and ecosystem health, and material welfare.
- Human toxicity includes the impacts on human health of toxic substances emitted to the environment.
- Fresh water aquatic ecotoxicity refers to the impact of toxic substances emitted to freshwater aquatic ecosystems.
- Marine aquatic ecotoxicology refers to the impact of toxic substances emitted to marine aquatic ecosystems.
- Terrestrial ecotoxicity refers to the impact of toxic substances emitted to terrestrial ecosystems.
- Photochemical oxidation is the formation of reactive chemical compounds, such as ozone, by the action of sunlight on certain primary air pollutants. These compounds may be injurious to human health, ecosystems, materials and crops.
- Acidification is the result of acidifying pollutants emissions, such as SO2 or NOx, to the air. These emissions have negative impacts on soil, groundwater, surface waters, biological organisms, ecosystems and materials.
- Eutrophication is the consequence of high levels of macronutrients, such as nitrogen and phosphorus, in the environment.
- Land use refers to the transformation and occupation of land by human activities, such as agriculture, housing, road infrastructure etc. This has direct impacts on biodiversity, soil erosion, groundwater protection and other environmental aspects.
- Stratospheric ozone depletion refers to the reduction of ozone in the stratosphere ("Ozone hole") caused by chemical and photochemical reactions e.g. with chlorofluorocarbons (CFCs) and other substances.

[79] These defintions have been taken from H. Cabal Y.Lechón R. Sáez (2005) European Sustainable Electricity; Comprehensive Analysis of Future European Demand and Generation of European Electricity and its Security of Supply research partly funded by DG RTD.

ANNEX VII

External cost factors to monetarise environmental impacts[80]

This annex summarises the external cost factors to monetise environmental impacts which can be found in the literature.

External Cost Factors Considered to Monetarise Environmental Impacts

Data sources (1) ExternE
(2) RDC-Environment & Pira Internl (2001)
(3) Spadaro & Rabl (1999)
(4) CML 2002
(5) Goedkoop & al. (1999 - Ecoindicator 99)
(6) COWI (2000)
(7) J.V. Spadaro & Ari Rabl, Int J.LCA 4 (4) 229-243 (1999).

AIR EMISSION IMPACTS	Cost factors (Euros/g)			Impact factors	
	Min a	Max	Data source	Value b	Data source
Stratospheric Ozone Depletion (g CFC11 eq.)	0.00068	0.00068	(2) & (3)		
Air Acidification (g SO2 eq.)	0.00009	0.00438	a_{SO2}/b_{SO2}		
(a) Sulphur Oxides (SOx as SO2)	0.00011	0.00525	(2) & (3)	1.2	(4)
Greenhouse effect (direct, 100 years) (g CO2 eq.)	0.000019	0.000048	(1)		
Photochemical oxidation (g ethylene eq.)	0.0007	0.0009	(1) & (7)		
(a) Nitrogen Oxides (NOx as NO2)	0.0008	0.0031	(1) & (3)	0.028	(4)
Human Toxicity (g 1-4-dichlorobenzene eq.)					
(a) Cadmium (Cd)	0.021	0.021	(3)		
(a) Chromium (Cr III, Cr VI)	0.140	0.140	(3)		
(a) Nickel (Ni)	0.003	0.003	(3)		
(a) Arsenic (As)	0.171	0.171	(3)		
Human health effects caused by dusts (g)	0.0014	0.0593	(1)		
Human health effects caused by dioxins (g)	12950	27750	(1)		

WATER EMISSION IMPACTS	Cost factors (Euros/g)			Impact factors	
	Min a	Max	Data source	Value b	Data source
Eutrophication (g eq. $P0_4$)	0.0015	0.0015	a_{PO4}/b_{PO4}		
(w) Phosphorus (P)	0.0047	0.0047	(1)	3.06	(4)

SOLID WASTE IMPACTS	Cost factors (Euros/kg)		
	Min	Max	Data source
Disaminity caused by incineration (kg of waste)	0.004	0.014	(6)
Disaminity caused by landfilling (kg of waste)	0.006	0.019	(6)

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[80] This annex is based on page 71 of Labouze et al.

ANNEX VIII

Estimation of costs and benefits for some products in option 1 and 2

For option 1, the case of water heaters was analysed in detail. On the basis of the results of the Preparatory Study, Task 6 (http://www.ecohotwater.org/), the following information was used for the extra small water heaters:

Category	XS	
Market share	12.5%	
Life-time (years)	10	
Type	BC XS	EIWH E 8
Energy consumption kWh/y	1,762	1,348
Electricity consumption	1,527	1,348
Gas consumption	235	0
Purchase price (EUR)	187	318
Life-cycle cost (EUR)	1,961	1,667
CO2 emissions (Tn)	1.198	0.917

And

Number of appliances sold per year	2,152,000
Estimated number of installed appliances	21,520,000

The results are presented in the following table:

		Baseline	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
total number of appliances-Least LC purchased (million)		0.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Number of Least LCC installed (million)		0.0	0.0	2.2	4.3	6.5	8.6	10.8	12.9	15.1	17.2	19.4
Remaining number of appliances-BC (million)		21.5	19.4	17.2	15.1	12.9	10.8	8.6	6.5	4.3	2.2	0.0
Additional Purchase Cost (million EUR)	N	0.0	281.9	281.9	281.9	281.9	281.9	281.9	281.9	281.9	281.9	281.9
Discounted additional purchase cost (million EUR)			281.9	256.3	233.0	211.8	192.5	175.0	159.1	144.7	131.5	119.6
Runing cost (M€/y)	N	0	493	493	493	493	493	493	493	493	493	493
	I	0	0	493	986	1,479	1,973	2,466	2,959	3,452	3,945	4,438
	O	5,799	5,219	4,639	4,059	3,479	2,900	2,320	1,740	1,160	580	0
	T	5,799	5,712	5,626	5,539	5,452	5,365	5,279	5,192	5,105	5,018	4,932

Upfront + running cost (M€)		5,799	5,994	5,907	5,821	5,734	5,647	5,560	5,474	5,387	5,300	5,213
Difference between Upfront and runnig costs to baseline (M€)			-195	-108	-22	65	152	239	325	412	499	586
NPV of the difference of upfront and running cost to baseline (M€)			-195	-99	-18	49	104	148	184	211	233	248
Energy consumption (Gwh)	N	0	2,901	2,901	2,901	2,901	2,901	2,901	2,901	2,901	2,901	2,901
	I	0	0	2,901	5,802	8,703	11,604	14,504	17,405	20,306	23,207	26,108
	O	37,918	34,126	30,335	26,543	22,751	18,959	15,167	11,375	7,584	3,792	0
	T	37,918	37,027	36,136	35,245	34,355	33,464	32,573	31,682	30,791	29,900	29,009
Energy savings compared with baseline			891	1,782	2,673	3,564	4,455	5,346	6,236	7,127	8,018	8,909
CO2 emission (M Tn)	N	0	2	2	2	2	2	2	2	2	2	2
	I	0	0	2	4	6	8	10	12	14	16	18
	O	26	23	21	18	15	13	10	8	5	3	0

	T	26	25	25	24	23	23	22	22	21	20	20
Emission saving compared with baseline (M Tn)			1	1	2	2	3	4	4	5	5	6

N= New appliance (least life-cycle); I= Installed New appliances (least life-cycle); O= currently installed capacity, assimilated to Baseline appliance in the markets; T= Total

For the case of extra large water heaters, the following information was used:

Category	XL	
Market share	5,5%	
Life-time (years)	10	
Type	BC XL	COMBISTOR condensing
Energy consumption kWh/y	11,566	7,334
electricity	7,293	134
gas	4,273	7,200
Purchase price (EUR)	665	1,037
Life-cycle cost (EUR)	11,786	8,636
CO2 emissions (Tn)	8	5

And

Number of appliances sold per year	946,880
Estimated number of installed appliances	9,468,800

The results are

		BAU	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
total number of appliances-Least LC purchased (million)		0	1	1	1	1	1	1	1	1	1	1
Number of Least LCC installed (million)		0	0	1	2	3	4	5	6	7	8	9
Remaining number of appliances-BC (million)		9	9	8	7	6	5	4	3	2	1	0
Additional Purchase Cost (million EUR)	N	0	352	352	352	352	352	352	352	352	352	352
Discounted additional purchase cost (million EUR)			352	320	291	265	241	219	199	181	164	149

Runing cost (M€/y)	N	0	308	308	308	308	308	308	308	308	308	308
	I	0	0	308	616	925	1,233	1,541	1,849	2,158	2,466	2,774
	O	13,441	12,097	10,753	9,409	8,064	6,720	5,376	4,032	2,688	1,344	0
	T	13,441	12,405	11,369	10,333	9,297	8,262	7,226	6,190	5,154	4,118	3,082
Upfront + running cost (M€)		13,441	12,757	11,721	10,685	9,650	8,614	7,578	6,542	5,506	4,470	3,435
Difference between Upfront and runnig costs to baseline (M€)			684	1,719	2,755	3,791	4,827	5,863	6,899	7,935	8,970	10,006
NPV of the of difference between upfront and running cost to baseline (M€)			684	1,563	2,277	2,848	3,297	3,640	3,894	4,072	4,185	4,244
Energy consumption (Gwh)	N	0	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944
	I	0	0	6,944	13,889	20,833	27,778	34,722	41,667	48,611	55,555	62,500
	O	109,516	98,565	87,613	76,661	65,710	54,758	43,806	32,855	21,903	10,952	0
	T	109,516	105,509	101,502	97,495	93,487	89,480	85,473	81,466	77,459	73,451	69,444

Energy savings compared with baseline			4,007	8,014	12,022	16,029	20,036	24,043	28,050	32,058	36,065	40,072
CO2 emission (M Tn)	N	0	5	5	5	5	5	5	5	5	5	5
	I	0	0	5	9	14	19	24	28	33	38	42
	O	74	67	60	52	45	37	30	22	15	7	0
	T	74	72	69	66	64	61	58	55	53	50	47
Emission saving compared with baseline (M Tn)			3	5	8	11	14	16	19	22	25	27

N= New appliance (least life-cycle); I= Installed New appliances (least life-cycle); O= currently installed capacity, assimilated to Baseline appliance in the markets; T= Total

For option 2, the case of windows was analysed.

The data for the analysis is from PricewaterHouse Cooper (2007).

standard	single glazed	Double glazed
Purchase price (euro/m2)	100	150
Energy use during lifespan (kwh/m2)	8400	6480
CO2 emitted during lifespan (kg CO2e/m2)	6297	4980
Replacement surface (m2/y)	52,141,600	52,141,600

The replacement rate represents 4% of the still unrefurbished windows throughout the EU.

The results are shown in the table below.

	Baseline	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Purchase costs (M EUR)	5,214	7,821	7,821	7,821	7,821	7,821	7,821	7,821	7,821	7,821	7,821
Additional purchase costs (M EUR)		2,607	2,607	2,607	2,607	2,607	2,607	2,607	2,607	2,607	2,607
NPV of Additional purchase costs (M EUR)		2,607	2,507	2,410	2,318	2,229	2,143	2,060	1,981	1,905	1,832
Energy consumption of new installations (GWh/y)	14,600	11,263	11,263	11,263	11,263	11,263	11,263	11,263	11,263	11,263	11,263
Cumulative energy savings compared with baseline (GWh/y)		3,337	6,674	10,011	13,348	16,685	20,022	23,359	26,696	30,034	33,371
Energy consumption (M €)	2,482	1,915	3,829	5,744	7,659	9,573	11,488	13,402	15,317	17,232	19,146
Cumualtive energy savings (M €)		567	1,135	1,702	2,269	2,837	3,404	3,971	4,538	5,106	5,673
NPV of cummulative energy savings (M€)		567	1,091	1,574	2,017	2,425	2,798	3,138	3,449	3,731	3,986

Total purchase cost - energy savings (M EUR)		- 2,040	- 1,416	- 837	- 300	196	655	1,078	1,468	1,826	2,154
CO2 impacts (M t CO2e)	11	9	17	26	35	43	52	61	69	78	87
Emissions avoided relative to baseline (M T CO2)		2.3	4.6	6.9	9.2	11.4	13.7	16.0	18.3	20.6	22.9

In the case of only considering 50% of the windows replaced with double glazing and the other 50% with single glazing, the results are presented below.

	Baseline	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Purchase costs (euro)	5,214	6,518	6,518	6,518	6,518	6,518	6,518	6,518	6,518	6,518	6,518
Additional purchase costs		1,304	1,304	1,304	1,304	1,304	1,304	1,304	1,304	1,304	1,304
NPV of Additional purchase costs		1,304	1,253	1,205	1,159	1,114	1,071	1,030	991	952	916
Energy consumption of new installations (GWh/y)	14,600	12,931	5,631	5,631	5,631	5,631	5,631	5,631	5,631	5,631	5,631
Cummulative energy savings compared with baseline (GWh/y)		1,669	17,937	26,905	35,873	44,842	53,810	62,778	71,747	80,715	89,684
Energy consumption (M €)	2,482	2,198	4,397	6,595	8,793	10,991	13,190	15,388	17,586	19,785	21,983

Cummualtive energy savings (M €)		284	567	851	1,135	1,418	1,702	1,986	2,269	2,553	2,837
NPV of cummulative energy savings (M€)		284	545	787	1,009	1,212	1,399	1,569	1,724	1,865	1,993
Total purchase cost - enegy savings		- 1,020	- 708	- 418	- 150	98	327	539	734	913	1,077
CO2 impacts (M t CO2e)	11	10	20	29	39	49	59	69	78	88	98
Emissions avoided (M T CO2)		1.1	2.3	3.4	4.6	5.7	6.9	8.0	9.1	10.3	11.4