Background report I: Literature review

Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive

ENER/C3/2012-523

Background report I: Literature review

Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive

ENER/C3/2012-523

- Confidential –

By:
Edith Molenbroek, Heleen Groenenberg,
Maarten Cuijpers, Luis Janeiro, Matthew Smith, Nesen Surmeli (Ecofys)
Paul Waide (Waide Strategic Efficiency)
Sophie Attali (SoWatt)
Corinna Fischer (Őko-Institut)
Juraj Krivošik (SEVEn)
Paula Fonseca, Bruno Santos, João Fong (ISR, University of Coimbra)

Date: 18 December 2013

Project number: BUINL13345

Table of contents

1 Introduction

1.1 Context and purpose of the evaluation

According to Article 14 of the Energy Labelling Directive (ELD), the Commission has to evaluate the effectiveness of the directive and of its delegated acts not later than 31 December 2014.

Likewise, according to Article 21 of the Ecodesign Directive (ED), its review should be performed not later than 2012. The final report of this evaluation study was published on 16 April 2012. However, certain aspects of the application of the Directive could not be assessed thoroughly because the Directive had been in force for only two years. For this reason an assessment on the basis of new data and evidence is required.

In consequence, the Commission has launched a review process to:

a) Evaluate the effectiveness of the Directive 2010/30/EU on energy labelling and of the implementing measures adopted under the Directives 2010/30/EU and 92/75/EEC, and
b) Evaluate specific aspects of the Ecodesign Directive 2009/125/EC (that are identified further in this document).

Purpose of the study
The aim of this evaluation study is to compile, analyse and provide the Commission with all the information required for the review process and the possible revision of the directives to the extent this is justified. In addition to this, the evaluation will identify options and provide recommendations for the improvement of the current legal framework and its application by the national authorities and industry. These recommendations will be supported by an analysis of the most relevant arguments for and against identified options.

1.2 Priorities

The Commission defined seven priorities to address in the evaluation of the Energy Labelling Directive:

1. Assess whether energy labelling has fulfilled its objectives in terms of informing consumers about the environmental characteristics of products during their use.
2. Evaluate the appropriateness of the existing energy labels for meeting the objectives of the Directive and the delegated acts and implementing directives.
3. Examine the effectiveness of the application of energy labelling in the EU and the Member States.
4. Examine whether the criteria and procedures for defining and developing delegated acts and implementing directives on the one hand, and as implemented by the Commission on the other hand have been effective and cost efficient.

5. Examine the political, legal and (if appropriate) procedural relationship of energy labelling with other relevant EU policies and instruments, i.e. the Energy Performance of Buildings Directive, Green public procurement, the regulation on labelling of tyres, and the EU Ecolabel.
6. Examine the appropriateness of laying down labelling requirements for non-energy related products, product systems, means of transport[1], thus extending the scope of the Directive.
7. Evaluate effects of energy labelling on the market and on industry's competitiveness (including innovation).

Additional evaluation of the Ecodesign Directive is needed on the three following aspects:

1. The effectiveness of the mandatory and self-regulatory implementing measures adopted under the Ecodesign Directive.
2. The appropriateness and feasibility of laying down ecodesign requirements for non-energy related products and systems and means of transport.
3. The effectiveness of the standardisation process carried out for the Ecodesign Directive.

1.3 Focus and structure of this literature report

This literature report presents findings in the available literature to date that shed light on strengths and weakness of the existing regulatory framework for Energy Labelling and Ecodesign, and options to improve this.

The implementation of both directives in the EU27 is considered in chapter 2, and the relation with other EU legislation in chapter 3. Different aspects of the Energy Labelling Directive are addressed in Chapters 4-7, namely objectives (chapter 4), appropriateness (chapter 5), criteria and procedures (chapter 6), and market effects of energy labelling (chapter 7). The report then continues addressing specific aspects of the Ecodesign Directive. These include objectives of implementing measures (chapter 8), market effects of Ecodesign legislation (chapter 9), criteria and procedures (chapter 10), and the effectiveness of standardization (chapter 11). The final chapter includes a summary of findings on the Energy Labelling and Ecodesign Directives jointly (section 12.1), and on the Energy Labelling and Ecodesign Directives individually (resp sections 12.2 and 12.3).

[1] Power generating devices were also initially included here but have been removed following further discussion with the Commission.

ENERGY LABELLING AND ECODESIGN DIRECTIVES

2 Implementation of Energy Labelling and Ecodesign Directives

2.1 Introduction

In this chapter, findings from the literature concerning the implementation and enforcement of the Energy Labelling and Ecodesign Directives are summarised. Implementation and enforcement of both directives were considered jointly, as they relate to almost identical obstacles and opportunities from the market compliance verification point of view.
The review of available literature and information related to market monitoring, compliance verification and enforcement activities is in the following areas:

- Monitoring of compliance activities by individual Member States (section 2.2);
- Achieved level of compliance in individual countries and for products (section 2.3);
- Detailed overview of challenges in undertaking compliance verification (section 0);
- Opportunities for increased and improved level of market surveillance (section 2.5);
- Uniformity and campaigns (section 2.6).

Key findings are provided in the summarizing chapter at the end of this report (section 12.1.1). In all of these sections, the findings and the data relate to market surveillance activities under the Energy Labelling and Ecodesign Directives, with the exclusion of market surveillance under product safety legislation.

2.2 Monitoring of compliance activities

The principle findings related to the compliance activities in the EU are:

- Energy labelling and Ecodesign legislation are intended to contribute 25% to the EU´s 20% primary energy use reduction by 2020 (Waide, 2011).
- Currently, even the most active national authorities limit their testing to some 20-30 model types per year, equivalent to 0.1% of the market (CEECAP, 2008, b).
- Five EU Member States are considered to have an active market surveillance policy, regularly testing products and visiting shops, six countries report no activity, the rest of the countries report medium to low market surveillance activity (European Commission, 2013, e).
- Many stakeholders, from industry associations to non-profit organisations, consider the market surveillance activities to be ineffective and not sufficient (eg. Rambaldi 2011, ORGALIME 2012).
- In terms of resources, the annual expenditure on equipment compliance activities around the EU/EEA is estimated to be seven million Euro, with a typical staff of 0,5 to 3-4 full time equivalent, but in many cases without exact monitoring on expenditures on product compliance activities (Waide, 2011).

- Some ten EU countries perform product testing, with various categories covered and numbers of products tested, ranging from 1-5 products to 20 – 100 per year in some cases.
- Up to 15 countries report the organisation of shop visits to verify proper label display. In some cases individual shops are visited where there has been consumer complaints. In at least 8 countries typically between 50 to 100 shops are visited annually.

Table 1 provides an overview of resources invested, number of tests and number of shop visited for compliance purposes.

Table 1 Overview of compliance activities in the Member States (Sources: Come On Labels (2013), ATLETE (2010 and 2013), Fraunhofer et.al. (2009), ANEC (2007))

Country/Source	Staff resources dedicated	Product testing activities	Number of shop visits
Austria	Declared confidential	No testing, or not published	Around 70 shops per year
Belgium	Up to 100 field inspectors	25 lamps in 2010 (22 noncompliant) 12 fridges in 2010-2011 (1 noncompliant) 5 dishwashers in 2011	202 in 2011, typically 100 – 250, sporadically more then 1000
Bulgaria	Up to 134 market surveillance inspectors	No testing	No/100 – 250
Cyprus	2 part time at ministry level	No testing	20 – 50
Czech Republic	2 part time at authority level, number of inspectors not known	No testing, only 6 refrigerators in 2011 (all compliant)	4 in 2010 18 in 2011, Ca. 300 in 2012
Denmark	5-6 part time at authority level	Yes, 60 per year + 150 technical declarations and CE marks in 2012	50 – 100 shops inspected, plus catalogues, internet shops, advertising
Estonia	2 part time at authority level	Yes, 2 per year	100 – 250
Finland	1 full time and 1 part time at authority level, 3 field inspectors	Yes, 5 -10 per year	250 up to 1000 inspected
France	Part 1 part time at ministry level 1 part time at energy agency	No testing	No (only 2005 study)

Country/Source	Staff resources dedicated	Product testing activities	Number of shop visits
Germany	Regional government responsibility, 1 part time at ministry	Yes, varies from year to year, not centrally reported	Unknown, not reported centrally
Greece	5 part time at authority level	No testing	7 in 2012
Hungary	30 part time authority level	Yes, 200 per year	20-50
Italy	Not available	Yes, numbers or results not known	Ca 10-50, not reported
Latvia	1 full time and 2 part time, plus 30 enforcement authority level	No testing	No/50-100 (different sources)
Lithuania	11 part time	No testing	No/50-100 (different sources)
Luxembourg	Not available	0 – 5 per year	20 – 50
Malta	4 on market surveillance	No testing	20 in 2012 and 20 planned in 2013
Netherlands	4 full time and 1 part time at energy agency	Yes, 70 – 100 per year	700 shops inspected, 250 – 1000
Poland	Not available	No testing	No, sporadically 20 – 50
Portugal	Not available, but 350 market surveillance staff	No testing	No in 2011 and 2012
Romania	40 inspectors	No testing	No/More then 1000 (different sources)
Slovakia	10 part time at authority level	No testing	At random or non-compliant
Slovenia	Not available	No testing	Not available
Spain	1 full time (energy agency) and regional government responsibility	About 40 by IDEA in 2008 – 2012 About 75 by Regional Governments in 2011 – 2012 About 20-30 by manufacturers in 2010-2012	In 10 regions, 450 appliances and 350 CFLs in 2011
Sweden	3 full time and 6 full time on ecodesign	Yes, varies from year to year	100 - 250

Country/Source	Staff resources dedicated	Product testing activities	Number of shop visits
United Kingdom	6 full time, including ecodesign	Yes, between 20 – 100. EST 15 in 2010/2011 and 9 in 2011/2012.	188 in 2012, 50 – 100, not reported centrally.

2.3 Level of compliance

Individual compliance tests do find cases of non-compliance, the average being **10 – 25% of products** tested, and **20% of products in shops** not being labelled and 15% not being labelled correctly (Table 2).

Concerning the label display at the points of sales, overall, kitchen and furniture studios are mainly considered to be the shop types with the lowest share of properly energy labelled products (Come On Labels, 2013 b) followed by general hypermarkets and electric specialist shops. In the case of kitchen and furniture studios the situation worsened between late 2011 and early 2013 when comparing the Come On Labels project´s three rounds of shop visits, and only 26% of all appliances were labelled properly in the last round (30-33% in the previous shop visit rounds). General hypermarkets showed a similar trend with an overall compliance just reaching 50% during the third round of shop visits.

Table 3 provides an overview of compliance level per product group. Wine storage appliances, air-conditioners and electric ovens are the product types with the lowest level of label display (Come On Labels, 2013 b).

In addition energy label display on TVs is also low compared to other product types with a new energy label. This is partly due to the fact that labelling for this type of appliance only became mandatory on 30 November 2011 and there may still be non-labelled products in stock that may legally be sold. But, on the other hand, the turnover rate of TVs, eg. due to major sporting events, is also the reason why the rate of correctly labelled TVs increased significantly.

The Come On Labels project (2013 b) also makes the comment that the **new energy labels** have effectively contributed to a lower level of partly and/or incorrectly labelled appliances. This is mainly due to the fact that the new energy labels are supplied in one piece which reduces the possibility for partial or wrong display of the label. Furthermore, shops are more inclined to display them on the appliances compared to the old label. Consequently, a considerable share of the partly/incorrectly labelled appliances found in the third round of shop visits belong to product groups still bearing the old energy label.

Table 2 **Compliance level of proper label display per shop type**

Type of shop	Fraunhofer, 2009 (%) (all EU)			Come On Labels, 2013 (%) (13 EU countries)		
	Correctly labelled	Mislabelled	Not labelled	Correctly labelled	Mislabelled	Not labelled
Electro superstore	66	25	8	70	9	21
Electric specialist chain	60	27	13	56	12	31
Electric specialist independent	58	31	11			
Kitchen/furniture store	39	43	17	26	15	59
Hypermarket/Cash and carry	56	32	12	54	10	37
Department store	69	25	7	---		
Internet stores	---			52	38	10
Total	61	28	11	52	14	34

Table 3 **Compliance level of proper label display identified per product type**

Type of appliance	Fraunhofer, 2009 (%) (all EU)			Come On Labels, 2013 (%) (13 EU countries)		
	Correctly labelled	Mislabelled	Not labelled	Correctly labelled	Mislabelled	Not labelled
Refrigerators	63	29	8	78	13	9
Freezers	67	25	8			
Washing machines	65	26	9	77	13	10
Tumble driers	70	22	9	62	26	16
Dishwashers	62	30	8	72	15	13
Electric ovens	45	34	20	44	22	34
Air conditioner	26	24	50	38	28	34
TVs	---			63	9	28
Wine storage appliances	---			33	8	59
Total	61	28	11	63	19	19

As regards the level of **compliance verified by product testing**, results from individual testing activities undertaken by individual countries or specific products show very different compliance rates, ranging from 100% compliance for specific product groups (eg. electric motors) to some 10 – 15% serious noncompliance rate for "classic" white appliances (serious noncompliance being eg. energy class to be wrongly declared) to 50 to 0% compliance (when products are selected on a high risk suspicion base and when also formal aspects, such as the content of technical documentation is being evaluated).

Overall, estimates say that at least 10% of energy could be lost due to non-compliance with energy label and ecodesign legislations - as much as the residential electricity consumption in all Eastern European Member States combined, or 90 TWh of final energy per year by 2020, (MarketWatch, 2012).

Table 4 Estimates of level of non-compliance and energy lost

Non-compliance rate	Note	Source
25 – 50%	Global estimate of non-compliant products	Ellis, 2012
10 – 20%	Ecodesign related non-compliant products	CSES, 2012
10%	Value of energy lost, global	Waide, et.al., 2011
15%	Label and ecodesign non-compliant products	Defra, 2009
25%	Non-compliant products concerning missing label declarations at sales points	Defra, 2009
21% 54%	Refrigerators, products non-compliant, - energy class declaration - some requirement	ATLETE, 2011
33 – 38% 11-14%	Products offered for sale without label display Products with partial or incorrect label display	Come On Labels, 2013 b
0 – 60%	Denmark, non-compliant products based on tests of various product groups.	DEA, 2012; Atlete, 2011; Atlete II, 2013b
20 – 73%	UK, non-compliant products based on tests of various product groups	IEA, 2010; Atlete, 2011; Culling, 2010; Waide et.al., 201; CLASP, 2010

Non-compliance rate	Note	Source
0 – 27%	Netherlands, non-compliant products based on tests of various product groups	Presutto, 2013b
25%	Spain, non-compliant products based on RENOVE plan subsidy scheme	Waide, et.al., 2011

Limited compliance results from a series of **obstacles** preventing higher level of market compliance and product verification. These include (eg. Attali et.al. 2009, ATLETE 2010, ATLETE 2013 b, Come On Labels 2013, CLASP 2013, CSES 2012, Ecopliant 2013, European Commission 2012):

- **Resources**: As resources are often scarce, resources for energy efficiency related compliance are not a priority in most countries and national authorities lack resources for higher level of compliance verification activities. In general, market surveillance also receives industry support, when industry associations confirm to understand that safety related compliance is more straightforward to perform, but specifically support that environmental and energy related compliance activities should also take place. One reason for lack of resources invested into surveillance is the lack of information on benefits which this activity brings to the society. Therefore a calculation of effectiveness of investments into compliance verification in terms of preventing losses to the society in higher energy consumption could be made.

- **Staff** constraints: Several countries do not have dedicated energy label and ecodesign compliance staff, but have inspectors also following other issues. One of the constraints relates to the growing family of product groups covered by the legislation, requiring more technical expertise and experience. Common best practice, guidelines and manuals, as well as common projects could make the involvement easier, in terms of the national authorities´ interest.

- **Laboratories** and **costs** of tests: Some countries argue that the lack of national accredited laboratories is preventing them from undertaking surveillance tasks, as well as adding to the cost of product testing. Individual examples show (Ecopliant 2013, Presutto 2013b)), however, that it is possible to use foreign laboratories and, potentially an even more useful approach, to accept results of tests from other foreign laboratories, if undertaken by surveillance authorities.

Barriers are addressed in more detail in the next section.

2.4 Obstacles to compliance

The literature relating to individual obstacles, problems and barriers in performing market surveillance has been reviewed. The findings from the literature are summarised below (eg. ATLETE 2011, ATLETE II 2013, Come On Labels 2013, Ecopliant 2013).

- Testing and laboratories:
    - **Lack of labs**: some countries argue that the lack of national accredited laboratories is a barrier for performing product testing, with costs of establishing such laboratories being a prohibitive barrier. Establishing a list of accredited laboratories, sharing results between authorities, and using foreign laboratories are potential ways of solving this.
    - **Different results of tests**: several stakeholders highlight the probability that one product, tested in several laboratories, could be judged compliant or non-compliant, depending on the quality and conditions of testing. Common procedures, report templates and minimum ambiguity in how certain detailed legal requirements should be fulfilled could reduce this obstacle.
    - **Costs**: Cost of testing varies between laboratories, countries, and product groups, and is a barrier to conducting more product tests. Establishing lists of test laboratories, sharing results and common testing projects could increase number of product tests.
    - **Sharing costs**: opinions vary on whether the cost of testing in Step 2, where three additional units of the model under compliance verification procedure are tested again, or costs of tests of the non-compliant products or testing costs at all, should be charged to the responsible supplier, or how costs of testing could or should be shared between the authority and the product supplier, in order to increase potential for testing more products, but to maintain full independence and neutrality of testing (Defra 2009, ATLETE 1010 b,c, 2011, Ellis 2012).
    - **Third party test results**: there are legal barriers reported to the use of test results from foreign laboratories for some national authorities. However, other sources of literature (Ecopliant 2013) claim that such barriers have not been specified in a number of countries and therefore the usage of foreign laboratories could improve quality and quantity of tests, enabling countries without specific laboratories to test products abroad.
- **Third party certification**: (currently, manufacturers are allowed to use self declaration in declaring specific values used for the energy label or for ecodesign compliance declaration. Some regions outside the EU or individual (non EU) countries require a third party certification by independent bodies, seeking high quality and comparability of product declarations), which could increase the quality of documentation provided by suppliers to authorities and, in consequence, also the level of product compliance with its individual declarations (Ellis 2012). In Europe, where third party certification is not requerd, some stakeholders (European Commission 2009 and 2011b) however raise the issue of the quality of third party certification and the difference between the tested product and the units sold – highlighting the need for surveillance.
- **Use of tolerances**: all stakeholders, from authorities to industry associations, (CECED 2012, Presuttto 2013), acknowledge the fact that tolerances should be used as a tool to allow for uncertainty of measurement in laboratories, not to modify manufacturer declarations for individual models from the values measured.

Some authorities (Defra 2009, Culling 2010) claim to have evidence of such cases happening and a new legislation amendment (European Commission, 2013d) is proposed to make it clear that such use of tolerances is illegal.

- **Databases**: database of products, either a registration of all products available on the market (for the market monitoring purposes), or list of the models identified by authorities as non-compliant is a tool discussed possibly contributing to the improvement of verification activities, by enabling authorities, and possibly other stakeholders, to learn about compliant and noncompliant models identified in other countries (to be undertaken via EU databases, regularly updated byMember States, and currently also trailed by a European project (Ecopliant 2013) of authorities) (supported also eg. by IEA 2010, and evaluated for ecodesign by CSES 2012).
- **Placing on the market** (eg. European Commission 2011c: The exact definition of market placement (or putting into service) is one of the barriers in verifying the applicability of a certain ecodesign or energy label requirements, since it may not be fully clear to all authorities what exact documentation to request. Templates and guidelines would assist individual inspectorates. For example, national authorities may have difficulties in defining the exact documentation to be requested from a retailer and/or supplier to provide evidence, that a specific model entered the market before a certain legal (label or ecodesign) requirement entered force – eg. sales of products within energy class below ecodesign requirements.
- **Equivalent model names**: manufacturers establish the energy label parameters or the CE declarations by a self-declaration and/or calculation for the whole family of products, both nationally and among various EU countries. The authorities, on the other hand, have to inspect every model individually to declare its (non)conformity (Attali et.al. 2009, CEECAP 2008b). Manufacturers should therefore be obliged to provide the list of model names for all models where the energy label and/or ecodesign declaration was issued under the family of products. They should also link models that are sold under different names in other EU countries – so that a non compliant model can be removed from all countries markets (ORGALIME 2012).
- **Compliance verification procedure** (2 steps where one unit of a model is tested in Step 1 and 3, additional units are tested in Step 2 if measurements in Step 1 indicate possible product non-compliance): some authorities claim the verification procedure (as defined by the individual Commission Regulations for individual products groups, eg. Annex V for household refrigerating appliances) to be too complicated, consisting of two steps, and a number of parameters to be reviewed. This is demanding in both costs of testing and the required technical expertise. Some call for simplified verification procedures; in practice many surveillance tests take place in simplified format (Step 1 only, only selected parameters being tested). A technical documentation pre-check could be a simplified procedure for countries unable to perform any or a substantial amount of tests.
- **Fines and penalties** (size and form): the size of penalties among countries varies substantially, and so does the methodology of determining its size, from the size of the company to the amount of energy lost. Industry stakeholders (CECED, DIGITALEUROPE, ORGALIME, TechAmerica Europe 2013) argue that the size of the company or its general turnover should not be a prerequisite for determining the size of the fine, rather the turnover of the specific product at stake, or even the energy lost due to the sale of non-compliant product.

  - **Publishing:** some argue that the size of penalties is symbolic in some countries, and not prohibitive to larger companies. Some stakeholders (Waide 2013) therefore argue that the result of compliance activities should be made public, as the threat of being published with a non-compliant product is a higher threat to the manufacturers and suppliers.
- **Economic operators**: there needs to be a better definition of the economic operators and their responsibilities– eg. product manufacturers, national suppliers, distributors, retailers, and their responsibility in ensuring product compliance and information provision to consumers and authorities. The role of manufacturers and suppliers should be specified on both national and headquarter-level in order for the authorities to have a clear partner in negotiating individual compliance cases.
- **Suppliers from third countries**: contacting suppliers and manufacturers from third countries, EU and non-EU, may be more problematic, not only in terms of the language, but also in terms of identifying the proper entity. Authorities could therefore contact and inform the national supplier, headquarters of the manufacturer, and the Authority in the state of the manufacturer headquarters.
- **Internet shops**: internet shops represent a specific problem for two reasons – in terms of label information display, they often do not display all information required, and internet shops based in non-EU countries may be importing products which do not conform to the EU legislation. Authorities could, in such cases, have problems contacting these providers and consumers could be advised to take a precautionary approach before purchasing such products.
- **Technical documentation:** checking the technical documentation for individual products is considered a more feasible option for authorities, demanding fewer resources than product testing. Some stakeholders argue that checking the technical documentation is an option for countries unable to perform product testing and see it as a suitable form of establishing product non-compliance suspicion, but others (CECED 2012) would like to ensure that testing and full compliance needs to be verified before issuing a formal decision. The exact format and content of technical documentation to be verified is often also questionable; there are issues of suppliers delivering insufficient lists of documentation, or even documentation for different models than claimed. Templates for the format and content of such documentation would help in further increasing this verification activity.
- **Language:** One of the issues related to the technical documentation also relates to the languages in which it should be supplied. While the ecodesign legislation requires it to be supplied in "one of the community languages", some authorities ask for its national language. Manufacturers may require the ability to use their own language (CECED 2013). A good practice among stakeholders would be using English.

2.5 Opportunities for improving compliance

Formulated by the literature, stakeholders´position papers, studies and conference papers, the following main recommendations for improvement of compliance have been identified.

2.5.1 National surveillance activities

Some views on market surveillance seem to be shared by most stakeholders. The level of market compliance is considered to be low or insufficient (eg. Attali 2009, ATLETE 2010 b, Come On Labels 2013, European Commission 2013e, Rambaldi 2011a, Waide et.al. 2011), and it should be profitable for the society as a whole to increase the level of market surveillance activities – benefiting individual consumers, the society, environment, industry, and energy labelling and ecodesign reputation. There is scope for national authorities to increase capacities, and the impact of actions in a number of ways.

- **Facilitating compliance**: one important recommendation, that (CSES 2012), , is not mentioned often in the literature, is to negotiate the results of activities with the headquarters of the manufacturer or the supplier chain, asking to undertake remedy actions on a larger scale – for the family of products, for all shops involved, or internationally. Manufacturer associations (eg. ORGALIME 2012, ELC and CELMA 2011, CECED 2012, EPEE 2012) are asking to be involved in surveillance activities, to provide intelligence.
  - **Notices of compliance**: shop visits by the authority usually are documented and reported to the shops. In addition, some authorities organise follow up activities, informing the headquarters about the past activities, planning to re-visit shops with a certain level of low compliance, as this has shown to have a positive impact on the overall label display in shops in general.
  - **Training, guidance and communication**: with stakeholders, retailers, suppliers, and industry association, starting with a very clear set up of the responsible body and contact point, can have a positive impact, limiting the needs for individual non-compliance cases.
- **Technical documentation**: templates for technical documentation to be provided by suppliers, as well as the templates for test reports would improve the quality and comparability of documentation.
- **Resources**: Resources are limited and some of the options increasing capacities and impact of market surveillance are:
  - Calculate the benefits and loss from (non)compliance to make the impact of losses from non-compliance more visible. Current evidence (Waide et.al., 2011) indicates that total government expenditure on European compliance activities is about €7m across the EU and EEA and hence is only about **one 2000th** of the value of the energy being lost.
  - Some proposals (Waide et.al. 2011) suggest increasing the compliance budgets to some 1 Euro per capita, increasing product testing capacities.
  - Sharing costs of tests, most notably demanding the costs of tests for non-compliant products (Defra 2009), could increase the capacity for the number of tests being carried out with the condition to ensure independence (Ecopliant 2013).
  - Undertaking a documentation check, without physical testing, could increase the authority´s capacity to focus its attention on products with suspected non-compliance (Ecopliant 2013).

    - Participation in international projects, sharing plans and results of surveillance activities, learning from others´ best practice, and adapting muster procedures (templates, procedures and documentation check guidelines) – this all could increase the effectiveness of surveillance, without a need for substantial increase of resources (Come On Labels 2013, Ecopliant 2013, ATLETE II 2013 b).
- **Internet sales**: stakeholder recommendations include to increase international co-operation to enable compliance controls of Web sites and warehouses based outside of the EU/EEA territory that target EU customers, possibly offering products noncompliant to the EU legislation Consumer communication campaigns could also be put in place (ORGALIME 2012) to inform consumers that there is a risk if they buy products from non-EU/EEA based web sites, which do not indicate whether or not such products comply with EU legislation.

2.5.2 Cooperation between Member State authorities

It may not be realistic to expect that resources can be increased at a national level for a number of Member States. Consequently, it is important to find ways to increase cooperation; to share plans, best practice and results of national surveillance activities; and to develop common procedures and projects to ensure applicability of results in more countries.

Cooperation between surveillance authorities and common activities can be considered as the best and most effective way to increase the volume, effectiveness and impact of energy labelling and ecodesign related market surveillance. Specific opportunities (eg. ATLETE II 2013b, Come On Labels 2013, Ecopliant 2013) are listed below.

- **Sharing plans**: one of the starting points is to share plans for market surveillance on a national level. Authorities should share their plans for market surveillance, most specifically in the product testing area, to ideally select product types among the countries to avoid any duplication.
- **Developing templates**: developing common templates for individual types of documentation (technical documentation to be demanded from suppliers or test reports from laboratories) would help individual authorities to focus their attention on the content of such documentation from the suppliers and dealers. This would also help avoid situations where the same product could be declared compliant or non-compliant by different authorities. Industry appreciates templates (AMDEA 2010) but also requires sufficient details in legislation (Rambaldi 2011).
    - **Test reports**: A specific type of documentation is test reports to be received from laboratories, which should all ideally contain the same information based on the same testing procedures. Templates of test reports can help ensure that the laboratories provide the same amount of information, and limit the possible ambiguities in conducting the individual tests.
    - **Technical documentation formats**: experience showed that some suppliers may supply an insufficient set of documentation to verify product´s energy label and/or ecodesign compliance. The definition of specific formats of such documentation can help to increase effectiveness of authority’s surveillance.

- **Sharing results:** Scholand, et al (2011) make the case that manufacturers may have one particular model that is sold across several markets, and sometimes under different brand names. If an enforcement agency finds a particular model to be in violation of its regulation, this information should be shared with other enforcement agencies in countries that have the same regulation. In Europe, the sharing of data on market surveillance across the European Union and the European Economic Area markets is the function of the Administrative Cooperation (ADCO) Working Group. Due to the fact that regulations are set at an EU level but enforced at a country level, a strong opportunity exists for ADCO to share data across the EU Member States to facilitate and lower the costs of enforcement. Looking beyond the EU market, as harmonisation becomes more prevalent in the market (with the aforementioned lower costs associated with the regulatory analysis), sharing of enforcement data between regulatory entities can also help to lower administrative costs and protect the markets from unscrupulous manufacturers or importers who seek to undercut the regulations. This can be combined with sharing the results with stakeholder associations, and – most of all- by being able to implement the results from other countries on the authority´s own territory (also supported by NGOs (Arditi, Toulouse 2012) and stakeholders (ORGALIME 2012) and by ATLETE II (2013 b) and performed by the ATLETE II project, other examples by Presutto 2013b).
- **Model names**: unequivocal identification of the products would help sharing and adapting results of surveillance activities from other countries. Authorities therefore could seek to:
  - Consider the results of their surveillance actions to be applicable to all the models under the "family of products" as declared by the supplier (since only one label or ecodesign testing or calculation is typically done by the manufacturer for the whole family of products);
  - Consider obtaining the list of equivalent models also for other EU national markets, so that the results of compliance verification could be adapted to the other countries as well.
- **Product database**: the ability to store and share results of compliance verification is considered as crucial (Krivosik, Toulouse, 2013) and supported by stakeholders (Ecopliant 2013, EPEE b, MSC 2012, ORGALIME 2012) and the literature (CSES 2012, CLASP 2011, IEA 2010, ATLETE 2010, Olesen 2013). Product databases are supported, and the increased usage of systems similar to the product safety is recommended. A "discipline" is required however from the side of the authorities, to report on individual cases undertaken. Specific databases have been put in place already (RAPEX, ICSMS), mainly dealing with product safety. databases could also be used for label and ecodesign non-compliance evidence but would need additional resources.
- **Laboratories**: cost of testing and lack of laboratories is considered as a barrier to higher number of tests undertaken. The suggested options to improve this include:
  - **List of adequate laboratories**: elaborating the list of adequate laboratories for individual product groups would enable authorities, eg. via ADCO (Defra 2009) to more easily identify appropriate laboratory or to invite them for a tender application submission.

- **Usage of foreign laboratories**: already undertaken by some countries, and in general encouraged by the EU open market rules, authorities should not only rely on domestic laboratories.
- **Accepting results**: accepting results of tests undertaken by other laboratories and used by other national authorities, most importantly if accepted by the national supplier, should enable individual authorities to increase the amount of product related non-compliance cases, either by issuing a fine, request documentation (and/or the energy label) modification, or even to demand a market removal, without conducting the test on its own.
    - **Projects:** organisation of common projects in this area, ensuring finances, expert knowledge and capacity, and practicing the information sharing and adaption is one of the most practical ways of bringing this activity more into common practice.

2.5.3 Role of the EU and the European Commission

Due to the low level of market surveillance in a high number of EU Member States, an increased role for the EU and the EC is considered as one of the key opportunities to ensure higher product compliance level with the energy labelling and ecodesign legislation. The increased involvement, coordination and support role (also via the Market Surveillance Package, European Commission 2013) is seen as a positive and needed service.

- **Higher role for coordination**: the EU/EC ability to coordinate, collect and compile information from individual authorities is supported by the literature sources reviewed, consisting of both stakeholder associations and relevant European projects conducted recently.
- **Consistently applied market surveillance**: one of the roles of the EU/EC could be to ensure:
    - "Benchmarking" level of market surveillance, ensuring consistent (in terms of conclusions from information receive, e.g. relating to the same products) results of surveillance around the EU;
    - Ensuring certain minimum level of surveillance on all national markets, including countries performing no or very few market surveillance activities.
- **Fostering cooperation and communication**: the EU/EC can provide a platform for the authorities to exchange plans and results of their own activities, helping to avoid duplications and to adapt lessons learned in other countries.
- **Registering non-compliant products**: within the product databases, a strong registry of non-compliant products would help individual authorities to share and adapt the results of non-compliant cases, and also give a broader picture on non-compliance. This would allow better formulation of priorities for future actions.
- **Providing templates and guidelines**: by providing the templates and guidelines, individual authorities could focus more on implementing individual actions, less on developing methodologies, and it would also help to obtain consistent and higher quality documentation.
- **Organisational assistance**: The EU/EC role in providing the authorities with a platform for meeting and cooperation is a crucial one, facilitating their cooperation and information exchange.

- **Financial support**: funding for meetings (via ADCO groups or similar) and in supporting market surveillance projects is considered a very welcome and effective tool in increasing the level of surveillance and its impact on the community markets (supported also by stakeholders, eg. ORGALIME and ANEC 2013, Svensk Handel 2009).
- **Product traceability**: assistance in ensuring that products would be traceable on the market, by establishing guidelines on how the suppliers should inform authorities in terms of the product families covered by the same energy label/ecodesign testing and calculations.
- **Ensure MSA package/MSA Forum to fully cover labelling and ecodesign**: the MSA Package and its Forum have been appreciated by the stakeholders. While the majority of attention is being given to product safety, its needs to be ensured that energy label and ecodesign regulations are fully "represented" within these activities (European Commission 2013c, Presutto 2013, ORGALME 2012 and 2013).
  - **Information sharing between authorities**: improving data collection and establishing the system, provide organisational assistance to perform surveillance tasks.
  - **Obligations to manufacturers, importers as well as distributors**: improve product traceability, provide guidance, consider specific needs of SMEs.
  - **Action at EU level**: little evidence is based in the literature on if and how the surveillance activities could be moved from the national responsibility to the EU level authority. Some stakeholders generally support the higher level of EU role in the coordination, ensuring increased level and quality of compliance verification, as well as coordination activities.

2.6 Uniformity and campaigns

A specific section of the research has focused on the evaluation of how the stakeholders have been informed on the interpretation and application of the energy labelling and ecodesign related implementing measures.

2.6.1 Evidence of information activities

Anecdotal evidence exists regarding information activities to inform stakeholders, such as retailers and suppliers, about their energy labelling and ecodesign related duties. However, no centralised evaluation or monitoring on how they have been informed has been identified.

There are some **national authorities,** which have elaborated information materials and placed them on their websites (eg. Ireland 2012, ELMS 2013, CAP, Ellis et.al. 2010, Attali et.al. 2009). Some have also established a contact point for stakeholders, and in a small number of cases, information is also available on the level of enquiries received (DEA 2012).

Materials have also been developed by the appliance **manufacturer association (eg. CECED)**, ranging from a detailed website to targeted leaflets introducing the new energy labels. Other information activities for stakeholders have been undertaken on EU and national level by several **European projects** (eg. ATLETE, ATLETE II, Come On Labels, ComplianTV, Euro Topten, PremiumLight), funded by the Intelligent Energy Europe programme of the European Commission. Consumer and environmental **NGO**s have also organised a number of individual projects targeting consumers.

The main information **carriers** include leaflets, websites, training manuals, brochures and posters, organisation of seminars and publishing articles in specialised as well as general media.
The information elaborated by these materials mainly **focuses on** the proper label display in shops, as well as on the explanation of the meaning of individual icons, rules concerning the duties to elaborate labels for certain specific (or untypical) product types, etc.

2.6.2 Perceived effects of information activities

Article 3(c) of the 2010/30/EU energy labelling directive requires that the introduction of the system of labels and fiches concerning energy consumption or conservation is accompanied by educational and promotional information campaigns to promote energy efficiency and more responsible use of energy by end-users. Each country has benefited from a different level of such activities. While energy labels are considered to be very efficient in moving the market towards more efficient products, monitoring of the impact is made complex as many factors are included in the decision making process of consumers.

According to a range of consumer surveys, including a recent consumer comprehension study (CLASP, 2013 b) it is clear that the new labels are generally appreciated, and have a reasonably high level of comprehension. Most consumers were able to use them to correctly rank the efficiency of products when comparing three different models with a different energy label, but a significant minority had difficulty in so doing. However, there was evidence that this could be overcome through explanation, which implies that it would be useful if the public education programmes better explained how to use the energy labels.

Efficiency was a reasonably important parameter for participants in the consumer surveys, with the majority being strongly motivated by the information on the label. They would not consider buying products in lower efficiency classes and were claiming to be prepared to pay roughly half as much again on average for higher efficiency products, compared to those with mid-range efficiency.

Product replacement schemes
Around the EU, there are also many product replacement schemes (Come On Labels 2013c), which many stakeholders consider among the most significant in supporting the quicker uptake of more energy efficient products to the market (Rambaldi 2011b). Some recently formulated recommendations include:

- Decide on whether the goal is to support better replacement or early replacement;
- Choose eligibility criteria wisely;
- Make sure the old appliance is being disposed of;
- For financial incentives, design accompanying information measures;
- Monitor effects and efficiency of the program.

Advertisement for a specific model (Art 4c)
A relevant question relates to the effects of information activities as formulated in Article 4(c) of the 2010/30/EC Energy Label Directive. This article regards advertisements for a specific model where energy-related or price information is disclosed, with a reference to the energy efficiency class of the product. The question is whether this article has contributed to the aim of the Directive.

Since the advertising requirement is one of the new features of the Energy Label Directive, only anecdotal evidence exists about the monitoring of the fulfilment of this specific feature (eg. DEA 2012, Dünhoff et.al. 2013). The observations suggest that the energy class display in advertisements is generally displayed properly, presumably also because the energy class is in most cases within the range of A to A+++, perceived by consumers as an energy efficient model (which is not the case for A class for many product types). An examples where fewer energy class declarations are made is for televisions, in part because it is a new product covered by energy label declarations, and in part due to the fact that B class products are well represented on the market. Specific literature on this however has been only identified for Denmark and the UK.

2.6.3 Option for improving the effect of information activities

Options, regularly listed by literature (eg. Come On Labels 2013, CEECAP 2008), to improve the effect of information activities include:

- Involving sellers through training/information campaigns on energy labelling purposes and requirements;
- Training needs to be conducted on a regular basis, as the turnover of staff in retail shops is often significant;
- It needs to involve both shop staff and managers;
- It should include both shops and distant sellers;
- State institutions could support information activities to advance a large participation of retail chains and shops;
- Educating suppliers and informing them on the proper usage of labels, CE marking and documentation for individual (sub) types of products.

2.7 References

- AMDEA, 2010, Industry´s Commitment to Product Compliance – A UK View, Douglas Herbison, AMDEA Chief Executive, IEA 4E MVE Conference, London, 14 September 2010, http://www.iea-4e.org/files/otherfiles/0000/0102/HERBISON.pdf
- ANEC, 11.5.2007, ANEC Study reveals: Significant shortcomings in implementation of EU Energy Label scheme, press release, Brussels, http://www.anec.org/attachments/ANEC-R&T-2007-ENV-003final.pdf
- ANEC, 2007, A review of the range of activity throughout Member States related to compliance with the EU Energy Label regulations in those countries, ANEC-R&T-2006-ENV-008 (final), http://www.anec.eu/attachments/ANEC-R&T-2006-ENV-008%20%28final%29.pdf

- Arditi Stéphane, Toulouse Edouard, 5.3.2012, Priorities for the improvement of the EU Ecodesign & Energy Labelling policies, Brussels, http://www.eceee.org/Eco_design/%20Horizontal%20matters/ENGO%20Ecodesign%20improvement%2005-03-12.pdf
- Arditi Stéphane, Meli Luigi, Toulouse Edouard, 2013, Revising EU energy label: evolution or revolution?, Eceee Summer Studies, June 2013
- ATLETE, 2010, Recommendations for an EU conformity assessment methodology, Deliverable 2.3, http://www.atlete.eu/index.php?option=com_docman&Itemid=111
- ATLETE, 2010, b, Overview of the methodology and the results achieved in the conformity assessment action at EU Member States and international level, Deliverable 2.2., http://www.atlete.eu/index.php?option=com_docman&Itemid=111
- ATLETE, 2010 c, Call for Tender for Testing Laboratories, Deliverable 4.1, main authors Milena Presutto and Michal Zakrzewski, February 2010, www.atlete.eu/index.php?option=com_docman&task=doc_download&gid=14&Itemid=111
- ATLETE, 2011, Publishable Result Oriented Report, http://www.atlete.eu/doc/Publishable%20Result%20Oriented%20Report.pdf
- ATLETE, 2011 b, FINAL CONFERENCE: Appliance testing for energy label evaluation (ATLETE) project – Market Surveillance both possible and vital, Press Release, 12 April 2011, http://www.atlete.eu/doc/ATLETE%202nd%20PRESS%20RELEASE%20June2011_final.pdf
- ATLETE II ,2013, Minutes of the 2nd IAC Workshop, 24.5.2013, Swedish Energy Agency, Stockholm, http://www.atlete.eu/2/project-resources/category/5-meetings-with-target-groups
- ATLETE II, 2013b, Implications of the new Energy Labelling Directive (2010/30/EU) and the Ecodesign of energy-related products (Ecodesign) Directive (2009/125/EC) on market surveillance activities, ADEME, 6. May 2013, http://www.atlete.eu/2/doc/Report%20on%20implementation%20and%20national%20legislation
- Attali Sophie, Bush Eric, Michel Anette, 2009, Factors influencing the penetration of energy efficient electrical appliances into national markets in Europe, report for Defra/the MTP, Paris, June 2009, http://www.topten.eu/uploads/File/Factors%20influencing%20the%20penetration%20of%20energy%20efficient%20electrical%20appliances%20into%20national%20markets%20in%20Europe-1.pdf
- Biswell, Stephen, 2012, Energy Labelling Framework Directive: UK Compliance Project 2012, National Measurement Office, May 2012, UK, http://www.bis.gov.uk/assets/nmo/docs/elf/news/energy%20labelling%20framework%20directive%20uk%20compliance%20project%202012%20final.pdf
- CAP, Broadcast Committee of Advertising Practice, Energy Labelling, UK, (undated, accessed 7/2013), http://www.asa.org.uk/News-resources/Media-Centre/2013/~/media/Files/CAP/Help%20notes%20new/Energy%20Labelling%20Help%20Note%20FINAL.ashx
- CECED, 2007, The importance of market surveillance – Press conference, 21 March 2007
- CECED, 2012, CECED Comments on Tolerances following the outcome of the Consultation forum on "Use of Tolerances" , Brussels, December 2012, http://www.ceced.eu/

- CECED, 2003, CECED Comments on the Proposal for a Regulation of the European Parliament and of the Council on market surveillance of products and the Proposal for a Regulation of the European Parliament and of the Council on consumer product safety, Position Paper, Brussels, May 2013, www.ceced.org/IFEDE//easnet.dll/GetDoc?APPL=1&DAT_IM=213B84&DWNLD=2013-05-15-PP-CECED%20Comments%20on%20the%20Revision%20of%20Goods%20Package.pdf
- CECED, DIGITALEUROPE, ORGALIME, TechAmerica Europe, 2013, Joint Industry Response to IMPCO Draft Regulation on the Proposal for a Market Surveillance Regulation, Brussels, 8 July 2013, http://www.orgalime.org/sites/default/files/position-papers/Joint%20position%20on%20IMCO%20draft%20report%20on%20MSPR_0.pdf
- CEECAP, 2008, Shop Visits and Label Compliance Control, SAVE project, Prague
- CEECAP, 2008, b, Experiences with verification and enforcement of the EU Energy Label, SAVE project, main authors Frank Klinckenberg, Hans Paul Siderius, 8 April 2008
- CLASP, 2010, A Survey of Monitoring, Verification and Enforcement Regimes and Activities in selected countries, main authors Mark Ellis, Zoe Pilven, June 2010,
- CLASP, 2011, Enforcement of energy efficiency regulations for energy consuming equipment: findings from a new European study, at EEDAL 2011, www.eedal.dk
- CLASP, 6.6.2013, How do we future-proof the European framework for setting MEPS and energy labels? An eceee Summer Study Solutions Workshop, Belambra, http://www.eceee.org/summerstudy/programme/solutions-workshops/thursday-clasp-eceee
- CLASP, 2013 b, The New European Energy Label – Assessing Consumer Comprehension and Effectiveness as a Market Transformation Tool, lead authors Paul Waide, Rowan Watson, May 2013, http://www.clasponline.org/Resources/Resources/StandardsLabelingResourceLibrary/2013/~/media/Files/SLDocuments/2013/2013_05_EU-Energy-Labelling-Comprehension-Study.pdf
- Come On Labels, 2013, National legislation and its practical implementation related to energy labels on energy-related products, Deliverable 2.2, March 2013, http://www.come-on-labels.eu/legislation/energy-labelling-legislation-in-the-project-countries
- Come On Labels, 2013 b, National Shop Visits Report on the 3rd round - Covering shop visits undertaken between January – February 2013 in 13 European countries, March 2013, http://www.come-on-labels.eu/displaying-energy-labels/status-of-appliance-labelling
- Come On Labels, 2013 c, New Product Replacement Schemes in the Come On Labels Countries, Deliverable 6.15, main author Corinna Fischer, March 2013, http://www.come-on-labels.eu/replacements/description-of-activities
- Culling Richard, 2010, Refrigerators & Freezers – Eco-design & Energy Labelling Compliance Project, National Measurement Office, October 2010, http://www.bis.gov.uk/assets/nmo/docs/elf/news/news-2009/refridgerators%20and%20freezer%20report%20anonymised.pdf
- CSES, 2012, Evaluation of the Ecodesign Directive, http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/review/index_en.htm
- DEA, 2012, Annual Report 2012 – Secretariat for Ecodesign and Energy Labelling of Products, http://www.ens.dk/sites/ens.dk/files/forbrug-besparelser/apparater-produkter/aarsrapport_2012_eng.pdf

- DEFRA, 2009, Summary of responses to the Consultation on the Implementation of the Market Surveillance and Enforcement Requirements f the Eco-Design of Energy Using Products and Energy Labelling Framework Directives held 11 June 2009 – 4 September 2009, London, September 2009, http://webarchive.nationalarchives.gov.uk/20100505154859/http://www.defra.gov.uk/corporate/consult/eup-labelling/summary-responses.pdf
- Dünhoff Elke, Negatsch Katrin, Strüh Carmen, 6.5.2013, Energy labelling of electric appliances – Results of the second market check in December 2012, Mainz, https://www.verbraucherzentrale-rlp.de/link1119589A.html
- Ecopliant, June 2013, Work Package 2: Overcoming Barriers and Establishing Best Practices, Task 1: Identify and describe existing best practices for market surveillance and possible barriers to coordination, draft Report, accessed July 2013, http://www.ecopliant.eu/meeting-papers/
- ELC and CELMA, European Lighting Industry activities on Market Surveillance, EEDAL conference, Copenhagen, 26 May 2011, www.eedal.dk/Conference/~/media/EEDAL/Sessions/Session%207/European_Lighting_Industry_activities_on_Market_Surveillance_Stuerm.ashx
- Ellis Mark, Barnsley Ingrid, Hols Shane, 2009, Barriers to maximising compliance with energy efficiency policy, eceee 2009 summer study, http://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2009/Panel_2/2.072/paper
- Ellis Mark, 2012, Survey of Market Compliance Mechanisms for Energy Efficiency Programs in APEC economies, May 2012, http://www.clasponline.org/en/Resources/Resources/SLHeadlines/~/media/Files/SLDocuments/2012/MVEworkshop/APEC-MVEsurvey-FullReport.pdf
- ELMS, 2013, Energy Labelling Regulations – Frequently Asked Questions – General Information, Ecodesign and Labelling Market Surveillance Authority/Department of Communications, Energy, and Natural Resources, July 2013, http://www.dcenr.gov.ie/NR/rdonlyres/4D989FF3-B5BF-45B3-8118-798A230D777E/0/FAQsELDGeneralInformation20130724.pdf
- EPEE, 2012, The EPEE experience with Market Surveillance on HVAC equipment in Europe, Brussels, March 2012, http://www.epeeglobal.org/epeedocs/internet/docs/EPEE-Market_Surveillance_-_position_paper_on_Market_Surveillance_in_Member_States-final2012_6229.pdf
- European Commission, 2009, Minutes of meeting – 1st meeting of the Ecodesign Directive Working Group, Brussels, 8 September 2009, ENTR/B/1, LB-ME, D(2009)32923
- European Commission, 17 May 2011, Implementation of the Energy Labelling Directive, Energy Community, Vienna, http://www.energy-community.org/pls/portal/docs/904192.PDF
- European Commission, 2011 b, Minutes of meeting – 3rd meeting of the Ecodesign Directive Working Group, 4 October 2011, Brussels, ENTR/B/1 LB ARES(2011)
- European Commission, 2011 c, Frequently Asked Questions on Ecodesign Directive and its Regulations, Brussels, version April 2011, further updates http://ec.europa.eu/enterprise/policies/sustainable-business/documents/eco-design/guidance/files/faq_en.pdf

- European Commission, 19.4.2012, Minutes of the Consultation Forum on horizontal issues, Brussels, 19.4.2012, http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/consultation-forum/files/20120419_minutes_en.pdf
- European Commission, 13.2.2013, Product safety and market surveillance package - Communication from the Commission – 20 actions for safer and compliant products for Europe, Brussels, COM(2013) 76 final, http://ec.europa.eu/consumers/safety/psmsp/docs/psmsp-communication-actions_en.pdf
- European Commission, 13.2.2013 (b), Product safety and market surveillance package - Report from the Commission – on the implementation …setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No. 339/93, http://ec.europa.eu/consumers/safety/psmsp/docs/psmsp-implementation-report_en.pdf
- European Commission, 13.2.2013 (c), Product Safety and Market Surveillance Package – Commission Staff Working Document – A proposal for a regulation…, Brussels, COM(2013) 33 final, http://ec.europa.eu/consumers/safety/psmsp/docs/psmsp-impact_en.pdf
- European Commission, July 2013 (d), Working document on the Ecodesign Consultation Forum on the use of variations in the verification procedures under Ecodesign implementing measures and Energy Labelling delegated acts, Brussels
- European Commission, 1 March 2013 (e), Market Surveillance, Ecodesign Consultation Forum, Brussels
- Fraunhofer, 2009, Survey of Compliance Directive 92/75/EEC (Energy Labelling) - Final Report, Fraunhofer ISI, GfK Marketing Services, BSR Sustainability, Karlsruhe, January 2009 http://isi.fraunhofer.de/isi-media/docs/x/de/aktuelles/Energy-Labelling_Final-Report.pdf
- IEA, 2005, International Energy technology Collaboration and climate Change Mitigation – Case Study 3: Appliance Energy Efficiency, Paris, lead author Thomas Guéret, COM/ENV/EPOC/IEA/SLT(2005)3
- IEA, 2010, Monitoring, Verification and Enforcement, improving compliance with equipment energy efficiency programmes, Paris, lead author Shane Holt, http://www.iea.org/publications/freepublications/publication/monitoring-1.pdf
- Ireland (2012), National Sector Specific Market Surveillance Programme 2012 – 2013, January 2012, http://ec.europa.eu/enterprise/policies/single-market-goods/files/market_surveillance/ie_nmsp_en.pdf
- Krivošík Juraj, Toulouse Edouard, 2013, Benefits and challenges of product databases for energy labelling related market surveillance, Come On Labels, http://www.come-on-labels.eu/legislation/eu-product-energy-labelling
- MarketWatch, 2012, Involvement of Civil Society in Market Surveillance of Ecodesign and Energy Labelling – Detailed description of the action, EST UK, 2012
- MSC, 2012, General Market Surveillance Programme 2013, Market Surveillance Council, Sweden, 23. November 2012, http://www.marknadskontroll.se/sites/default/files/General%20Market%20Surveillance%20Plan%202013%20final_0.pdf
- Olesen Gunnar Boye, 2013, Summary of Panel and Visions of the Future of Ecodesign and Energy Labelling, INFORSE-Coolproducts event at EU SEW, 27.June 2013, http://www.inforse.org/europe/pdfs/Conf_EUSEW-13-Panel-conclusions-27-june.pdf

- ORGALIME, 2012, Position Paper – Efficient and effective Market Surveillance: a priority to preserve the benefits of the Internal Market and the competitiveness of legitimate manufacturers, Brussels, 30 October 2012, http://www.orgalime.org/sites/default/files/position-papers/Orgalime%20position%20on%20the%20Future%20of%20Market%20Surveillance%20-%2030-10-2012.pdf
- ORGALIME, 2013, Market Surveillance of Products – Orgalime Comments on the Commission Proposal for a Regulation on Market Surveillance of Products, Brussels, 27 May 2013, http://www.orgalime.org/sites/default/files/position-papers/PP_Market_Surveillance_of_Product_Regulation_may13.pdf
- ORGALIME/ANEC, 2013, Position Paper – Market Surveillance Regulation: A brave step towards an effective pan-European market surveillance system, Brussels, 28 May 2013, http://www.orgalime.org/sites/default/files/position-papers/PP_Orgalime-ANEC_MSPR_may13.pdf
- Premium Light, 2013, Efficient top quality lighting with LED lamps?, accessed July 2013, http://www.premiumlight.eu/index.php?page=news-first-product-test
- Presutto Milena, 2013, Appliance testing and market surveillance – European appliance test results exchange system, Come On Labels, http://www.come-on-labels.eu/appliance-testing/results-exchange
- Presutto Milena, 2013 b, Appliance Testing – Summary List 3, Come On Labels, http://www.come-on-labels.eu/appliance-testing/appliance-tests-2011-2013
- Rambaldi Matteo, CECED, 2011,b, Instruments that enhance the uptake of better appliances – EESC Public Hearing, Brussels, 18.5.2011, http://www.eesc.europa.eu/resources/docs/presentation-rambaldi--2.pdf
- STEM, 2006, Ten Years of Energy Labelling of Domestic Appliances 1995–2005, Stockholm, http://webbshop.cm.se/System/TemplateView.aspx?p=Energimyndigheten&view=default&id=44e8db62c0d5467b983817162752cf5e
- Svensk Handel, 2009, Collaboration and Market Surveillance Success Factors for Collaboration, Stockholm, September 2009, http://www.neytendastofa.is/lisalib/getfile.aspx?itemid=2113
- Waide Paul, Watson Rowan, Eide Anita, Scholand Michael, 2011, Enforcement of energy efficiency regulations for energy consuming equipment: findings from a new European study, EEDAL 2011 conference paper and presentation, Copenhagen , http://www.eedal.dk/Conference/Programme%20and%20Presentations.aspx
- Waide Paul, February 2013, International Comparisons of Product Policy, Coolproducts http://www.coolproducts.eu/resources/documents/International-Comparison.pdf

3 Relation of Energy Labelling and Ecodesign to other EU policies

In the context of policies for Sustainable Consumption and Production (SCP) and Sustainable Industrial Policy (SIP), the Ecodesign and Labelling Directive are only two instruments within a broad set of policy tools, including energy efficiency-related instruments (Energy Efficiency Directive, Energy Performance of Buildings Directive, Energy Star) and other environmental policy instruments (Ecolabel, RoHS, WEEE, REACH, F-gas regulation). Furthermore, general health and safety legislation also applies to products. The question is therefore, how do these different instruments interact? Do they complement each other, are synergies exploited, do they conflict, or do problems fall in between various instruments? This section is dedicated to this question. First, the research questions and approach are described (section 3.1). The original questions (sections 3.1.1 and 3.1.2) are reorganised (section 3.1.3) to be able to answer them more coherently. A six-step approach towards answering them is described (section 3.1.4).

In sections 3.2 - 3.5 the results of the first four steps are presented and first conclusions are drawn. They cover the *theoretical* relations between the policies: Overlaps in scope are shown, and areas where conflicts, synergies or gaps can arise, are highlighted. Steps 5 and 6, dealing with the *practical* examples of conflicts, synergies, and gaps with regard to specific products, will be conducted in the future course of the project, with the help of the stakeholder process.

3.1 Research questions and approach

The analysis started out with the original research questions, as presented in the tender specifications. They are presented below:

3.1.1 Original questions – Energy Labelling directive

117. Has the Directive fulfilled its policy role within the context of the SCP/SIP Communication?
118. How do the results achieved from the energy labels compare to the results from other relevant policy instruments (e.g. Ecodesign, Energy Star, Ecolabel)?
119. Has Energy Labelling complemented, overlapped or contradicted other policy instruments and in that case which ones and how? Is it possible to better integrate the product related policy instruments, especially Ecodesign, Energy Star, Ecolabel and GPP (e.g. common preparatory studies, stakeholder working groups)? How?
120. How has the interaction with the relevant environmental legislation (e.g. WEEE, RoHS, and REACH) functioned? What have been the main challenges? How could the interaction be improved?
121. How has the interaction with the relevant health and safety legislation functioned? What have been the main challenges? How could the interaction be improved?
122. How has the interaction with the relevant energy efficiency legislation (e.g. the Ecodesign Directive, the Directive on the Energy Performance of Buildings and the Energy Services Directive) functioned? What have been the main challenges? How could it be improved?

123. Would it make sense to establish a mechanism updating public authorities about the highest ranking products available, with a view to facilitate the implementation of the public procurement requirements in the new Energy Efficiency Directive? If yes what would be best format for this mechanism?
124. How do the Energy Labelling requirements compare with product information requirements set out in Ecodesign implementing measures? What are the pros and cons of using one or the other to require information?
125. What has been the effectiveness of the Energy Labelling for those product groups that can be considered part of 'technical building systems' (i.e. heating and hot water systems, air-conditioning and large ventilation systems or combinations of such systems) versus the measures that Member States have taken regarding such systems under the implementation of Directive 2010/31/EU (or its predecessor Directive 2002/91/EC)?
126. What have been the challenges in implementing both the Energy Labelling and technical building system requirements in the Member States?
127. Going forward, what would be the best regulatory framework for improving the energy efficiency of technical buildings systems and why?
128. Would it be more beneficial if the Energy Labelling Directive was merged with the Ecodesign Directive and Energy Performance of Buildings Directive? What would be the pros and cons of such a merger (in terms of resources, adoption procedures, implementation by Member States, etc.)?
129. What would be the advantages and disadvantages of merging the tyre labelling framework and the Energy Labelling framework?
130. What would be the benefits and disadvantages of merging energy label and Ecolabel? Why?

3.1.2 Original questions – Ecodesign directive

72. Have the implementing measures fulfilled their policy role within the context of the SCP/SIP Communication?
73. Have the implementing measures overlapped or contradicted other policy instruments and in that case which ones and how? Is it possible to better integrate the measures with other policy instruments, especially Energy Label, Energy Star, Ecolabel and GPP (e.g. common preparatory studies, stakeholder forums and committees)?
74. How has the interaction with the relevant environmental legislation, such as WEEE, RoHS, REACH, F-gas Directive, Emissions Trading System, IPPC functioned? What have been the main challenges? How could the interaction be improved?
75. How has the interaction with the relevant health and safety legislation functioned?
76. How has the interaction with the relevant energy efficiency legislation (e.g. the Energy Labelling Directive, the Directive on the Energy Performance of Buildings and the Energy Services Directive) functioned? What have been the main challenges? How could the interaction be improved?
77. What has been the effectiveness of the implementing measures for those product groups that can be considered part of 'technical building systems' (i.e. heating and hot water systems, air-conditioning and large ventilation systems or combinations of such systems) versus the measures that Member States have taken regarding such systems under the implementation of Directive 2010/31/EU (or its predecessor Directive 2002/91/EC)?
78. What have been the challenges (e.g. practical, legal, institutional, etc.) in implementing both the Ecodesign implementing measures and technical building system requirements in the Member States?

79. Going forward, what would be the best regulatory framework for improving the energy efficiency of technical buildings systems and why?

3.1.3 Reorganisation of the questions

The underlying question is: How do Ecodesign and Energy Labelling relate to each other, and to a group of other policy instruments? Do these relations help to fulfil the policy goals, and if not, how could they be improved?

At the core of the matter is, therefore, a network of various policies that are the object of study. Most questions apply to the whole network, which is reflected by the fact that many of them are almost identical, only with different policies in the focus. Therefore, in order to avoid duplication, it was decided to reorganise the questions instead of working through them one by one, in a linear way.

First, questions relating to the *evaluation* (backward oriented) were separated from questions relating to the *future* (forward oriented). Questions No. 117-122, 124-126, and 72-78 were considered to be evaluation questions, questions No. 123, 127-130, and 79 were considered to be forward-looking questions.

3.1.3.1 Evaluation questions

The *evaluation questions* were organised according to the following considerations:
Most questions aim at analysing the *interactions between a set of policies*. Some of these interactions are specifically named in the questions: overlap, complement, or conflict. Many questions speak more generally about "interactions". Therefore, it was considered that, in principle, the following types of interactions are possible:

- **Overlap**: Overlap occurs when different policies have, in part, the same scope, be it in terms of products regulated, or in terms of environmental aspects or life cycle phases considered. The analysis of scope is at the heart of the analysis of any other interaction: it defines, for example, where conflicts are possible (e.g. when there is an overlap of both product scope and regulated aspects), or where policies can complement each other (e.g. when they have the same product scope but regulate different environmental aspects). The analysis of scope must therefore be the first step.
- **Complement/synergies**: Policies can complement each other or produce synergies. For example, the scope can be complementary when different policies regulate complementary products, environmental aspects and life cycle phases covered); the mechanisms used can work together to produce a common goal (e.g. push and pull mechanisms for market transformation); or there can be synergies in procedures (e.g. common usage of prep studies, stakeholder processes).
- **Contradiction/conflict:** Policies can contradict each other e.g. with respect to the requirements they formulate, or the responsibilities assigned to various bodies.

- **Misfit**: Misfit was not specifically mentioned in the original questions, but it is an important element of interaction. Misfit can, for example, occur with respect to product requirements, e.g. when the Ecolabel is less strict than the highest energy class, or with respect to timing of procedures e.g. when Ecolabel or GPP criteria are developed/revised before Ecodesign requirements or Energy classes are known.
- **Gaps**: Gaps are also not specifically mentioned, but are an important element of interaction: Gaps occur when problems are "shifted" between various policies that are supposed to deal with them, and in the end are treated nowhere.

Furthermore, there is a set of questions that does not look at interactions but asks for *comparison of results*/effectiveness of the various instruments that address similar problems or use similar mechanisms (Q77, 118, 124, 125).

Finally, there are *overarching questions* (original questions 72 and 117), which aim at giving an overall assessment of policy interactions.

As a next step, the policies mentioned in the questions were identified. Most policies were specifically named. A few had to be researched. This is especially the case for the "health and safety legislation" where relevant policies are not named in the questions and therefore had to be identified. The same was true for "Green Public Procurement", where the Procurement Directive 2004/18/EC and the Energy Efficiency Directive 2012/27/EC have been identified as relevant sources.

For analysing interactions, it makes sense to address all issues with respect to all policies to get the full picture. Therefore, the issues were organised in the following way. A matrix structure was developed, relating the set of issues (types of interaction) to the set of policies (Table 5). The policies are mentioned in the line headings. The issues (types of interaction) are mentioned in the column headings. The cells indicate which original questions are covered.

ECOFYS
sustainable energy for everyone

Evaluation questions ("Insights to date")

Overarching question: Have the Directives and their Implementing Measures fulfilled their policy role within the context of the SCP/SIP Communication? (Original questions 72, 117)

Table 5: Mapping of original questions against regulations concerned, and type of interactions between policies that will be analysed

Policies	Overlap	Complement/ synergies	Contradiction	Misfit	Gaps	Comparison of results
a) Environmental product policies						
- Ecodesign (Dir 2009/125/EC)	73, 74, 75, 76, 78, 119, 122,	74, 75, 76, 119, 122	74, 75, 76, 119, 122	74, 75, 76, 122	74, 75, 76, 122	77, 118, 124
- Energy Labelling (Dir 2010/30/EC)	73, 76, 119, 120, 121, 122, 126	76, 119, 120, 121,122	76, 119, 120, 121, 122	76, 120, 121, 122	76,120, 121, 122	118, 124, 125
- Ecolabel (Regulation No. 66/20120)	73, 119	119	119			118
- Energy Star (Regulation No. 106/2008; Decision 2006/1005)	73,					118
- GPP (Energy Efficiency Directive Dir 2012/27/EC, Procurement Directive Dir 2004/18/EC)	73, 119	119	119			
-						
b) General environmental policies						
- WEEE (Dir 2012/19/EC)	74, 120	74, 120	74, 120	74, 120	74, 120	
- RoHs (Dir 2011/65/EU)	74, 120	74, 120	74, 120	74, 120	74, 120	
- REACH (Regulation No. 1907/2006 and 1272/2008)	74, 120	74, 120	74, 120	74, 120	74, 120	
- F-Gas (Regulation No. 842/2006)	74	74	74	74	74	
- Emissions trading system	74	74	74	74	74	
- IED (Industrial Emissions Directive, 2010/75/EU; replaces the IPPC (Integrated Pollution Prevention and Control, Dir 2008/1/EC))	74	74	74	74	74	

Policies	Overlap	Complement/ synergies	Contradiction	Misfit	Gaps	Comparison of results
c) Energy efficiency policies						
- Energy Performance in Buildings Directive (Dir 2010/31/EC)	76, 78, 122, 126	76, 122	76, 122	76, 122	76, 122	77, 125
- Energy Efficiency Directive (former Energy Services Directive) (2012/27/EC)	76, 122	76, 122	76, 122	76, 122	76, 122	
d) Health and safety policies						
- General Product Safety Directive (Dir. 2001/96/EC)	75, 121	75, 121	75, 121	75, 121	75, 121	
- Sector legislation on chemicals (REACH), construction products (Dir 89/106, amended by Dir 93/68, and Regulation 305/2011), cosmetics (regulation 1223/2009), food (regulation 178/2002 and many more specific pieces of regulation), dangerous food imitations (Dir 87/357), low voltage electrical equipment (Dir 2006/95), machinery (Directive 2006/42), medical devices (Dir 90/385, 93/42 , 98/79), medicinal products (Dir 2001/83 and various amendmends), motor vehicles (Dir 70/156 and various amendments), personal protective equipment (Dir 89/686/EEC), recreational craft (directive 94/25 and proposal for recast), and toys (Dir 2009/48)	75, 121	75, 121	75, 121	75, 121	75, 121	

3.1.3.1.1 Forward-looking questions

Some of the forward-looking questions could be merged, but in general they remained as they were. The table below shows the reorganised forward-looking questions.

Table 6: Forward-looking questions

Reorganized question	Source question
Overarching question: How could the interaction between the various policy instruments be improved?	74, (75), 76, 120, 121, 122
Could procedures be streamlined and the substantial work be better integrated? (e.g. common preparatory studies, stakeholder working groups) – especially for Ecodesign, Energy Labelling, Energy Star, Ecolabel, Green Public Procurement	73, 119
Would it make sense to establish a mechanism updating public authorities about the highest ranking products available, with a view to facilitate the implementation of the public procurement requirements in the new Energy Efficiency Directive? If yes what would be best format for this mechanism?	123
Going forward, what would be the best regulatory framework for improving the energy efficiency of technical buildings systems and why?	79, 127
Would it be more beneficial if the Energy Labelling Directive was merged with the Ecodesign Directive and Energy Performance of Buildings Directive? What would be the pros and cons of such a merger (in terms of resources, adoption procedures, implementation by Member States, etc.)?	128
What would be the advantages and disadvantages of merging the tyre labelling framework and the Energy Labelling framework?	129
What would be the benefits and disadvantages of merging energy label and Ecolabel? Why?	130

3.1.4 Approach

The approach is as follows.

- Evaluation questions dealing with policy interactions (Q 117, 119-122, 126, 72-76 and 78): These can be answered on two different levels:
    - A first level comprises the *theoretical,* or conceptual, interactions between the policies: The question is whether the policies have built-in overlaps, complements or conflicts.
    - On the second level is, the question is whether and which *actual* cases of conflict, misfit etc. occurs. This can only be answered on the level of concrete products, procedures, and requirements. To illustrate the difference: if a certain policy (such as Energy Labelling) works by a pull mechanism, and another one (such as Ecodesign) by a push mechanism, the two are, by design, complementary. If they address the same aspects and life cycle phases of the same products, there is also a potential for misfit or conflict regarding the requirements. Only a concrete product example shows whether push and pull mechanisms work well together (for example, in speeding up the uptake of highly efficient tumble driers), or whether misfit actually occurs (for example, in the form of "empty classes" at the bottom of the label for cold appliances and washing machines.)
- Evaluation questions comparing results (Q 118, 124, 125, 77). These can of course only be answered on a practical level.
- Overarching evaluation questions, dealing with the overall policy performance of Ecodesign and labelling (Q 72, 117). These can only be answered as a conclusion of all the other detailed questions.
- Forward-looking questions (123, 127-130, and 79). To answer them, both a careful evaluation and an assessment of the future, preferably by different sources, is needed.

The analysis was conducted in 7 steps that cover different sets of questions. Step 1 (analysis of secondary literature) covers all questions in principle but did not lead to many results (see below). Steps 2-4 cover the theoretical or conceptual level of the evaluation questions and will be mostly answered in this report (at least as a first assessment). Steps 5-7 cover the practical level of the evaluation questions dealing with policy interactions, the results-oriented evaluation questions, the overarching evaluation question and the forward-looking questions. They will be answered later in the course of the project. The steps were the following:

Step 1: Screening of secondary literature. The screening covered all questions. As there were not many conclusive results, it was decided to analyse the original legislative texts to identify the interactions at the conceptual level (step 2-4).

Step 2: Screening of legal texts and determination of focus. The most important texts of the relevant legislation were identified.

Step 3: Comparative analysis of the legal texts. The legal texts were analysed and compared using a matrix that covered the following features:

- Objectives;
- Product scope:
  - Coverage of products: theoretical, actual;
  - Scope exemptions;
  - Other restrictions of scope: e.g. limit values, thresholds…;
- Aspects of products that are affected (ED/ELD: and that might be affected in the future):
  - Environmental aspects;
  - Life cycle stages;
  - Other aspects;
- Basic policy mechanisms used:
  - Information (mandatory/voluntary? to whom?);
  - Standards/requirements: product-related, process-related, system-related;
  - Public procurement;
  - Others;
- Procedures:
  - Additional legal act necessary to implement legislation?
  - Decision making process in arriving at this additional act;
  - Actors and responsibilities in the process;
  - Update procedures;
- Cross-references to other legislation.

Step 4: Instrument mapping and coherence analysis: The matrix was then used to identify the interactions described in section 3.2 (overlap, complement/synergy, conflict, gaps, misfit) on a *conceptual* level. This was a first assessment, to be further elaborated in the course of the project. It was conducted in the following sub-steps:

- Discussion and graphic presentation of overlaps of scope (Product scope, aspects covered; in theory and in practice);
- Short general discussion of objectives, policy mechanisms and their relations;
- Graphic presentation of the system of cross-references as given in the legislation itself;
- Short discussion of different procedures and their relations (to be completed in the course of the project).

On this basis, conclusions were drawn and presented with respect to:

- Scope/overlaps (conceptual and actual level);
- Complement/synergy (conceptual level);
- Conflict (conceptual level);
- Misfit (conceptual level);
- Gaps (conceptual level).

Step 5: **Analysis of policy relations on the concrete product level.** *Actual* examples of complement/synergy, conflict, gaps, misfit will be identified and discussed. Furthermore, the questions regarding the comparison of results (77, 118, 124, 125) will be addressed. In principle, this could be done by analysing the product-specific legislation (Implementing Measures, Ecolabel criteria etc.). The most relevant cases will be identified on the basis of stakeholder feedback (especially from the Commission) and analysed with respect to:

- Lessons learned from complement/synergies; how can they be extended?
- Reasons for conflict or misfit, e.g. lack of communication/coordination;
- Comparison of results;
- Recommendations.

Step 6: Overall evaluation (Q 72, 117) will be conducted as a result of the above.

Step 7: Ideas for improvement. This step will address the forward-looking questions. The main basis for this will be stakeholder input and conclusions from the above analysis.
The following sections cover step 1-4 and address the conceptual level of the evaluation questions.

3.2 Results of secondary literature review (step 1)

Scientific databases (SCOPUS, SCIRUS) and the web have been searched for literature since 2010, using the keywords "EU product policy", "Integrated product policy", "SCP/SIP" "energy labell(ing)" and "Ecodesign" in various combinations. However, very little literature could be identified that referred to the specific questions. Basically, these were relatively general overviews of Ecodesign and other mechanisms (e.g. ITRE 2008, Malcolm 2010); some well-known discussions of the complementary nature of push vs. pull mechanisms by standards and labelling (e.g. Wiel and MacMahon 2005, ch.2; Waide, and many others), and some general literature on energy efficiency policy vs. the Emissions Trading System (e.g. Cowart 2011; Lecuyer and Bibas, 2012; Thema et al 2013). One publication (Cetik 2011) deals with the perceived convergence of the EU Ecolabel, Energy Label, and CE marking. One very relevant source is of course the CSES evaluation of the Ecodesign Directive (CSES, 2012). Core results are:

Positive interaction between standards and labelling. It has long been shown how standards (as "push" instruments) and labelling (as "pull" instruments), if well adjusted, can play together to achieve market transformation. The figure by Paul Waide (IEA/Waide 2006) reproduced many times in different variations, illustrates the concept:

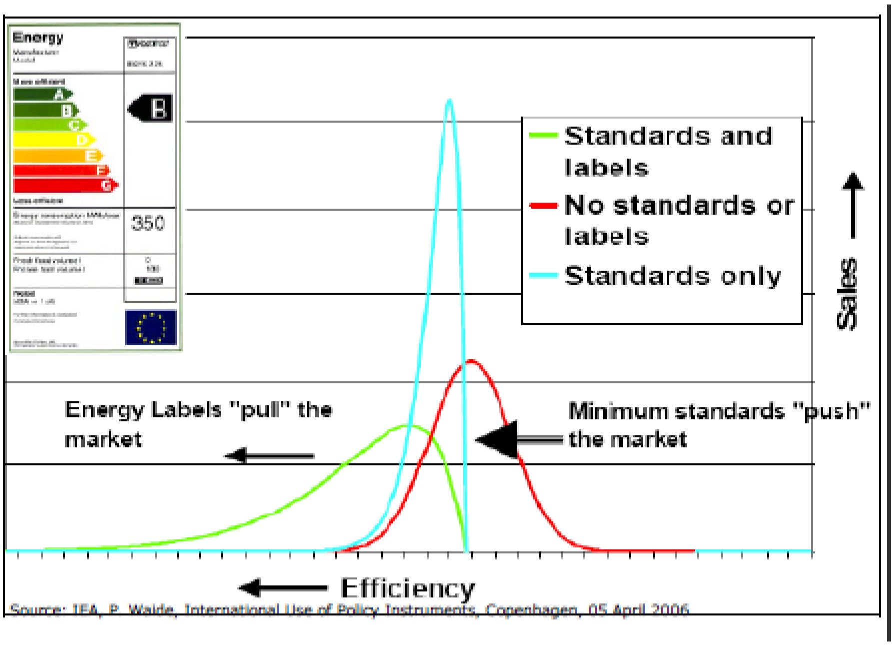


Figure 1: Positive interaction between standards and labelling in market transformation

Product related policies complement the Emissions Trading System: It has also been shown that, contrary to pure economic theory, a carbon price alone does not unlock all potentials for energy savings. This is due to market failures such as incomplete information, transaction costs, or split incentives, and to the fact that not all sectors are covered by carbon trading. Therefore, additional energy efficiency policies are needed to unlock these potentials. Authors (e.g. Thema et al, 2013) also agree that unlocking these potentials will lead to reduced carbon prices, even if they have differing views on whether this effect is beneficial. While Lecuyer and Bibas (2012) are critical that it weakens the effectiveness of the carbon trading mechanism, Cowart (2011) points out that it can, depending on policy objectives, lower the social cost of climate policies, or provide space for tightening caps and therefore making carbon trading *more* effective.

Convergence of Ecolabel, Energy Label and CE marking – and the role of Ecodesign: Cetik (2011) describes for a longer historic period, the tendency forf the Ecolabel, Energy Label, and CE marking to converge. First, there is convergence in substance; while the CE marking has for a long time only been dealing with product safety issues, it has recently been turned, by means of the Ecodesign Directive, into a tool for ensuring energy efficiency and other environmental issues. In turn, some product-specific Ecolabel rules have recently been dealing with product safety issues. Secondly, there is convergence in procedures; both Energy Labelling and Ecolabelling have started to rely on procedures that have first been used and tested with CE marking, be it the use of standardisation, or the procedures for conformity assessment, market surveillance, and enforcement. The author goes on to discuss the possibility that an integrated label might replace CE marking, Ecolabel, and Energy Label in the future. This remains an issue to be followed up when discussing "Options for Improvement".

Ecodesign evaluation 2012: The previous evaluation of the Ecodesign directive (CSES 2012) also looked at interactions between various policies (chapter 3.2). This has been done by primarily relying on stakeholder input. It has been concluded that the Ecodesign Directive is, in general, a very important tool within the SCP/SIP policy portfolio, and will continue to be so.

Stakeholders agree that its main purpose to remove the worst performing products from market is appropriate. However, interactions with specific other policies need to be improved. With respect to our questions, the following issues have been identified:

- **Complements/synergies:** Most stakeholders appreciated the strong complementarities between Energy Labelling and Ecodesign that were, among other things, guaranteed by the identity of staff working on both.
- **Conflicts:** The appropriateness of Ecodesign in dealing with complex systems such as technical building systems was questioned. It was argued that the optimisation of individual components may conflict with the optimisation of overall system performance as, for example, reflected in the Environmental Performance of Buildings Directive. In general, it was highlighted that the focus on **different** indicators and priorities between legislations might lead to conflicts, if the various aspects cannot be optimised at the same time. Reconciliation would be needed both on a substantive and a procedural level.
- **Misfit**: Even if Ecodesign and Energy Labelling were in general considered as complementing each other well, cases of misfit were also identified. One of these was the empty classes at the bottom of some labels, where the Ecodesign minimum standard prohibits the placing on the market of classes B, C, D, and sometimes even A. Another problem was that procedures were not anymore well aligned since the removal of the regulatory committee stage in Energy Labelling. This meant that delegated acts for Energy Labelling were often ahead of implementing measures for Ecodesign; further promoting that type of misfit.
  Furthermore, it was stated that the existing interfaces with Ecolabel and Green Public Procurement were less than optimal. "One clear example of failure is the case of TVs where the EU Eco-label was provided to class B products because there was no effective sharing of information with the relevant preparatory study on market developments. Similarly, due to the different time schedule for revisions, the Eco-label requirements for air conditioners and heat pumps have been set at a lower level than the Ecodesign requirements." (CSES 2012, p. 26).
- **Gaps**: Some stakeholders deplored missed opportunities for including non-energy aspects into Ecodesign. The authors cautioned, however, that it is important to choose the appropriate instrument for tackling such issues. Other instruments might be more suitable than the Ecodesign Directive. The case of mercury in lamps was discussed as an example of learning how to integrate various environmental aspects and handle them, using various instruments. However, it was also pointed out that some problems such as toxicity or end of life issues tend to fall in between legislations because of policymakers' and stakeholders' inclination to "shift" them around. Various examples were given, for example that "the Implementing Measure on washing machines states that the end of life related requirements concerning product design (recyclability) is to be covered by the WEEE Directive (Article 4)22, while in the context of the WEEE Directive stakeholders claimed that it was thought that eco-design requirements should be addressed under the Ecodesign Directive. This has in practice led to the absence of any relevant provisions." (CSES 2012, p.26).

The general conclusion was that better coordination, sharing of data and methodologies was needed especially for Ecodesign and the Ecolabel. Furthermore, practical guidance should be developed to clarify the interfaces between the various policies and indicate which ones have priority.

In our opinion, these findings are still valid. However, we are aiming at complementing them in this study. First, their focus on Ecodesign will be complemented by a stronger look at the energy label. Secondly, the findings are almost exclusively based on stakeholder input. This may lead to certain biases depending on stakeholder availability and interest. In this report, a more systematic approach will be usedto see whether additional aspects can be identified.

3.3 Information base: choice of legal texts (results of step 2)

As a second step, the relevant legislation has been compiled and screened
The policy instruments mentioned in the questions and listed in Table 5 formed the basis.
A few policies have been excluded from analysis, and some others have been added, for reasons presented below.

3.3.1 Policies and aspects that were focused on

It was decided to focus on those pieces of legislation that are, regarding their subject, most closely related to Ecodesign and Energy Labelling, and/or where issues are already known. These are the Ecodesign Directive, (2009/125/EC), the Energy Labelling Directive (2010/30/EC), the Ecolabel Regulation (Reg. No. 66/2012), the Energy Star Regulation (Reg. No. 106/2008; Decision 2006/1005), the Energy Performance in Buildings Directive (2010/31/EC), the Energy Efficiency Directive (2012/27/EC), Green Public Procurement legislation (Energy Efficiency Directive 2012/27/EC, Procurement Directive 2004/18/EC), Waste Electrical and Electronic Equipment (Directive 2012/19/EC), Restriction of Hazardous Substances (Directive 2011/65/EU), REACH (Regulation No. 1907/2006 and 1272/2008), and the F-Gas Regulation (Reg. No. 842/2006). Within this set of policies, the work focus was the framework legislation. Product-specific legislation could not be considered in detail within the scope of this study. However, a list of products that are affected by such legislation has been drawn up (see .Annex B). For some complex pieces of legislation such as REACH, it there is a focus on basic mechanisms.

3.3.2 Policies that were added

The following policies were added:

- The Marketing of Products Framework (Regulation (EC) 765/2008; Regulation (EC) 764 (2008), and Decision 768/2008/EC of the European Parliament and the Council) as it provides the general framework for CE marking and market surveillance in which Ecodesign Legislation is embedded;
- The Waste Framework Directive (Dir 2008/98/EC) as it includes a provision on Ecodesign as a possible measure to prevent waste.
- The Car Labeling Directive (Dir 1999/94/EC). Although there is currently no overlap of scope, it may become relevant in the context of a possible expansion of scope to means of transport (details will be discussed in the context of scope expansion in the first findings report). Specific issues in this context will be
    - that the format of car labelling is left to the Member States and implemented differently in different countries, some of them using scales similar to the energy label while others don't;

- that car labelling includes, besides fuel efficiency, CO_2 labeling and therefore covers a different (although closely related) impact than energy efficiency.

3.3.3 Policies and aspects that were excluded

Health and safety legislation has only been screened in a very broad way (General Product Safety Directive 2001/96/EC, selected sector-specific legislation such as the Construction Products Regulation where overlaps in scope are known). This legislation is too extensive and detailed to be considered within the scope of this study, and no major issues are known here so far. The results from stakeholder consultations will be used to validate and, if necessary, review this approach. The same applies to other product-specific consumer protection legislation, covering e.g. product lifetime or product information issues. The latter may conflict for specific products with requierements under Ecodesign or Energy Labeling. Concrete examples will be collected in the course of the stakeholder consultations and eventually be discussed in the First Findings Report.

The Emissions Trading System and the Industrial Emissions Directive have been excluded from the analysis. Both do not overlap in scope with ED and ELD, as they address industrial scale installations (e.g. in IED: combustion plants of at least 50 MW thermal input.) There had been hints to possible conflicts by stakeholders before – however, the issue turned out to be not so much about the IED than about national legislation that had been put in place in the course of the IED transposition into national law, and later came into conflict with Ecodesign[2].
Also, EURO emission standards for cars have not been considered here. As there are currently no overlaps of scope, conflicts are only to be expected in the course of scope expansion, and there are no specific labelling issues as in the Car Labeling Directive. They will therefore be discussed in the context of scope expansion.

3.4 Instrument mapping (results of step 3)

In step 3, instruments have been mapped with respect to their objectives, scope (product scope, environmental aspects, life cycle stages), the basic policy mechanisms they use, related procedures, actors and responsibilities, as well as cross-references to other legislation. The detailed analysis is given in Annex A. Here, the most relevant results are presented, starting with the scope, because it is the basis for any possible interactions.

3.4.1 Scope

Regarding scope, there are two separate issues. First, the analysis of *product scope* shows to what degree various policies deal with the same product groups. Secondly, the analysis of *(environmental) aspects and life cycle phases* shows whether within their product scope, they address similar issues.

<u>Product scope</u>

[2] In the course of the transposition of the IED into national law, the German government had also imposed relatively strict requirements on domestic boilers and small furnaces (which are not in the scope of the IED though). This was possible under the IED, but no more so under Ecodesign which did not allow stricter national limits.

Figure 2 shows the product scopes for the respective pieces of legislation in a simplified way (e.g. not considering all scope exemptions). Table 7 explains the scope more precisely, either as stated in the legislation itself, or as can be deduced. It becomes clear that Ecodesign and energy label at least partly share their scope with almost all other pieces of legislation considered here (except for tyre labelling).

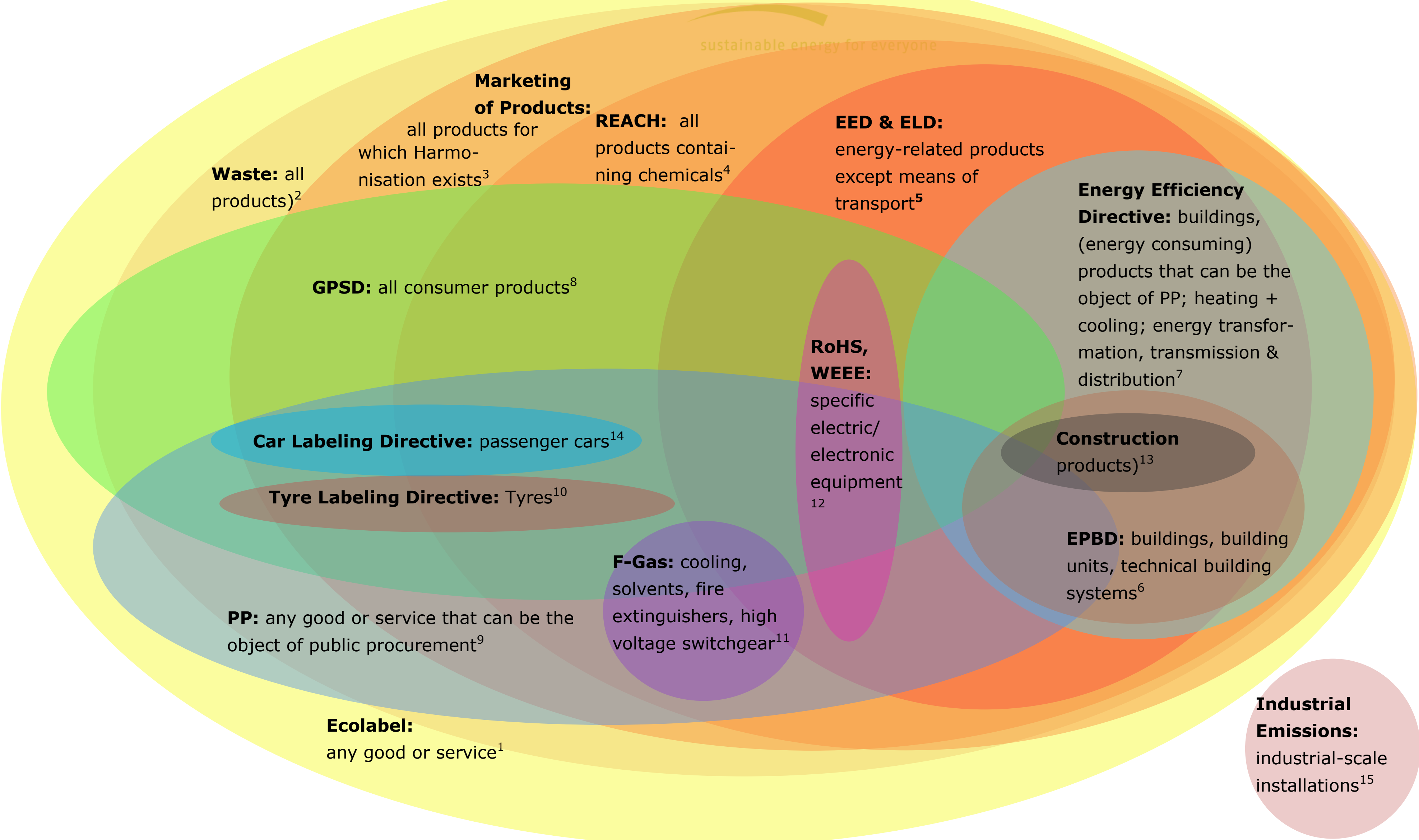


Figure 2: Overlaps of product scope between various policies. Footnotes are explained in Table 7.

Table 7 Clarification of scope of various policies

1	Ecolabel	Any goods or services which are supplied for distribution, consumption or use on the Community market whether in return for payment or free of charge (Article 2.1)".
2	Waste Directive	Everything that appears in the "list of waste" established by Decision 2000/532/EC (Art. 7). Products are covered by category 16, Waste not otherwise specified, sub-category "discarded equipment", category 17, "construction and demolition waste", and and category 20. municipal and similar waste, which would include all waste products (the other categories are waste from industrial, construction, or agricultural processes) Excluded are: (a) gaseous effluents, (b) land (in situ) , (c) uncontaminated soil and other naturally occurring material excavated in the course of construction activities, (d) radioactive waste; (e) decommissioned explosives; (f) faecal matter, straw and other natural non-hazardous agricultural or forestry material and, if covered by other community legislation: (a) waste waters; (b) animal by-products, (c) carcasses of animals, (d) waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries; non-hazardous sediments.
3	Marketing of Products Framework	All Products for which community harmonization legislation exists.
4	REACH	Not product- but substance-related legislation. As it applies in principle to all chemical substances and mixtures with certain exemptions (Art. 1.2 – 1.5), it can be deducted that all products containing these substances and mixtures are affected.
5	Energy Label and Ecodesign	*Energy Label*: "This Directive shall apply to energy-related products which have a significant direct or indirect impact on the consumption of energy and, where relevant, on other essential resources during use. (…) This Directive shall not apply to: (a) second-hand products; (b) any means of transport for persons or goods; (c) the rating plate or its equivalent affixed for safety purposes to products. (Art. 1.2 und 1.3) *Ecodesign*: "This Directive establishes a framework for the setting of Community Ecodesign requirements for energy-related products (…). This Directive shall not apply to means of transport for persons or goods." (Art. 1.1 and 1.3). "'Energy-related product' (…) means any good that has an impact on energy consumption during use which is placed on the market and/or put into service, and includes parts intended to be incorporated into energy-related products (…) of which the environmental performance can be assessed independently" (Art. 2.1).
6	Energy Performance of Buildings Directive	"(i) existing buildings, building units and building elements that are subject to major renovation; (ii) building elements that form part of the building envelope and that have a significant impact on the energy performance of the building envelope when they are retrofitted or replaced; and (iii) technical building systems whenever they are installed, replaced or upgraded (Art. 1.2c).
7	Energy Efficiency Directive	Not product-related legislation. From various places in the legislation, it can be deducted that it affects (a) buildings (Art. 4,5), (b) any product that can be "energy-efficient" and the object of public procurement (Art. 6), (c) appliances in a household (as part of an consumer-oriented energy savings programme) (Art. 7,12) (d) heating and cooling co-generation plants, (Art. 14) (e) equipment for energy transformation, transmission, and distribution (Art. 14,15).
8	General Product Safety Directive	" 'product' shall mean any product — including in the context of providing a service — which is intended for consumers or likely (…) to be used by consumers (…) and is supplied or made available, whether for consideration or not, in the course of a commercial activity, and whether new, used or reconditioned. (Art. 2a).
9	Procurement Directive	Not a product-related legislation. From the context, it is clear that it affects all products and services that can be the object of public procurement.
10	[8]Tyre Labelling Directive	This Regulation shall apply to C1, C2 and C3 tyres. (…) 2. This Regulation shall not apply to: (a) re-treaded tyres; (b) off-road professional tyres; (c) tyres designed to be fitted only to vehicles registered for the first time before 1 October 1990; (d) T-type temporary-use spare tyres; (e) tyres whose speed rating is less than 80 km/h; (f) tyres whose nominal rim diameter does not exceed 254 mm or is 635 mm or

		more; (g) tyres fitted with additional devices to improve traction properties, such as studded tyres; (h) tyres designed only to be fitted on vehicles intended exclusively for racing (Art. 2). For the purpose of this Regulation (…) 'C1, C2 and C3 tyres' means the tyre classes defined in Article 8 of Regulation (EC) No 661/2009. (Art. 3.1).
11	F-Gas Regulation	"refrigeration, air conditioning and heat pump equipment, including their circuits, as well as fire protection systems, which contain fluorinated greenhouse gases listed in Annex I" (Art. 3); plus in addition "(b) equipment containing fluorinated greenhouse gas-based solvents; (c) (…) fire extinguishers; and (d) high-voltage switchgear (...) other products and equipment, including mobile equipment unless it is serving military operations (..) to the extent that it is technically feasible and does not entail disproportionate cost" (Art. 4); and "all fluorinated greenhouse gas containers." (Art. 7).
12	RoHs	1. Large household appliances. 2. Small household appliances. 3. IT and telecommunications equipment. 4. Consumer equipment. 5. Lighting equipment. 6. Electrical and electronic tools. 7. Toys, leisure and sports equipment. 8. Medical devices. 9. Monitoring and control instruments including industrial monitoring and control instruments. 10. Automatic dispensers. 11. Other EEE not covered by any of the categories above" (ANNEX I) (with a number of exemptions, such as photovoltaic panels and medical devices).
12a	WEEE	During a transitional period: "1. Large household appliances, 2. Small household appliances, 3. IT and telecommunications equipment, 4. Consumer equipment and photovoltaic panels, 5. Lighting equipment, 6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools), 7. Toys, leisure and sports equipment, 8. Medical devices (with the exception of all implanted and infected products), 9. Monitoring and control instruments, 10. Automatic dispensers" (Article 2.1a, ANNEX 1). Later to be extended to all EEE, with certain exemptions.
13	Construction Products	concrete products, (2) doors, windows, shutters, gates etc., (3) membranes, (4) thermal insulation products, (5) structural bearings, (6) chimneys and flues, (7) gypsum products, (8) Geotextiles, Geomembranes, and related products, (9) curtain walling, cladding, structural sealant glazing,(10) fixed fire fighting equipment, (11) sanitary appliances, (12) road equipment, (13) structural timber products, (14) wood based panels and elements, (15) cement, building limes, and other hydraulic binders, (16) reinforcing steel for concrete (17) masonry, (18) waste water engineering products, (19) floorings, (20) structural metallic products, (21) wall and ceiling finishes, internal partition kits, (22) roof coverings and other roof equipment, (23) road construction products (24) aggregates (25) adhesives, (26) products related to concrete, mortar and grout, (27) space heating equipment, (28) pipes, tanks etc. for non-drinking water, (29) products in contact with drinking water (30) glass products (31) power cables and controls, (32) sealants, (33) fixings (34) building kits and prefabricated elements (35) fire protective products (Annex IV).
14	Car Labeling	"'Passenger car' means any motor vehicle of category M1, as defined in Annex II to Directive 70/156/EEC (1) and which falls under the scope of Directive 80/1268/EEC. It does not include vehicles falling under the scope of Directive 92/61/EEC (2) and special purpose vehicles as defined in the second indent of Article 4(1)(a) of Directive 70/156/EEC. 'New passenger car' means any passenger car which has not previously been sold to a person who bought it for a purpose other than that of selling or supplying it." (Art.2, 1. and 2.)
15	IED	"Industrial activities referred to in Chapters II to VI." (Art. 2(1.)) ChapterII refers to a list of activities in Annex I (covering a number of industrial activities relating to energy industry, production and processing of metals, mineral industry, chemical industry, waste management, pulp and paper, animal products, textile / leather treatment, surface treatment using organic solvents, Production of carbon, Capture of CO_2 streams, preservation of wood and wood products with chemicals.) Special provisions apply to: Chapter III: combustion plants, chapter IV: waste incineration; chapter V: installations and activities using organic solvents, chapter VI: installations producing titanium dioxide. The activities are either typical industrial activities or are specified according to industrial size (e.g. combustion > 50 MW).

The theoretical overlaps presented in Figure 2 and Table 7 are only in a few cases identical with the *actual* overlaps for the product groups that are in fact covered by Ecodesign and Labeling legislation until now. Ecodesign is firmly embedded in the regulatory structure of the Marketing of Products Framework, as a general framework that covers all products for which Community Harmonization Legislation exists. As the CE marking has been chosen as the tool for declaring compliance with Ecodesign requirements, the rules for conformity assessment, affixing the mark, market surveillance, border control, and accreditation of conformity assessment bodies, also apply to the products regulated under Ecodesign and the respective minimum requirements.
Also, the Waste Directive applies to any product that can be discarded, and therefore to any WEcodesign-regulated product, too.

In most cases, though, policies do not (yet) cover all the products they legally could. They have to be applied for specific products, either by derived legislative acts on an EU level, such as Delegated Acts or Implementing Measures, or by Member State Legislation, or by specifications and criteria development (e.g. in the case of Ecolabels).

Therefore, the presentation of the theoretical scope can show which legislation may *in principle* affect product groups for which Implementing Measures and Delegated Actscan be developed und Ecodesign and Energy Labeling. It can used as a checklist for future policies and help to analyse possible conflicts or synergies in advance.

However, for evaluation purposes, it is relevant to know which other legislation affects the *actual* product groups that have been covered by Ecodesign and Labelling so far (e.g. whether actual Ecolabel or Energy Star specifications exist, or legislative acts based on the General Product Safety Directive for some product groups have been issued). Table 8 gives a simplified overview of product groups for which Implementing Measures either exist, are ongoing, or preparatory studies are being conducted. The Marketing of Products Framework and Waste Directive are not covered for space reasons, because they already now affect all product groups.

A more detailed table is presented in Annex B. This Annex also shows product groups for which currently no Ecodesign and Labelling Implementing Measures are developed, but which might be covered in the future.

Table 8: Legislation pertaining to the Ecodesign product groups

Lot	Ecodesign	Label (existing or under consideration)	Other relevant legislation
	Simple Set-Top Boxes		RoHs, WEEE, GPSD,
ENER1	Boilers and combiboilers,	y	Parts/aspects also covered by Ecolabel, RoHS, WEEE, EED, EPBD, F-Gas Dir., construction products,
ENER 2	Water heaters,	y	Parts/aspects also covered by RoHS, WEEE, EED, EPBD
ENER 3	PCs (Desktops and Laptops) and monitors,		Ecolabel, Energy Star, RoHS, WEEE, GPSD,
ENER 4	Imaging Equipment		Energy Star, RoHS, WEEE
ENER 5	TV	y	Ecolabel, displays: Energy Star; RoHS, WEEE, GPSD
ENER 6	Standby and off-mode losses,		
ENER 7	Battery chargers and external power supplies,		RoHS; WEEE
ENER 8	Office lighting,	y	EPBD, RoHS, WEEE

Lot	Ecodesign	Label (existing or under consideration)	Other relevant legislation
ENER 9	Street lighting	y	RoHS, WEEE
ENER 10	Room air conditioning,	y	RoHS, WEEE, EED, EPBD, F-Gas
ENER 10	Comfort Fans,	y	RoHS, WEEE, EED
ENER 10	Residential Ventilation,	y	RoHS, WEEE, EPBD, EED
ENER 11	Electric motors,		RoHS, WEEE
ENER 11	Circulators,		EPBD, RoHS, WEEE,
ENER 11	Fans		RoHS, WEEE, EED
ENER 11	Water pumps		EPBD, RoHS, WEEE
ENER 12	Commercial refrigerators and freezers,		RoHS, WEEE, F-Gas
ENER 13	Domestic refrigerators and freezers,	y	RoHS, WEEE, F-Gas
ENER 14	Domestic dishwashers,	y	RoHS, WEEE
ENER 14	Domestic washing machines,	y	RoHS, WEEE
ENER 15	Solid fuel small combustion installations,		Construction Products, EPBD
ENER 16	Household tumble driers,	y	RoHS, WEEE
ENER 17	Vacuum cleaners	y	RoHS, WEEE
ENER 18	Complex set-top boxes,		RoHS, WEEE
ENER 19	Domestic lighting part I "non-directional lamps",	y	EPBD, Ecolabel, RoHS, WEEE
ENER 19	Domestic lighting part II "directional lamps",	y	RoHS, EPBD, WEEE
ENER 20	Local room heating products,	y	RoHS, WEEE, EED
ENER 21	Central heating products using hot air to distribute heat,		RoHS, WEEE, EED, EPBD, F-Gas (if heat pump), construction products
ENER 22	Domestic and commercial ovens,	y	RoHS, WEEE
ENER 23	Domestic and commercial hobs and grills,	y	RoHS, WEEE
ENER 24	Professional washing machines, dryers and dishwasher,		RoHS, WEEE
ENER 25	Non-tertiary coffee machines,		RoHS, WEEE
ENER 26	Networked standby losses of energy using products,		
ENER 27	Uninterruptible power supplies (UPS),		RoHS, WEEE
ENER 28	Wastewater pumps,		RoHS, WEEE, construction products
ENER 29	Clean water pumps (larger than those under 11),		RoHS, WEEE, construction products
ENER 30	Motors and drives (outside scope of Regulation 640/2009)		RoHS, WEEE
ENER 31	Compressors		RoHS, WEEE
	Medical imaging equipment,		RoHS, WEEE
ENTR 1	Refrigerating and freezing equipment,		RoHS, WEEE, F-Gas
ENTR 2	Transformers,		RoHS, WEEE, EED, F-Gas

Lot	Ecodesign	Label (existing or under consideration)	Other relevant legislation
ENTR 3	Sound and imaging equipment,		RoHS, WEEE, GPSD
ENTR 4	Industrial and laboratory furnaces and ovens,		RoHS, WEEE
ENTR 5	Machine tools,		RoHS, WEEE
ENTR 6	Air-conditioning and ventilation systems	y	RoHS, WEEE, EED, EPBD, construction products

<u>Aspects and life cycle phases covered</u>

In addition to the products covered, it is also important to check whether the instruments deal with the same environmental aspects and life cycle phases of those products. If so, there is a potential for conflicts or gaps (when problems are "shifted" between legislations), but also for synergies. On the other hand, if instruments deal with different aspects or life cycle phases, they complement each other. The table below gives a short overview of the different environmental aspects and life cycle phases covered by each piece of legislation.

Table 9: Environmental aspects and life cycle phases covered by various policies

	environmental aspects	life cycle phases	other aspects
Ecodesign Directive 2009/125/EC	(a) weight and volume of the product; (b) use of materials issued from recycling activities; (c) consumption of energy, water and other resources throughout the life cycle; (d) use of substances classified as hazardous to health and/or the environment (e) quantity and nature of consumables needed for proper use and maintenance; (f) ease for reuse and recycling (g) incorporation of used components; (h) avoidance of technical solutions detrimental to reuse and recycling of components and whole appliances; (i) extension of lifetime (j) amounts of waste generated and amounts of hazardous waste generated; (k) emissions to air (l) emissions to water and (m) emissions to soil (ANNEX I) see also MEErP method	(a) raw material selection and use; (b) manufacturing; (c) packaging, transport, and distribution; (d) installation and maintenance; (e) use; and (f) end-of-life, meaning the state of a product having reached the end of its first use until its final disposal. (ANNEX I)	- no significant negative impact on the functionality of the product, from the perspective of the user; - health, safety and the environment shall not be adversely affected; - no significant negative impact on consumers in particular as regards the affordability and the life cycle cost of the product; -no significant negative impact on industry's competitiveness; - consequence of imposing proprietary technology on manufacturers - no excessive administrative burden shall be imposed on manufacturers (Articel 15.5)
Energylabelling Directive 2010/30/EU	consumption of electric energy, other forms of energy and where relevant other essential resources during use (Article 4)	Only use phase (Article 4)	
Energyefficiency Directive 2012/27/EU	energy efficiency	use phase, transformation, transmission, distribution	

	environmental aspects	life cycle phases	other aspects
Energy performance of buildings 2010/31/EU (replacing 2002/91/EC)	energy performance	in use	
Construction Products Regulation 305/2011	(2) (a) the giving-off of toxic gas; (b) the emissions of dangerous substances,(c) the emission of dangerous radiation; (d) – (e) the release of dangerous substances into various environmental media, (f) faulty discharge of waste water, emission of flue gases or faulty disposal of solid or liquid waste, (3), low energy consumption, energy efficiency	energy in use phase, other environmental aspects throughout the life cycle	health, safety, stability
RoHS Directive 2011/65/EU	Restricted substances referred to in Article 4(1) and maximum concentration values tolerated by weight in homogeneous materials - Lead (0,1 %) - Mercury (0,1 %) - Cadmium (0,01 %) - Hexavalent chromium (0,1 %) - Polybrominated biphenyls (PBB) (0,1 %) - Polybrominated diphenyl ethers (PBDE) (0,1 %) (ANNEX II).	aimed at production, affecting all life cycle phases	only refers to homogeneous materials
WEEE Directive 2012/19/EU	disposal of waste; efficient use of resources; reducing the adverse impacts of the generation and management of waste on human health and the environment	production and end-of-life	
REACH Directive 1999/45/EC old; repealed by 1272/2008 and 1907/2006	The evaluation of the hazards of a preparation shall be based on the determination of: — - physico-chemical properties, — - properties affecting health, — - environmental properties. These different properties shall be determined in accordance with the provisions laid down in Articles 5, 6 and 7 (Article 3).	production	
Energy Star: REGULATION (EC) No 106/2008 (see also: ; Council Decision 2006/1005/EC	energy consumption/energy efficiency	use phase	
Ecolabel REGULATION (EC) No 66/2010	The most significant environmental impacts, in particular the impact on climate change, the impact on nature and biodiversity, energy and resource consumption, generation of waste, emissions to all environmental media, pollution through physical effects and use and release of hazardous substances (Article 6.3a).	Considering the whole life cycle of products (Article 6.3).	Where appropriate, social and ethical aspects, (Article 6.3e). As far as possible the principle of reducing animal testing (Article 6.3g).
GPP: Directive 2004/18/EC on procurement	no specification	no specification	
F-Gas-regulation No 842/2006	F-gas content	production, use phase, disposal	
Regulation 1222/2009 Tyre labelling	fuel efficiency, noise	production, use phase	wet grip,
Car Labeling Directive 1999/94/EC	fuel efficiency, CO2 emissions	use phase	
General Product	none	production, use	safety

	environmental aspects	life cycle phases	other aspects
Safety Directive: 2001/96 and sector legislation		phase	
Waste Framework Directive	risk to water, air, soil, plants or animals; nuisance through noise or odours; adverse affect to the countryside or places of special interest	End of life	human health
Marketing of products Framework	not specified	not specified	health and safety

The table shows that potential conflicts as well as synergies exist, especially between Energy Labelling and Ecodesign on the one hand and the Ecolabel and Energy Star regulations on the other. Furthermore, with regard to buildings, there is a relevant potential for conflict (or synergies) with the EPBD, EED, and Construction Products Regulation which both deal with energy efficiency in the use phase. Other relevant areas for potential conflicts or gaps are the WEEE and Waste Framework directive (for end-of-life issues) and the RoHS directive and F-Gas regulation (for hazardous content).

3.4.2 Objectives and mechanisms

It is also important to know whether the instruments share objectives and which basic policy mechanisms they use. When policies share objectives, the potential for both synergies and conflicts/misfits is greater than when they have different objectives that may complement each other. Furthermore, policies may complement each other better when they are using complementary policy mechanisms (such as standards and labelling, or standards and information requirements) than when they are using the same mechanism (e.g. product-related requirements).

Table 10 shows the main objectives and policy mechanisms of the instruments in question.

Table 10: Objectives and mechanisms of various policies

Instrument	Objective	Product-related policy mechanisms
Ecodesign Directive 2009/125/EC	Establishing a framework for the setting of Ecodesign requirements for energy-related products (subheading).	Main mechanism: product- related requirements (Annex I). Connection to process-related requirements possible: "Possibilities for reuse, recycling and recovery of materials and/or of energy". Supplementary mechanism: information (consumer information requirements possible).
Energy Labelling Directive 2010/30/EU	(…) labelling and standard product information, on the consumption of energy and (…) other essential resources during use (…) thereby allowing end-users to choose more efficient products (Article 1.1).	Main mechanism: Information (Labelling) (Article 10). Supplementary mechanisms: Public procurement and incentives: "(…) contracting authorities (…) shall endeavour to procure only such products which comply with the criteria of having the highest performance levels and belonging to the highest energy efficiency class. " (Art. 9).
Energy Efficiency Directive 2012/27/EU	(…) promotion of energy efficiency (…) in order to ensure the achievement of the Union's 2020 20 % headline target on energy efficiency (Article 1.1).	Various mechanisms directed at small customers (Art. 12): Information and communication, fiscal incentives, grants or subsidies, exemplary projects, workplace activities Public procurement (Art. 6): "Member States shall ensure that central governments purchase only products, services and buildings with high energy-efficiency performance (…) MS shall encourage public bodies, including at regional and local levels (…) to purchase only products, services and buildings with high energy-efficiency performance."
Energy performance of buildings Directive 2010/31/EC	This Directive promotes the improvement of the energy performance of buildings within the Union (Article 1.1).	Information: energy certification of buildings or building units (Article 11-13) Product- and system-related requirements: minimum requirements for buildings, building units, building elements and technical building systems (Article 1.2b and c, 4,6,7,8,9). Mostly to be set by MS, but some requirements regarding near-zero energy buildings are fixed. Procedural requirements: minimum requirements for inspection and control (Art. 1.2 f and g, 14,15,16). Other mechanisms (e.g. national plans or financial incentives) to be set up by MS (Art. 9,10).
Construction Products Regulation	"This Regulation lays down conditions for the placing or making available on the market of construction products by establishing harmonised rules on how to express the performance of construction products in relation to their essential characteristics and on the use of CE marking on those products." (Art. 1).	Declaration of performance (using levels, classes or descriptions to describe the performance of building products). The declaration has to be set up by the manufacturer, using harmonized standards, where they exist, or European Technical Assessments, where they don't.
RoHS Directive 2011/65/EU	(…) restriction of the use of hazardous substances in electrical and electronic equipment (…) protection of human health and the environment (…) environmentally sound recovery and disposal of waste EEE (Art. 1).	product-related requirements (maximum concentrations of restricted substances).
WEEE Directive 2012/19/EU	(…) prevention of WEEE (…) re-use, recycling and other forms of recovery (…) to reduce the disposal of waste and contribute to the efficient use of resources	Procedural requirements: Separate collection (Article 5); Collection rate (Article 7), Proper treatment (Article 8) (MS responsible).

Instrument	Objective	Product-related policy mechanisms
	and retrieval of (…) secondary raw materials (…) to protect the environment and human health (Art. 1).	Other mechanisms to choose by MS, for voluntarily encouraging recycling-friendly design (in line with Ecodesign Directive).
REACH Regulations 1272/2008 and 1907/2006	(…) to ensure a high level of protection of human health and the environment, including the promotion of alternative methods for assessment of hazards of substances, as well as the free circulation of substances (Article 1.1, Regulation 1907/2006).	Main mechanism: Information. (Labelling, registration; upstream and downstream information and communication requirements) Supplementary: Requirements/authorization (Substances of very high concern need to be notified to ECHA and may be subject to authorization.).
Energy Star: Regulation (EC) No 106/2008; Council Decision 2006/1005/EC	energy-efficiency labelling for office equipment (Article 1).	Voluntary Labelling/Logo.
Ecolabel Regulation (EC) No 66/2010	(…) rules for the establishment and application of the voluntary EU Ecolabel scheme (Article 1).	Voluntary Labelling.
General Product Safety Directive: 2001/96	The purpose of this Directive is to ensure that products placed on the market are safe. (Art. 1)	information requirements of producers towards consumers product-related requirements: manufacturers and importers are required to put only safe products on the market (determined by national law, national voluntary standards, or requirements set up by the Commission). procedural requirements: testing, keeping register of complaints.
GPP: Directive 2004/18/EC on procurement	coordination of procedures for the award of public works contracts, public supply contracts, and public service contracts (subtitle).	Public procurement. Allows public purchasers to include environmental criteria (product-related or management-related) into procurement procedures and tender specification; lays down rules for doing so (recital 5, 29, 33, 44 46.
F-Gas-Regulation No 842/2006	The objective of this Regulation is to contain, prevent and thereby reduce emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol. (Art.1).	Information: reporting requirements for producers, importers and exporters of F-gases (Art. 6). Product-related requirements: prevent leakage, repair leaks, install leakage detection systems (Art.3). Prohibition of certain substances (Art. 8, 9). process-related requirements: check for leakages at defined intervals, keep track of gases used (Art. 3), requirements for recovery (Art. 4). training and certification: minimum standards for personnel dealing with F-gases (Art. 5).
Regulation 1222/2009 Tyre labelling	The aim of this Regulation is to increase the safety and the economic and environmental efficiency of road transport by promoting fuel-efficient and safe tyres with low noise levels. (Art. 1.1).	Main mechanism: Labelling (Art. 1.2). Supplementary mechanism: Incentives. MS shall not provide incentives with regard to tyres below class C with respect to either fuel efficiency or wet grip within the meaning of Annex I, Parts A and B respectively. (Art. 10).
Car Labeling Directive 1999/94/EC	"The purpose of this Directive is to ensure that information relating to the fuel economy and CO2 emissions of new passenger cars offered for sale or	Mechanisms: Labeling (CO2 and fuel efficiency), consumer information (poster on CO2 and fuel efficiency data at point of sale, consumer guidebook, mentioning of issues in promostional material

Instrument	Objective	Product-related policy mechanisms
	lease in the Community is made available to consumers in order to enable consumers to make an informed choice." (Art. 1)	
Waste Framework Directive	To protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use." (Art. 1).	Requirement to the Member States to set up appropriate policies. MS have relatively big freedom to choose instruments. They do however have to set up waste management plans and waste prevention programmes. One interesting fact is that "The promotion of eco-design (the systematic integration of environmental aspects into product design with the aim to improve the environmental performance of the product throughout its whole life cycle)" is mentioned explicitly as a possible measure to be applied by member states in order to promote waste prevention (Annex IV, 4.).
Marketing of Products Framework	To ensure free circulation of products while at the same time guaranteeing minimum standards for health, safety, and the environment.	CE marking, conformity assessment, border controls, market surveillance, accreditation of conformity assessment bodies.

It becomes clear that many of the instruments *share the objective* of promoting energy efficiency and contribute to Union's energy savings goals: ELD, ED, EED, EPBD, Tyre labelling, Car Labeling, Ecolabel, Energy Star, and the Construction products regulation. Some of them are using complementary policy mechanisms: ED and ELD complement each other as push and pull instruments. On the other hand, EED complements ED and ELD with its detailed arrangements for public procurement (adding additional incentives for certain product groups) while the Procurement Directive provides the legal basis for this. The EED also complements the EPBD which is specifally mentioned in relation to the renovation of public bodies' buildings. The Construction products regulation complements both ED and ELD by providing more detailed information on the energetic performance of building products as well as on other environmental aspects.
There is a potential for conflicts even with a shared goal when both instruments use similar mechanisms – specifically, when they use a mechanism involving product-related criteria.(These criteria may conflict, for example, in their level of ambition or with respect to the unit they refer to (product or system). This could hold for the EPBD, Ecolabel, or the Energy Star. Also, information requirements under Ecodesign or Energy Label and Construction Products Regulation might conflict. The same would be true for Energy Labeling and Car Labeling if the scope of Energy Labeling was extended to include means of transport: The different labelling mechanisms (one including CO_2, the other energy efficiency only; one harmonized on a Community Level, the other one leaving the format to the Member States, while several of them use a scheme very similar to the Energy Label) would have to be aligned. This will be discussed in more detail in the Scope Extension section of the First Findings Report.

Other instruments have a *different, but complementary set of objectives*. First, there are instruments with *environment-related, but not (only9 energy-related objectives:* the F-Gas Regulation, REACH, RoHS, WEEE, Ecolabel; the Construction Products Regulation, the Waste Framework Directive. They are complementary as long as there are no conflicts of goals in the optimization of different environmental aspects.
However, even if there are conflicts of goals, the instruments may complement each other. This is the case when they use compatible mechanisms that do not interfere with each other. For example, very little conflicts are expected for REACH because the mechanism of notification, classification and information is in general compatible with both the mechanism of Energy Labelling and of minimum requirements. Also, conflicts are not expected for WEEE because the mechanism of waste collection and recovery is not expected to interfere with any of the other mechanisms. Another interesting example is the Waste Framework Directive: it points explicitly to the possibility of setting Ecodesign requirements in order to improve durability and avoid waste. Thereby, the Ecodesign Directive is strengthened as an instrument.

Problems occur, though, when there is a conflict of goals between the optimisation of different environmental aspects and when, at the same time, both instruments use the same mechanism, for example, product-related criteria, or specific information requirements. This situation can make it difficult to set consistent requirements. This can arise, for example, with Ecodesign and labelling on the one hand, and Ecolabel, RoHS, the F-Gas Regulation, or the Construction Products Regulation on the other.

One example is the case of air conditioners (Regulation No. 206/2012). The preparatory study identified refrigerant leakage as a possibly important environmental impact, representing on average 10-20 % of the combined direct and indirect greenhouse gas emissions. However, no specific Ecodesign requirements could be set with respect to refrigerants as these are regulated by the F-gas regulation. (The solution to this conflict will be discussed in chapter 3.5.3)

On the other hand, increasing the durability of a product can also hinder energy efficiency improvements because market transformation is slowed down. Furthermore, the Waste Framework Directive addresses Member States, and it remains open whether, and to what degree Ecodesign can, or should be, promoted at a member state level and how this would relate to EU Ecodesign[3].

Secondly, there are instruments that pursue *objectives other than environmental protection* – such as health and safety legislation, or legislation intended to harmonise public procurement procedures. These are complementary as long as the goals do not conflict. Specifically, procurement legislation has been adapted to allow public authorities to include environmental and energy efficiency criteria into their tenders and award procedures and has been very well harmonised with the respective energy efficiency legislation (see below). Conflicts may occur in specific cases where specific health and safety requirements may conflict with energy efficiency requirements, although no such conflicts have been identified so far. Table 11 summarises potential areas for conflict with respect to objectives and mechanisms.

Table 11 Areas for possible conflict

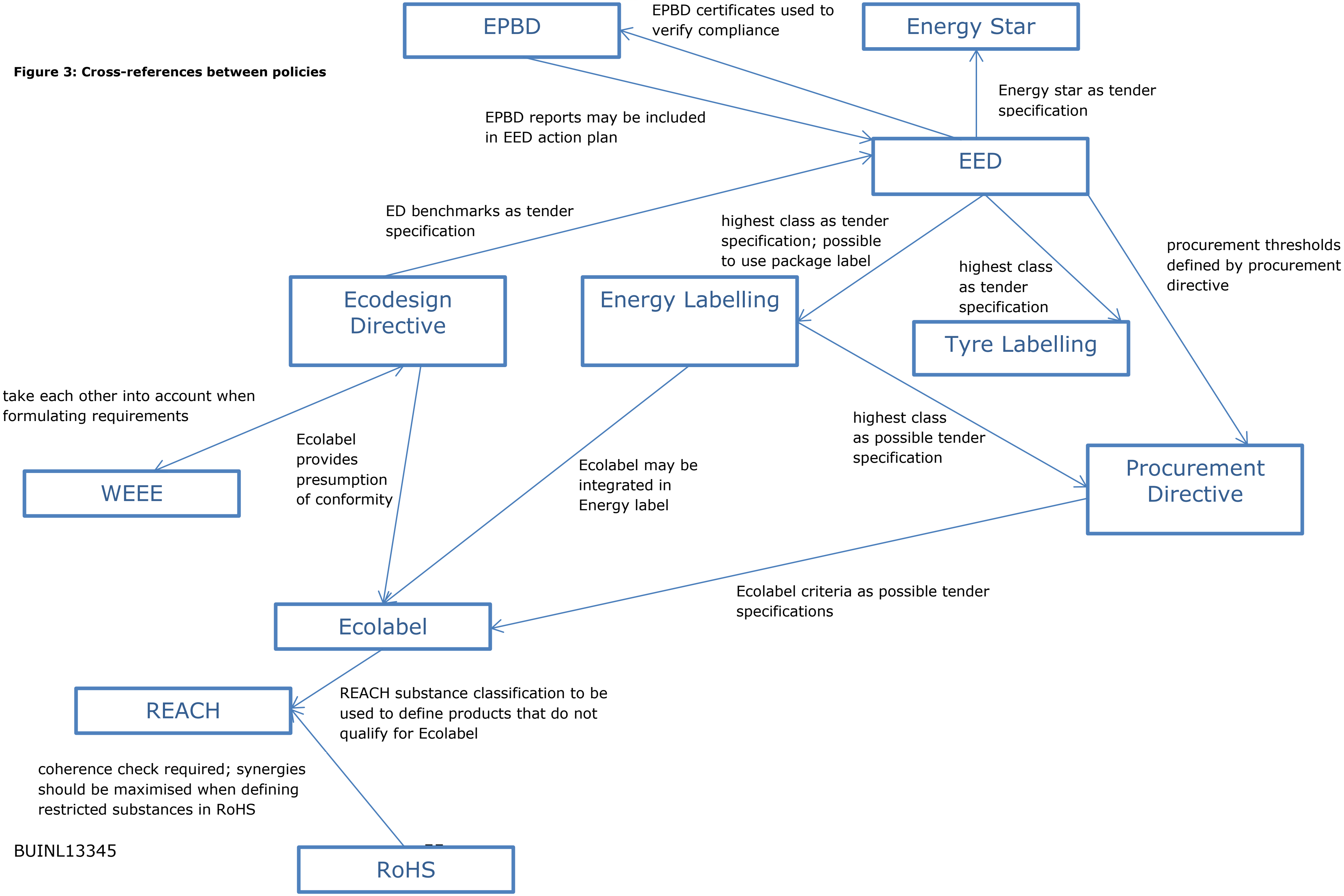
	Conflicting goals possible?	Conflicting mechanisms possible?	Conflicting goals possible?	Conflicting mechanisms possible?
	Between Energy label and…		Between Ecodesign and…	
Energy Label				
Ecodesign	no	no	no	no
Energy Efficiency Directive	no	no	no	no
Energy Performance of Buildings	no	no	no	yes (product vs. system approach; requirements on MS vs EU level);
Construction Products	no	yes	no	yes
RoHS	yes	no	yes	yes
WEEE	yes	no	yes	no
REACH	yes	no	yes	no
Energy Star	no	yes	no	no
Ecolabel	yes	yes	yes	no
General Product Safety Directive	yes	no	yes	yes
Procurement Directive	yes	no	yes	no
F-Gas-regulation	yes	no	yes	yes
Tyre labeling	no	no	no	no
Car labeling	no	yes	no	no
Waste Framework Dir	no	no	yes	yes
Marketing of Products Framework	no	no	no	no

[3] Detailed legal analyses were out of scope for this study.

3.4.3 System of references

In general, the legislation includes clauses that it is "without prejudice" to or "shall be coordinated with" the relevant other legislation, intending to avoid conflicts. However, there are more specific references between each piece of legislation that aim to provide for synergies. The most important references of this more specific type are shown below in Figure 3. The origins of the arrows show the referencing document, their target the referenced document.

Figure 3: Cross-references between policies



3.4.4 Procedures

Policy interactions often do not occur on the level of the framework legislation, but during the procedures which implement them for specific products, target groups, or sectors (e.g. the development of Implementing Measures, or other legal acts specifying the original legislation). Procedures are extremely relevant because they determine which actors can influence the decision making process at which time, how the processes are coordinated, and which information is used. Poorly aligned procedures may lead to long delays as well as misfit in results. A more thorough analysis of the various procedures will therefore be conducted in the future course of the project in order to inform the analysis of interactions.

3.5 Coherence analysis and first conclusions (results of step 4)

At this point, a first set of conclusions can be drawn with respect to the types of interactions that may occur and are presented in Table 5. These conclusions cover the questions dealing with the interaction of policies (Q 117, 119-122, 126, 72-76 and 78) on a theoretical level. An assessment of the interactions on a practical level, as well as answers to the questions regarding comparison of results (Q77, 118, 124, 125), overall evaluation of the performance of the Directives (Q72 and 117, and forward looking questions dealing with possibilities for improvement (Q 123, 127-130, and 79) will be provided in the course of the project, as a result of the stakeholder consultation and possibly of detailed analysis of selected product-specific legislation.

The following conclusions can be drawn:

3.5.1 Scope/Overlaps

With regard to types of products, the theoretical scope of the Ecodesign and Energy Labelling Directive overlaps with almost any other piece of legislation discussed, with the exception of the Tyre Labelling Directive. For any new product group to be added, it is therefore advisable to carefully cross-check all the other instruments to identify possible overlaps.

In the existing lots, the amount of overlap is somewhat more restricted. A few product groups are affected by specific requirements stemming from an extremely broad range of policies, including Ecolabel and/or Energy Star criteria, requirements in the framework of the EPBD and EED, specific safety policies, and substance-related policies such as the F-Gas Directive and RoHs. These are typically electronics and products that are part of the technical building system. The respective lots are lot 1 to 5 and lot 21 (Boilers and combiboilers, Water heaters, PCs (Desktops and Laptops) and monitors, Imaging Equipment, TV sets, and central heating products using hot air to distribute heat).

Most other product groups are affected by detailed requirements within no more than two or three other policies, generally RoHS and WEEE, sometimes also Construction Products Regulation. This also shows that RoHS and WEEE are currently – as long as Ecodesign and Labelling are dealing predominantly with energy-using products – the most frequent and relevant instruments to consider.

As Ecodesign can, by design, deal with all life cycle phases and various types of environmental impacts, the potential for overlap is relatively big. However, as the actual focus has been on energy efficiency on the use phase so far, real overlaps are somewhat smaller. The same is true for Energy Labelling which focuses by design on energy and a few other resources and aspects in the use phase (in practice, where relevant, water consumption and noise). The main overlaps are between Energy Labelling and Ecodesign, and the Ecolabel and Energy Star. There is a relevant potential for conflict (or synergies) with the EPBD and EED, which both deal with energy efficiency in the use phase or offer potential to assess efficiency but from a system rather than product perspective. For example, minimum requirements for technical building systems that are defined by Member States under the EPBD may conflict with mimum requirements under the Ecodesign Direcitve.
Other areas for potential conflicts or gaps are the WEEE directive (for end-of-life issues) and the RoHS directive and F-Gas regulation (for hazardous content).

3.5.2 Complement and synergies

Policies complement each other

(a) When they share objectives, but address different (complementary) products or aspects;
(b) When they share objectives, but address different actors (this may also produce conflicts, though);
(c) When they share objectives and use different (complementary) policy mechanisms for achieving them, and
(d) When policies share both objectives and scope, there are furthermore possibilities for synergies in the use of information (preparatory studies…), standards, methods or benchmarks. It might also be useful to consider merging policies (such as Ecodesign and Energy Labelling), or aspects of them, in these cases, to the degree that this would be practical;
(e) When they address the same products or aspects, but have different objectives, as long as these objectives do not contradict each other (else, this situation may also produce conflicts).

Many of the policies discussed do partly share the objective to improve energy efficiency and contribute to the European Union's energy savings goals: ELD, ED, EED, EPBD, Tyre labelling, Ecolabel, Energy Star, and the Construction products regulation.

For Tyre labelling (and in some respects, EED and ED), case (a) is true: they complement Energy Labelling and Ecodesign because they focus on some products/activities/sectors that are not covered by ELD and ED (buildings, building units, energy transformation, transmission and distribution, industrial activities; tyres.) In the same wake, ED and ELD complement EED. They are expected to fill possible gaps of EED in achieving the Union's 20% energy saving goals by applying additional mechanisms (product-related minimum requirements, end user information) and cover more product groups.

Furthermore, for ELD and ED vs. EED and EPBD, case (b) is also true: ELD and ED operate on the EU level, with Implementing Measures being immediately valid in Member States, while EED and EPBD leave the implementation of many activities to the Member States. Therefore, ELD and ED might partly, to the extent that product policy influences building and system efficiency, compensate for gaps that have arisen in the policy mix due to the inactivity of Member States.

For example, during the consultation process on boilers and water heaters, some stakeholders deplored the inactivity or lack of ambition by some Member States in regulating energy efficiency of heating systems under the EPBD. They raised this problem as a core argument for regulating these products under the Ecodesign Directive.

Finally, case (c) is true where ED and ELD complement each other as push and pull instruments. Also, EED complements ED and ELD with its detailed arrangements for public procurement (adding additional incentives for certain product groups) and the EPBD for the renovation of public buildings.. Furthermore, it has been proposed that the Ecodesign Directive might be a suitable complement for WEEE. By its life-cycle and product-specific approach, it could help to address various scarce resources in a more targeted way (Friege 2012). Finally, the Construction Products Regulation with its more detailed declaration requirements supports ED and ELD. Another interesting example is the case of mercury in CFLs: The RoHS Directive included limit values for mercury content. It could be complemented by the Ecodesign Directive because the latter allows the setting of requirements for consumer information which RoHS does not. Therefore, the Ecodesign required the display on the packaging of the amount of mercury, and a link to a website where cleanup procedures of broken CFLs are explained.

Case (d) is also, in theory, true for ED, ELD, Ecolabel and Energy Star. The potential for synergies is already exploited to a large degree between ELD and ED (common preparatory studies, methods, and benchmarks), but less so for Ecolabel and Energy Star. There are indeed some arrangements designed to align the policies. For example, if a product has earned the Ecolabel, conformity with Ecodesign regulation is assumed. However, specific product-related requirements related to the Ecolable or Energy Star on the one hand and to Ecodesign or Energy Labelling on the other, are not always in line (see sections 3.5.3 and 3.5.4 for examples). For Energy Star, the barrier lies in the procedure, as Energy Star specifications are not developed on an European level, but adopted by agreement from US requirements. Still, Energy Star requirements, specifications and methods are an important source to be considered in the elaboration of preparatory studies and Voluntary Agreements. This is already partly the case but could be further developed.

Case (e) is partly true for ED and ELD on the one hand, and other environment-related, legislation such as the F-Gas regulation, REACH, RoHS, WEEE, and Ecolabel, on the other. As they cover different (or additional) environmental aspects than ELD and ED they are, in general, complementary. This is especially true when they use mechanisms that by design are complementary to those used in Ecodesign/Energy Label, so that they cannot conflict. For example, very little conflicts are expected for REACH because the mechanism of notification, classification and information is in general compatible with both the mechanism of Energy Labelling and of minimum requirements. Also, conflicts are not expected for WEEE because the mechanism of waste collection and recovery is not expected to interfere with any of the other mechanisms. Furthermore, case (e) is also true for legislation with other than environmental objectives, such as health and safety legislation, and legislation intended to harmonize public procurement procedures instruments. Specifically, the Procurement Directive is designed to allow public authorities to include environmental and energy efficiency criteria into their tenders and award procedures. The role of public procurement in energy efficiency has been further strengthened with the EED, where it is not only allowed, but required to integrate energy efficiency requirements into procurement procedures, where possible. In referring to Energy Label criteria and Ecodesign benchmarks, procurement legislation has been very well harmonized with the respective energy efficiency legislation and provides additional incentives.

3.5.3 Conflicts

Conflicts between policies arise when:

(a) They overlap in scope, but have conflicting objectives (which may be reflected by conflicting indicators). This is especially true when they both use mechanisms involving product- or process-related criteria, be it in the form of minimum standards or labelling criteria. These criteria can then easily happen to contradict each other.

(b) They overlap in scope and also share objectives, but use mechanisms with conflicting logic, or are enacted by different actors who pursue conflicting strategies (see below for examples).

Case (a) can occur, especially, between ED and ELD on the one hand and other (or broader) environmental legislation or health and safety-related legislation that also uses the instrument of requirements or labelling criteria, on the other. Possible candidates for such conflicts are the Ecolabel, RoHs, the F-gas regulation, or the General Product Safety Directive and specific, sector-related safety legislation. One known case is the case of refrigerant leakage in air conditioners. This example however also shows that the Ecodesign Directive is equipped to solve this kind of conflict. In the case of air conditioners, a bonus was introduced in the specific Ecodesign requirements: Appliances using refrigerants with a Global Warming Potential below 150 have to meet less strict efficiency requirements than those with higher GWP, in order to incentivise the use of low-GWP refrigerants. The preconditions for finding this kind of compromise are a careful screening of possibly conflicting policy objectives and broad stakeholder involvement.
Cases where ED and ELD conflict with health or safety-related legislation have not been identified so far. However, this topic will be the object of the stakeholder consultation and further cases for actual conflicts will be researched in the course of the project.

The main example for case (b) are technical building systems. First, there is the potential conflict between the product approach in ELD and ED, and the systems approach in EPBD and EED. EPBD and EED aim primarily at improving the overall energetic performance of a building. This goal can be achieved by various combinations of heat generators, controls, pumps, heat distribution systems and the building shell. Individually improving the heat generator, as is the basic approach of Ecodesign, may not be the most effective or cost-efficient solution for a given building.
Secondly, there may be conflicts between the strategies pursued on the European level and by the individual Member States. On the other hand, both levels are needed: the widely varying climatic conditions, building traditions and market structures require a tailored approach on the MS level, while on the other hand a European approach is important to ensure minimum standards. This issue will be further explored in the course of the project.

3.5.4 Misfits

Misfits occur when policies overlap in scope and share objectives, but when specific mechanisms, procedures, timing, requirements, thresholds, standards or methods are not well aligned. They therefore occur basically beween Ecodesign and Energy Labelling, but also between both and the Ecolabel, Energy Star, EPBD, and possibly EED. Well-known examples for misfit are:

- Temporal misfit (e.g. Ecolabel criteria developed before ED/ELD regulation finished, or Energy Labelling classes developed before Ecodesign minimum standards); which may then lead to
- Misfits of requirements, e.g. the misfit between Ecodesign and labeling in the form of "empty classes"; very undemanding Ecolabel criteria for televisions, awarding the Ecolabel to class B, C or even D products[4]; or GPP requirements that are only partially aligned with ED/ELD;
- Use of different thresholds/test methods/benchmarks.

Recent examples for misfits will be researched and analysed in the future course of the project.

3.5.5 Gaps

Gaps occur when policies overlap in theoretical scope but then need to be implemented for specific product groups by way of additional legal acts, and when in the course of the development of those acts, stakeholders try to "shift" problems and responsibilities to other legislations. Therefore, there is a specific potential for gaps between ELD and ED on the one hand, and environmental legislation covering other aspects or life cycle phases and also needing to be implemented, such as Ecolabel, RoHS, REACH; or WEEE, on the other hand. Issues such as end-of-life issues, hazardous content, and resource consumption other than energy in the use phase. More specific examples will be identified in the course of the project.

Table 12 summarizes which instruments are specifically prone to which type of interactions.

[4] Depending on the year; staged requirements.

Table 12 Summary of possible interactions of Energy Labelling with other policies

Potential for…	Complement/synergies	Conflicts/ contradictions	Misfit	Gaps	Complement/synergies	Conflicts/ contradictions	Misfit	Gaps
	Between Energy Labelling and…				Between Ecodesign and…			
Environmental product policies								
Ecodesign	x (mechanism, information, methods)	-	x	-	-	-	-	-
Energy Labelling	-	-	-	-	x (mechanism[5], information[6], methods[7])	-	x	-
Ecolabel	x (aspects, information, methods)	x (objective, mechanism)	x	-	x (mechanism, aspects[8], information, methods)	x (objective)	x	-
Energy Star	x (information, methods)	x (mechanism)	x	-	x (mechanism, information, methods)	-	x	-
GPP	x (mechanism)	x (objective)	-	-	x (push-pull mechanism)	x (objective)	-	-
Construction Products Dir	x (mechanism)	x (mechanism)	-	-	x (mechanism)	-	-	-
Tyre Labeling	x (product)	-	-	-	x (product[9])	-	-	-
Car Labeling	x (product)	x (actors / aspects)	-	-	x (product)	-	-	-
General environmental policies								
WEEE	x (aspects)	x (objective)	-	-	x (aspects)	x (objective)	-	x
RoHs	x (aspects)	x (objective)	-	-	x (aspects)	x (objective, mechanim)	-	x
REACH	x (aspects)	x (objective)	-	-	x (aspects)	x (objective)	-	x
F-Gas	x (aspects)	x (objective)	-	-	x (aspects)	x (objective)	-	-
Waste Framework Dir	x (aspects)	-	-	-	x (aspects)	x (actors (MS vs. EU	(x)	-

[5] Policy mechanism, e.g.: labeling, minimum requirements, registration requirements…
[6] Information base used for developing the policy, e.g. preparatory studies.
[7] E.g. calculation and test methods used for determining compliance or classifying a product.
[8] Environmental aspects covered, e.g. energy efficiency, resource use, end of life issues.
[9] Product scope covered by the respective instrument.

Potential for…	Complement/synergies	Conflicts/ contradictions	Misfit	Gaps	Complement/synergies	Conflicts/ contradictions	Misfit	Gaps
	Between Energy Labelling and…				**Between Ecodesign and…**			
						Ecodesign)		
Energy efficiency policies								
EPBD	x (product, mechanism, actor)	?	?	?	x (product, mechanism, actor)	x (mechanism)	x	?
EED	x (product, mechanism, actor)	?	?	?	x (product, mechanism, actor[10])		x	?
Health and safety policies								
miscellaneous)	x (aspect)	x (objective)	?	?	x (aspect)	x (objective)	?	?
Single market policies								
Marketing of Products Framework	-	-	-	-	-	-	-	-

[10] Actors responsible for the implementation of the policy.

3.6 Outlook on future policies

The future of Energy Labeling and Ecodesign may also be influenced by policies that are currently still under development. One relevant such policy is the policy on the Product Environmental Footprint (PEF)[11], as reflected in the Communication from the Commission to the European Parliament and the Council: Building the Single Market for Green Products - Facilitating better information on the environmental performance of products and organisations (April 2013) and the attached Commission recommendation on "the use of common methods to measure and communicate the life cycle environmental performance of products and organisations" (April 2013). The PEF aims at reducing barriers for the circulation of green products that stem from different assessment methodologies in different Member States and from an overflow of sometimes contradictory and often not trustworthy environmental information.
In order to streamline assessment methods and provide for a simple, trustworthy information tool, a generic methodology for expressing the Environmental impact of a product is being developed. Currently, a three-year pilot phase with the goal of developing Product Category Rules is taking place. If the methodology proves to be robust, feasible, and provides meaningful results, it could also be used as a basis for further developing ED and ELD, for example in terms of including more non-energy aspects and life cycle phases.

3.7 References

Cowart, Richard (2011): Prices and policies. Carbon caps and energy efficiency policies for Europe's low carbon future. eceee Summer Study Proceedings, 2011, p. 503 ff. http://proceedings.eceee.org/visabstrakt.php?event=1&doc=2-432-11

CSES (Centre for Strategy and Evaluation Services) and Oxford Research (2012): Evaluation of the Ecodesign Directive (2009/125/EC). Final Report. March 2012. http://www.cses.co.uk/ecodesign_evaluation/documents/

IEA; Waide, Paul (2006): International Use of Policy Instruments. Copenhagen, April 5, 2006.

Lecuyer, Oskar, and Bibas, Ruben (2012): Combining climate and energy policies: synergies or antagonisms? Author manuscript, 29 March 2012, published in "FEEM Working Paper (2011) 2011.98". http://halshs.archives-ouvertes.fr/docs/00/80/19/17/PDF/120329_Lecuyer_Bibas_Combining-Climate-Energy-Policies.pdf

Johannes Thema, Felix Suerkemper, Katharina Grave, Adrian Amelung, 2013, The impact of electricity demand reduction policies on the EU ETS: Modelling electricity and carbon prices and the effect on industrial competitiveness, Energy Policy 60 (2013) 656-666 2013

Wiel, Stephen; McMahon, James E. (2005): Energy efficiency labels and standards: A guidebook for appliances, equipment, and lighting. 2nd edition. Collaborative Labeling and Appliance Standards Program (CLASP), Washington, February 2005

[11] The Commission's initiative also includes an organizational environmental footprint (OEF) which is however not relevant in this context.

ENERGY LABELLING DIRECTIVE

4 Objectives of Energy Labelling

4.1 Insights to date

To answer the question of whether the EU energy labelling scheme has fulfilled its objectives it is necessary to consider what those objectives have been defined as. The Directive 2010/30/EU of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products makes the following recitals to the Directive which either specify or imply objectives:

(4) Improving the efficiency of energy-related products through informed consumer choice benefits the EU economy overall.

(5) The provision of accurate, relevant and comparable information on the specific energy consumption of energy-related products should influence the end-user's choice in favour of those products which consume or indirectly result in consuming less energy and other essential resources during use, thus prompting manufacturers to take steps to reduce the consumption of energy and other essential resources of the products which they manufacture. It should also, indirectly, encourage the efficient use of these products in order to contribute to the EU's 20 % energy efficiency target. In the absence of this information, the operation of market forces alone will fail to promote the rational use of energy and other essential resources for these products.

(8) Information plays a key role in the operation of market forces and it is therefore necessary to introduce a uniform label for all products of the same type, to provide potential purchasers with supplementary standardised information on those products' costs in terms of energy and the consumption of other essential resources and to take measures to ensure that potential end-users who do not see the product displayed, and thus have no opportunity to see the label, are also supplied with this information. In order to be efficient and successful, the label should be easily recognisable to end-users, simple and concise. To this end the existing layout of the label should be retained as the basis to inform end-users about the energy efficiency of products. Energy consumption of and other information concerning the products should be measured in accordance with harmonised standards and methods.

(10) Member States should regularly monitor compliance with this Directive, and include the relevant information in the report that they are obliged to submit every four years to the Commission under this Directive, with special regard to the responsibilities of suppliers and dealers.

(20) The Commission should regularly submit to the European Parliament and the Council a synthesis, covering the EU and each Member State separately, of the reports on enforcement activities and the level of compliance submitted by Member States under this Directive."

Some of these objectives are somewhat obliquely stated and are open to interpretation. According to Dena (2005) who considered the aims of the labelling scheme prior to the recast of the Directive:
"The aims of energy labelling and the revision thereof are as follows:

- To establish the energy efficiency of a particular appliance as a significant product feature;
- To help the end user to classify an appliance according to energy efficiency;
- To help the end user to decide which appliance to buy;
- To provide details on other important features such as performance;
- To make the EU Energy Label suitable for the manufacturer's product marketing activities.

This issue of objectives was addressed more fully in the impact assessment to the recast Directive (EC 2008b) which states:

"The general objective of this policy revision is to contribute to the EU energy policy goals sated in the Energy Efficiency Action Plan and in the Climate Change Package; to save at least 20% of its present energy consumption in a cost-effective manner and reduce overall emissions to at least 20% below 1990 levels by 2020, with contribution to the Lisbon Agenda and to the EU Sustainable Development Strategies. This will be done in identifying the most cost-efficient way(s) to reinforce the market transformation towards more efficient and environmental-friendly products, which contribute to energy savings, better environment and sustainable production and consumption, while providing useful and easy-to-understand information on product performance to consumers
The specific objectives are to contribute to energy saving, and related emissions reduction, within two sub-categories of products:
(1) household appliances;
(2) all energy-related products.
Depending on the policy option chosen, the specific objectives will be achieved by means of operational objectives that were consulted with stakeholders (Annex 13) as summarised in Table 3.1. The outcomes sought by the ELD are realised through the implementing measures and are to be evaluated on the basis of the results of these measures.

Table 3.1: Operational objectives
1 Increase the number of household appliances for which an energy label is introduced.
2 Introduce energy label to priority energy-using and energy-related appliances.
3 Regularly review existing implementing measures according to timeframe indicated in each implementing measure.
4 Provide additional useful product information in labels based on product specific impact assessment.
5 Cover distant mail, media advertising and other distant selling activities with energy label as defined in implementing measures based on specificities of each product group.
6 Save administrative cost in implementing ELD with implementing measures.
7 Prevent unauthorised use of label.
8 Ensure adequate framework requirements on measurement tolerances and market surveillance activities.
9 Ensure framework requirements for Member State public procurement and incentive schemes and that these schemes are linked with energy labelling scales of individual implementing measures.

The degree to which consumers have been adequately informed is considered in 5.1.1. The relevancy and comparability of the labelled information is considered in section 6.2. on Appropriateness, as is the suitability of the layout. The contribution labelling has made to the EU's 20% energy efficiency improvement target is considered in section 5.2. Protection of the label scheme is addressed in section 5.1.11. The scope, in term of product selection, is considered in section 5.1.4 and in terms of focus in 5.1.9. Procedural issues are addressed in section 7. The accuracy of labelled information and the issue of market surveillance is considered in section 2.3 and 2.2. Standardisation is addressed in section 12.

It could also be argued that the objectives of the labelling Directive may benefit from being more clearly stated and perhaps even revised. The text in the following sections also considers this to the extent that the published literature has commented on this issue.

4.1.1 Informing consumers (ELD1)

A review of the literature confirms that the EU energy labelling scheme has largely fulfilled its primary objective of informing consumers with respect to the energy performance of products, at least with regard to the products it has been applied to. For example, according to Kubiak et al who cite research from Langley et al (2012):

"Since its introduction, the energy label has been a story of success. It is well known (80% of citizens recognise the label), and has helped create offspring labels for buildings, cars, and tyres. European consumers trust the energy label and usually take it into account when they buy electrical household appliances with the undeniable effect of transforming the market towards more energy efficient products."

There is no evidence of any literature that challenges the broad gist of this view and there are many that cite evidence of the labelling scheme being widely recognised and mostly understood; however, the research into this topic has also shown that a significant minority (of roughly 20 to 30% depending on the precise test and survey) has been unable to understand the label information sufficiently well to be able to correctly rank the efficiency of a set of labelled products. The ability of consumers to be able to correctly rank products has been measured to be as low as 56% when the rank order of four products is tested and when the labelled products include non-re-enforcing factors (Waide and Watson 2013) e.g.:

- When the rank order of efficiency is not the same as the rank order of energy consumption (this is quite a common occurrence);
- When the highest efficiency class presented on the scale is inconsistent between labelled products (a situation which can occur for TVs, for example, as the top efficiency class shown on the label migrates from A to A+ to A++ and labels that already attain the thresholds beyond A are permitted to use the scale that will become mandatory for all products in the future).

In addition, the literature also indicates that comprehension of some of the new language neutral icons used to convey specific information for the recast energy labels can be poor depending on the icon (see section 6.3 on Appropriateness).

There are a wide range of energy and other environmental product labels presently in use globally. Many have been designed without research to test their effectiveness with consumers despite the fact that they are a vehicle for conveying information to consumers about the energy (or other environmental) performance of products (Egan and Waide 2005). To be effective as an instrument to change behaviour and transform markets they must provide information in a way that positively influences consumer purchase decisions.

Langley et al (2012) conducted an extensive literature review to provide insights into an ideal product label design and reported the following key observations:

- "International research into labels to date has demonstrated that the design of the label is crucial in its success. Using comparative scales to compare the performance of similar appliances is better understood, and more motivating, than those that present technical information only.
- Price is commonly the most important criteria to consumers, with energy efficiency a lower priority than other product features. Historically, take-up of low carbon products has tended to happen where there are other, more direct, consumer benefits (e.g. saving money or hassle) and where the take-up involves minimal individual effort.
- Product labelling can very successful in driving market changes. The current EU Energy label has been an undeniable market transformation success and much of the credit must be attributed to its design. European consumers trust the Energy Label and they also, to a large degree, take the label into account when they buy electrical household appliances.
- Wider consumer education and retailer training may be required to ensure new labels are widely understood and used by consumers.

International research into energy information labels conducted to date has demonstrated the following general (i.e. universally applicable) findings:

- Label design by committee or policy and technical stakeholders rarely matches the needs of consumers as found in market research (Egan and Waide 2005). As consumers are the intended end-users, new energy labels should always be designed through consumer-based market research (Berg et al 2009).
- Good label design is a necessary requirement. Having a good design, i.e. one which achieves high levels of: comprehension, motivation, appeal and credibility; does not of itself ensure that the labelling programme will be effective; however, the opposite is true (i.e. if the label design is poor the labelling programme will be ineffective) (Du Pont 2000).
- Proposed revisions to energy labels should be tested for effectiveness with key stakeholders (most importantly consumers) prior to adoption. Existing labels that do not undertake such evaluation risk losing hard won marketing leverage and brand equity (Heinzle & Wüstenhagen 2009)
- Ensure consumers are given options not just information: always return to the question 'what do we actually want consumers to do?'
- The most appropriate design will depend upon local cultural factors and should be assessed by multi-method research. Often these cannot be foretold even by local policymakers as they lie outside of their expertise.

- Any label design will have some limitations in consumer comprehension with visual and latter based labels. These potential problems can and should be addressed over time through public education.
- Consumers often (but not always) express a preference for including operating costs on the label (Huodong 2009, Bull 2012); however, no international labelling programme has resolved how to do this given that energy prices vary regionally and over time and given the high potential for confusion between operating costs and savings (Egan and Waide 2005).
- Policy-makers should aim to achieve 70%+ scores for consumer: comprehension, appeal, credibility, and motivational response from the label. Higher comprehension rates are typically found in labels designed from first principles than those designed through an a priori policymaker decision. The ability to recall the relative efficiency of competing products when shopping should also be measured (Egan and Waide 2005).
- Price is commonly the most important criteria with energy efficiency a lower priority than other product features. Historically, take-up of low carbon products has tended to happen where there are benefits (e.g. save individual money and hassle) and also involve minimal individual effort (IPSOS 2008).
- The current EU Energy Label has been an undeniable market transformation success and much of the credit must be attributed to its design. European consumers trust the current Energy Label and they also, to a large degree, take the label into account when they buy electrical household appliances."

4.1.2 Fulfilling its potential for energy savings (ELD2)

There is clear evidence that energy labelling has had a significant impact on energy savings for the products to which it has been applied. This topic is also partially addressed in the Market Impacts section (see section 8). This impact was first demonstrated unequivocally in the Monitor I, II and III studies (Waide 2001) which assembled matched model sales databases from a market research company (GfK) with technical model databases provided by an industry association (CECED) to produce an extensive model by model sales database for a variety of labelled products. Sales-weighted analysis of this database showed unequivocally that:

a) The market had evolved to higher efficiency products since the development of the labelling programme;
b) Manufacturers were often pre-empting the expected sales-increase by shifting their product ranges prior to each product label being formally implemented;
c) The products were being designed to meet specific energy performance thresholds associated with the top label grades (A, B and C at the time of the study) and as a result the sales-weighted energy efficiency index (EEI) distributions shifted from being randomly distributed (i.e. of a roughly Gaussian nature) prior to the introduction of labelling to being extremely non-randomly distributed post labelling i.e. having strong and sharp peaks at the boundaries of the higher efficiency classes.

Unfortunately this depth of model sales analysis exercise has not been repeated since and more recent studies have simply looked at the evolution in sales by efficiency class (as opposed to the distribution of sales by EEI); nonetheless, it is clear from these that for most labelled products there has been a marked shift towards higher efficiency classes.

The Monitor I, II and III studies which addressed data from pre-labelling times up to 2000 (Waide 2001) clearly demonstrated that this evolution towards higher efficiency was due to the influence of the energy label and was not a simple result of autonomous market effects; however, it was not as simple to quantify how much of the overall market transformation was due exclusively to labelling or was also stimulated by other policy measures, such as voluntary agreements and (pre-Ecodesign) minimum efficiency standards. When products are sold on the market at efficiency thresholds that have been specified in an energy label and are at a markedly higher efficiency than minimum regulatory requirements it is reasonably clear that this has not occurred in direct response to minimum efficiency standards; however, this is not inconsistent with meeting the requirements of a fleet average voluntary agreement (as were negotiated at various times for household appliances prior to the adoption of Ecodesign regulations). Nonetheless, even in these cases the label has clearly acted as the catalyst that has facilitated the specifications in the voluntary agreements and most probably has driven a substantial portion of the market transformational impact in its own right.

The impact assessment to the recast of the labelling directive reports the following historic impacts at that time:

"In the absence of systematic monitoring and evaluation of the ELD over the past years, a specific background study (European Economics 2006) was launched by the Commission. The background study, together with a number of other reports on the performance of the energy labelling, provide a clear broad picture on main issues at stake, although many of the details are beyond the reach of this report.

There have been a number of studies on the impact of the ELD (European Economics 2007), including the external background study to this report. The studies demonstrate an increased take up of higher efficient appliances over the past decade. The impact has been greatest for white goods, particularly refrigerators, freezers and washing machines. The take up of higher energy efficient appliances has been greater in the EU-15, where the directives have been in place for a longer time, than in the new Member States. However, the New Member States are currently making a leap directly to A-class appliances thanks to the label that has made manufacturers less interested in producing lower-efficiency appliances. The success of the labelling scheme is also demonstrated in the high number of third countries that have adopted a similar label or sometimes an exact copy of the EU energy label 108 as show in Annex 7. Also, the energy label has been recently copied by other sectors within the EU and third countries (see Annex 8).

It is estimated that with all current policies already in place, a total of 65 TWh to 75 TWh per year would be saved by 2010 (Bertoldi & Atanasiu 2007). While it is difficult to separate out the impact of labelling from other factors such as minimum efficiency standards or "business as usual" technical development, it has been estimated that energy labelling schemes could account for about half of the increased take up of higher energy efficient appliances, contributing in total to some 35 TWh of savings per year (2010) (EC 2007) and corresponding to some 3 Mtoe[12] of primary energy.

[12] Estimated electricity savings by the ELD are about 35 TWh by 2010. For convenience, savings in electricity (TWh) are converted to savings in primary energy (Mtoes). A conversion factor of 0,086 is used based on the EU Energy and Transport in Figures, Statistical pocketbook, 2007/2008.

The rest of the savings is composed mainly of technological development and minimum energy performance requirements set under Directive 2005/32/EC (Ecodesign Directive) for fridges, freezers, ballasts for fluorescent lighting and hot-water boilers. For example, as to cold appliances, it has been estimated that between 1996 and 2004, the average efficiency of newly purchased cold appliances improved by 30 per cent, dishwashers by 35 per cent and washing machines by 23 per cent. The above estimate on the savings due to energy labelling is supported by a report from CECED estimating that annual electricity consumption by appliances installed in European households fell by 34 TWh per year on 1995 to 2005 (CECED 2006). The scale of the current take-up of higher efficiency appliances can be seen in Table 1 and Figure 1 for the EU15."

And

"It has been estimated that between 1996 and 2004/05, the average efficiency of newly purchased cold appliances improved by 30 per cent, dishwashers by 35 per cent and washing machines by 23 per cent. It is estimated that with the current policies already in place, 65 TWh to 75TWh per year could be saved by 2010 (Bertoldi & Atanasiu 2007). It is assumed that more than half, some 35 TWh (3 Mtoe), is due to labelling, the remaining part is due to structural technical improvements (EC 2006). Industry comes to conclusions of the same order of magnitude estimating that annual electricity consumption by appliances installed in European households fell by 34 TWh between 1995 and 2005, a fall of 12 per cent (CECED 2006)."

And

"Nonetheless, one must be careful not to attribute the increase in sales of energy efficient products wholly to energy labelling. Given the range of policy instruments directed at encouraging the take up of energy efficient products and the financial benefit to consumers from reduced energy costs, it is difficult to attribute a specific degree of influence to the introduction of the mandatory labelling schemes. One study (Scheillerup et al 1998) suggested that the impact of labelling was closely linked both to the level of compliance and to general awareness of the importance of energy efficiency. It was told that in favourable circumstances the existence of the label could account for over half of the take up of the higher efficiency appliances.

These studies also identified problems with labelling. In the early years, compliance in terms of failure to display labels or incorrect labelling, was an issue. The situation has improved but compliance remains a concern. The design of the label has generally been commended for its effectiveness in signalling relative efficiency of products but there has been concern that consumers can be confused by a mix of formal and informal advice.

More recently criticism has focused on the fixed nature of the A-G scale and the need to recalibrate the scale to allow for improvements in technology which have taken place since the scale was first set which mean that "A" rated products are no longer at the leading edge of energy efficiency. A more detailed description of the directives and of the main evaluation studies is given in Appendix 1 of the background study."

The same source also forecast the expected savings due to the final policy option adopted for the recast labelling Directive (policy option 3) to be as follows:

"Policy option 3 (fully exploit current framework and extend the scope to all energy-related products) involves some administrative burden for the recast but would save some €4 million in transposition costs for every upgraded or newly developed implementing measure if implementing Directives were replaced by implementing Regulations. It is estimated that broadening the scope of the ELD to energy-related products could lead to additional savings of some 27 Mtoe by 2020[13], corresponding to emission reduction of close to 80 Mt of CO_2 in comparison to BaU. This represents additional savings of some 5 Mtoe against the policy option BaU +1 alone from the three priority product groups considered (commercial heating and refrigeration and windows). More precise knowledge on the savings potential of these products will be available from the Ecodesign preparatory studies followed by product specific impact assessments. Additional changes like introducing provisions on the legal protection of the use of the label, clarifying information requirements and introducing a framework for mandatory public procurement and incentives would further reinforce the effectiveness of the scheme as well as increase the savings."

There are no more recent assessments that exclusively analyse the impact of labelling as opposed to combined labelling and Ecodesign implementing measures (see Section 9). However, if it is assumed that:

- Labelling continues to deliver half of the savings for jointly regulated products;
- The projected combined Ecodesign and energy labelling savings to 2020 reported in the energy labelling regulations are accurate;
- And making a simple extension of reported savings for domestic non-directional lighting (said to be 10% more efficient due to energy labelling alone (EC 2012b)) and for refrigerators, washing machines, dishwashers and tumble dryers.

Then the total projected savings from existing energy labelling regulations would be expected to amount to 65 Mtoe of primary energy in 2020, of which about 35 Mtoe is due to purely electrical end-uses and the remaining 30 Mtoe is from space and water heating equipment. However, these estimates are very approximate and should be considered to be indicative only. Note too that this value is not necessary inconsistent with the 27Mtoe figure reported previously as that did not consider on-going labelling induced savings but only those associated with the recast of the Directive.

While it is clear that the labelling Directive has stimulated significant energy efficiency improvements among most labelled products this does not demonstrate that it has fulfilled its full potential for savings. In principle savings could be higher were:

- More energy-related products to be labelled than have been to date;
- The effectiveness of the label to be further optimised;
- The implementation of the label to be strengthened.

The Commission's impact assessment for the energy labelling Directive (EC 2008b) references limitations of staff and resources as being a primary reason that labelling had not been expanded more rapidly to other product groups:

[13] The figure is composed of the estimated 22 Mtoe savings by 2020 from the full implementation of the ELD and of some 5 Mtoe additional savings from the broadening on the scope, based on considerations on three priority product groups (windows, commercial refrigeration and heating appliances).

"The potential of the ELD has not been fully exploited mainly due to shortage of staff in the Commission and allocation of resources to other priorities, which has led, among others, to no implementing measures on boilers and water heaters."

Nonetheless, the public literature tends to be complementary about the EU labelling scheme e.g. (Waide and Watson 2013):

"The EU energy label is actually one of the most successful labelling programmes:

- In part it is the result of consumer research before its first introduction;
- Many regions of the word have copied the European label concept and design;
- It brings transparency on the market and corrects the lack of information market failure".

The EC Commission Staff Working Document (EC 2008a) reported that the energy label scheme is successful in contributing to pull the market of household appliances towards more energy efficient products and as a "win-win instrument for consumers, industry and the environment".
It supports both:

- Consumers as it "provides useful and comparable information, allowing (consumers) to consider investing in better performing appliances in order to realize savings in taking into account the running costs (mainly energy consumption in use);
- And manufacturers as it "helps manufacturers to position their products on the market and get some payback on their investments for introducing better and more innovative appliances."

Salmons 2011 reports from Weiss et al (2010b):
"There is also evidence in the literature of experience curve effects in relation to product energy efficiency; with learning rates for white goods in the Netherlands ranging from 13- 35% over the past forty years, with an average of around 20%. Product energy efficiency was improving prior to the introduction of the first wave of EU regulations in the early-mid 1990s, although the learning rate accelerated significantly thereafter. Again this is supported by the empirical analysis of the more recent data for the United Kingdom, which shows a significant improvement in energy efficiency for all product categories."

The industry association with the longest direct experience of the EU's mandatory energy labelling scheme, CECED, have described it as (CECED 2012):
"A success story

- Proven good practice & results achieved by ecodesign and energy labelling policies.
- Both policies have ensured the penetration of a growing number of performing products in the market.
- Need to ensure these policies remain key reference legislation for future energy related products."

And cited the example of refrigerators where the best performing products are "80% more efficient than 20 years ago" and the market average is "55% more efficient". Many similar views are reported in the literature.

4.1.3 Is labelling needed or will other regulatory instruments suffice? (ELD8, 9, 3)

Labelling is frequently cited as a key communication tool necessary to overcome primary information barriers that would otherwise prevent market actors from placing value on energy performance. In principle, in the absence of information on energy performance a products energy performance is invisible to the market place and therefore is ignored and not acted upon. Labelling is an established tool to help give visibility to energy performance and communicate it into the market.

The Commission's 2008 impact assessment for the Recast labelling Directive is quite explicit about the market failures that labelling is designed to overcome, stating:

"The SCP/SIP impact assessment identified several market failures and imperfections, which prevent society from reaching the social optimum (EC 2008d). The most important market failures were summarised in the IA on 2005/32/EC as:

- Environmental externalities that result from prices not reflecting the negative environmental impacts of the production or consumption of products leads consumers to choices that do not necessarily act in the interest of the society.
- 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 one, thus consumers are buying products that are cheaper at the purchase but more expensive over the life cycle.
- Bounded rationality explaining 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 forthcoming benefits (EC 2008d) 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 short-sightedly on the purchase price only.
- Principal-agent problems that occur where there is a misalignment of incentives of those purchasing the product (e.g. landlord or industrial plant) and those using it (e.g. tenant or provider to an industrial plant).

The above market failures have negative effects on development of better performing products since they limit the demand for products with lower environmental impacts. The market failures result in products that are not designed such that environmental impacts of products over their life cycle are optimal. The Ecodesign preparatory studies show that typically more than 90% of the life cycle environmental impacts take place during the use phase[14]."

This view is supported by a wide body of external literature. For example, the IEA's World Energy Outlook (2012) cites lack of visibility as being one of the key barriers to energy efficiency improvement and indicates labelling as being a fundamental tool to both measure and rank efficiency and to communicate it the market.

14

Schleich (2009) states "Labelling schemes are often promoted as a cost-effective measure to overcome barriers related to information and search costs, or to bounded rationality on the part of appliance purchasers (e.g. Sutherland, 1991). In this case, the labelling scheme is designed to make consumers aware of the relative energy efficiency of appliances and associated potential cost savings through the provision of observable, uniform, and credible standards (e.g. Truffer et al., 2001). Evaluation studies based on aggregate observed data typically find that the existing energy labelling programs for household appliances in the EU, the US or Australia are effective in terms of energy and carbon reductions (e.g. Sanchez et al., 2008; Lane et al., 2007, Banerjee and Solomon, 2003; Schiellerup, 2002; Bertoldi, 1999; Waide, 2001; Waide, 1998)."

The preamble to the Recast Labelling Directive implicitly recognises the role labelling plays in overcoming this information failure:

"(8) Information plays a key role in the operation of market forces and it is therefore necessary to introduce a uniform label for all products of the same type, to provide potential purchasers with supplementary standardised information on those products' costs in terms of energy and the consumption of other essential resources and to take measures to ensure that potential end-users who do not see the product displayed, and thus have no opportunity to see the label, are also supplied with this information. In order to be efficient and successful, the label should be easily recognisable to end-users, simple and concise. To this end the existing layout of the label should be retained as the basis to inform end-users about the energy efficiency of products. Energy consumption of and other information concerning the products should be measured in accordance with harmonised standards and methods."

In addition European industry appears to share the same view, for example, ORGALIME (2012) state:

"Industry supports the combination of

- Eco Design Directive to cut off least performing products,
- Energy Label to promote informed consumer choices, and
- Eco Label to promote best performing."

See also the comments from CECED (2012) section 5.1.2.

4.1.4 Selection of product groups (ELD4)

Only a limited set of literature addressing the EU's energy label has considered the question of whether the most appropriate products have been selected for labelling thus far (VHK 2012). Prior to being recast the labelling Directive was obliged to focus exclusively on household appliances that used energy directly, but since the recast the scope has been expanded to all energy-related products excluding transport related end-uses.

The Recast Directive specifies:

"(7) The Commission should provide a priority list of energy-related products that could be covered by a delegated act under this Directive. Such a list could be included in the Working Plan referred to in Directive 2009/125/EC.

(13) Energy-related products have a direct or indirect impact on the consumption of a wide variety of forms of energy during use, electricity and gas being the most important. This Directive should therefore cover energy-related products having a direct or indirect impact on the consumption of any form of energy during use.

(14) Energy-related products which have a significant direct or indirect impact on consumption of energy or, where relevant, of essential resources during use and which afford adequate scope for increased efficiency should be covered by a delegated act, when provision of information through labelling may stimulate end-users to purchase more efficient products."

The Scope of the Directive is specified as:

"1. This Directive establishes a framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products.
2. This Directive shall apply to energy-related products which have a significant direct or indirect impact on the consumption of energy and, where relevant, on other essential resources during use.
3. This Directive shall not apply to:
(a) second-hand products;
(b) any means of transport for persons or goods;
(c) the rating plate or its equivalent affixed for safety purposes to products."

The Commission's 2012 - 2014 work plan outlines plans to develop energy labelling specifications for:

- Domestic refrigeration;
- Domestic dishwashers;
- Domestic washing machines;
- Household tumble driers;
- Boilers and combi-boilers;
- Water heaters and storage tanks;
- Vacuum cleaners;
- Domestic lighting II (reflector lamps and luminaires);
- Domestic and commercial ovens including when incorporated in cookers;
- Domestic and commercial hobs and grills, including when incorporated in cookers;
- Non-tertiary coffee machines;
- Tertiary sector lighting II (luminaries or lighting systems).

Interestingly there were no plans to develop labelling requirements for a range of product groups for which Ecodesign requirements were being produced including almost all non-domestic equipment including:

- Motor systems;
- Network, data processing and data storing equipment;
- Professional refrigerating and freezing equipment;
- Commercial refrigeration;
- Transformers;
- Water-cleaning appliances and irrigation equipment;
- Professional washing machines, dryers and dishwashers;
- Industrial and laboratory furnaces and ovens;
- Machine tools.

Some purely domestic products:

- Domestic ventilation/kitchen hoods;
- Set top boxes.

And some product groups that are found in both domestic and commercial applications:

- Air-conditioning and ventilation systems;
- Electric and fossil fuelled heating equipment;
- Solid fuel small combustion installation;
- Office equipment in both the domestic and tertiary sectors;
- Sound and imaging equipment;
- Stand-by losses.

The rationale for the distinction between when labelling and Ecodesign or just Ecodesign requirements are considered appropriate is not addressed in the plan, but appears to be guided by:

- A concern/belief that labelling may be less effective or important in business to business applications than in applications where consumers procure the product directly;
- Pragmatic constraints on staff and committee capacity coupled with a belief that Ecodesign regulations are more important than labelling regulations and hence should be prioritised;
- A view that labelling is addressed (or partially so) through other instruments such as Energy Star;
- A belief that some products may evolve too rapidly to be subject to mandatory labelling specifications.

It is also noteworthy that no ErP, as opposed to energy-using product, was considered for labelling despite the Recast directives impact assessment (EC 2008b) explicitly focusing on the importance of extending the scope to cover energy related products such as windows, showerheads and taps. With these thoughts in mind it is interesting to compare the approach taken in the EU with that applied in other jurisdictions to product selection for labelling (e.g. in Waide 2013).

4.1.5 Relative focus on energy consumption and energy efficiency (ELD5)

This topic of whether energy policy should focus on efficiency alone or also give more emphasis to conservation, especially for larger products or homes, is addressed in: Nørgard (1995), Moezzi (1998), Waide et al (2000), Wilhite & Nørgard (2003), Wijshoff & Attali (2003), Harris et al (2006), Granda et al (2008), Deumling (2004), Baker (2004), Barkenbus (2006), Harris et al (2008), Holladay (2009) and Calwell (2010).

All these analyses have pointed out a narrow focus on raising efficiency will be insufficient to meet broader energy security and climate change challenges due to the phenomenon of up-scaling in product sizes, numbers and services. This is sometimes also referred to as a rebound effect although really it is predominantly a consequence of economic growth and technological development. The rebound effect is really concerned with the degree to which these trends are exacerbated by the recycling of the money economised through energy savings into extra economic activity and its associated energy use. Many of these analyses have also pointed out that attainment of nominally higher efficiency levels actually seems to be easier for larger products due to the way that efficiency has been defined. In the case of cold appliances and TVs the analyses show that the use of linear regressions across a broad size range tends to be more favourable to larger appliances due to the physical constraints involved for smaller products and therefore there is a risk that reliance on linear efficiency definitions in MEPS and labelling may inadvertently create a competitive advantage for larger products. Some of the analyses listed above go beyond this to argue that even if biases in efficiency definitions are fully addressed product policy should still give weight to absolute energy savings and therefore should apply "progressive efficiency" limits that are more challenging to attain for larger capacity products. Most of these analyses advocate weighting the efficiency threshold criteria used in labelling and MEPS to make it relatively more difficult for high energy consuming products to attain the policy thresholds i.e. to attain the higher efficiency label classes.

Very few of these analyses have also considered how consumers use the information presented on the label and the relative priority that they place on the efficiency scale and the energy consumption information. Waide and Watson (2013) did, however, and assessed the degree to which consumers focus on efficiency rather than energy consumption in the way they use the label. They found that both the efficiency scale (and classification grade) and the energy consumption value were used by consumers to understand the energy performance of the product, albeit a greater share of consumers focused on the efficiency scale/classification than on the energy consumption value. They also found that the comparatively large font given to the energy consumption value drew user attention to that value and did convey that it was important information. Equally, an important minority of consumers were found to be sceptical of the validity of the energy consumption value when it was presented as an annual value for products that were not continuously activated (i.e. for all products except cold appliances). The reason for this scepticism was that these consumers thought that their appliance usage level was likely to vary greatly from the assumed values.

It is also worth noting that the preamble to the Recast Directive states:

"(15) In order to meet the Union climate change and energy security objectives, and given that the total energy consumed by products is expected to continue to rise in the longer term, the delegated acts under this Directive could, where relevant, also highlight on the label the high total energy consumption of the product."
Lastly, the Commission's impact assessment for the tyre labelling Directive (EC 2008c) also comments on the merits of relative labelling versus absolute labelling, which is germane to the issue of how information on energy performance is conveyed:

"5.2.2.5. Relative versus Absolute Labelling
The European Commission has consistently, within the existing labelling Directive on household appliances (Directive 1992/75/EC), favoured relative grading as against absolute grading. The rationale behind this is to allow consumers to compare products which provide similar functionalities and correspond to consumers' needs. Someone needing a big refrigerator because he/she has a large family will not change his/her purchasing decision because smaller fridges obviously consume less energy. The same argumentation may well be true for tyres, as consumers have a limited choice in the dimension of the tyres they have to replace on a given vehicle.

A relative grading scheme would make sense only if there is a proven correlation between rolling resistance and other parameters, such as external diameter (OD) and/or load index (LI). Although the available figures from the tyre industry point to the existence of a correlation, it is considered too weak to call for a relative grading scheme (see Annex 3 for a detailed explanation)."

4.1.6 Appropriateness of information presented (ELD6)

This is discussed in section 6.

4.1.7 Strongest and weakest elements of the current labelling scheme (ELD10)

There is no literature that gives a thorough assessment of the strongest and weakest elements of the EU labelling scheme; however, the principle weaknesses would appear to be (Waide & Watson, 2013; Kubiak and Grönroos-Saikkala, 2013; Toulouse and Arditi, 2012; EC, 2008b):

- The relatively slow rate of expansion of energy labelling to cover more products including energy related products;
- The difficulty in upgrading the energy label efficiency thresholds in response to market evolution towards higher efficiency levels and the problem that consumers appear to be less motivated by the A+++ to D scale than the A to G scale;
- The potential to mislead the public in maintaining efficiency classes on the label that have been prohibited by Ecodesign regulations;
- Confusion about the meaning of some icons and the lack of local language text to explain aspects of the label;
- Insufficient market surveillance;
- Unresolved standardisation issues that affect the degree to which energy consumption and efficiency metrics reflect real use and the magnitude of tolerances.

The strongest elements would appear to be (Egan and Waide, 2005; Kubiak and Grönroos-Saikkala, 2013; Waide & Watson 2013; Toulouse and Arditi, 2012; Waide 2013; EC, 2008b):

- A proven track record in overcoming informational barriers and encouraging consumers to take energy performance into account in their procurement decisions;
- A well-known and comparatively well understood design (especially the colour coded efficiency scale) that enables relatively technical information on energy efficiency to be conveyed in an accessible manner;
- A relatively powerful market transformational effect on labelled product markets;
- Substantial extended impacts through emulation in third jurisdictions.

4.1.8 Focus on in-use and life-cycle phase impacts (ELD7)

When considering the focus of the energy label on energy-in-use as opposed to life-cycle phase impacts the impact assessment for the recast labelling Directive (EC 2008b) comments:

"Most product legislation addresses specific aspects of a product's life-cycle and not all the life cycle aspects. While the Ecodesign Directive and the Eco-label take a life-cycle perspective, in the case of energy-using products, studies show that typically more than 90% of the life cycle environmental impacts take place during the use phase.

Information to consumers under EU policy focuses on energy and consumables efficiency of household appliances in the use phase under the ELD and of energy efficiency of office equipment under the Energy Star Programme. The Eco-label covers all life cycle phases but in practice only a limited number of products are registered under the scheme. Finally, actions at national level (Nordic Swann, Blue Angel…) are not coordinated."

It goes on to justify the current focus of the labelling Directive on energy in use with the following statement:

"Energy consumption in use is not the only environmental impact of products. However an EIPRO study (ENV 2006) on environmental impact of products identified that energy consumption in use is the single most important factor for energy-using products. Broadening the focus from energy and resource efficiency in use phase to all significant environmental impacts over the life cycle of the product would risk increasing information asymmetries in providing more information on complex environmental impacts over the life cycle of the product. Given that the present focus of the ELD on energy and resource already tackles typically more than 90% of the environmental impacts of energy-using products, broadening of the focus at the expense of the clarity of information is considered inappropriate. When consulted specifically on this issue, all stakeholders, including consumer associations and environmental NGOs, were in favour of, at least for the coming years, a focus on the consumption of resources in use, thereby guiding consumers on the cost of running an appliance."

But adds the following caveat:
"No further objectives for the savings of other essential resources (Article 1 of the Directive) in the use phase are developed in order to keep the focus clearly on the main environmental impacts. A well designed product labelling ought to take such trade-offs into account and ensure that the focus on one environmental parameter (energy consumption in use) is not promoted at the

detriment of the global environmental performance of the product over its lifecycle. Potential trade-offs must be addressed in product specific impact assessments.

However, the issue of consumption of 'other essential resources' in use phase and the trade-off with energy mainly applies to a very limited number of well-known products, the so called 'wet goods' (washing and dish washing machines and dryers to some degree). Currently there is no accepted methodology that could prioritise between environmental impacts. However in the case of energy-using products it is clear that typically more than 90% of environmental impacts take place in the use phase corresponding to energy consumption."

Other studies have looked into feasibility issues associated with labelling life cycle impacts (Ernst & Young 2009, 2010, 2013; Langley 2012; Mugdal et al. 2012; Policy Studies Institute 2009). This is addressed more fully in section 6.11.3.

4.1.9 Mandatory and voluntary labelling (ELD13, 14, 12, 15)

There is little literature that examines the relative merits of mandatory versus voluntary labelling as applied to the EU energy labelling schemes. The introduction to Directive 2010/30/EU of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products states:

"(12) A completely voluntary scheme would lead to only some products being labelled, or supplied with standard product information, with the risk that this might result in confusion or even misinformation for some end-users. The present scheme should therefore ensure that for all the products concerned, the consumption of energy and other essential resources is indicated by labelling and standard product fiches."

And it would appear to be self-evident that mandatory labelling schemes have the merit that they present a level playing field for all products as any product subject to the scheme has to be labelled regardless of whether its performance is good or poor and thus it is not possible for poorer performing products to hide their poor performance through not presenting the information.

The main arguments in favour of voluntary labelling are that they:

- Can be introduced as private sector initiatives when regulators do not have the appetite to introduce mandatory labelling (e.g. the eurobac, Eurovent and EVA voluntary labelling schemes for building controls, HVAC equipment and vending machines respectively);
- May be able to respond more rapidly to changing circumstances, such as technological evolution, than mandatory schemes as they do not require legal changes to be updated;
- Can be easier to agree to operate over a broader international scale for widely traded and rapidly evolving goods e.g. the international Energy Star labelling scheme for ICT equipment jointly operated by the EU and USA;
- The burden of implementation is lighter for industry and retailers as they are free to choose not to engage;
- They enable an additional level of product endorsement to be communicated.

These factors have also led to a number of voluntary energy labelling schemes being introduced in EU member states such as: the GEA Consumer Information Scheme (Schmitz 1999), the UK Energy Efficiency Recommended label[15] and the Danish Electricity Savings Trust energy label.

Furthermore, the impact assessment leading to the adoption of the recast labelling directive reported that industry has shown little appetite for voluntary labelling and some associations have indicted a strong preference for mandatory labelling (EC 2008a).

It is interesting to note too that while many international labelling schemes have begun as voluntary schemes they have often evolved into mandatory labelling schemes with time, not least because participation rates have not been as high as desired and hence the impact of the schemes has been weaker than hoped for. The Indian, Korean, Swiss and Thai energy labelling schemes were all voluntary when first implemented but have all been made mandatory (with or without other adaptation) over time. Information on other international voluntary labelling schemes is given in section 5.1.12.

4.1.10 National mandatory energy labelling schemes compared with EU-wide schemes (ELD12)

The impact assessment of the energy labelling directive (EC 2008b) warns of the potential for mixed market signals from national labelling schemes, as follows:

"Regulatory instruments are not sufficiently connected and potential synergies between different instruments are not sufficiently exploited. Implementation could be more dynamic and forward-looking to drive the performance of products upwards. Divergent national and regional approaches send conflicting signals to producers, and as a result the full potential of the Internal Market is not realised."

The only mandatory national energy labelling schemes currently in place within the EU either apply to non-traded goods e.g. to energy labelling of buildings or to cars. The latter are traded across EU boundaries and Member States are permitted to apply mandatory labelling for fuel economy and or CO_2 under the auspices of Directive 1999/94/EC relating to the availability of consumer information on fuel economy and CO_2 emissions in respect of the marketing of new passenger cars. It is likely there was a debate about the relative merits of introducing a harmonised EU fuel-economy and CO_2 labelling scheme for cars versus allowing national prerogatives to apply under the subsidiarity principle, however, the record of this discussion has not been discovered in the literature and the Directive text does not remark on the rationale for adopting non harmonised labelling requirements across the EU. Note, while the Directive does require EU harmonisation in the test procedures to be used, label size, text wording and fuel economy and CO_2 emissions to be displayed, it does not require a common format, delineation of performance classes or harmonised classes when used.

In terms of the impact of the Directive a 2011 review of the implementation of the Directive by AEA (2011) for DG CLIMA found that:

[15] http://www.energysavingtrust.org.uk/Take-action/Find-Energy-Saving-Trust-Recommended-products/About-Energy-Saving-Trust-Recommended

"The effectiveness of the information tools were considered in terms of increasing consumer awareness and reducing the average CO_2 of new passenger cars. There is limited evidence to suggest that the Directive may have a positive impact on raising consumer awareness. However, very few studies or surveys have been undertaken within Member States with regards to awareness or effectiveness of the Directive. Average CO_2 emissions from passenger cars have decreased to 140.3g CO_2/km in 2010 down from 145.7g CO_2/km in the previous year. However, due to the range of other policies and measures that have been implemented within Europe/Member States (including the Voluntary Agreement on Passenger Car CO_2 emissions; Regulation 443/2009, and vehicle and fuel taxation), it is not possible to state that this decline in average CO_2 emissions is due to the implementation of Directive 1999/94/EC in isolation. It is therefore likely that the package of measures working in combination have led to this decrease."

The EU White paper (EC 2011) found that "Fuel efficiency labelling would have limited effect with mandatory CO standards enforced, but it would still play a role in raising awareness and ensuring independent and comparable information for consumers".

Thus it seems that while there has been a marked improvement in average vehicle fuel-economy it has not been possible to separate out the effect of the car labelling Directive from the voluntary agreement and other policies. Nonetheless, successive reviews of the Directive have all proposed that it would be better to have an EU-harmonised scheme than continue with national labels as at present. For example, (Gartner 2005) found that:

"In a Europe that is characterised by the growing mobility of its citizens, a multinational car industry and great ease in purchasing all kinds of cars in different Member States, an identical labelling system used in all Member States would surely be the most effective measure.
A harmonised system would clearly support general awareness throughout the EU, and it would equally avoid distortions and create synergies between the Member States. This would also offer an easier handling and lower cost for the manufacturers, for example the labels could be fixed right after the vehicle production."

The AEA (2011) study examined the case for greater harmonisation across the EU and made the following recommendations:

- "It is recommended to consider harmonising the design of the label reflecting the design of the EU household energy product label.
- It could be considered to make the inclusion of information on annual vehicle running costs on the label mandatory.
- It could be considered to require Member States to include information on relevant vehicle taxation rates on their respective labels, e.g. where these are linked to a car's CO_2 emissions.
- It is recommended that any future harmonisation of the label should not be too prescriptive in relation to other elements to be included on the label, so as to enable Member States to take account of national circumstances.
- It is recommended to investigate the potential to have a composite label that is clear and easy for consumers to understand and which includes information on both the absolute and relative CO_2 performance of the vehicle.
- If it is not possible to develop a simple and clear composite label, a requirement to use an absolute label could be considered.

- However, it is recommended to base this policy choice on a consumer behavioural study to test the effectiveness of alternative schemes.
- If it proves not to be possible to agree on either a composite or an absolute label, then it could be considered to develop guidelines in the Directive for the development of relative labels.
- It could be considered to leave the definition of bands to Member States, but in such a case the revised Directive should set out clear principles for the allocation of cars to bands".

To these recommendations can be added the argument that a harmonised labelling scheme involving common performance thresholds for all products sold in the EU provides a much clearer set of performance targets for product designers and manufacturers to aim for than would be expected from 27 sets of divergent performance specifications. As the market transformational impact of labelling, whether mandatory or voluntary, involves a manufacturer response to a perceived (and hopefully actual) sales increase from attainment of higher efficiency levels, the setting of a common set of thresholds across the EU would clearly be expected to send a clearer signal to industry than divergent performance thresholds.

In principle the potential benefits of national labelling schemes include:

- The presentation of nationally relevant information and especially language;
- Setting of energy performance thresholds that reflect national circumstances and thresholds;
- Giving the imprimatur and endorsement of a nationally known or trusted entity to the labelling programme.

Theoretically, none of these benefits need conflict with an EU harmonised labelling scheme in principle. The original EU scheme allowed nationally specific language. The range of performance thresholds can be set to cover all national market conditions found in the EU and in theory provisions could be made to permit nationally known and trusted bodies to add their imprimatur to an EU harmonised scheme as implemented in their country. However, addressing the language and imprimatur issues would entail changes to be made in the way the current labelling Directive is implemented. Permitting national specific language (at least in any quantity) would necessitate a reversion to a two labelling element structure (e.g. the technical strip and the language specific background, as was originally the case). Adding imprimatur would require a similar arrangement.

4.1.11 Legal protection of the labelling scheme (ELD16)

None of the literature has looked into the issue of the legal protection of the labelling scheme beyond the observation in the Commission's impact assessment of the recast energy labelling Directive that:

"The energy label has no legal protection, which entails risks of abuse by third parties. The lack of provisions ruling the voluntary use of the Community energy label by third parties can put the credibility of the scheme in danger."

The project team note that many other entities, including EU industry associations and in one case an airline, have copied the form and appearance of the EU energy label to use in their own private efficiency or carbon footprint initiatives but we are not aware of any assessment of the impact of these initiatives on the credibility of the EU labelling scheme.

4.1.12 Relevant international experience (ELD17)

The preamble to the Recast Directive implicitly recognises the importance of the EU energy label to programmes developed outside the EU's boundaries:

"(9) As pointed out in the Commission's Impact Assessment accompanying its proposal for this Directive, the energy labelling scheme has been followed as a model in different countries around the world."

The impact assessment of the recast labelling directive (EC 2008b) gives examples of the following countries whose labels have at least drawn on the EU energy label design and are harmonised with the scheme overall to a more or less extent:

Argentina, Brazil, Chile, China, Egypt, Iran, Israel, South Africa and Tunisia

Other countries known to the project team whose labelling schemes have also been influenced by the EU's include: Algeria, Columbia, Jordan, Norway, the Russian Federation, Switzerland, Turkey and the Ukraine.

The motivation for this alignment will vary. In the case of Norway the EU labelling scheme was adopted as part of a package of broader legislative harmonisation in the framework of the European Economic Area, in the case of Jordan as part of an association agreement and in the case of Turkey as part of its candidacy process for EU membership. For the other economies mentioned such EU alignment frameworks do not apply and hence their motivations for adopting a EU harmonised labelling scheme are more likely to be predominantly due to expected benefits in energy savings and trade.

The impact assessment also reports:

"These results (the magnitude of energy savings attributable to energy labelling in the EU) are similar to those in third countries, e.g. in Australia and Switzerland when the provision of information on appliance running costs has been increased. From the Australian NAEEP programme there is evidence to demonstrate decreases in energy consumption of 1 to 6% and increases in energy efficiency of 1.4 - 3.6% across the use of 5 main appliances during the period 1993 - 2001. It has been estimated if labelling had not been introduced, the annual electricity consumption of all new appliances (of the types labelled) in 1992 would have been about 11% higher than it was, and the total household electricity consumption in Australia would have been about 1.6% higher. Projections from the Swiss E2000 energy label (which were granted only to appliances which met targets of power consumption in different modes of operation, linked to running costs) also estimated savings of approximately 1% of Switzerland's overall electricity consumption (EC 2006).

Using only energy savings as a benefit (that is allocating no monetary value to the environmental benefits), the NAEEEP is projected to deliver almost 4.2 billion Australian dollars to the community (after the projected $2.6 billion costs are deducted from the $6.8 billion energy savings at 10% discount rate by 2018). This experience suggests that such schemes to increase awareness of running costs/energy efficiency are cost effective. Savings can be achieved at a negative cost to society. The extra costs of more efficient appliances are offset by savings in running costs over the life of the appliance. No effect expected on availability or cost of inputs, access to finance or investment cycle. Action will promote the most efficient technologies available over inefficient technologies."

Collated information is scarce on the level of ambition of the EU energy label compared to that in place in peer economies largely due to limited investment in such studies and because of problems incurred in benchmarking policy settings with those in place in economies that use different test procedures, product categories/groupings and efficiency definitions. In recent times benchmarking work has been done by the IEA 4E implementing agreement, by CLASP and SEAD. This has usually focused more on the efficiency of products and of MEPS than on labelling criteria. One such benchmarking study (Baillergeon et al 2012) found that Japanese energy efficiency policy settings for room air conditioners were much more stringent than those applied elsewhere, including in the EU.

There has been extensive international experience with both mandatory and voluntary labelling schemes. In the case of voluntary labelling the impacts are usually greatest when there is a clear commercial reward from attaining the voluntary labelling requirements. The US Energy Star label is applied to many products beyond the scope of international Energy Star scheme and the main attraction for producers in engaging with the scheme is to gain access to rebates and other financial incentives associated with utility energy efficiency programmes. The Federal Energy Management Program (FEMP) also stipulates that products should be Energy Star compliant to be considered for government procurement. China also operates a voluntary labelling scheme whose principle attraction to producers is that only products that meet the requirements are eligible for consideration in public sector procurement (EU SME 2011). Japan also operates a voluntary energy labelling programme (ANRE 2007) that apples to 16 product types. This programme is promoted by METI and is thought to apply to a significant proportion of affected products although the motivation for engagement by industry has not been reported in the literature. Interestingly all of the above economies also operate mandatory labelling programmes in conjunction with the voluntary programmes, There are likely to be various rationales for this including competing agencies with different mandates, issues related to label design effectiveness, etc. however the literature is largely quiet on the rationale for operating voluntary and mandatory labelling schemes simultaneously for the same product types.

Perhaps the most important lesson that could be learnt from other economies pertains to how they have upgraded their energy labelling schemes as products have migrated into the highest efficiency classes. Many economies using categorical energy labels like that in place in the EU have revised their efficiency classes but nearly all of them have simply rebased the existing scale rather than adding new efficiency classes. Economies that have done this include: Australia, China, India, New Zealand and Thailand. The Australian experience in transitioning from an old energy label to a revised label with new efficiency classifications is reported in EES (2004). No major problems were incurred but the following lessons were reported:

“Process Control – The process of label transition is a complex process affecting many stakeholders. The process needs to be professionally managed and it needs to be transparent. The formation of a steering committee (Energy Labelling Review Committee) consisting of Key industry Groups, Key consumer groups, Government and Technical advisors is considered essential. The formation and management of key working groups with broad industry participation to analyse the market for each appliance type and develop new energy labelling equations is also critical.

Scope of Transition – The Australian experience involved a label transition for all five energy labelled product groups. In hindsight this was most likely overly ambitious and caused an excessive burden on industry. For future transition programs consideration should be given to a staged transition process.

Timing – The transition process from conception to completion was originally intended to take two years but ended up taking three. Realistically, plans for future transitions should allow for at least a three year transition period. Furthermore, from the outset the process needs to be rigorously programmed with set timelines for each stage. The time allocation for the regulatory impact assessment process can be significant and programmers should consider parallel development of communications strategies during this period.

Research – The timely commissioning and delivery of research papers to support the transition process is a key element in the success of the program. The main areas of research are:

- International review of energy labels;
- Technical Analysis of the basis for labelling including current household energy use;
- Market Research using focus groups to determine consumer attitudes to the current label followed by a later study to assess alternative new label designs produced as a result of the first study.

Standards – The timely publication of standards that set out the algorithms and define labelling requirements are critical to the process. Industry needs to have published standards in place before it can confidently commit to a transition process.

Communication Strategy – An effective communication strategy is the key to the public success of any label transition program. The communication process must be well planned in advance. Specific lessons learnt from the communications strategy adopted were:

- Research and consultation with industry during the development of the communications strategy is critical;
- Public information services must provide a satisfactory level of service. Poor service (as was the perception with the telephone hotline) can undermine the credibility of the entire program. Service providers must be well briefed, they must have immediate access to senior staff so as to provide rapid responses to the more difficult questions and finally standards of service (including maximum response times) should be established;
- Media launches should be well tailored to the target audience of each publication and ideally scheduled for “slow news days”;
- There are risks associated with relying on a third-party, in this case buying groups and major department stores, to distribute information materials which are the central focus of the campaign. Lead times need to be adequate to seek co-operation from the organisation. Benefits to that organisation need to be clearly stated. Contact needs to be made prior to

dispatch of materials to ensure they know when to expect them. Courtesy calls following distribution need to be made to ensure materials were received in a satisfactory manner.

Assessment – A continuous process to assess the success of the label transition process should be undertaken. Assessments need to be made to:

- Evaluate the effectiveness of the communications strategy;
- Evaluate the level of compliance with the revised labelling program. Program managers should expect to continue this process for some time beyond the actual transition period."

A summary of the findings of the review of international labelling on label design and layout issues is presented in section 6.

4.1.13 Two separate frameworks? (ELD18, 19, 20)

The literature has not generally considered the question of the most appropriate legal framework for labelling and whether energy labelling should be managed under one Directive and another set of legal instruments are used to address other significant environmental impacts or whether the two elements should be combined into one. Merging the ELD and the Ecodesign directives was considered in the impact assessment for the ELD (EC 2008b) but was not considered to offer any advantages compared to using two separate Directives.

4.1.14 Increasing the dynamism of the labelling scheme

There has been much discussion about how best to manage dynamic developments in the energy labelling scheme and especially about how to ensure that the efficiency scale covers a wide range of products and continues to encourage innovation at the high efficiency end. This topic was addressed by the impact assessment of the energy label directive (EC 2008b) which states:

"The dynamism of the ELD - within a given scope – depends, first of all, on the resources allocated within the Commission to develop new implementing measures (periodic reviews) and on the support by the Member States in the Regulatory Committee. Another obstacle to the adoption of reviews is the industry stakeholders' resistance in upgrading the A–G ratings, as it implies downgrading of appliances in stock (an 'A' appliance becomes a 'B' or a 'C' appliance, which leads to decreased value of these appliances in stock due to reduced consumer interest).
Currently the ELD framework only allows implementing Directives, which require transposition by Member States and the follow up of the transposition by the Commission. Implementing measures in the form of regulations or decisions would reduce administrative burden and respond to a strong request made by industry in order to ensure level playing field for competition in the Internal Market and the harmonised introduction of measures across the Member States."

The recast Directive aimed to address this problem by introducing new efficiency classes up to A+++ for products that were already saturated in the higher efficiency classes.

Section 6.5 addresses recalibration isuses and section 7.2 includes a proposal on how to best set the top labelling thresholds. Section 6 also disucssss the importance of the threshold delineating the green from the yellow labelling classes.

4.2 Options for improvement

Waide (2013) proposes for both the Ecodesign and labelling Directives:

Enhance the strength of monitoring and compliance activities by ensuring adequate resources are committed to compliance at the Member State level and that synergies are explored that would facilitate greater cooperation among national market surveillance authorities. Given the low level of compliance activity seen to date in the EU it may be appropriate for the Commission to be given a coordination role and for legal obligations on the scale of compliance activity to be established.

Other recommendations:

The Ecodesign preparatory studies should consider the application of learning curves to estimate and account for the expected rate of technological and production cost progress associated with higher efficiency design options and the use of this in the techno-economic and least life-cycle cost determinations. Application of a shadow price for carbon emissions should also be considered in the life cycle cost determinations.

The Commission should explore options to strengthen the technical foundations of the preparatory studies by: organising the development and maintenance of product energy and cost simulation tools to be used to examine proposed design changes; conducting product tear -down analyses to establish the bill of materials and associated production costs, establishing longitudinal market and field data collection; farming out the impact assessments to a dedicated consultancy that applies the same approach across all product types; developing a long-term bottom-up energy consumption forecasting tool for products in the EU based on a stock modelling approach.

Efforts should be taken independently of the preparatory studies to benchmark EU product regulatory energy efficiency settings against those applied in peer economies and clarify reasons for the differences observed.

Stronger efforts should be made to integrate the energy labelling specifications into green public procurement plans potentially including clear targets or obligations across the EU and similarly, to leverage other economic instruments to accelerate the adoption of advanced and innovative technologies.

4.3 References

- Ademe & Afnor (2011), « ote du collectif d'associations de consommateurs sur le format d'affichage» (Summary of responses from consumer associations on communication support of environmental information).
- ANRE (2007) *Energy Saving Labeling Program*, Prepared from "Energy Conservation Policy & Measures in Japan 2007" Agency for Natural Resources and Energy, Ministry of Economy and Trade, Japan.
- Appleton, Arthur E. (2000) "The labelling of GMO products pursuant to international trade rules", New York University *Environmental Law Journal*, Vol. 8:3, p. 566-578

- Baillergeon et al (2012) *Cooling Benchmarking Study Report, by* Baillergeon, P. (Econoler), Waide. P. (Navigant), Sachs, H. (ACEEE), Riviere, P. (Armines) and CEIS, http://www.clasponline.org/Resources/Resources/StandardsLabelingResourceLibrary/2012/Cooling-Benchmarking-Study#files
- Baker, L. (2004) "Great big green monster mansions", salon.com, 7 July 2004
- Banerjee, A. & Solomon, B. (2003); "Eco-labelling for energy efficiency and sustainability: a meta-evaluation of the US programs." *Energy Policy* 31, pp. 109-123.
- Banks, M., 16 arch 2010, "MEPs reject traffic light system for food labelling"
- [Accessed online 25/03/2010: www.theparliament.com/no_cache/latestnews/newsarticle/newsarticle/meps-reject-traffic-light-system-for-food-labelling/]
- Barkenbus, J. (2008) "Putting Energy Efficiency into a Sustainability Context: The Example of Refrigerators", Environment, October 2006
- Berg et al (2009) *Consumers and the EU Energy Label Report from a European comparative study*, Lisbeth Berg, Eivind Stø & Pål Strandbakken, BARENERGY project, Deliverable D 23
- Bertoldi, P. (1999) "Energy efficient equipment within SAVE: Activities, strategies, success and barriers" Proceedings of the SAVE Conference for an Energy Efficient Millennium. Graz, Austria, 8-10 November 1999 (www.eva.wsr.ac.at).
- BSR (2008) Eco-promising: communicating the environmental credentials of your products and services
- Bull, J. (2012) "Loads of green washing—can behavioural economics increase willingness-to pay for efficient washing machines in the UK", Joe Bull, *Energy Policy*, November 2012 p 242-252
- Calwell (2010) *Is efficient sufficient? The case for shifting our emphasis in energy specifications to progressive efficiency and sufficiency*, Calwell, C. for ECEEE, 2010 http://www.eceee.org/policy-areas/sufficiency
- CECED (2012) "Which future for ecodesign and labelling?" Presentated by CECED at the 19 April 2012 Consultation Forum.
- Cheyne, I. (2009), "Proportionality, Proximity and Environmental Labelling in WTO Law", *Journal of International Economic Law*, Vol. 12: 4 (December 2009), pp. 927-952
- della Faille de Leverghem, (2012) "Ecodesign standardisation: State of play in CEN and CENELEC" Alexandre della Faille de Leverghem, Programme Manager –CEN-CENELEC Management Centre, presented at Ecodesign Consulation Forum, April 2012.
- Deumling R. (2004) "Thinking Outside the Refrigerator: Shutting Down Power Plants with NAECA? ACEEE 2004 Summer Study on Energy Efficiency in Buildings"
- Dröge, Susanne, 2001, Ecological Labelling and the World Trade Organization, DIW Discussion Paper No. 241, Berlin
- Du Pont (2000) Designing and Implementing a Labelling Programme, Peter du Pont, IIEC, Presentation at the CLASP Latin American Regional Workshop on Energy Efficiency Standards and Labelling,2000
- EC (2008a) COMMISSION STAFF WORKING DOCUMENT Accompanying document to the Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products SUMMARY OF THE IMPACT ASSESSMENT, European Commission, {COM(2008) 778 final} {SEC(2008) 2862}

- EC (2008b) COMMISSION STAFF WORKING DOCUMENT Accompanying document to the Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products IMPACT ASSESSMENT, European Commission, {COM(2008) 778 final} {SEC(2008) 2862}
- EC (2008c) COMMISSION STAFF WORKING DOCUMENT Accompanying document to the Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on labelling of tyres with respect to fuel efficiency and other essential parameters IMPACT ASSESSMENT {COM(2008)779} {SEC(2008)2861}
- EC (2011) Brussels, 28.3.2011 SEC(2011) 358 final COMMISSION STAFF WORKING PAPER IMPACT ASSESSMENT Accompanying document to the WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, SEC(2011) 359 final, SEC(2011) 391 final, COM(2011) 144 final
- EC (2012) Ecodesign Consultation Forum meeting on horizontal issues. Agenda Point 2: Presentation of the state of the regulatory work on the new implementing Ecodesign and Energy Labelling measures, Adam Romanowski, DG ENER, C3, 19 April 2012
- EC (2012b) Brussels, 12.7.2012 C(2012) 4641 final COMMISSION DELEGATED REGULATION (EU) No …/.. of 12.7.2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires
  ECOS (2012) Environmental NGO priorities, presented at Consultation Forum meeting on horizontal issues
- EES (2004) Energy Label Transition –The Australian Experience: Main Report, NAEEEC Report 2004/05, July 2004, Energy Efficient Strategies for the Australian Greenhouse Office
- Egan and Waide (2005) A multi country comparative evaluation of labelling research", Christine Egan & Paul Waide presented at ECEEE 2005 SUMMER STUDY – WHAT WORKS & WHO DELIVERS?
- ENV (2006) Environmental impact of products (EIPRO); analysis of the life-cycle environmental impacts related to the final consumption of the EU-25. Summary of the final report by DG Environment and DG Joint Research Centre, May 2006.
- Ernst & Young (2009) Pistes pour un étiquetage environnemental lisible et efficace
- Ernst & Young (2010) Product Carbon Footprinting –a study on methodologies and initiatives
- Ernst & Young (2013) Bilan des retours des entreprises sur l'expérimentation nationale de l'affichage environnemental
- Eurobarometer (2009) Attitudes of European citizens towards the environment
- Europe Economics (2007) Study on a possible extension, tightening or simplification of framework directive 92/75/EEC on energy labelling of household appliances, Report by Europe Economics and Fraunhofer-ISI with BSR Sustainability and FfE, 19 October 2007.
- European Food SCP Round Table (2011) Communicating environmental performance along the food chain, draft for public consultation until the 15th of September 2011,
- www.foodscp.eu/files/consultation2/Communicating_environmental_performance_along_the_food_chain.pdf
- EU SME (2011) Overview of voluntary labelling in China, EU SME Centre China, 2011.
- Faculty of Public Health (2008) Traffic-light food labelling, A position statement Faludi, Jeremy and Dawn Danby, www.worldchanging.com/archives/007256.html

- Gartner (2005) Study on the effectiveness of Directive 1999/94/EC relating to the availability of consumer information on fuel economy and CO 2 emissions in respect of the marketing of new passenger cars, by Andrea Gärtner ADAC e.V. for Directorate-General for Environment, Contract No.: 07010401/2004/377013/MAR/C1, March 2005
- Gasc (2012) The Energy Label Observatory (ELO) Emilien Gasc, Ecodesign Consultation Forum, Brussels 19 April 2012
- Granda et al (2008) "Tackling Efficiency Paradoxes. Possible Responses to Today's Landscape of "Energy-Efficient" 10,000 sq. ft. Houses and 60-inch Televisions", ACEEE 2008 Summer Study on Energy Efficiency in Buildings
- Haodong et al (2009) Haodong Gu, Pamela Morrison and Chongxin Yu, 2009, Energy Labels: Formats and Impact on Consumption Behaviour
- Harris J. et al (2006) "Don't Supersize Me! Toward a Policy of Consumption-Based Energy Efficiency", ACEEE 2006 Summer Study on Energy Efficiency in Buildings
- Harris, J. et al (2008) "Towards a sustainable energy balance: progressive efficiency and the return of energy conservation", Energy Efficiency 2008, Issue No. 3
- Heinzle and Wüstenhagen (2009) Consumer survey on the new format of the European Energy Label for televisions - Comparison of a "A-G closed" versus a "beyond A" scale format, Stefanie Heinzle and Rolf Wüstenhagen. University of St. Gallen, 2009:
- Holladay M. (2009) "Raising the Bar for Energy Star Homes", 29 April 2009
- IEA (2012) *World Energy Outlook 2012*, IEA/OECD, Paris.
- IISD & UNPE (2005), Environment and Trade: A Handbook, http://www.iisd.org/trade/handbook/5_1.htm
- IPSOS (2008) EU Energy Labelling, Global Research Report, Ipsos Marketing, December 2008
- Manoj, J. (2004), "Are Eco-Labels Consistent with World Trade Organization Agreements?", *Journal of World Trade* Vol. 38:1, p. 69-92
- Lane et al (2007) "Evaluating the impact of energy labelling and MEPS – a retrospective look at the case of refrigerators in the UK and Australia". Lane, K.; Harrington, L.; Ryan, P. in Proceedings of the 2007 eceee Summer Study.
- Langley (2012), Research on EU product label options, Final report, report for the European Commission
- Kubiak & Grönroos-Saikkala (2013) "Energy Labelling- State of play and conceptions for future," Kubiak, R and Gronroos-Saikkala, DG Energy, European Commission
- Moezzi, M. (1998): "The Predicament of Efficiency", ACEEE 1998 Summer Study on Energy Efficiency in Buildings
- Mugdal et al. (2012), Study on different options for communicating environmental information for products, BIO Intelligence for the European Commission
- Nørgard (1995) "Efficient technology in an inefficient economy", Nørgard J. ECEEE 1995 Summer Study proceedings,
- ORGALIME (2012) ECO DESIGN & ENERGY LABEL DIRECTIVES: An industry point of view
- Sigrid Linher, Environment Manager, ORGALIME, presented at Consultation Forum, 19 April 2012
- Policy Studies Institute (2009), Designing policy to influence consumers, Consumer behaviour relating to the purchasing of environmentally preferable goods, Report for the European Commision
- Salmons, R. (2011) Impacts of innovation on the regulatory costs of energy-using product policy, Policy Studies Institute & BIO Intelligence for Defra.

- Sanchez et al (2008) "Savings estimates for the United States Environmental Protection Agency's ENERGY STAR voluntary product labelling program",.Sanchez, M. C.; Brown, R. E.; Webber, C.; Homan, G. K. Energy Policy 36, pp. 2098-2108.
- Schiellerup, P. (2002): An examination of the effectiveness of the EU minimum standard on cold appliances: the British case. *Energy Policy* 30, pp. 327-332.
- Schmitz (1999) "The GEA Consumer Information Scheme", in Energy Efficiency in Household Appliances, pp 326-331, Springer Verlag, by Rolf Schmitz (http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&cad=rja&ved=0CC8QFjAA&url=http%3A%2F%2Flink.springer.com%2Fcontent%2Fpdf%2F10.1007%252F978-3-642-60020-3_39&ei=QA0RUoSIDOau0AXIrYHQCA&usg=AFQjCNGCVF17EuOZaI4AEoqYiUP53cB2KQ&sig2=3y2v_H4Rpjz3ep4Bs_49Bw)
- Schleich (2009) "Label it and they will buy it? The case of energy efficient class-A appliances" Schleich, Mils, ECEEE Summer Study, 2009.
- Sutherland, R.J. (1991) "Market barriers to energy efficiency investments". *Energy Journal* 12, pp. 15-34.
- Toulouse & Arditi (2012) Priorities for the improvement of the EU Ecodesign & Energy Labelling policies 05/03/12 Stéphane Arditi (EEB, coolproducts campaign) and Edouard Toulouse (ECOS) – edouard.toulouse@ecostandard.org
- Truffer et al (2001) "Eco-labeling of electricity – strategies and tradeoffs in the definition of environmental standards". Truffer, B.; Markard, J.; Wüstenhagen, R.: Energy Policy 29, pp. 885-897.
- VHK (2012) Study on Amended Ecodesign Working Plan under the Ecodesign Directive (remaining energy-using and new energy-related products), Van Holsteijn en Kemna, http://www.ecodesign-wp2.eu/documents.htm
- Waide, P. (1998) *Monitoring of Energy Efficiency Trends of European Domestic Refrigeration Appliances, final report*. PW Consulting for ADEME on behalf of the European Commission (SAVE). PW Consulting: Manchester.
- Waide et al, (2000), *COLD II: The revision of energy labelling and minimum energy efficiency standards for domestic refrigeration appliances*; Waide P., Lefevbre, H. Kreitz, T, Trines R., Vergeest I., Clodic D., Pougin A., Ciucasu C., Beaufils M., Zoughaib A., Kemna R., van der Sluiss S., Tosato G., Presutto M., Rusconi E. Mebane B., Meli M., Casandrini S., Lanzavecchia D., Janssen and M., Scholand S. for Directorate-General for Transport and Energy (DG-TREN) of the Commission of the European Communities, December 2000.
- Waide, P. (2001) *Monitoring of Energy Efficiency Trends of Refrigerators, Freezers, Washing Machines and Washer- Driers Sold in the EU*, final report. PW Consulting for ADEME on behalf of the European Commission (SAVE). PW Consulting: Manchester.
- Waide, P. and Watson, R. (2013) *Energy labelling, The New European Energy Label: Assessing Consumer Comprehension and Effectiveness as a Market Transformation Tool* www.clasponline.org
- Waide, P. (2013) *International Comparisons of Product Policy*, http://www.coolproducts.eu/resources
- Weiss M, Patel MK, Junginger M, & Blok K (2010b) "Analysing price and efficiency dynamics of large appliances with the experience curve approach." *Energy Policy* 38:770-783
- Wijshoff, L. & Attali, S. (2003) "Energy+ cold appliances beyond the A label, thanks to pan-European procurement", eceee 2003 Summer Study proceedings

- Wilhite H. & Nørgard, J. (2003) ”A case for self-deception in energy policy”, ECEEE 2003 Summer Study proceedings
- Winward et al (1998) *Cool Labels*, Winward, J., Schiellerup, P. & Boardman, B., Environmental Change Unit, Oxford, UK

5 Appropriateness of Energy Labelling

The literature covers numerous issues related to the overall question of the EU energy label's appropriateness. It discusses whether:

- The label benefits overweight its cost and its market impacts;
- The label is correctly designed and its content is appropriate and easy to understand;
- The label includes relevant information and what kind of information can actually be put on a label.

Fewer references were found on issues relating to the appropriateness of the product fiche, and the label use in distance selling and technical documentation.

5.1 EU Energy Label's Costs and Benefits (ELD21 to 26)

The current Energy Labelling Directive focuses on addressing the energy efficiency potential of the household sector, which represents 25% of the total energy consumption in the EC staff Working Document, Impact Assessment, 2008.

- "The success of the European Energy label, its positive impact on consumers, manufacturers and the environment, is underlined in several publications;
- For the society, the label has enabled Europe to achieve important energy savings and has contributed to reaching CO_2 emissions reduction targets."

In its 2006 Status report (Bertoldi and Atanasiu, 2007), the JRC states that "Most of the energy efficiency measures are cost-effective. This means that they will result in net money savings for end-users, as the reduced electricity cost over the lifetime of the appliances will outweigh the additional purchasing cost for a more efficient model. In many cases there is an increase in manufacturing cost to manufacturers, which can be passed on to the users or can be compensated by productivity gains (and in many cases will decrease over time when the most efficient components will be mass produced). Over the last ten years, the EU white goods appliances cost less and the efficiency has improved, while keeping the industry sector healthy (though with limited margin) and despite fears by manufacturers that the policy action introduced in the 90ies could have had a negative impact. Instead the "white goods" industry sector acknowledges the added value of the label as a means to differentiate products on the market. Overall it can be concluded that energy efficiency measures and in particular minimum requirements and labels are cost effective for society and reduce CO_2 emissions at a negative cost."

Kubiak and Grönroos-Saikkala, 2013, summarise:
"Since its introduction, the energy label has been a story of success. It is well known (80% of citizens recognise the label), and has helped create offspring labels for buildings, cars, and tyres. European consumers trust the energy label and usually take it into account when they buy electrical household appliances with the undeniable effect of transforming the market towards more energy efficient products.

Much of the credit must be attributed to its design, which also helped in exporting the idea of the label to numerous countries abroad (…). Today, over 70 countries have an energy label, allowing some 500 million people to make an energy efficient choice in buying products. It has achieved this by being:

- Easy to understand: comparative information is presented without the need for technical knowledge, and it touches the heart of consumers: money (85% of consumers pay attention to cost while only 15% pay attention to environmental aspects);
- Language neutral, which is a prerequisite for an EU label with over 20 language zones within the internal market. Pictograms, however, limit the complexity of the message that can be passed and today's/tomorrow's products will be more and more complex."

EC staff Working Document, Impact Assessment, 2008, estimates that energy labelling has contributed to annual primary energy savings in the order of 3 Mtoe corresponding to emission reductions of some 14 Mt of CO_2 annually over the period 1996 - 2004. Among the details, the average efficiency of newly purchased cold appliances improved by 30 per cent, dishwashers by 35 per cent and washing machines by 23 per cent. It was estimated that with the current policies already in place, 65 TWh to 75TWh per year could be saved by 2010[16]. More extensive details regarding the cost-benefits from the impact assessment are presented in Appendix D.1

CSES 2012 evaluated the cost effectiveness of the Eco-design Directive and found "potentially a very high benefit to cost ratio. The expected savings for the period 2005-2020 are estimated to be in the range of €90-120 billion while the costs of implementation for the Commission and Member States for the same period are in the range of €320-450 million." More details on cost-benefits are presented in Appendix D.2.

In addition, international comparison shows that, even if numbers should be interpreted with caution, the relative administrative and technical capacity (expressed in terms of annual person-hours of administrative and technical consulting support) in the EU compared with peer economies seems limited (Waide 2013). "The EU commits substantially less resources to support its programme than any of the peer economies. […] It is interesting to note that the US figure is roughly 10 times that of the EU despite both having similar sized economies and similar magnitudes of benefits achievable from optimising their equipment energy efficiency programmes. The estimated person-hours per year for development of the Chinese programme are over twice those of the EU's".

Nevertheless, the EU energy label is actually considered as one of the most successful labelling programmes (Waide and Watson 2013):

- In part it is the result of consumer research before its first introduction;
- Many regions of the word have copied the European label concept and design;
- It brings transparency to the market and corrects the lack of information market failure.

[16] National level evaluations are also positive. For example, in France Mugdal et al, 2011 estimate, based upon sales projections and energy savings calculated over the life time of products and related to the labelling scheme between 2000 and 2010, a minimum saving of 26 600 GWh. This corresponds to 1,10 million tons of CO_2 emissions avoided, and a net discounted value (in 2000) of 23 million Euros of environmental benefits (one ton of avoided CO_2 equals 32€).

Industry has reacted quickly and is actually benefiting from the labelling scheme.
European industry has come to similar conclusions as the EC, estimating that annual electricity consumption by appliances installed in European households fell by 34 TWh between 1995 and 2005, a fall of 12 per cent (CECED 2006).

Windward et al. (1998) conducted an analysis in the early stages of the label’s implementation that showed manufacturers had benefited from the energy label ("An overall increase of sales of class A, B, C and D refrigerators and freezers, at the expense of less efficient appliances, was reported by all manufacturers. Manufacturers claim that there has been no overall effect on their market share") but that only component manufacturers producing efficient components had benefited from it.

Windward et al. (1998) also shows that the labelling scheme did not weigh too much on manufacturers' cost: "Total expenditure by manufacturers on promoting energy efficient products is estimated to be about 8.5m ecu *pa*, out of a promotions budget of about 3-400m ecu (3% or less). Manufacturers have not felt it appropriate or necessary to initiate major advertising campaigns in support of the Energy Label and there has been limited additional promotion of more efficient models. Nevertheless, they claim that the manufacturing companies and their trade associations are playing a leading role in co-ordinating publicity for the labelling scheme; the effort most often quoted was the series of campaigns run by ZVEI in Germany."

On the contrary, it seems to have shifted expenses and R&D strategies: "Although overall spending has not increased, the introduction of the Energy Label had an effect on the priorities of the research and development programmes of companies that were not already focused on energy efficiency. Most appliance manufacturers had to adjust some product features or dimensions to improve the efficiency of individual products. In some cases new tooling was also necessary, but the overall investment was limited. Manufacturers appreciate getting early and detailed notice of policy developments, as this prevents research and development resources being wasted".

From the manufacturers' perspective, the label generated a learning process (see below) and helped turn prototypes into marketable products (CSES, 2012). It is highly probable that, as for the Eco-Design directive, manufacturers have not suffered – in general – from excessive additional costs. They also benefited from means to differentiate their products and from price premiums associated to this differentiations.

Consumers are also benefiting from the labelling scheme
Joyce, 2010 states a DG Energy estimate that "up to 50% of total efficiency gains by the EU are due to labelled products. The EU A - G labelling has been enormous and is projected to save 12% of EU electricity in the period up to 2020. Translated to an average Belgian consumer's energy bill a 12% saving would amount to €8.4 per month or over €100 per year at present energy prices."

The following figure, based on industry numbers (BSH), confirms the financial benefits for consumers (from Seifried, 2013).

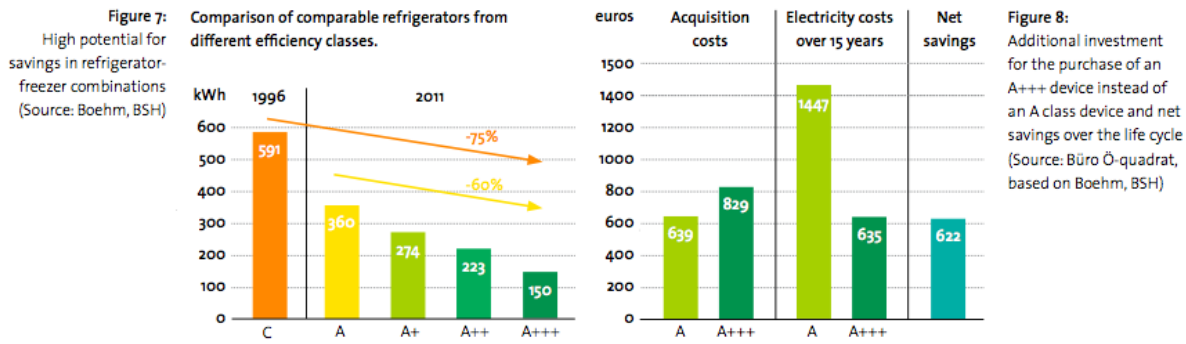


Figure 6 **Economic and energy benefits from labelling (Seifried 2013)**

To summarise the energy label scheme is viewed as successful in pulling the market of household appliances towards more energy efficient products and as a "win-win instrument for consumers, industry and the environment" (EC staff Working Document, Impact Assessment, 2008).

The labelling scheme supports:

- Consumers as it "provides useful and comparable information, allowing (*consumers*) to consider investing in better performing appliances in order to realize savings in taking into account the running costs (mainly energy consumption in use)";
- And manufacturers, as it: "helps manufacturers to position their products on the market and get some payback on their investments for introducing better and more innovative appliances".

Even if evaluations are not very precise, most stakeholders agree that the labelling scheme is largely positive and appropriate

Representatives of NGOs and industry agree on the fact that the Energy label has played a crucial role in forcing manufacturers to recognise the value of energy efficiency and in raising consumer awareness (Arditi et al., 2013). This has been confirmed by many studies and ex-post measurement campaigns. They underline that "It is important to insist that despite some limits to the impact being expressed (such as overestimation of savings or inadequate reflection of actual usage conditions), the reports on the subject tend to recognise the EU Energy Label as a historical success story, worth being pursued."

It can be concluded, as a generic statement, that the benefits of the ELD outweigh the costs by far, but there are uncertainties on the quantification of both costs and benefits because comprehensive reliable numbers are not available.

Finally, as Mills and Schleich (2010) note, external factors are also influencing the label's appropriateness:

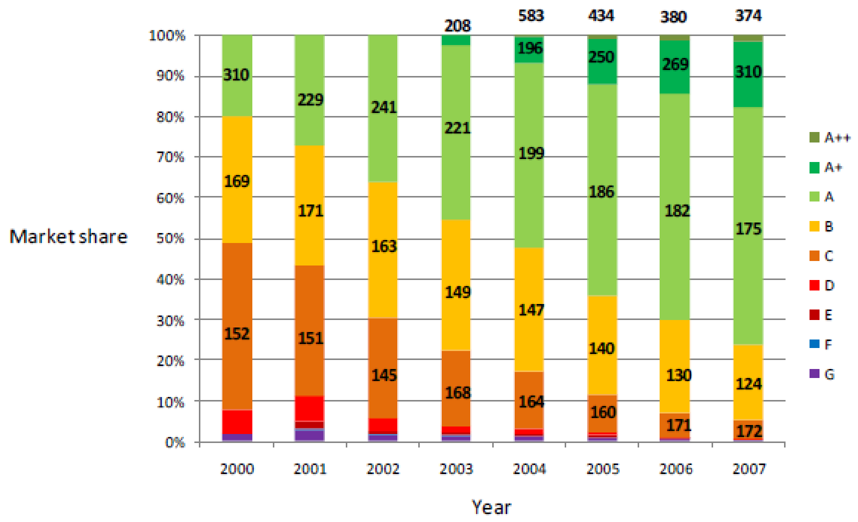
- "The general awareness of household energy use and energy saving technologies spills over into awareness of the energy class of specific appliances".
- "Socioeconomic characteristics matter, as education increases label class awareness and older age reduces awareness".
- "Economic incentives matter, as stated economic importance of energy saving and higher country electricity prices both generate greater label awareness. By contrast, stated concerns about global warming do not appear to have a broad impact on awareness".

- "Effective country implementation of the labelling scheme raises label awareness".

More details on this assessment are given in Appendix D.3.

5.2 Impact on the market (ELD25)

There is no doubt that the energy label impacted both the supply side and the demand side of the market. Numerous sources of evidence, especially from market share figures, clearly show that the labelled products' markets have transformed towards higher energy efficiency.



Source: GfK market data

(a) Average prices deflated to 2005 prices using the consumer price index

Figure 7 Evolution of energy class market shares and average prices[a] for fridges, from Salmons et al., 2011

A literature review by Salmons et al. (2011) reports evidence concerning the white-goods market in the Netherlands that "…average product energy efficiency has been improving over a long period of time as cumulative production has increased, with improvements pre-dating the introduction of legislation in the 1990s. However, there is considerable evidence from the UK, Europe and the United States that policy interventions have accelerated the rate of improvement in product energy efficiency, with minimum performance standards appearing to be more effective than demand-side measures."

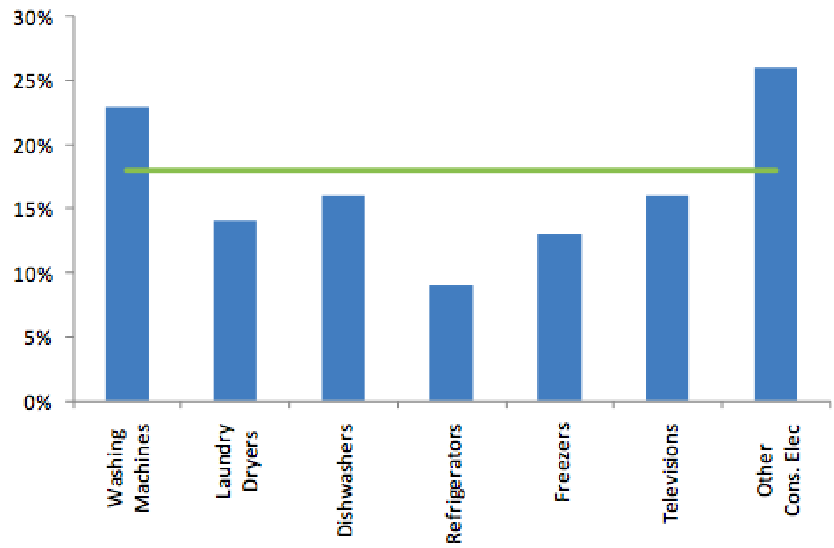
Manufacturers were the driving force at least at the beginning of the label's implementation

Though labels are generally considered as an information tool for consumers, at least at the beginning of the label's introduction for a new product group, it seems that manufacturers and importers are the first ones to take action (Salmons et al., 2011), so that their products do not receive poor energy label ratings. This is confirmed in Waide (2001) who shows that a shift of product offer towards higher efficiency classes occurs after the label's design but prior to the labels' implementation. Consumers subsequently get to learn about the label and use it in their purchasing decision, which in turn encourages manufacturers to continue to improve the efficiency of their product range.

From an early stage of the labelling implementation, manufacturers viewed the Label is an important policy tool and supported the principle of energy efficiency. They underlined that labelling was most effective when third parties (such as government, utilities and consumer associations) promote and explain the Energy Label. They reported that particularly strong consumer response had been associated with rebate programmes run by utilities (Windward et al., 1998).

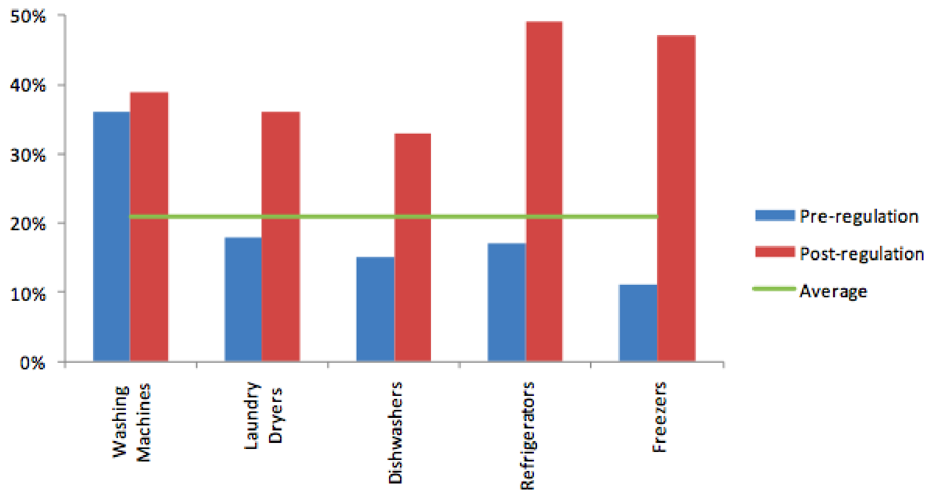
The Label's impact on prices

As first studied in Waide (2001) and confirming its conclusion, Salmons et al. (2011), studied the theme of experience curve in the literature and found that average prices and average unit production costs of energy-using products have declined over a long period of time as cumulative production has increased: "experience curve effects exist for a wide range of energy-using products, with learning rates averaging around 18". This situation did not seem to affect mark-ups /margins that have remained relatively stable as prices have declined. "This long term picture is reflected in the price trends for white goods in the United Kingdom over recent years; with average prices declining in real terms for most white good categories (e.g. a 15% fall for refrigerators between 2000 and 2007). Average prices also declined for individual energy classes within categories and for individual models."



Source: *Weiss et al (2010a)*

Figure 8 Average cost/price learning rates for selected EuP categories (Weiss et al, 2010)



Source: *Weiss et al (2010b)*

NOTE: Differences only statistically significant for dishwashers, refrigerators and freezers

Figure 9 Average energy efficiency learning rates for selected EuP categories (Weiss et al, 2010)

Salmons et al. (2011) also found that more efficient products have a higher average price (and unit cost) but that the average price of the most efficient product is declining over time: "empirical analysis of the UK data suggests that – all else being equal – the average price of the most energy efficient products at the time that they enter the market (…) is declining over time. That is, the most efficient product available on the market this year is cheaper than the most efficient product available on the market last year."

Pushing further this analysis and focusing on MEPS (though there are links with energy labelling), Siderius (2013) analyses how to integrate the concept of the experience curve into LCC calculations for setting MEPS in the European Union. In most frameworks for setting MEPS "the concept of life cycle costs (LCC) is used to guide setting the MEPS levels. The rationale is that users should not be worse off with the standards, i.e., an increase in product price should at least be compensated by the decrease of other costs, especially lower energy costs. (…). As demonstrated by Dale et al. (2009) for MEPS set by the Department of Energy (DOE) in the US the assumption of constant product prices over time overestimated actual retail prices. As a consequence MEPS were set less stringent than they would have been if decreasing product prices would have been used in the calculations.
When integrating experience curvesinto LCC calculations for MEPS for household laundry driers, refrigerator-freezers and televisions in Europe, Siderius results indicate that "for driers and refrigerator-freezers at least twice the energy savings compared to the current approach can be achieved. These products also show that energy label classes can successfully be used for setting MEPS. For televisions an experience curve is provided, showing a learning rate of 29%. However, television prices do not show a relation with energy efficiency but are to a large extent determined by the time the product is placed on the market. This suggests to policy makers that for televisions and other products with a short (re)design and market cycle timing is more important than the MEPS levels itself."

5.3 Consumers' recognition and understanding (ELD54-59)

Several studies and publications concentrate on whether consumers recognise the EU energy label and to what extent they understand it and actually use it in their purchasing decisions.

Energy-related performance is a top-of-mind concern for consumers
There is no quarrel in the literature: energy-related performance is a top-of-mind concern for consumers, often the most frequently mentioned purchasing consideration (along with price) more than twice as frequently as appliance brand (Waide and Watson 2013).
For example, PROMOTION 3E (2009) notes "The appliance characteristic that costumers value most when choosing is its cost (42.3%), followed by quality (39.9%), a balance of quality and price together (32.5%) and energy consumption (25.1%)", or Ipsos Marketing (2008) notes that energy efficiency is a Top of mind factor when purchasing appliances in all European markets (secondary in the UK), and cost savings are the most common driver, i.e. "energy efficient appliances represent money-saving first and foremost and environmental benefits are secondary".

European consumers recognise the EU energy label
Already soon after its implementation, Windward et al. (1998) assessed the label as well known and used: "The Energy Label is used by consumers and they understand its message. It has the greatest influence on purchases when the consumer was already concerned about the use of energy in appliances and where most appliances in the shop are fully labelled. Across the EU, about a third of consumer purchases of cold appliances are now influenced by the Energy Label".
Ten years later, good levels of awareness are confirmed, with recognition rates of up to 81% in Poland, even 95% in Netherlands, France and Denmark (Ipsos MORI, 2008).

Consumers trust the label
It is also important that consumers trust the label and the information they carry so that it is influential. It seems to be the case, since the first label evaluation (Winward et al., 1998).
However, Waide and Watson 2013 point out that the most common consumer response on who has issued the label is manufacturers (33%), 16% think that is it issued "by the EU", meaning a European institution or according to a European standard and 7% by a consumer association. Even if more consumers understand after a group discussion that the EU has issued the label a "majority of participants thought the label was issued by some entity other than the EU […]. This suggests there may be benefit in promoting the role of government in authoring and managing the labelling scheme to increase its credibility among consumers". The same study also found that many consumers distrusted the annual energy consumption information because they didn't believe it could be known how frequently they would use the appliance. This was commony reported for products that were not operated continuously.

European consumers' use of the label
The PROMOTION 3E (2009) consumer survey reports that "with regard to energy efficiency, 82.7% of the costumers reported having heard before about energy efficiency. When asked about how they assess the energy efficiency of an appliance, the majority (41.3%) consider that their assessment is based on the energy class/energy label, with the remaining basing their assessment on energy and water consumption levels", as shown in the next figure.

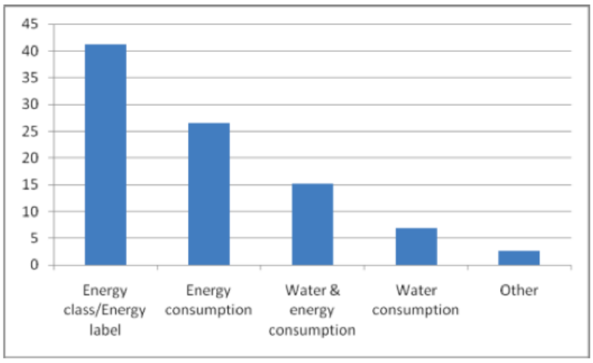


Figure 10 Factors considered in costumer's assessment of energy efficiency (Prmotion 3E, 2009)

Numbers vary between countries: in France, where in 2011, 85% of consumers recognised the label, 63% of them use it as a buying criteria (Centre d'Analyses Stratégique, 2013).

Whether the label is useful depends on interactions between the label's content, its general use on the market and consumers' concerns for appliances and the environment

The literature discusses the prerequisites necessary for consumers to actually use the label. Winward et al. (1998), states the "link between the Label and actual purchasing behaviour depends upon a complex interaction between:

- The proportion of appliances fully labelled in the shop;
- Consumer understanding of the Label;
- Consumer concern about appliance energy use;
- Consumer concern about the environment;
- Trust in the information on the Energy Label. "

However, other authors note, when talking more generally about eco-labels, that even if "attention to and use of eco-labels depends on how highly the consumer prioritizes environmental protection, and how strong his or her beliefs are in the purchase of eco-labelled products as a strategy towards achieving this goal (Thøgersen, 2000 in Grankvist et al., 2004) (…) to highly value environmental protection is not tantamount to choosing eco-labelled alternatives. Many studies have reported weak correlations (i.e., weak linear relationships) between environmental concern and the choice of eco-labelled products (see, for example, Magnusson et al., 2001)".

The new label has introduced some changes

The recast of the energy label has led to several significant changes from the original energy label format. "Changes include updating the label's appearance and introducing additional high efficiency classes up to the A+++ class for household refrigerators, washing machines, and dishwashers. They also include an important design change, moving from a two-part label with a language-specific background to a single, language-neutral label that is the same across the whole EU (…). This latter change (…) has been achieved by using illustrative icons (pictograms) in place of the former explanatory text to indicate which product performance parameter is being referred to" (Waide and Watson, 2013).

Evaluation of the comprehension of the new label format is generally positive:
Waide and Watson (2013) report consumer research which showed that "most consumers were able to use the label to identify the most efficient products" and "The highest energy efficiency class it is possible to have correctly identified by 80% of participants without conferring. When presented with a choice among three labelled products, averages of 85% and 81% of participants were able to correctly identify the products with the highest and lowest energy efficiency classes, respectively, on first exposure to the labels without assistance or discussion. The share of participants who correctly identified both the highest and the lowest efficiency products was 77%."

The same research showed that most consumers understand the objective of the label is to inform people about products' energy performance, and most of them focus on the energy and energy efficiency information – even if an important minority struggles.
The great majority can also identify which is the highest energy efficiency class. Furthermore a substantial proportion expresses a willingness to pay more for efficient models (Waide and Watson, 2013), (Heinzle and Wüstenhagen, 2010).

However, these tests were not carried out for the new air conditioner label (nor the new space and water heater labels) thus, the understanding of the new air conditioner energy label has not been tested. This specific label seems to be the most complex label because of information given for three different regions and because of the efficiency indexes used. Consumer understanding could therefore be significantly lower than for the other labels. Similar problems may also apply for the space and water heater labels.

For the future
Several publications make recommendations for the future:

- As group learning through exposure/explanation was shown to substantially improve comprehension, if Member States would "strengthened their education and outreach efforts, labelling comprehension rates – and therefore label market transformation impacts – would be raised (Waide & Watson 2013)". Even if research shows that consumers are aware of energy consumption and efficiency issues (e.g. Ipsos Markeing, 2008) such education campaigns would also "increase confidence in the label, as most consumers are unsure who operates the scheme, and this causes its independence and credibility to be questioned." (Waide and Watson, 2013).
- Green NGO and Industry representatives (Arditi et al., 2013) recommend "the label (*be*) based on a reasonable number of indicators/information, usually 3 or 4. The main focus should be energy. Balance between energy and other resources and performance shall be ensured, especially when they are correlated."
- Market research generally concludes as e.g. in Ipsos Marketing (2008) that "Consumers don’t want to spend time deciphering the meaning of energy labels and seek CLARITY and SIMPLICITY in energy labelling". This was confirmed by Mudgal et al. (2012) and Waide and Watson (2013).

The literature tends to conclude that the label is widely understood by European consumers in its general purpose and functions (e.g. in Waide and Watson, 2013, 80% of consumers identify the highest energy efficiency class). However, as the next section shows, some of the information is not clear enough or sometimes misleading, or can lead to a suboptimal impact of the label.

Thus the energy labels succeed in conveying the basic message but not all details are understood (Ipsos Marketing, 2008).

5.4 Lay out/design/content of the energy label (new label) (ELD 27 to 33)

Overall, consumers appreciate the energy grades and coloured scale even if they do not understand the full label. However, an important minority (or sometimes majority) is confused by some elements, mainly specific icons and felt the need for more information (Waide and Watson, 2013)[17].

Classification scale

The classification scale is the core of the European energy label. Arditi et al. (2013), define: "The basis of the EU Energy Label is to display the energy performance of a product on a scale, originally a 7-class scale from A (most efficient products) to G (least performing products). This has been decided from 1992 onwards for an increasingly larger number of household appliances. The label becomes obsolete when too many products populate the top classes and differentiation is no longer possible. The rate of obsolescence depends on how the top classes' boundaries are originally set and the pace of market transformation and technological progress".
This obsolescence is a major difficulty as it means the information conveyed by the label is no longer appropriate.

Market research showed that even if most consumers are not aware of all the details on the energy label, there is a strong general recognition and "intuitive understanding" of the alphabetical colour-coded scale (A-G) in all markets. "Consumers understand that A is the most energy efficient and want to retain this simple labelling" (Ipsos Marketing, 2008).
With the new label, the A-to-G and alphabetical ranking remains clearly understood. There seem to be doubts about the signification of the arrows in the A-to-G scale, what is the meaning of their length, especially for the A+++ to A part of the scale (Waide and Watson, 2013) (see also next section for the A+, A++ and A+++ issue), although many consumers believe their length is in some way proportional to the product energy consumption.

EEI and thresholds between energy classes

The label scale is composed of a number of classes, which are set at precise thresholds. Arditi et al. (2013) points out that "Two conflicting interests influence the definition of the classes' thresholds: satisfy consumer expectations to find top class products on the market, and avoid too frequent updating of the label, due to the perturbations generated on the marketplace. The dynamism of the label is largely determined by finding the balance between these two interests".

Energy Efficiency Indexes (EEI), whose formulae are set in the related product regulations, determine these thresholds. EEI and threshold settings, i.e. differences in energy consumed between the energy classes on the label, are different for each labelled product.

---

[17] The new air conditioner energy label has not been tested (it had not been introduced at the time of the most recent consumer research). This specific label seems to be the most complex label because of information given for three different regions and of the efficiency inidces and units used. Consumer understanding could therefore be significantly lower than for the other labels.

EEI and thresholds are crucial to manufacturers who design their products just to cross the efficiency classes (Waide 2001; Wiel and McMahon, 2005; Waide et al, 2000), i.e. the choice of threshold may promote or hinder the relative energy efficiency classification of their products (Attali et al., 2009).
This complex information is purposely not shown on the label. On the one hand, for consumers, it seems that a constant increment of energy or efficiency between each class thresholds would be more consistent and easier to understand (Waide and Watson, 2013), but on the other hand, the downside, in principle, is that the effort to attain and hence the associated price increase would be progressively higher i.e. is non-linear, so the increase in payback period would also be non-linear (Waide et al, 2000).

The formulae used to calculate EEI are also important because of the manner in which they may award bonuses to appliances providing a specific services, i.e. some appliances may be allowed to consume more than other models and still be classified in the same energy class. For example in the domestic cold appliances label, frost-free appliances, built-in appliances, models with a 0°C zone, and sub-tropical and tropical climatic class models are all given such bonuses that do not show in the labelling energy class. Without discussing the legitimacy and the merits of such a situation, Enerdata and Sowatt (2012) note that a model cumulating these functionalities will have the same EEI as a model without, while at the same time consuming an additional 90 kWh/year.

In detailed research for the UK government, Lee et al. (2012) actually recommend to reduce the level of the frost-free correction factor and remove the three others:

"An impact assessment to consider the energy reductions achievable if all correction factors were all removed and energy performance improved (to compensate for the loss of correction factors) shows a significant reduction in energy consumption of around 4.6TWh for the whole of Europe in 2030, based on current market pictures for appliances using correction factors.

The analysis is illustrative and not intended to advocate the removal of the factors principally as an energy saving option but does show the comparative effects of the different correction factors. For the UK the frost-free factor would theoretically have the greatest effect due to the popularity of this type of appliance. In relation to energy consumption in 2030, the removal of the frost-free factor would result in nearly 50% of the energy reduction compared to other factors."

Certain EEI formulae have also been identified as favouring larger appliances (i.e. the larger the appliance the better its energy class would be all oter factors being the same), and thereby encourage the market towards larger volumes, larger capacities and larger screen sizes. Thus, while the relative efficiency has improved the absolute energy consumption has not decreased proportionately. For example Dünnhoff et al. (2012) show that, at the end of 2012, A+++ and A++ formed 68% of the offered washing machines in Germany but that the electricity consumption did not decrease between 2005 and 2011. Likewise, for the same period, A+++ and A++ refrigerators and refrigerators-freezers formed 58% of the offered products on the German market but the electricity consumption decreased by only 14 % to 15 % between 2005 and 2011.

Even if the information is not visible to consumers, thresholds settings are also important for consumers and especially the efficiency threshold delineating the boundary between yellow and green classes because most consumers state they are willing to buy only products in the green efficiency classes (Waide and Watson, 2013). It appears, then, that the choice of this threshold is critical to the overall market transformation impact that will result from the label.

Another non-visible element for consumers related to thresholds is when different technologies are not using the same calculation methodologies even though they bear a similar label. For example, for cooking appliances "Two similar labelling schemes are being proposed for electric and gas ovens based on different metrics, meaning it is next to impossible for consumers to compare the products easily and fairly. Gas ovens will be labelled based on their primary energy consumption, while electric ovens would be labelled according to their final energy consumption. This is especially tricky for the now popular hobs and ovens using both gas and electricity combined, so it would make sense to have a comparable label based on primary energy." NGOs are therefore "calling on the Commission to at least include the primary energy consumption of electric ovens on the energy label, to allow some basic comparison between the technologies"[18].

Another example concerns local room heaters using electricity, gaseous, liquid and solid fuels: Ecodesign requirements will be put to vote in September 2013 and an energy label requirement is expected to be adopted by the Commission in the coming months. "In order to avoid the direct comparison between gas and electric powered products, electric heaters have been excluded from energy labelling, which would have otherwise been given red labels. Civil society organisations have raised strong concerns on the proposed exclusion of electric heaters from energy labelling […][19]" and:
"To compensate for the lack of an energy label based on primary energy for electric heaters, which we believe is the way forward for these products that constitute 87% of the scope for this lot, the Commission proposes a sticker alerting Europeans to their low efficiencies. This minimum tool should be safeguarded in the current proposal. In addition to this, and in order to allow only the very best electric heaters on the market, environmental NGOs want to see the ecodesign requirements for these products tightened. We are in the process of formulating our proposals on this point. The expected savings are roughly 183PJ/year by 2020".

Tolerances
Because testing procedures are often very complex, the regulations set a tolerance margin for the energy consumption measurement and declaration from manufacturers for each labelled product. In the event of verification test, the measured consumption is required to stay within the boundaries of this tolerance margin.

The literature found several examples of overly generous tolerance margins, or incorrect positioning of the A to G scale that have been underlined as diminishing the efficiency of the label. This problem was noted as early as 1998 (Windward et al., 1998), and continued to be present in the literature.

[18] http://www.coolproducts.eu/blog/a-recipe-for-confusion-kitchen-appliance-labelling
[19] From ECOS July 2013 e-mail Update on the EU Ecodesign & Energy Labelling policies

For example, the permitted tolerance of 15% between the claimed and measured efficiency of room air conditioners allows manufacturers to jump by up to three efficiency classes with their products (Attali et al., 2009[20]).

After the recast of the energy-labelling Directive, the tolerance margins have been revised and reduced. Whether the new levels are appropriate is still a subject of discussion e.g. for domestic cold appliances, Lee et al. (2012) support the "latest domestic refrigeration energy label and Ecodesign Regulations […] verification procedure for market surveillance purposes which states verification tolerances of 3% for volume measurements and 10% for energy consumption". They also underline that "the tolerance should only be accounting for differences between testing laboratories and should not be used by manufacturers to deliberately make lower energy claims than appropriate, as has been reported by the UK market surveillance authority and also seen in the analysis of test results from across Europe and in the UK".

Colour code

Consumer research shows that consumers understand and appreciate the label colour code; however, several elements may weaken its impact:

- The sense of the red part of the scale is not clear for all consumers and some are unsure whether products in the red part of the scale are permitted for sale on the market – nonetheless, a red classification is seen as a very negative property and hence this part of the scale has a strong market transformational impact (Waide and Watson, 2013).
- The black arrows indicating the product's letter could potentially weaken the colour code because, in few cases and during in-depth interviews, consumers "did not always connect the ranking in the black arrow with the ranking of the specific product in question, nor did they associate it with the alphabetical rankings in the efficiency scale on the left of the label". (Waide and Watson, 2013).

The EC cites research that puts the colour code in perspective showing that if "the colour coding should be consistent, (*it*) is much less important than the numerical or alphabetical value presented (such as A class)" (Kubiak and Grönroos-Saikkala, 2013). This finding, which is reportedly from Heinzle (2012), is not supported by the research conducted by Waide & Watson (2013), which found that the label colour code was a very strong motivating factor for consumers and a large majority said that they would only purchase products in the green part of the scale. Hence the importance of setting the threshold for this turning point at a good level in order to achieve market transformation.

Icons

Most icons and language-neutral imagery are generally well understood, but several problematic ones have to be deciphered, with the assistance of peers or sales staff (Waide and Watson, 2013). The most problematic icons (among those used in the TV, refrigerator, washing machine and dishwasher labels) appear to be:

- The dish-drying performance icon, which is either not understood at all or wrongly interpreted as the energy efficiency of the drying rather than the quality of the drying service;

[20] Quoting Saheb, Pierrot, Becirspahic (Eurovent), 2006: Energy Labelling Directive, 2002/96/EC and EN 14511 standard for Room Air conditioners. EEDAL 06.

- The on/off icon on the television label, the most confusing of all icons "only a minority of participants correctly interpreting it as indicating the presence of an on/off switch. Many either thought it refers to the presence of standby mode functionality or had no idea of its meaning";
- The television on-mode power demand icon "Only 30% of the in-depth interviewees and two of the ten focus group discussions correctly interpreted its meaning. The most common incorrect answer was that the figure represents energy consumption in standby mode. Other incorrect answers linked the figure to energy and power consumption but could not categorically say what the figure refers to".

It is likely though that many of the icons used in the newer labels (air conitioners, space and water heating appliances) will have even lower comprehension scores due to the underlying complexity of the concepts they are aiming to convey.

Units

Consumers are not familiar with some units present on the label, and/or seem to disagree with the chosen ones (Waide and Watson, 2013). Power expressed in Watts (W) and consumption expressed in kilowatt-hours (kWh) are not clearly understood and often mixed-up. In the formulation "kWh/annum", the "annum" is often not understood as "per year", although this appears to depend strongly on the country concerned. This is confirmed by Dünnhoff et al. (2012), who state that more than 70% of German consumers do not understand "per annum" on the energy label. Only respondents with a qualification for university or a university degree respond correctly with over a 50% comprehension rate, which leads the authors to conclude that the "Energy label is something for graduated people".

Some consumers found it inappropriate to show energy consumption per year, as opposed to per cycle, because their use of the appliance cannot be reflected in average values (many doubted that average values could be of direct relevance to them). This finding constitutes an argument to consider returning to the previous system of labelling energy consumption per cycle (for washing machines, dishwashers, and tumble dryers) and only keep the annual figures for cold appliances or other products used continuously.

Text and legal references

Even with a neutral-language (i.e. essentially language free) label, some information on what is its general purpose, who is behind it and the regulatory framework used is still conveyed; obstensibly to explain the purpose and reinforce trust in the label. However, consumer research (Waide and Watson, 2013) shows that most consumers do not understand that:

- The text across the top of the label says "energy" in each national language;
- The label originates from the European Union (prior to group discussion, it is most commonly understood as a manufacturer initiative);
- The number given at the bottom of the label corresponds to a Euroean Directive number.

Waide and Watson, 2013, conclude that optimising the detailed information and content of the new label is a complex exercise because the content and format needs to find an optimal balance between the technical richness of the information and its accessibilty. Although the new design is generally understood and there is sufficient information on the label (although this assessment differs according to the product label in question) there is still significant scope to increase the overall understanding.

In addition, some stakeholders and consumers themselves have pointed out that the information conveyed on the label is too removed from the actual use of products in the home and hence their real energy use. This creates a possible mistrust for consumers regarding the label. For example, when undertaking product testing, consumer organisations do not always follow international measurement standards for the energy consumption and rather try to adapt the standard to a more "real life type of use". Likewise, Waide and Watson 2013 showed that many consumers mistrusted annual energy use figures for appliances like dishwashers or washing machines because they did not believe anyone could know how often they use their machine.

This section is the one for which the literature proposes recommendations for the future in order to improve the label's appropriateness, in particular two references:

Waide and Watson, 2013, recommend for future label revisions:

- Consider re-grading the A-to-G efficiency scale in preference to adding more plus signs;
- Maximise the impact of the demarcation between the green and yellow parts of the scale;
- Ensure that all efficiency classes indicated on the label are still permitted for sale;
- Review problematic icons;
- Revisit the 'Energ[y]' text;
- Raise awareness that labelling is an EU scheme operated by the European Commission with support from Member States; and
- Strengthen label comprehension through educational communication campaigns.

And:

"In general, it is strongly recommended that all future proposed design modifications for the energy label be tested for efficacy with consumers prior to any decision being made on their deployment. This concern arises because around the world there has been an extensive history of energy label designs being decided upon by technical or regulatory committees without testing their effectiveness with consumers first. This has often resulted in suboptimal outcomes where the market transformation impact of the label is weakened as a result of deficiencies in design".

For the future, representatives from NGO and manufacturers (Arditi et al., 2013) draw a list of 11 principles for future labels. The most relevant ones for this ection are quoted:

"Foundation principles:

- Principle #3. The energy information should be available both in absolute value and relative value. Their level of prominence of display should be determined on a product- by-product basis to ensure best consumer understanding. By 'relative' we mean a matrix taking into account technical specificities such as volume, size, functionalities, etc. The absolute value informs about the actual impact of the product. The relative value informs about the efficiency of the product in its category.
- Principle #4. The calculation methodologies behind the parameters should be clear, credible and sufficiently close to real life use of the products, provided that uncertainty and complexity remain acceptable. When energy use is substantially influenced by regional variations in the EU (e.g. heat pumps, air-conditioners...), the label should help consumers evaluate the performance for their geographical situation.

Layout principles:

- Principle #5. Layouts should be as uniform as possible across product groups and visual simplicity should be a priority.
- Principle #6. The main parameter(s) should be displayed in a way that allows clear differentiation and comparability between products and encourages innovating towards the top.
- Principle #7. The layout should include a reference point allowing consumers to quickly spot how the product per- forms against benchmarks and/or the top of the market at a specific time and/or the regulatory levels set under the Ecodesign Directive.
- Principle #8. The scale and reference should be designed in a way that ensures that consumers are not encouraged to buy products with high absolute impact (even if they are efficient in their category).
- Principle #9. Labelling scales should be used in a way that minimises the need for complicated reclassifications or scale modifications.
- Principle #10. Colour codes are a fundamental component of the layout. They should be used in a simple and understandable way that helps identifying the top performing products on the market".

5.5 New classes A+, A++, A+++ (ELD33, 29, 31)

Appendix D.4 quotes an extensive extract of Heinzle and Wüstenhagen, 2010 summarising the difficult and long process which led to the adoption of the A+, A++ and A+++ classes.

Because the new label was very much discussed and consensus was difficult to find at the time the Directive was recast, the introduction of the A+, A++ and A+++ energy classes and its impact together with the number of active classes, are a strong focus of discussion in the literature.

Temporary fix

Many stakeholders, including representatives of NGOs and Industry, view the introduction of additional A+, A++ and A+++ classes as a "short-term 'fix'" which was needed because the old label could no longer provide sufficient efficiency differentiation at the top of the label. However, these new classes do not solve the issue of empty bottom classes, which are seen as potentially misleading for consumers (Arditi et al., 2013) (Waide and Watson, 2013).

NGOs expressed concerns about "potential undermining of the energy labelling impact through the introduction of the class names A+, A++ and A+++ (…) For that reason, some stakeholders consider that a simple 'return' to a G to A scheme, with an update of the class boundaries to reflect actual market conditions, should be the main possibility to be considered for the coming revision. Yet, this straightforward solution had not gathered a majority of decision-makers during the 2010 revision. " (Arditi et al., 2013).

Research was undertaken before the new label was adopted (Heinzle, 2012) and concluded that the "energy label based on a scale ranging from A+++ to D is less effective in guiding consumer decisions towards buying energy-efficient goods than the proposal by consumer organisations to maintain the existing categories of the original energy label ranging from A to G.

Policy makers can conclude from this study that responding to industry requests can actually countervail their efforts to increase consumer awareness about the real energy use of appliances".

Generally understood but has weakened the label

Consumer research shows the label scale is well understood, whether A-G or A+++ -D, however:

- A+++ as the top of scale is less compelling than when A is at top (Waide and Watson, 2013).
- The difference between an A and a D is much faster for consumers to process than A+++ to A (Kubiak and Grönroos-Saikkala, 2013).
- The subdivision of the A class has reduced consumers motivation to buy efficient products. Consumers understand the scale but are not as motivated by differences in A+/++/+++ as by C/B/A. This change and the addition of these new categories has weakened the market transformation impact of the label (Waide and Watson, 2013), resulting in a lower willingness to pay an increment for higher efficiency products. Heinzle and Wüstenhagen, (2010) report, "whereas with the old label, the energy efficiency rating was almost equally important to price, the importance of the energy label sharply dropped (from 33.6% to 23.0%) with the introduction of the new label, and consumers relied much more heavily on price (importance increasing from 34.5% to 42.6%). Hence, our results suggest that the confusion introduced by the new label categories makes consumers switch away from energy efficient products (…)."

Consumer research in the UK that assessed label design options under consideration prior to the recast of the Directive found that consumers prefered the A-G design over A+++ style labels and found it easier to understand (Which?, 2009). It concludes:

"The A–G type label is the most preferred option, with 59% of people ranking it first. It is also the clearest option, with 86% finding it 'very easy' or 'fairly easy' to understand.

The A-40% type label is clearly the label that people find most difficult to understand out of the three. It is also the least preferred: with 37% finding it 'very difficult' or 'fairly difficult' to understand.

The A+ type label ranked second in terms of preference and ease of understanding. It was not as difficult to understand as the A-40% type label, but fewer respondents found it 'very easy' to understand compared with the A-G label.

Awareness of the current A-G scheme is very high among British consumers (78% aware). Nearly all British consumers find the current label useful for comparing the energy efficiency of different products and 65% find it 'very useful' and 28% consider it 'fairly useful'."

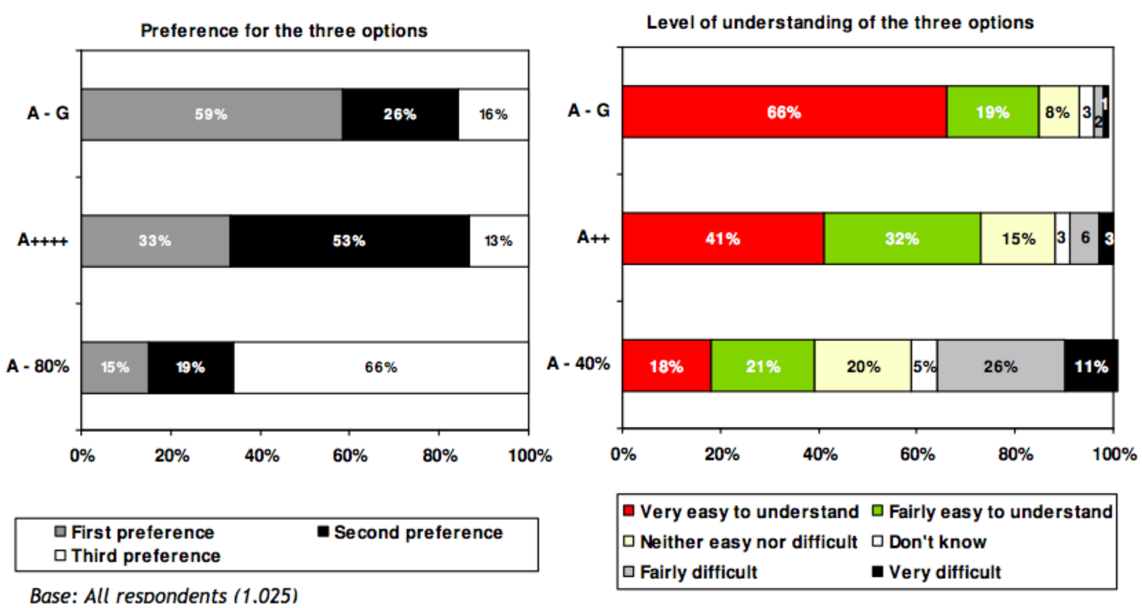


Figure 11 **Consumer preference for and understanding of three label classification options (Which 2009)**

Negative impact on manufacturers?

While industry agrees on the fact that avoiding concentration in the top classes necessitated revision of the label in order to trigger innovation and competition amongst manufacturers, it underlines that data for cold appliances tend to show that the introduction of A+ and A++ for cold products has had an impact on the market. Between 2003 (the date of the introduction of plusses on top of A for refrigerating appliances) and 2010, the market penetration of A+ and A++ cold products increased to reach nearly 50 % in ten European Member States (Eckl, 2011). Industry therefore attests that "the introduction of plusses has favoured the uptake of best performing products" (Arditi et al., 2013). Nonetheless it is important to recognise that Ecodesign requirements applying to cold appliances would have forced much of this change in anycase and thus attribution of this effect to the new scale is far from conclusive.

Heinzle and Wüstenhagen, 2010 also studied (before the new label was applied) how the introduction of the A+ / ++ / +++ classes affects consumers willingness to pay. Results show that these new classes not only risked (at the time) "to confuse consumers and hence countervail European Union targets to cut energy consumption and carbon emissions, it would also not be in the best interest of industry. (*The*) strong willingness to pay for a labelled product should be encouraging for manufacturers to support the maintenance of the well-known A-G scheme in order to differentiate themselves based on energy-efficient products. By reaping the benefit of this higher latent willingness to pay, manufactures might get a higher return on their investment in R&D with the “A-G closed” scheme. Manufacturers who are already producing energy efficient models would have a special international competitive advantage with a closed scale, whereas the introduction of new "A classes" would be a disadvantage".

Table 13 Willingness to pay for a change from a lower to a higher efficiency class

	WTP for a change from the second highest to the highest efficiency class	WTP for a change from the second lowest to the second highest efficiency class	WTP for a change from the lowest to the second lowest efficiency class
"A-G" closed scale	B→A: 133€	C→B: 194€	D→C: 141€
"A+++" scale	A++→A+++: 49€	A+→A++: 79€	A→A+: 109€

Source: Heinzle and Wüstenhagen, 2010

These results are confirmed by Waide and Watson, 2013: though the extra amount that consumers expressed a willingness to pay are less important than the ones quoted above (though still quite high), it clearly shows that when information on efficiency is clearly communicated, consumers are willing to invest in it – but the introduction of the A+/++/+++ classes is less motivating. Therefore, "reconsideration should be given to moving to a regular re-grading of the A-to-G scale in preference to adding new, higher efficiency classes. The research findings indicate that the lowest energy efficiency class that the majority of consumers say they are willing to purchase is two label classes lower when A+++ is the highest efficiency class on the label compared to when A is the highest class" (Waide and Watson, 2013).

Thus, the consumer research reported by Waide & Watson, Heinzle, Which, Ipsos etc. does not imply that adding new A+ classes would have no effect but rather that it is likely to be less effective in encouraging a shift to higher products and in being able to command a price premium for efficient products than were the A to G scale reset.

5.6 Maintaining 7 classes, Recalibrating (ELD34, 33, 29, 30, 31)

In Kubiak and Grönroos-Saikkala, 2013, the EC examines the context and various difficulties relating to the issue of recalibrating future labels:

"The success of the European Union's energy efficiency legislation created a fundamental issue hard to resolve. Energy labelling and ecodesign measures have removed products with low energy efficiency from the market. More and more products end up in the highest class with empty lower classes, and rapidly diminishing possibility to differentiate anymore between the efficiency of products.
This problem was first addressed in 2010 with the introduction of A+/++/+++ classes. However, the introduction of 'plus-classes' better than A was only seen as an intermediate step, because a further drive towards better products will lead to the same problem again (…). Other important aspects are:

- Many classes in the label are empty, which gives misleading information to consumers on the relative energy efficiency;
- It will be practically impossible to populate seven classes in the future, because there will be not enough difference in terms of energy efficiency between the worst and best appliance given the impact of tolerances and/or insignificant difference in consumer savings between models;

- Any attempt to 're-launch' an A-G scale replacing the current A+++ scale will require the downgrading of existing appliances, which will receive industry opposition when faced with a situation without return to investment (e.g. A appliances to be downgraded to e.g. class D);
- Due to increasing complexity of products and aspects labelled, more complex information is entering into the label making it more difficult for consumers to understand. Several labels will also include information for new target groups such as installers. However, a positive aspect is that some of this new information triggers useful questions from consumers to installers;
- Thus far only products have been labelled but the situation is changing. The current system does not allow for the labelling of important products and systems such as most modes of transport (aircraft...), services (holidays...), systems (other than buildings), or energy producers (nuclear, renewables...). The question is if we should be aiming towards savings through labelling within these new areas or are there other more suitable tools for this objective."

This is not a new discussion as the problem was first debated for cold appliances in 2003 when A+ and A++ classes were introduced and previously analysed in Waide et al (2000). Waide and Watson, 2013, note that "Much discussion preceded the adoption of these new labels with respect both to aspects of the design and how to effectively address the concentration of the markets in the highest label classes for products that had been labelled for some time (DGTREN, 2009; Heinzle & Wüstenhagen, 2010; Ipsos Marketing, 2008; Which?, 2009). This discussion centred on whether it would be better to re-grade the old A-to-G energy efficiency scale or to add new higher efficiency classes above class."

DGTREN (2009) presented different design options to consumers in 8 countries and found out that:

- The closed A-G scale with rescaling was the most difficult options for people to comprehend and the least popular in a direct preference context.
- A-20% and A+ were both well understood by consumers, were the most chosen route when given a free choice amongst the options (once people have been exposed to either route) and the easiest transition from A-G to new format.
- The colour-graded scale was equally understood for the various designs: the top dark green arrow is equally perceived as the highest level of efficiency irrespective of the name of the class.

Nonetheless, it could be argued that the design of this research might have biased the findings against the rescaling of the A to G label, due to the manner in which it asked consumers to identify the most efficient appliance before and after rescaling. When comparing a closed A-G label before and after rescaling, with no other indication of the rescaling than the date on the label, most consumers thought the appliance with the best letter rating was more efficient, even though the other information on the label showed that there was no difference in efficiency (Figure 10). This research design only tested whether consumers could tell which was the more efficient of two labelled products under a hypothetical situation where old and new labels are in use at the same time. As this situation would only be likely to occur for a quite limited period were the label to be rescaled, one can question how pertinent this finding is, compared to the more enduring issues of which label design is easiest to comprehend and is more motivating when only the new labels are seen on products. These factors were not tested in the above research but have been assessed in other research.

Beyond consideration of a rescaled closed A-G label there is little research yet on alternative approaches to rebase an energy label label that would be feasible in practice (taking into account both how manufacturers, distributors and consumers interact in reality), salient and comprehensible.

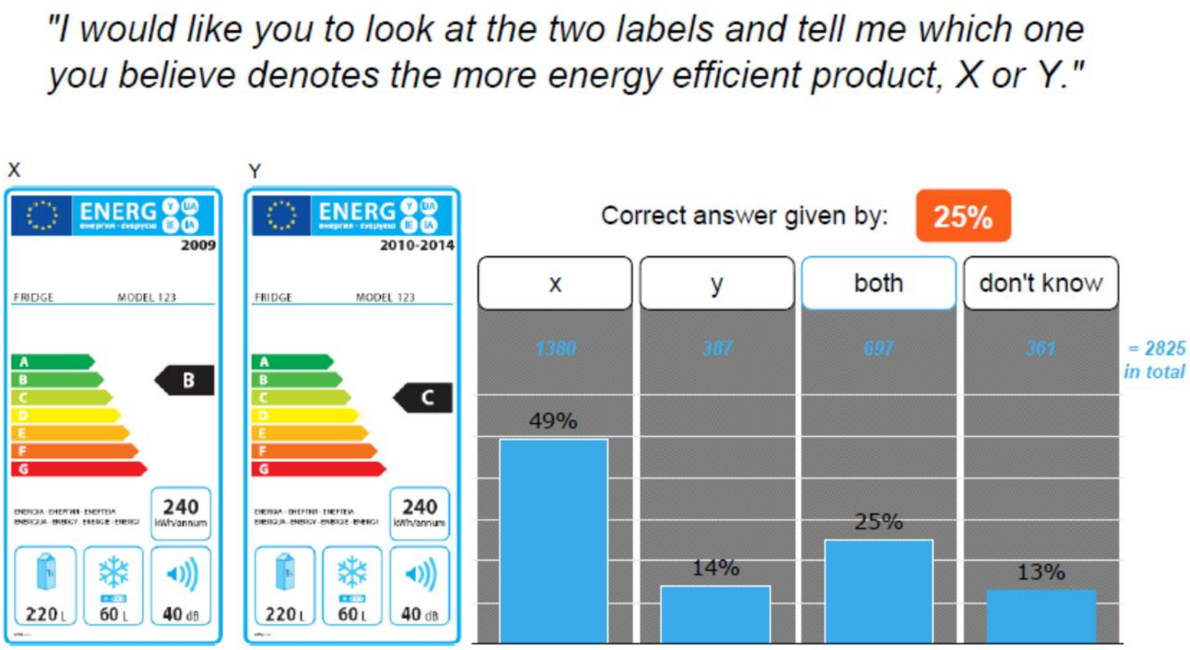


Figure 12 **Reported comprehension test of which is the most efficient appliance for an existing A-G label design and a recalibrated A-G design (DGTREN 2009).**

Ipsos MORI, 2008, researched the understanding and preference for a 7-1 scale compared to A-G in seven countries and concluded that across all 7 markets, the majority of respondents found A-G easier to understand than the 7-1 label. When comparing A-G and 9-3, again the A-G label came out as being the easiest to understand in all markets

Several options were considered in Ipsos MORI, 2008. In Figure 11 the percentages show how many of the respondents (1000 adults in each market) found which option the easiest to understand:

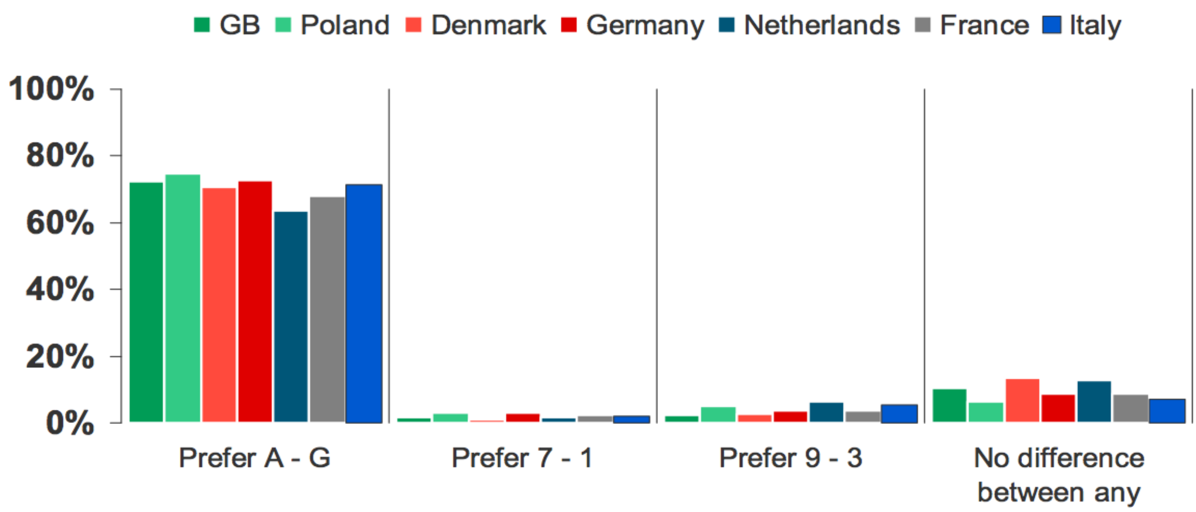


Figure 13 **Comprehension of labelling energy efficiency classification options (Ipsos MORI 2008).**

Another issue is the perception that all classes are available on the market
Beyond the top of scale and subdivision of scale issue, Arditi et al. (2013) identify another concern that consumers may not be aware that more efficient products are available on the market: "the definition of measures allowing the co-existence of voluntary and mandatory labelling scales for the same type of product. For example, televisions placed on the European market from 30 November 2011 have to display at least a G to A scale, but could, as deemed appropriate by the manufacturer, rather display a F to A+ scheme; or a E to A++ scheme, or even a D to A+++ scheme. Such parallel mandatory and voluntary schemes risk confusing consumers as potentially giving them the impression they will buy the best A product according to the first scheme, whereas in fact, some A++ products may already be available, but not necessarily displayed or perceived at their selling point. (As regard televisions, a recent analysis has showed that numerous A+ and A++ models were ready to enter the market)."

Waide and Watson (2013) analysed the impact the mixing of the permissible top of scales might have on label comprehension for the television energy label and found that:

"When no conferring was permitted, fully correct rankings were achieved by 63% of participants when the show card depicted a mix of the A+-to-F and A-to-G scales, and by 74% when only the A-to-G scale was used. This difference is statistically significant (P = 0.0001), indicating that participants did find the A-to-G scale labels easier to rank than the mix of labels with an A+-to-F or A-to-G scale".

Conversely, Waide and Watson, 2013, point out that consumers do not realise that products in lower efficiency classes may no longer be available on the market:
"It is clear that consumers generally thought that if a label class was shown on the label, products in that class were still available on the market. The fact that in some cases lower efficiency classes indicated on the label are prohibited from sale by Ecodesign regulations was not understood by any of the participants.

It would therefore be appropriate for efforts to be made to either discard redundant classes or use some other means to indicate when efficiency levels are no longer permissible, in order to avoid misleading consumers and to maximise market transformation effects."

Some authors have specific suggestions for recalibrating the label.
They first acknowledge that conveying complex information understandable by everybody is a challenge, and that, in essence, labels are not dynamic tools. This policy principle is also pointed out by Attali et al., 2009, who acknowledge that without updated efficiency classes of the energy label consumers are not able to find good products quickly and easily, whereas they assume that labels are revised continuously and products always improve – as the performance of computers – and many other policy instruments (such as rebate programmes) can not be implemented.

For example, Schjær-Jacobsen (2009) proposes to focus on a given year that would represent the year in which the performance of the appliance in question is/was state of the art. Each year the authorities would determine how much next year's requirements should be tightened compared to those of the current year. He argued that the format shown in Figure 14 below would have the advantages of always being up to date, easily understandable, adaptable to a variety of products and a variety of properties and would be mostly adaptable. No consumer research was done to corroborate these conclusions.

Figure 14 **Example of new proposed energy label for a washing machine (Schjær-Jacobsen, 2009)**

In Arditi et al. (2013) stakeholders from NGOs and industry make a contribution to the work in progress in the form of guiding principles and three possibilities for the EU Energy Label evolution:

- A 'towards zero' scale, enabling a stable scaling pattern;
- The indication of a dated benchmark, allowing the immediate comparison to best performers available on the market;
- And the use of a continuous numeric approach versus – or in addition to – a mere class based layout.

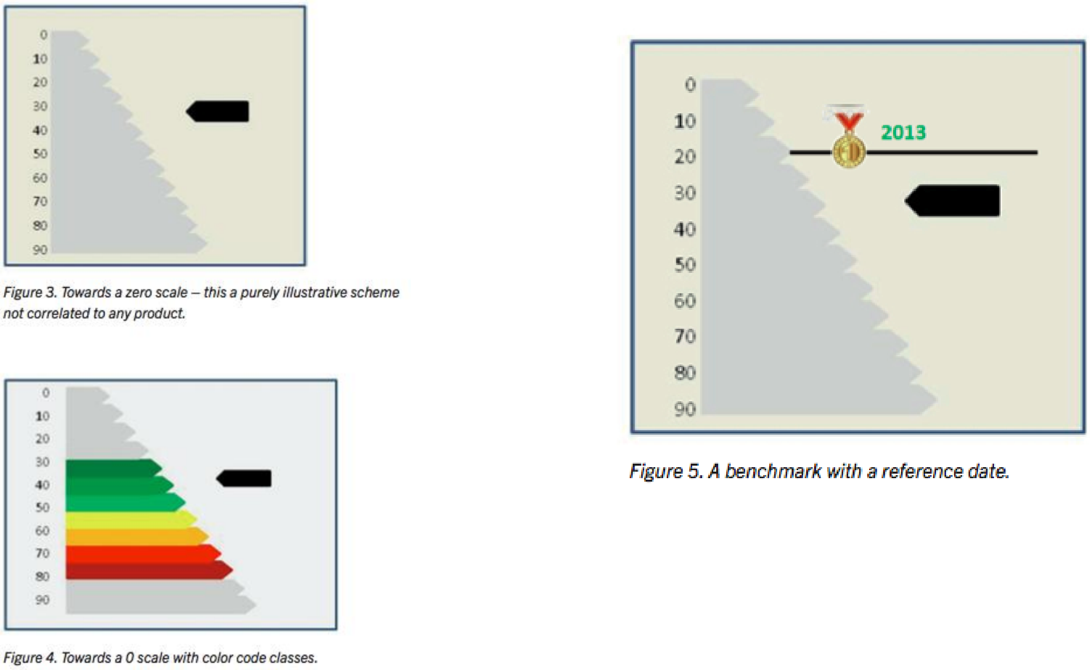


Figure 15 **Different potential approaches to energy labelling classifications (Arditi et al., 2013)**

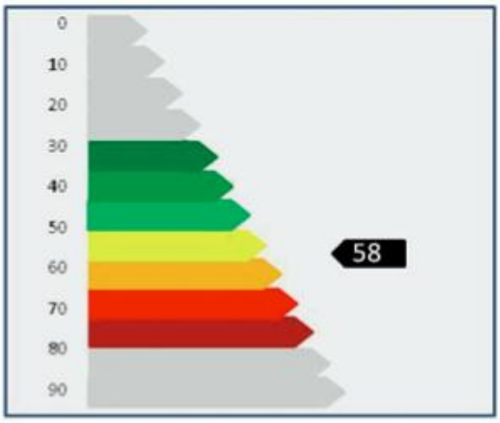


Figure 6. A continuous approach without A to G letters classes.

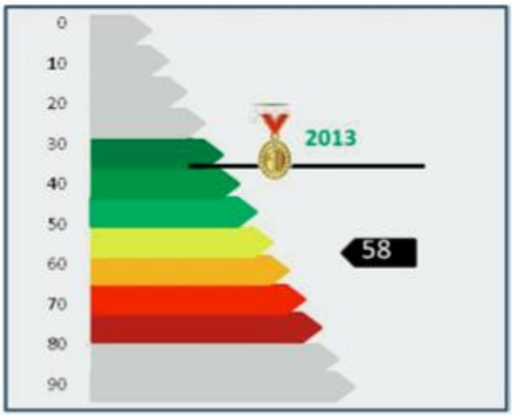


Figure 7. Combining a continuous approach (numeric value) and a benchmark.

Figure 16 Different potential approaches to energy labelling classifications (Arditi et al., 2013)

Arditi et al. (2013) underline that if and how these ideas could be adopted as constituents of the new label should be assessed by proper field-testing. As possible next step regarding the label lay out, they ask the European Commission to "Plan some consumer survey according to an agreed methodology where some of the proposals presented (…) could be further assessed. Collaboration with research centres, involved in behavioural studies or research programmes centred on consumers could be envisaged too".

At a more general level, Policy Studies Institute (2009) recommends making the choice easier for consumers by using recognition. "Consumer choice is often driven by recognition of products, brands or labels. Labels need to be consistent and easily recognisable, something which the current colour-coding system used within the European energy label will aid. Future labelling schemes should take advantage of the fact that consumers may already recognise 'A' rated products as the most energy efficient. A 'frontrunner' approach, whereby classes are updated periodically so that the most energy efficient products are always awarded an A label, would help to maintain this existing recognition".

Costs
Whatever the chosen solution, Joyce (2010) points out that recalibrating labels generates cost and cost is widely used as a business argument against changes in labelling. A study for the food and drink industry indicates "a significant overhead to a business amounting to €829 million for a single upgrade to food labels across the EU". However, Joyce argues that the cost would decrease considerably with the use of ICT to communicate the new information. More importantly, the product market is structured differently, and the product industry seems to be in favour of a recalibration of the energy label: "Industry can attest that the introduction of plusses has favoured the uptake of best performing products. The industry has thus a clear interest to make the best out of the coming revision and properly address the issue of a dynamic and more stable labelling scheme that was not solved by the 2010 revision" (Arditi et al, 2013).

5.7 Cohabitation with ED (correct levels compared to MEPS) (ELD32)

The evaluation study of the Eco-Design Directive (CSES, 2012) indicates that the ED and ELD are effectively linked. More details of this evaulation are presented in Appendix D.5.

In theory MEPS and Labels are perfectly complementary, but in the reality, timing issues makes it more complex as shown in Table 15. The question of how best to commiunicate this to consumers is challenging.

Table 14 Comparison of energy efficiency requirements of the energy labelling and Ecodesign legislation

Product group		Energy efficiency classes shown on the energy label	Energy efficiency classes allowed on the market by minimum ecodesign requirements	Energy efficiency classes shown on the label, but not allowed by minimum ecodesign requirements
Washing machines		A+++/D	A+++/A	B,C,D
Dishwashers		A+++/D	A+++/A	B,C,D
Refrigerating appliances	Compression type	A+++/D	A+++/A+	A,B,C,D
	Absorption type	A+++/G	A+++/E	F,G
Televisions		A/G	A/G	
Light sources		A/G	A/C	D,E,F,G

Source: (Work Package 2 – Deliverable 2.3), June 2012, Come On Labels project[21]

Note: for special purspose light sources, there have always been D, E, F, G class bulbs on the market.

Consumers may misinterpret the label because some of the classes indicated on the label have been taken out of the market due to ED measures:

[21] Comparison between energy label and Ecodesign requirements, http://www.come-on-labels.eu/legislation/eu-product-energy-labelling.

As cited in the previous section, "Whether the labels should be modified in some manner to indicate when classes are no longer permitted for sale is a point for discussion, but it is clear that at present many consumers will falsely interpret an efficiency class as being present on the market if it is indicated on the label. This could weaken the market transformation effectiveness of the eligible classes." (Waide and Watson, 2013)

Arditi et al. (2013) also underline that the issue of misleading empty bottom classes has not been solved by the new label: "the entry into force of Ecodesign measures has banned least performing products and emptied the lower energy label classes (for example, Ecodesign requirements for household refrigerators, freezers and washing machines force all products to be at least at the level of class A; B, C and D classes remain empty)".

5.8 Specificity of BtoB products (ELD69)

No literature was found that addressed the question of whether the product fiches should be introduced for products that are mainly purchased in B2B relations (e.g. products purchased by installers).

5.9 Product fiches (ELD60 to72)

Directive 2010/30/EU plans for the provision by supplier of a product fiche ("a standard table of information") with each appliance put on the market for sale, hire, hire-purchased or displayed to end-users. This fiche is product specific and must include detailed information in a specific order on the product energy related issues, depending on the delegated acts and products they cover.
The fiche should be included in product brochures or in other literature provided with the product. Suppliers have to provide for it, retailers have to display them and insure they are in the products they sell and Member States should check their compliance in terms of content and display.

The fiche supplies information, in national languages, that cannot be conveyed on the label. For example for washing machines, in addition to the information already included on the label, the fiche should also provide:

- The electricity consumption of a standard cycle (for a mix of three different types of cycles);
- The off-mode and left-on mode electricity consumption;
- An indication of which standard programmes are taken as a reference for the energy label information;
- The duration of these programmes;
- The duration of the left-on mode (if the machines is equipped with a power management system);
- An indication of whether the model is a built-in model or not.

In theory, the fiches are useful to consumers and to regulators and market surveillance authorities that can find detailed information on the products that would otherwise not be declared and publically available.

However, to our knowledge, no literature is available to provide feedback on whether fiches are indeed complete and correctly supplied / displayed, and how they are used by or understood by consumers.

5.10 Use of ICT in relation with the label (ELD52, 53)

Labels have to remain simple and straightforward, but the use of ICT could be an opportunity to convey:

- More information in national languages and especially better explanation of the label elements;
- More energy information;
- More information on environmental issues related to the products, on annual and life cycle costs, on cycle costs, calculators, etc.;
- More information on the best use of the products;
- Etc.

The Eco-Design directive has started to request the use of websites to display detailed information, notably in the case of lighting, for which product packaging is small and thus limits the amount of information that is possible to put on the label. To our knowledge, no evaluation of this requirement's implementation is available, but unpublished work undertaken by Topten when verifying product information on catalogue and on-line shows that manufacturers do not all comply and information is not always available on-line.

A lot of reports say ICT would be good to have

Several pieces of literature emphasise the need to complete the paper label by more refined information available through the internet and associated smart phone tools (Kubiak and Grönroos-Saikkala, 2013). This is corroborated by several reports (e.g. Waide and Watson, 2013) that indicate there are locally specific problems which ICT could help addressing in principle.
Aridit et al. (2013) underline that the "Energy label may also require an integration into a *media mix*, such as using web based tools, social media and communication at point of sales".
The French Government has undertaken an trial of environmental labelling and concludes on the same necessity of providing easily identifiable and simple to understand information at the point of sale as well as at home with a more detailed information via websites and QR codes[22] (Centre D'analyse Stratégique, 2013).

Attractive yes, but is ICT mature enough?

Though not focusing on the Energy label specifically, Joyce (2010) has studied the potential use of ICT as a means to enable innovative consumer services for the European Commission. Over 6000 consumers in Belgium and UK were surveyed on several initiatives that could, according to the authors, enhance consumer's role in achieving EU 2020 energy efficiency and environment targets i.e. the actions cited below have not yet been tested yet. The study concludes that several initiatives relying on ICT can be implemented across the EU Member States, within existing legal frameworks and business models.

[22] A "Quick Response Code is a two-dimensional barcode that ca be used for product tracking, general marketing, links to websites, etc.

For example, the initiative "Retail capture of product level carbon footprint data: Billions of individual products are bought by consumers in retail shops each year. Each product has a barcode to capture the price and other product data necessary for stock control and business management purposes. Information on the carbon footprint of a product can be added to the data captured from barcodes and RFIDs[23]."

The proposed ICT approach would not require: additional funding, additional research as the technologies are already in operation, or additional spending from consumers. It could also lower the labelling implementation costs as the label changes that currently require the information on products to be physically upgraded on every package could be avoided in the future.
Appendix D.6 presents more detailed conclusions from the Joyce study.

However, the maturity of technologies and the source of the information provided – whatever the support service – is discussed:

In Mugdal et al. (2012) the authors organised testing of different designs for communicating environmental information. These were tested them on 1500 respondents via an on-line questionnaire in three countries (Italy, Sweden, and Poland), including the issue of where best to communicate this information (e.g. shelf-tag, package, bar code). They conclude that:

"Communication over multiple channels generally has the most positive effects. For example, information made available in a brochure or on a website can support the more limited information made available via an on-product label.

Using smartphone technology to communicate environmental information could allow consumers to access detailed product information when making their purchasing decision. Obtaining real-time purchase input will become increasingly common as consumers become more comfortable using their phones as a shopping tool. Providing information over a "soft" platform such as a smartphone has the added benefit of allowing it to be updated more frequently and at lower cost than, for example, changing the tags on a shelf of products. Nonetheless, this technology is still developing and not all of the population have access to smartphone or similar technology. Therefore, such technologies remain most effective as a complementary source of information for the time being."

Policy Studies Institute (2009) recommends that policy makers make "it easier for people to do their own research. People are increasingly using the Internet and consumer guides to research the purchasing of white goods. Easy-to-understand price comparison sites, or other ways of helping consumers compare product options can highlight potential savings and encourage replacement. Consumers do, however, need to trust these sources. Policy has a role in ensuring the authenticity of these sources and working with independent, trusted providers of consumer information".

[23] Radio-frequency identification (RFID) is a wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects.

To our knowledge, no actual results or evaluation for actual large-scale use of ICT in the field of energy and/or environmental labelling is available in the literature. Filed trials are needed to understand in detail the type of information to convey and what proportion of the public would actually be ready to use such ICT tools.

Related to this topic, smart grids and smart meters issues are triggering the interest of various stakeholders in appliances and their use – whether to stimulate demand response and load management or to help consumers manage their energy consumption.
For example, Meloni et al. (2013), report on a starting experiment led by a consortium involving appliance manufacturers, utilities, telecommunication and solution providers, in which 50 households have been equipped with smart appliances, smart plugs to monitor energy of non smart devices, an interface to a digital meter, an inhome gatewas, and a PC user interface. The project will last 3 years and will show consumers various types of information, some aggregated (energy consumption per day, week, etc.) but also concerning each appliance: "The smart appliances can provide specific information about how they are used and the impact on energy consumption. For washing machines it is possible to inform consumers about the average power consumption of each cycle, about which programs they are using most and how much they are loading their washing machine compared to the rated capacity. Consumers have also been able to learn how much their refrigerator is consuming, this is valuable information to better plan the purchase of a new refrigerator, or simply to adjust appropriately the temperature setting". However this experiment does not show the information on the appaliance itself and does not assess if and how a display of some of this information in a label format would be effective.

5.11 Use of the label in distance selling and technical documentation (ELD73, 74)

The labelling Directve requires the information in mail-order catalogues and in the fiche in brochures to be accurate, up-to-date and properly presented, as this enables the consumer to obtain an efficient machine, even though they cannot see a fully labelled appliance in shops. Each delegated regulations for each labelled product group specifies which information should be displayed in mail order catalogues and internet retail websites, and in which order, e.g. for TVs:

a) The energy efficiency class;
b) The on-mode power consumption;
c) The annual power consumption;
d) The visible screen diagonal;

or, more complex for washing machines:

a) The rated capacity in kg of cotton, for the standard 60°C cotton programme at full load or the standard 40°C cotton programme at full load, whichever is the lower;
b) The energy efficiency class;
c) The weighted annual energy consumption in kWh per year;
d) The weighted annual water consumption in litres per year;
e) The spin-drying efficiency class;

f) The maximum spin speed attained for the standard 60°C cotton programme at full load or the standard 40°C cotton programme at partial load, whichever is the lower, and the remaining moisture content attained for the standard 60°C cotton programme at full load or the standard 40°C cotton programme at partial load, whichever is the greater;
g) Airborne acoustical noise emissions during the washing and spinning phases, for the standard 60°C cotton programme at full load, expressed in dB(A);
h) An indication if the washing machine is produced in order to be built-in.

The new energy labelling framework directive includes that advertisements should contain the energy efficiency class, if energy-related or price information is disclosed. In principle the compliance of internet sales, mail order catalogues, and advertisements should be checked by Member States market surveillance authorities.

Even in the first years of the energy label, Windward et al. (1998) concluded that "advice to mail-order companies on how best to incorporate the information required would be helpful the information in mail order catalogues".

Ten years later, Schlomann et al. (2009) showed that "the worst result of the survey of the retail trade was observed for mail order and Internet stores. On the whole, only 5% of appliances were correctly labelled in accordance with the Directive, which means that the mandatory information was provided completely and in the stipulated order. The main failings were not missing, but incomplete information or not shown in the right order. Though the general level of compliance was relatively low in all countries, the share of correctly labelled appliances varied between 41 % in Denmark and zero in the case of a considerable number of countries. It seems that though there is a general willingness to inform buyers on the part of the retailers, the large amount of information required by the Energy Labelling Directive and the stipulated order cause difficulties for this channel of distribution".

The poor performance of Internet shops in terms of correct implementation of labelling is confirmed by two other field projects, Come On Labels (2013) and Dünnhoff et al. (2012):

- Within the Come On Labels project three rounds of shop visits were undertaken in 13 European countries (over 900 shops including 8% of internet shops[24]). It found: "In terms of displaying energy labels only partially and/or incorrectly, internet shops are the most problematic type of shop when comparing all three rounds of shop visits. Despite an improvement compared to the second round of shop visits, in 35% of the cases web shops do not provide consumers with all required information from the energy label. The EU energy labelling legislation requires a specific set of information to be displayed with the product offered on Internet or catalogue sales. Whereas data such as the energy class or the volume of products are commonly displayed, other information such as noise or climatic class (for refrigerating appliances) is often missing."

[24] The size of the sample and the sampling characteristics result in a shop sample that is not representative of the EU appliance market or of the distribution of the shop types. The project visit results therefore are only indicative of some trends and highlight some of the problems with the label display, but do not represent the full situation of the household appliance retailers both at EU and national levels.

Figure 17 Example of an erroneous label class declaration (Come On Labels, 2013)

- Within Dünnhoff et al. (2012), results are available for internet shop visits in May/June and December 2012 in Germany showing rates of incorrect labelled appliances of 51% during the first visit (over 10 shops and 2094 products) and 32% during the second visit (over 14 shops and and 2064 products). (Dünnhoff et al. 2012). This project also notes that, within interent advertisements, it is easier for consumers to be made aware of the energy class of efficient products as the information is put forward, while it is more commonly hidden for low energy classes.

In order to address these problems identified in the literature, a proposal has been discussed in the labelling expert group and notified to the WTO[25] in June 2013 (but has not yet been adopted by the Commission) on a possible Delegated Regulation amending all relevant regulations so that the label, or at least a colored arrow with the energy class, be mandatorily displayed on the Internet and in cases when end-users cannot see the product (as opposed to the current situation in which the label information should be displayed in a specific order nut not necessarily the colored scale). The product fiche would also have to be displayed in the future.

5.12 Extension of the scope of the information on the label

5.12.1 To include environmental content (ELD35 to 40)

This section focuses on studies and experiments that have looked at environmental labelling in the perspective that it would become a mandatory and informative label - not an endorsement label like the Eco-Label or other national environmental marks such as the Blue Angel in Germany or TCO in Sweden (that are also known and used beyond these two countries, as if they were international benchmarks).

[25] http://ec.europa.eu/enterprise/tbt/tbt_repository/EU113_EN_1_1.pdf

Consumer research by Joyce (2010) identifies (at least from a sample with statistical relevance from UK and Belgium) that consumers want environmental information: 74% of respondents said that all products should have efficiency and environmental labels. This is consistent with the Waide and Watson (2013) findings which indicted that environmental performance was an important decision factor for a substantial minority of consumers.

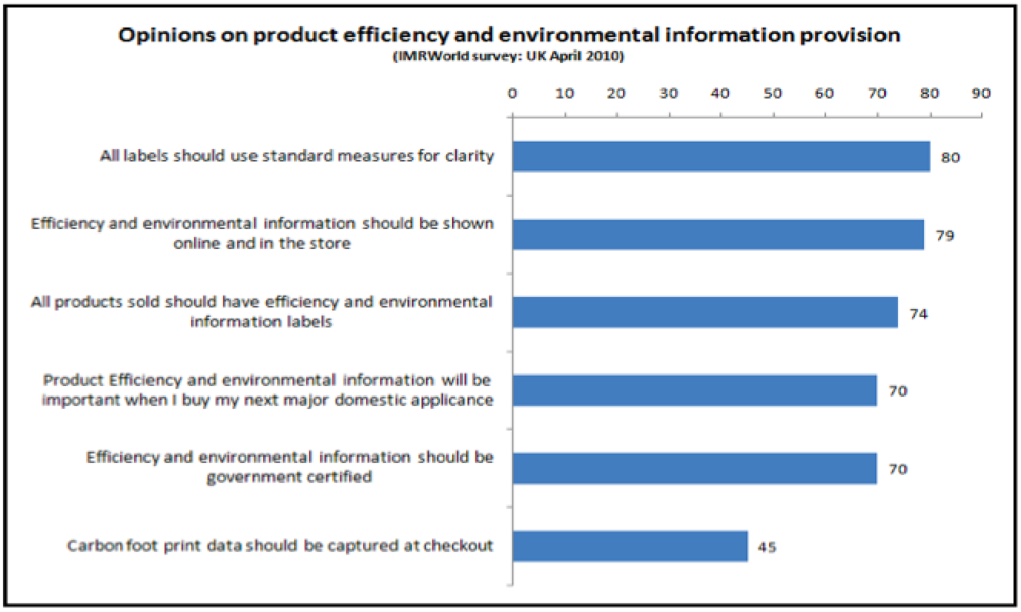


Figure 18 Opinions on product efficiency and environmental information provision 2010 (IMRWorld Survey 2010)

However, several other studies put this finding in perspective.

In order to prepare for the Energy Labelling Directive 2010 recast, the EC undertook an impact assessment (EC staff Working Document, Impact Assessment, 2008) which states a Stakeholder consultation workshop (held on 8 February 2008) attended by all relevant stakeholders, including members of the ELD Regulatory Committee and European associations representing the industry, retailers, consumers and environmental NGOs. One of the conclusions was that the label should "remain simple, relate to the consumption of energy in use and not be mixed with other environmental parameters during the life-cycle of a product, while keeping the possibility to include also additional information relevant to consumers on the products' performance".

Representatives of NGOs and industry (Arditi et al., 2013) also recommend "The label (*be*) based on a reasonable number of indicators/information, usually 3 or 4. The main focus should be energy. Balance between energy and other resources and performance shall be ensured, especially when they are correlated".

This could argue for having two labels instead of one label mixing energy and environmental information. However, as shown below, three important sources conclude on the necessity to keep labels simples – without too many elements, too many indicators or too much information on a label.

To our knowledge, it seems only one large-scale experiment of environmental labelling has been carried out (in France) and is reported in the literature. The French government has undertaken an ambitious trial of environmental labelling (Centre d'Analyse Stratégique, 2013). 168 enterprises participated voluntarily and displayed an environmental label on products reatiled in shops and/or on line. Most of these companies appear to be retailers rather than manufacturers, although three of the latter producing appliances participated. Examples of the types of labels displayed are shown in Figure 17.

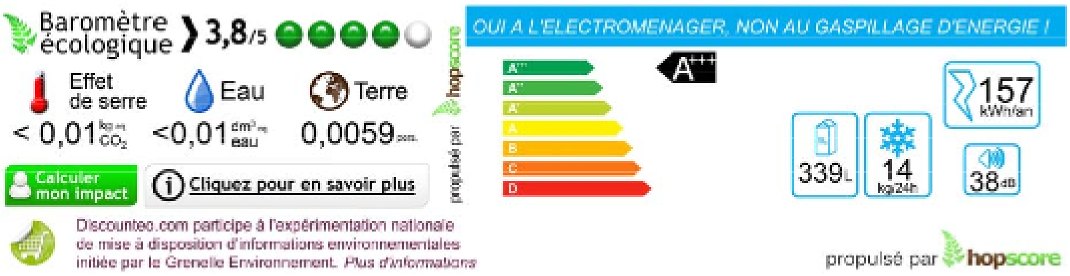


Figure 19 Example of label on the Internet and in shops for appliances implemented by Discounteo (Centre d'Analyse Stratégique, 2013)

Most participanting companies are in favour of environmental labelling over the more or less long term (more details about the trial and its evaluation are presented in Appendix D.7)[26], although they identify a number of pre-conditions in terms of the availability of the following elements:

- A harmonised methodological framework and technical background information, adapted to SME needs;
- Harmonised specifications per sector;
- Complete and updatable databases;
- Automated impact calculation tools to avoid start-up costs for enterprises;
- The definition of homogeneous formats to insure consumer understanding and information comparability;
- A system compatible with a (wished for) European or even gloabl harmonisation to optimise French technical investments;
- A standardisation framework to secure long term visibility and investments that will need to be made;
- Verification procedures to build trust in the system and insure quality information to consumers (the cost of these procedures should not constitute an economic obstacle to companies);
- Reasonable implementation timeframe, acknowledging the need of preparation and adaptation time (small enterprises do not have enough internal resources and large enterprises have large amounts of data to manage);
- Accompanying measures from public authorities such as information and communication campaigns.

[26] Two comprehensive reports with individual companies' labels, methodologies, evaluations, etc. were presented mid November 2013 at the French Parliament and will be used by French representatives within the current European work on environemental labelling with DG Environement. http://www.developpement-durable.gouv.fr/Bilan-au-Parlement-de-l.html

Given the limited scale of the experiment and within this scale the relativaly large number of sectors covered, formats tested and participating companies, no generic consumer evaluation could take place regarding possible change in purchasing behaviours or understanding of the various labels.

It seems however that lessons learnt could be gathered through companies' evaluations regarding consumers who:

- Prefer simple indicators' wording;
- Ask that data be presented as absolute value;
- Ask however that this absolute value be positionned on a relative scale in order to compare products;
- Are very attached to how the values are presented (with color codes and ordering with letters);
- With this respect, vote in favour of the energy label;
- Appreciate one general note complementing single impacts per factor.

Beyond this trial, several publications, including two reports for the European Commission (DG Environment and DG Energy) identify specific issues related to environmental labelling and outline themes for future research.

In a report for the European Commission, Mugdal et al. (2012) investigated the content that could be communicated, i.e. how many different indicators can a consumer realistically be willing to check and be able to understand and compare? The authors also investigated how best to communicate the information (i.e. using what sorts of formats: figures, grades, scaling systems, aggregated indicators, best in class label).

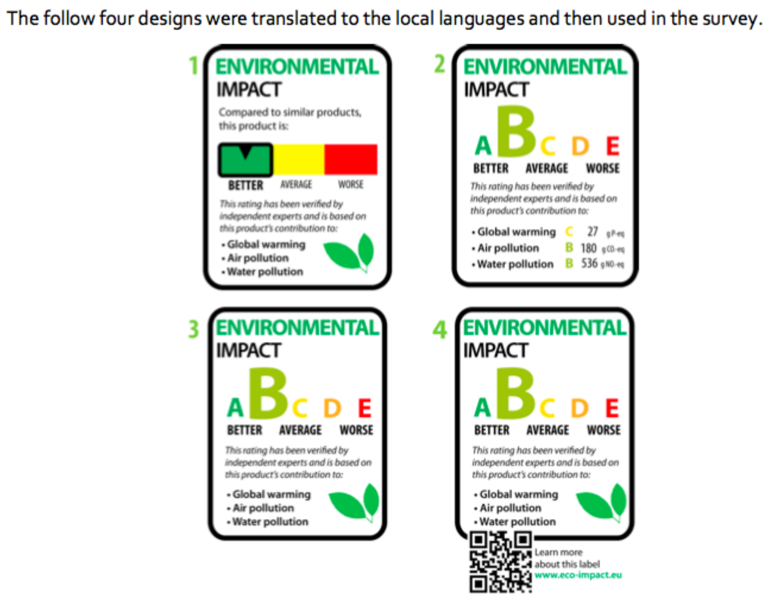


Figure 20 Examples of environmental labels tested in Mugdal et al. (20120)

Based on the findings of the literature review, different designs for communicating environmental information were developed. The designs were tested through focus groups in three target countries (Italy, Sweden, and Poland) on the basis of which the designs were further refined. The final designs were presented to 500 participants in each of the three target countries (i.e. 1,500 total respondents) via an online questionnaire. The results of the consumer survey helped to identify optimal design options. Among others, interesting findings are that:

- "The concept of multi-criteria environmental impacts across product life cycle is unfamiliar. In general, the participants were unfamiliar with the idea that products can have environmental impacts across different impact categories over their entire life cycle".
- "Too many environmentally indicators confuse consumers, therefore no more than three indicators should be communicated. The level of aggregation is a key consideration. Higher degrees of aggregation are quicker to take in and take up less space, but are less transparent. Greater disaggregation can take the information beyond three indicators, and risk being difficult for the consumer to understand. The use of an aggregated indicator, combined with up to three individual indicators, is recommended as an effective presentation of data."
- "The quality and clarity of information is more important that the quantity of information as too much information inhibits decision-making."
- "General terms for the indicators and simple units of measurements using an easy to understand rating system are preferred over technical descriptions (e.g. "climate change" is preferred over "CO_2- equivalent")."
- "Absolute values by themselves are not sufficient to communicate multi-criteria environmental information to consumers. A scale should be used."
- "Colour can be a strong factor to aid in comprehension, but is often contested by manufacturers as it can be difficult to integrate into existing packaging designs."
- "Consumers have different expectations for different product groups:
  - With regard to food and drink, and electronics, consumers expressed an understanding of certain impacts associated with these products. Understanding of environmental impact was closely entwined with nutritional and health concerns (in the case of food and drink) and energy use and the related cost (in the case of electronics).
  - For household cleaning supplies, consumers expressed an understanding of the potential for harm associated with toxic or hazardous products.
  - In the case of clothing, participants suggested a simplified label, like the EU Ecolabel, to indicate if the product is "environmentally- friendly" or not."

A review of existing studies about environmental indicators and a consumer research for the European Commission by Langley et al. (2012) identified that amongst several new environmental indicators carbon footprinting is the most mature.

a) Current Energy Label | b) Proposed Energy and Carbon Footprint Label | c) Proposed Energy and Environmental Label

Figure 21 Examples of the inclusion of environmental indicators on energy labels as assessed by Langley et al (2012)

They report: "Indeed, it will soon be underpinned by an ISO standard which is an important development and essential to rigorous product performance labelling. Water footprinting is also to benefit from an ISO standard in the near future. However, an ISO standard is not a pre requisite for a robust methodology. Indeed an ISO standard provides a degree of flexibility to the users. In the context of a mandatory label, ideally user flexibility for applying the methodology would be as limited as possible".

The first phase of their review concluded that:
"The current methodologies for resource depletion and water eco-toxicity require more development however, before such indicators could become a requirement of an EU wide labelling scheme. A number of individual methodologies do exist that could be used or further developed by the European Commission to support the introduction of either an Energy and Carbon Footprint Label or Energy and Environmental Label. An alternative approach would be to adopt a multi criteria method capable of determining all four indicators. This would mean further development of methodologies such as the BP X30 323 [specifications on environmental labelling good practices for consumer goods, elaborated by AFNOR, the French Standardisation body, and ADEME] or the Product Environmental Footprint".

The consumer survey identified the following issues, which are quite similar with the ones concerning the layout of the energy label (without extension to environmental issues):

- If consumers understand the meaning of the environmental lifecycle symbols, they are more likely to choose better performing products and to be willing to pay more for them.
- An education campaign that clearly explains the label is effective at improving consumer understanding of the proposed labels. It is therefore likely to push consumers towards making more environmental product choices as higher levels of understanding, as discussed above, are linked to purchases of more environmentally products at higher prices.

- Consumers' choices can be affected by adding a carbon footprint symbol to the current Energy Label, however a key driver of purchasing decisions is still likely to be the product performance characteristics.
- An education campaign which explains the meaning of the new symbols included on an environmental label is likely to increase consumer understanding of this label, as well as their product choices".

However, the choice to have environmental information added to the current energy label or to have it separately displayed is not an easy one:

"A revised product label containing only the carbon footprint symbol is likely to have as great an effect on consumer behaviour as a revised label with more environmental symbols. A key challenge for the Commission in introducing the proposed Energy and Environmental Label or the proposed Energy and Carbon Footprint Label will be to synchronise these with what is already being used. This is critical not only to reduce the burden placed on manufacturers in terms of the administrative and compliance costs they would incur, but also to prevent confusion among consumers. An active communication campaign will be needed, especially in markets with an established history of product labelling. It will be essential for the Commission to learn from the results of the French national experiment and to ensure that any new label designs are synchronised".

As in the French environmental labelling trial, the authors identify a number of additional considerations for the Commission in trying to introduce new environmental product labels.

- "Review and establish the availability of test methods and standards for use in a scheme. (…) The Energy Label is a mandatory requirement and as such the standard and test method needs to be available for manufacturers to use to verify (through paper trail checking) compliance with the label's requirements. In short, everyone needs to be working to and with the same standard.
- Make tools available to support manufacturers in reporting against product indicators. Generating a carbon footprint or other indicator requires investment (financial and man power). So as not to burden businesses there will be a requirement to develop generic tools, such as databases and software (…).
- Converge with existing methods. Environmental indicators are a flourishing field and numerous initiatives are being developed around the world. The Commission would benefit from ensuring that businesses are not burdened by having to comply with numerous schemes setting different requirements for their products."

Langley et al., 2012 conclude "there is evidence from this study to suggest that a new Energy Label incorporating other environmental performance symbols could have a positive impact on consumer purchasing behaviour. The extent to which this is likely to be reflected in the real world is also discussed, along with recommendations for ways to increase the likely impact of a new label".

The Carbon labelling roundtable (Boardman et al., 2007) did not focus specifically on appliances but came to generic conclusions and issues linked to carbon labelling: Which GHG to take into account? Which stages of the chain to cover? Which data to collect? Which reference data sets to use? Which calculation methodology to apply? How to organise verifications and limit costs?

Which products to be covered? Who puts the label on what? Which format for a label? How to update? Which links with other policies? More information on this is given in Appendix d.8.

Grankvist et al. (2004) focus on the message content for a possible environmental label, and whether the message should be positive or negative: Most "labels in use today signify environmentally benign outcomes: "Choose this product, it is better for the environment than the average product." Another strategy would be to indicate negative outcomes with the purpose of trying to persuade consumers to avoid a product: "Do not choose this product, it is worse for the environment than the average product." In a computer-based experiment, it was investigated how these two types of labels affected preference for some everyday products. Individuals who had a weak or no interest in environmental issues were unaffected by either kind of label. Individuals with an intermediate interest in environmental issues were more affected by a negative label than by a positive label. Individuals with a strong interest in environmental protection were equally affected by the two kinds of labels."

5.12.2 Extension to include monetary content (ELD43)

Consumers want monetary information

In setting the scene for the next label revision, the EC, in Kubiak and Grönroos-Saikkala (2013) state that: "another important insight is that the main criterion for a label should be the actual money saved by the consumer, or a value in a direct and easy-to-understand relation to it. For most consumers, saving money is the number one reason for choosing energy efficient products, and the energy label is seen as valuable information to achieve this task".

Also a Euro-Barometer shows that the concept of energy is more often related to high energy prices than to renewable energy sources and electricity supply. There are differences between countries: those countries who may be seen to be "environmentally oriented" mention environmental issues and renewable energy sources more often than those who have a more economically orientated approach and associate energy with prices less frequently. However, even in this group, prices are the first thing associated with energy (EURO-BAROMETER, 2007).

Hence the idea of investigating whether displaying monetary information on the future energy labels would help consumers choose energy efficient models.

Is this so sure?

However, although this topic was only indirectly alluded to, the research reported by Waide and Watson (2013) seemed to give mixed responses on consumer interest in monetary information, with some being in favour and many less so.

Mills and Schleich, 2010, seem to observe the same hesitation and conclude on the need for further research. "Stated preferences for energy savings for environmental reasons appear to have a more limited impact on label awareness. Thus, the provision of label information on environmental amenities associated with energy efficient appliance choice (e.g. reductions in CO_2 output) may have a weaker effect on purchase propensities than cost information. However, controlled experiments to identify the importance of different types of financial and environmental information on consumer energy efficient purchase propensity are an important area for further research".

There are several counter arguments to the display of monetary costs and/or savings on the energy label:

- Consumers sometimes imagine larger cost savings than there really are and hence presenting the information may demotivate them, unless – maybe – cost savings are shown for the product's lifetime.
  Societal economic interests may not be shown in individual calculations: For example, Attali et al. (2009) point out that, generally speaking, ADEME is opposed to explicit communication on money savings, judged to be counter productive as: the saved amount is not enough to convince consumers. Even if consumers can be sensitive to "green messages", they do not think on the long run and compare with expenses they understand. The average electricity-specific (i.e. excluding applications that can use other fuels) consumption of a household is about 2500 kWh/year, which represents about €300. Even reaching a 50% saving, i.e. €150 is not motivating, as it barely equals the price of two full tanks for the car. Messaging can thus rely on savings in percentage terms but not in Euros.
  However, not all policy experts share this position. In Germany, retailers expect long-term support from energy agencies, competence, communication support and consumer-oriented tools. Dena is highlighting the argument of running costs of electricity and retailers and their customers are interested in this. Environmental arguments are boosting consumer action but cost arguments are necessary (personal not only social benefit). (Attali et al 2009).

In addition, the correlation between price and efficiency is logical and acceptable as long as energy efficient features are included across producer product ranges and are not exclusively used, for marketing reasons, at the high-end of the range where the other attributes of high-end products can give a misleading impression of the incremental costs of higher energy efficiency (Attali et al., 2009).

- Heinzle (2012) provides evidence that "disclosing the estimated annual energy operating costs on the energy label for TVs is potentially not in the best interest of politicians, who aim to stimulate sales of energy-efficient TVs. There is a potential unintended consequence that the energy operating cost savings are perceived as too minimal to be worth taking into account when provided in annual figures on the energy label, with the final consequence that consumers look for the cheapest TV instead. However, disclosing energy consumption in physical measurements is seen as a poor second-best solution. Thus, serious thought should be given to disclosing lifetime energy operating costs on the label. Providing consumers with lifetime energy operating costs can help them appreciate the long-term financial implications of their purchase decisions. Although it is acknowledged that in many countries, including the U.S., Australia, and the European Union, variations in price between different regions and suppliers exist, making the inclusion of such information on energy labels complicated, governments should still seriously consider the societal benefits of including such information, which might outweigh the negative side effects. In the event that no agreement can be reached regarding the inclusion of lifetime energy operating costs on energy labels, policy officers should support retailers and manufacturers to develop alternatives to provide consumers with additional information at or beyond the point-of-sale".

Going in the same direction, Mills and Schleich (2010) present findings that show: "Energy labelling scheme awareness appears to respond to financial incentives, but purchase decisions are not directly influenced by financial incentives. This disconnect may stem from the fact that current labels provide no information on expected energy costs savings associated with the appliance purchase. Thus, consumers cannot readily calculate if the additional investment associated with a more energy efficient appliance is justified by future energy costs savings. The need to clearly identify energy-savings associated with energy efficient products has also been highlighted in the eco-marketing literature, which stresses that customers need to benefit (in this case via lower energy costs) from environmental innovations in order to generate green market demand (e.g. Kammerer 2009). Hence, a re-designed energy label for household appliances should not just include energy use (in kWh) but also energy costs, based on average energy prices for households in the country of sale in a particular year."

Another issue is the risk of frustrating consumers because cost information will be based on a standardised use whereas consumers will expect exact savings on his/her bill.

- In the USA research showed that 30% of consumers misunderstood the running cost information presented on the energy label to be the annual cost savings from that product compared to the average – i.e. it lead to exactly the unintended effect (Du Pont 1998)

- There are a series of practical problems to be solved: for example, is the display of energy operating costs feasible with 28 different countries and many more different energy utilities providing different energy prices (e.g. there are several hundred utilities in Germany alone)? Across Europe, electricity prices vary by a factor of two between countries. Market shares of efficient products are correlated to a certain extent. (Attali et al., 2009). Whie, in principle, ICT could help adress this issue it has not been tested yet.

If the decision was taken to display monetary information on the energy label, Policy Studies Institute (2009) suggest it would be better expressed if formulated as avoided loss rather than as savings. This is because "consumers read information when they perceive it as beneficial. This means that for many consumers, labels are more effective if they translate energy efficiency into costs or savings. Where feasible, labels should provide the life-cycle costs of white goods, which indicate to consumers the potential savings over the expected lifetime of the product. Policy should also work with retailers to promote consideration of the life costs of white goods, rather than just the purchasing price. (*Consumers*) are very averse to loss. Individuals want to avoid loss (or costs) more than they want to benefit from gains. Highlighting the costs associated with high energy-using white goods will be more motivating to consumers than focusing on the savings associated with low energy-using goods. It also means consumers find additional taxation more off-putting than a similar-sized incentive, such as a tax rebate. Requiring consumers to pay more (for example, higher VAT) for energy- inefficient white goods is likely to prove a more effective means of changing consumer behaviour than offering money-back rebates or incentives?"

5.12.3 Extension to include whole life cycle impact (ELD44 to 51)

EC staff Working Document, Impact Assessment, (EC 2008), quotes the EIPRO study[27] which identified that energy consumption in use is the single most important factor for energy-using products. It reports:
"Broadening the focus from energy and resource efficiency in use phase to all significant environmental impacts over the life cycle of the product would risk increasing information asymmetries in providing more information on complex environmental impacts over the life cycle of the product.

Given that the present focus of the ELD on energy and resource already tackles typically more than 90% of the environmental impacts of energy-using products, broadening of the focus at the expense of the clarity of information is considered inappropriate. When consulted specifically on this issue, all stakeholders, including consumer associations and environmental NGOs, were in favour of, at least for the coming years, a focus on the consumption of resources in use, thereby guiding consumers on the cost of running an appliance."

Waide and Watson (2013) also point out that while a sizeable minority of consumers were motivated by environmental impacts, a large proportion were mostly or exclusively motivated by their energy bills – which suggests that embodied energy information would dilute the appeal.

There is no literature which considers how the legal and procedural issues of a move toward lifecycle labelling should or could be addressed.

5.13 Cohabitation with endorsement/voluntary labels (EU and national) (ELD39)

In correlation with a possible extension of the scope of the label, the EC asked the question on how to practically convey additional information, and in particular if two distinct labels should be introduced and whether they should be voluntary or mandatory.

Windward et al., 1998, discuss the differences between endorsement and comparison labels "The endorsement label divides models into two categories: those which meet specified criteria and those which do not. Only models which meet the criteria may be awarded a label. Endorsement labels are normally voluntary: it is expected that manufacturers whose products are good enough to win a label will wish to display that fact. The Community Eco-label is an example of an endorsement label. In contrast, the comparison label is multiple- category. All models are awarded a label, and are classed from 'good' to 'bad'. Comparison labelling schemes, such as the Energy Label, are meant to show up bad models as well as good ones. To be effective, comparison labels have to cover *all* goods on the market, and are therefore normally compulsory.

[27] Environmental impact of products (EIPRO); analysis of the life-cycle environmental impacts related to the final consumption of the EU-25. Summary of the final report by DG Environment and DG Joint Research Centre, May 2006

The framework directive [*Council Directive 92/75/EEC*] recognises this explicitly: in its preamble, the need for a mandatory scheme is justified on the basis that a voluntary scheme could result in confusion among consumers, as not all of the relevant appliances would be labelled or supplied with standard product information."

This analysis seems to still be valid: if the additional information – whether on environmental information, monetary information or complete life cycle impact information – is to be different from the one potentially conveyed by the EU energy label, this information should be made mandatory.

NGO and industry stakeholders recommend in Arditi et al. (2013) that "All the necessary information should be displayed within the same label in order to allow the consumer easy access to comparison between models."

Endorsement labels allow the most efficient or environmental friendly products on the market to be readily identified – i.e. a relatively small fraction of the market. A simple logo certifies that the product complies with a set of specifications whose details are not communicated to consumers. The EU has, for example, developed the Ecolabel for a variety of products and adopted the Energy Star label, originally created in the US, for office equipment and now run jointly by the EU and US DOE. Some EU countries have developed environmental labels (Blue Angel in Germany, TCO in Sweden, etc.) and also Energy labels, such as the UK's "Energy Saving Recommended" (ESR) logo and Denmark's "Elsparfonden" logo.

Global Chance (2010), lists five conditions for endorsement labels to be effective:

- They are well enough recognised by consumers so that manufacturers want to participate in the scheme up to the point of changing their production;
- The credibility of the authority managing the scheme must be infallible: it must not have commercial interest, it should make product tests and communicate about the results;
- The label should not be in contradiction with other existing tools (for example a mandatory informative label which would work well);
- The Label specifications keep on being demanding enough, even when the market evolves;
- Important means of communications are dedicated to make the label known to consumers. For example, manufacturers are reluctant to ask for the European Ecolabel for appliances because the specifications [*were*] demanding for an awareness level [*assessed*] as being too low.

In the case of the energy endorsement labels from the UK and Denmark, these conditions were fulfilled (Lock and Galvanoni, 2007; Rasmussen and Kirkeby, 2009) for labels launched respectively in 2000 and subsequently:

- The recognition label is quite high in both countries: According to the EST National Attitude and Awareness tracker, 44 % of consumers recognise the ESR label (in 2007, while 55% recognised the EU energy label) and:
- The Energy Saving Trust in the UK and the Electricity Saving trust in Denmark were well placed to managed the label: public authorities with no commercial interest and explicit mission to help consumers save energy, with the capacity to organise product testing at a time when national Market Surveillance Authorities were not yet organised and no or very few verifications of the EU labelling schemes were made;

- EU energy label was perceived as not providing fully clear information and the procedure to update it was considered too long – at least in Denmark, Rasmussen and Kirkeby (2009) state "with the introduction of A+ and A++ categories for domestic refrigeration appliances and AAA categories for the most energy efficient washing machines, there was an increasing need for a less complicated system for the identification of energy efficient products on the market". Another stated advantage was the possibility to update thresholds quicker than within the EU energy label framework (Attali et al., 2009);
- The Label specifications allowed identification of the most efficient products, sometimes adding criteria according to international standards (to start embedding them in manufacturers' practice with good performance). They are frequently updated (e.g. in the UK the "Endorsement panel advising EST meets on a quarterly basis);
- Both institutions invested in marketing to make the label known with materials bearing the labels at the point of sales, implying numerous partnerships with manufacturers and retailers.

5.14 References

- Arditi et al. 2013, Revising EU energy label: evolution or revolution?, Eceee Summer Studies, June 2013
- Attali et al. 2009, Factors influencing the penetration of energy efficient electrical appliances into national markets in Europe, report for DEFRA/the MTP
- Bertoldi and Atanasiu, 2007, Electricity Consumption and Efficiency Trends in the Enlarged European Union - Status report 2006- JRC - Institute for Environment and Sustainability
- Boardman et al. 2007, Carbon labelling, Report on roundtable, 3rd-4th May 2007, St Anne's College, University of Oxford
- CECED 2006, Energy Efficiency, A Shortcut To Kyoto Targets, The Vision Of European Home Appliance Manufacturers
- Centre d'Analyse Stratégique, 2013, Pour un affichage environnemental obligatoire des produits de consommation ? Premier Ministre.
- Come On Labels, 2013, Common Appliance Policy – All for One, One for All – Energy Labels, IEE project final publishable report
- CSES, 2012, CSES and Oxford Research: Evaluation of the Ecodesign Directive (2009/125/EC). Final Report. March 2012
- DGTREN 2009, Consumer Survey on Graphic Layouts for the COMMUNITY ENERGY LABEL
- Dünnhoff et al. 2012, Misleading advertising within the energy labelling April 2012 – January 2014, Presentation
- Du Pont, P. (1998) PhD thesis, Energy and Environmental Policy, University of Delaware
- EC (2008) EC staff Working Document, Impact Assessment 2008: COMMISSION STAFF WORKING DOCUMENT Accompanying document to the Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products, IMPACT ASSESSMENT {COM(2008) 778 final} {SEC(2008) 2863}
- Eckl, 2011, At the doorstep of the new EU Label – How much further can White Goods cut down on the energy bills?, EEDAL 2011
- Enerdata and Sowatt, 2012, French higher domestic specific electricity consumption Compared to Germany: Explanatory Factors Assessment, report for ADEME

- Ernst&Young, 2013, Bilan des retours des entreprises sur l'expérimentation nationale de l'affichage environnemental
- Euro-barometer 2007, Energy Technologies: Knowledge, Perception, Measures, European Commission
- Global Chance, 2010, Du gâchis à l'intelligence - Le bon usage de l'électricité, N° 27 – janvier 2010 – ISSN 1270-377X- 15 – Associations Global Chance et Negawatt
- Grankvist et al., 2004, The Impact of Environmental Labelling on Consumer Preference: Negative vs. Positive Labels, Journal of Consumer Policy 27: 213–230, 2004
- Heinzle, 2012, Consumer Response to Energy Labels - Insights from Choice Experiments, Dissertation of the University of St. Gallen, School of Management, Economics, Law, Social Sciences and International Affairs
  Heinzle & Wüstenhagen, 2010, Disimproving the European Energy Label's value for consumers? Results from a consumer Survey, university of St. Gallen
- Ipsos Marketing 2008, EU Energy Labelling Global Research Report
- Ipsos MORI 2008, Recognising A-G - Summary of results from cross-EU survey
- Joyce 2010, Consumer 2020 - From Digital agenda to Digital action, report for the European Commission
- Jørgen Schjær-Jacobsen, 2009, Proposal for a New Energy Label, EEDAL 2009
- Kubiak and Grönroos-Saikkala, 2013, Energy labeling – State of plan and conceptions for future, in Rehva Journal
- Langley, 2012, Research on EU product label options, Final report, report for the European Commission
- Lee et al., 2012, Intertek, Assessment of the applicability of current EC correction factors and tolerance levels for domestic refrigerating appliances, a research report for DEFRA
- Lock and Galvanoni 2007, Energy Saving Recommended: Delivering improved product standards, market presence and quality, eceee 2007
- Kammerer, D. (2009): The effects of customer benefit and regulation on environmental product innovation. Empirical evidence from appliance manufacturers in Germany. Ecological Economics 68 (2009), 2285-2295.
- Meloni et al. 2013, Understanding the consumer perspective: product solutions to enable and inspire consumers, presented at the EEDAL 2013 conference
- Mugdal et al. 2011, Bilan de l'evolution du parc electromenager français et evaluation « bottom-up » des economies d'energie depuis la labellisation energetique des appareils, rapport pour l'ADEME
- Mugdal et al. 2012, Study on different options for communicating environmental information for products, Final report for the European Commission
- Mils and Schleich, 2010, Energy Efficient Appliance Choice under the EU Labeling Scheme, Working Paper No. 8 within the project: Soziale, ökologische und ökonomische Dimensionen eines nachhaltigen Energiekonsums in Wohngebäuden
- Policy Studies Institute, 2009, Designing policy to influence consumers, Consumer behaviour relating to the purchasing of environmentally preferable goods, Report for the European Commisison
- Promotion 3E, 2009, Report On The Major Factors Influencing Appliances' Choice, (IEE project, Workpackage 3 - Deliverable D12)
- Rasmussen and Kirkeby, 2009, The Danish Energy Saving Label – consumer friendly energy labelling for energy efficient products, eceee 2009

- Salmons et al., 2011, Impacts of innovation on the regulatory costs of energy-using product policy, report for DEFRA
- Schlomann et al. 2009, Survey of Compliance Directive 92/75/EEC (Energy Labelling) - Final Report.
- Seifried 2013, Cuban Energy Revolution – A Model for Climate Protection?
- Siderius 2013, The role of experience curvesfor setting MEPS for appliances, in Energy policy n°59 (2013) 762-772
- Waide et al, (2000), *COLD II: The revision of energy labelling and minimum energy efficiency standards for domestic refrigeration appliances*; Waide P., Lefevbre, H. Kreitz, T, Trines R., Vergeest I., Clodic D., Pougin A., Ciucasu C., Beaufils M., Zoughaib A., Kemna R., van der Sluiss S., Tosato G., Presutto M., Rusconi E. Mebane B., Meli M., Casandrini S., Lanzavecchia D., Janssen and M., Scholand S. for Directorate-General for Transport and Energy (DG-TREN) of the Commission of the European Communities, December 2000.
- Waide 2001, Monitoring of energy efficiency trends for refrigerators, freezers, washing machines, washer-dryers and household lamps sold in the EU, Report for the European Commission and ADEME
- Waide 2013, International comparisons of product policy, final report Cool Products for a cool planet
- Waide Paul and Watson Rowan, 2013, Report for CLASP - The New European Energy Label – Assessing Consumer Comprehension and Effectiveness as a Market Transformation Tool
- Wiel and McMahon, 2005: Energy efficiency labels and standards: A guidebook for appliances, equipment, and lighting. 2nd edition. Collaborative Labeling and Appliance Standards Program (CLASP)
- Windward et al., 1998, COOL LABELS - The first three years of the European Energy Label, Energy and Environment Programme Environmental Change Unit University of Oxford
- Which? 2009, CONSUMER RESEARCH ON ENERGY LABELLING, Review of Energy Labelling Directive, Which? Briefing

6 Criteria and procedures of Energy Labelling

6.1 Insights to date

There is generally only a very limited amount of literature that addresses the criteria and procedures applied to the EU energy labelling and much of that which does exist is: a) material submitted to the Consultation Forum (either by the Commission or other stakeholders) or is b) just as applicable to Ecodesign as it is to energy labelling, or is c) documents that set out the procedures. For this reason essentially all of the discussion of criteria and procedures presented in section 11 concerning the Ecodesign process also applies to the Energy labelling development process. Therefore the text in the remainder of this section is simply complementary to the text in section 11.

6.1.1 Procedure (ELD76-86)

6.1.1.1 Need for an energy labelling working plan (ELD76, 79)

The evaluation tender document raises many questions about the procedure applied to energy labelling (ELD76, 78, 79, 80, 85 and 86) but there are very few sources of literature that address this and non which do so independently of the Ecodesign development process . The procedure to develop and adopt Ecodesign regulations is as follows (EC 2012).

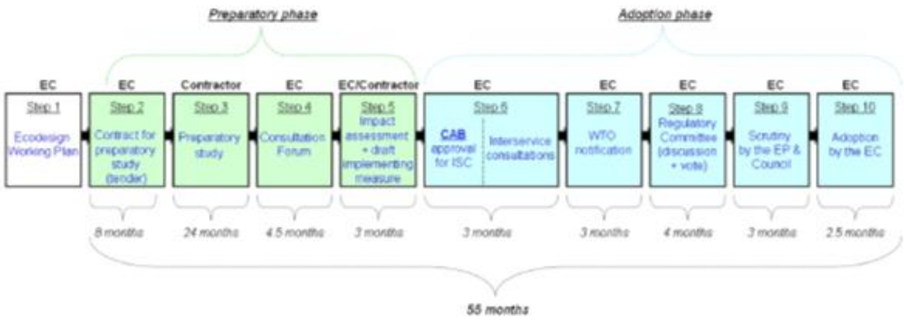


Figure 25 Procedure for adopting Ecodesign implementing measures

The following procedural an challenges issues were identified (EC 2012):
"1. (Over ambitious?) planning
– 18 priority product groups identified and 37 preparatory studies launched between 2005 - 2011
2. (Long and complex?) preparatory & adoption procedure
– 55 months required to adopt a new measure
– Multiple consultations with stakeholders
– Different internal and external (notification) procedures to be followed
3. (Significant?) increase of implementing and communication activities
– Checks of the legislation
– Guidelines, memos, press releases, FAQs
– Standardisation process (39 standardisation mandates launched)
– Calls for tenders, contracts, requests for service

– ADCO and WG meetings, workshops, conferences
– Strategies, roadmaps, policy documents
– Replies to queries sent by the EP, market surveillance authorities, stakeholders (NGOs, industry), media, citizens"

The Commission made the following suggestions to improve the situation:

"Challenge 1: (Too ambitious?) planning
Actions:

a. Focus on the implementation of the 2005 Ecodesign Directive and the 1st Ecodesign Working Plan 2009 – 2011:
   - 31 implementing measures still to be adopted by 2014;
   - 11 reviews/revisions to be carried out by 2014;
b. Limited number of new priority product groups identified in the draft 2nd Ecodesign Working Plan 2012 – 2014:
   - The 'priority list' includes six new product groups;
c. Better prioritisation of activities:
   - Outsourcing of non-legislative tasks;
   - Support from other actors, including: EACI, Member States, NGOs, other stakeholders".

"Challenge 2: (Complex and lengthy?) preparatory & adoption procedure
Actions:

a. Need to consider setting more stringent requirements for a longer time period (e.g. BAT as Tier III);
b. Fast track procedure for the expected reviews (updates of the main preparatory studies);
c. Need for up-to-date data:
   - Development of the database on energy efficiency and other environmental aspects of products to support future reviews of measures;
   - Limited number of products (at least in the 1st phase);
   - Main tasks: developing the database, collecting the data, day-to-day management, analysis;
   - Call for tenders – 36 months contract under IEE WP 2012".

"Challenge 3: Increase of implementing and communication activities
Actions:

a) Outsourcing of communication tasks;
i) 'Support to the EC in providing the information, guidelines, promotional and educational materials':
   - Two specific instruments: a website and an EuropeDirect helpdesk;
   - Call for tenders - 36 months contract under the IEE Work Programme.

b) Reinforced standardisation process;
i) New Approach consultants:
   - Recruited at the request of the EC by ESOs;
   - Monitoring of the standardisation work and providing quality assessments of standards;
   - Strong positive and beneficial impact on the process;
   - Managed by DG ENTR.

ii) Technical assistance offered by an external organisation:

- Support the EC in the monitoring of the standardisation process;
- Identifying new standardisation needs, monitoring of the process, analysis, recommendations;
- Call for tenders – contract under the IEE WP;

iii) More active involvement of NGOs:

- Representation of NGOs' interests in standardisation work;
- Call for tenders – contract under the IEE WP;

c) Support to and follow-up of national market surveillance activities ('msa')

- Annual market surveillance data collection exercise :
- Effective enforcement indispensable for meeting projected savings and ensuring the;
- credibility of the EU regulatory framework;
- Objective: - to have an overview of msa;
- To identify common problems and challenges when performing msa;
- To decide on further actions that could support MS in carrying out msa:
- Annual exercise.

d) Support of other actors:

- EACI: support in calls for tenders (Communication helpdesk & database);
- JRC: Pilot Project with 3 DGs: ENER, ENTR and ENV:
- Content of the project: - preparatory study for a selected product group;
- Development of a measure for commercial refrigerators;
- Monitoring of the standardisation work for professional refrigerators as well as for boilers and water heaters;
- Member States & stakeholders: support in developing new and reviewing existing implementing measures".

Hans Paul Siderius (Siderius 2013) has suggested the following

"The current process to prepare and adopt ecodesign and energy label implementing measures appears to be challenging, especially regarding (the uncertainty in) the total process time. Analysis suggests that the major delay factors are:

- Contracting under qualified consultants for the preparatory study;
- Low quality preparatory study;
- Lack of data;
- Lack of cooperation by stakeholders;
- Technical complexity of the matter;
- Contentiousness, including political sensitivity of the matter;
- Delays in the process.

Assuming that action has been taken on the first 3 factors, the key in reducing uncertainty in total process time is the proper management of complexity and contentiousness. The influence of these factors on delays in total process time can be indicated as follows:

		Contentiousness	
		Low	High
Complexity	Low	I: no delays expected, process may even go faster	III: delays if process cannot be moved to the political level; also process may become more complex
	High	II: delays if technical expertise to deal with complexity cannot be organized	IV: delays to be expected; large delays if contentiousness and complexity are not or cannot be separated

It is suggested that the Commission assesses complexity and contentiousness during the preparatory study and plans the rest of the process taking into account the results of this assessment, thereby decoupling the preparatory study from the rest of the process which starts with the preparation for the Consultation Forum. This assessment could also take a more critical look at whether for a certain product an implementing measure currently is warranted.
The preparation for the Consultation Forum should only be started when it is ensured (availability of staff, technical assistance, etc.) that the rest of the process can be executed. The planning including deadlines for reactions in the various steps should be communicated to stakeholders, thereby decreasing the uncertainty about the total process time; nevertheless this planning can never be more than indicative.

For each of the four categories indicated in the table a suggestion for a planning is provided. Furthermore it is suggested to keep the (last) Consultation Forum meeting (in step 4), step 5 and the start of the interservice consultation (in step 6) as close together as possible, and suggestions for the alignment of the ecodesign and energy label processes are given."

ECOS (2012) called for:
"Revision of the Directives

- Simultaneous revision prepared in 2012/13 and adopted by 2014 at the latest;
- To cover: scope, ambition, dynamism... and a better solution for the Label;
- Current implementation should be accelerated and not disrupted.
  Immediate improvements to the policy process;
- Resources and staffing need to be increased;
- More engaging deadlines and streamlined consultation should be used;
- A market monitoring tool is needed to better develop and revise measures;
- Market surveillance should be more coordinated and lead to higher sanctions.
  More ambition, to stop wasting environmental opportunities;
- Ecodesign measures should reach the least or equal 'life-cycle cost' earlier;
- A mid-term target at the level of BAT to send the right signal to the market;
- Large (intrinsically high consuming) models should not be unduly promoted;
- Non-energy aspects deserve more serious and well-prepared consideration."

According to Toulouse and Arditi (2012)
"The implementation of the Ecodesign and Energy Labelling policies has experienced delays and difficulties in the last two years. Improvements can be brought to the process. The revision of the two Directives also needs to be envisaged.

The priority is to increase the delivery rate and clear the backlog of pending product measures. A review of several existing measures is also tabled in the coming years. Dealing with all these measures is only possible if improvements are brought to the set up.

- Resources and staffing need to be increased;
- More engaging deadlines and streamlined consultation should be used;
- A market monitoring instrument is required, to better develop and revise measures;
- Market surveillance should be more coordinated and lead to higher sanctions.

In addition, there is evidence that the ambition and dynamism of the first adopted measures has often not been optimal. Greater and quicker impact is possible.

- Ecodesign measures should reach the least life-cycle cost for consumers earlier in time;
- A middle-term target at the level of best available techniques should be systematically added to send the right signal to the market;
- Measures should ensure that large high consuming models are not unduly promoted.

Other environmental aspects (beyond energy use) should be progressively subject to effective requirements, based on agreed measurement methods As regards the legal revision of the two Directives, we suggest the following sensible steps:

- The two Directives should be revised jointly. The political debate could be prepared in 2012 and 2013, with a final decision in 2014 (before the European elections);
- The revision should cover the scope, ambition, dynamism of the instruments. A better solution for the Energy Label layout will also be needed, as there are already A+++ products on the market in some categories;
- Sufficient time should be taken to prepare the revisions and reach acceptable compromises. In any case the current implementation process should not be disrupted."

The consumer association agencies ANEC/BUEC have called for the Commission to:

- Establish official product registration market sales monitoring instrument;
- Revise existing labels a.s.a.p.;
- Legislate on online labelling.

ORGALIME (2012) have a different view and state that:

"Yes to improving enforcement" through "Support for strengthening cooperation and information exchange, the sharing of best practices (ADCO)". However, the proposal for creating a European register is: "too costly an option" and "against current Directive (proposal for premarket control was rejected during legislative process on framework directive)".

CECED (2012) report that industry's priorities are:

- "Timeliness is the big challenge;
- Enforceability and effective enforcement are key;
- Founding principles must be preserved;
- Growth agenda is the priority."

Concerning the need for timeliness they state:

"Political process is complex and not quick, e.g. industry request for labelling:

- Water Heaters 1997;
- Vacuum cleaners 2001;
- Gas ovens 2002
- Hoods, Coffee Machines, 2008/2009

It can be improved:

- Better use of available resources (EC, Member States, stakeholders);
- Get started and activate competition; it will bring impressive results;
- Coordinate the revision of framework Directives.

Without losing momentum;
- Focus on what works and test new developments in parallel processes;
- Maintain separation of ErP and nErP legislation;
- Embed other parameters in ErP and label, if they are relevant, measurable and enforceable."

Many of these recommended actions have since been acted upon e.g.:
- The commission is in the process of outsourcing many communications activities;
- The evaluation of the labelling and Ecodesign directives are being done jointly;
- Attention has been focused on implementation of the 2005 Ecodesign Directive and the 1st Ecodesign Working Plan 2009 - 2011 with a limited number of new priority product groups identified in the draft 2nd Ecodesign Working Plan 2012 – 2014.

However, it is also apparent that the focus on prioritising products and Ecodesign measures has been a pragmatic necessity given the limited administrative resources and capacity available to the Commission and Member States and that a greater throughput (including more labelling regulations) could be achieved were these resources to be increased. Nor have any of these documents directly addressed whether or not it would be better to establish a separate working plan under the energy labelling Directive (ELD76) or whether it would be better to continue to tackle them under a single plan (as at present).

6.1.1.2 Appropriateness of criteria mentioned in paragraph 2 of Article 10 (ELD77)

Paragraph 2 of Article 10 of the labelling Directive specifies the following criteria need to be met in order for a product type to be eligible for the development and application of an energy label

"2. The criteria referred to in paragraph 1 are the following:
(a) according to most recently available figures and considering the quantities placed on the Union market, the products shall have a significant potential for saving energy and, where relevant, other essential resources;
(b) products with equivalent functionality available on the market shall have a wide disparity in the relevant performance levels;
(c) the Commission shall take into account relevant Union legislation and self-regulation, such as voluntary agreements, which are expected to achieve the policy objectives more quickly or at lesser expense than mandatory requirements."

There is no literature that has directly commented on the appropriateness of these criteria (ELD77); however, the following observations are worth mentioning:

It might be appropriate to revise criteria b) to include products with the potential to have a wide disparity in performance and not limit it to those that already do. The experience with clothes dryers indicates why this is important, as when the label was first introduced all the products were classified as either a C or D (i.e. there was very little differentiation); however, the technical analysis of clothes dryers had shown that it was feasible to manufacture heat-pump dryers that had class A performance and some years after the labels introduction industry rose to the challenge and started producing heat-pump dryers that attained class A and more recently, much higher efficiency levels (Waide 2001 (Monitor III), van Kemna (1995), section 8.2.1 showing current efficiency distributions for clothes dryers).

Clause c) seems to presume that voluntary agreements and self-regulation will be faster at achieving the policy objectives than mandatory labelling; however, it is worth noting that there is no evidence in the literature to support this presumption and that most voluntary agreements have either made use of an existing energy label (e.g. the CECED VAs for domestic cold appliances, washing machines and dishwashers) or have first involved the development of a voluntary energy label (e.g. the Eurovent, EVA and eu.bac self-generated labelling schemes which have been coupled to internal industry association agreements on energy efficiency). Energy labelling has thus proven itself to be a very helpful precursor to voluntary agreements which can then be framed in terms of fleet average performance levels or minimum performance levels compared to an established label performance threshold). Thus in principle the clause could be amended to state:
"(c) for products where there is reason to believe that relevant Union legislation and self-regulation, such as voluntary agreements, will achieve the policy objectives more quickly or at lesser expense than mandatory requirements the Commission may opt to not develop mandatory labelling requirements".

6.1.1.3 Appropriateness of delegated act procedure for energy labelling (ELD78, 79, 80, 85, 86)

Questions ELD78, 79, 80, 85 and 86 address this issue:

"78. Is the procedure for adopting delegated acts adequate for laying down energy labelling requirements for products?
79. How could the efficiency and effectiveness of the current procedure used for developing delegated acts be improved? Would other procedures (such as the ordinary legislative procedure) be better suited for the purpose? How could the efficiency of the reviews and revisions of the existing implementing legislation be improved?
80. Could delegated acts be revised on the basis of an agreed automatism based on the market developments? How?
85. If the procedure for adopting delegated acts is not adequate for laying down energy labelling requirements for products, which of all relevant existing procedures would be the most adequate?
86. Could the Commission review and revise existing delegated Regulation through one horizontal act (so-called 'omnibus')? What would be the benefits and risks?"

Unfortunately, there is no literature which comments on these topics.

6.1.1.4 Applicability of a horizontal labelling regulation (ELD81, 86)

This topic (ELD 86) was discussed at the Ecodesign Consultation Forum Meeting on Horizontal Issues on 1/3/13. (e.g. Agenda Points 3 and 4: State of Implementation of the Ecodesign Working Plan Ismo Grönroos-Saikkala, DG Energy C.3, Energy Efficiency Unit).

The Commission seems to have focused on the actions to deliver the existing Ecodesign working plan rather than the possibility of developing a horizontal labelling regulation and what this may entail.

6.1.1.5 Suitability of a horizontal verification procedure (ELD82)

This topic is considered in section 2.

6.1.1.6 Stakeholder engagement (ELD83, 84)

The importance of appropriate stakeholder engagement (ELD 76 and 77) has been alluded to in numerous Commission documents (e.g. EC 2008b, the recast labelling Directive and many of the specific delegated acts and regulations) it has also been mentioned in Consultation Forum presentations and other sources such as Waide (2013). In general these all agree on the importance of having a wide a representative stakeholder engagement process, however, there seems to be little call to modify the existing procedures (at least in the publically available literature).

6.1.2 Resources (ELD87, 88)

Several commentators have remarked on the importance of ensuring there are adequate resources to do the Ecodesign and energy labelling work (CSES 2012, Waide 2013, CECED 2012, Toulouse & Arditi 2012). Waide (2013) estimated that the combined estimate of administrative and consultant person-hours available for EU product energy efficiency regulatory development and administration is less than a tenth of the comparable US figure and less than half of the comparable Chinese figure. The implication is that insufficient resources have been a major limiting factor in the timely development of Ecodesign and labelling measures. Since this analysis the Commission have increased the throughput of Ecodesign measures and have somewhat increased staff resources to both Directives; however, the issue of resources will be a major factor in considering the future work programme and the related issues of extension of scope, and the quality and timeliness of regulatory development work (including preparatory studies, standardisation, impact assessments, stakeholder engagement and administrative effectiveness).

6.1.3 Scope (ELD89, 91)

Almost all the literature directly addressing the scope of the EU energy label directive has been through submissions produced in the context of EU Consultation forums and essentially comprises stakeholder views and positions.

At the Meeting of the Consultation Forum under Article 18 of Directive 2009/125/EC on energy-related products on HORIZONTAL MATTERS Brussels, 1 March a question was raised on delegated acts on transformers in rail services. The Commission replied that they are currently out of scope, because they are performing a function in the transport sector.

EAA suggested that a study on window products should be handled like the study on thermal insulation with first a limited study. EUBAC expressed its regret that heating controls are not studied, and points out the offer from industry to work on the issues.

The Commission clarified that heating controls are studied under product specific preparatory studies on various heating appliances.

GLASSFOREUROPE asked for Energy Labels for windows and showed appreciation for a study on window products.

EUBAC asked for intention of scope of smart appliances and water-related products. The Commission replied that there is always a stakeholder meeting to define products covered, and on water-related products the intention is on shower-heads and toilets.

BMWI/BMU (2012) states that:

- "Broad implementation: The Energy Label should be implemented in product segments, which are relevant for private consumers and commercial customers and also when mandatory ecodesign requirements are not (yet) in place or for product groups with a self-regulatory initiative;
- Make the best performing products visible – predefine future classes, which can already be displayed (e.g. Label for TV);
- The evaluation of the Energy Labelling Directive in 2014 needs to investigate again, in how far the present scale provides a transparent and comprehensive labelling."

ORGALIME (2012) state that re the Energy Labelling Directive
"Industry widely supports the Energy Label

- Notwithstanding that labelling is "only" one way of providing environmental information;
- Successful tool in area of consumer products (i.e.: energy and water consumption of dishwashers and washing machines).

However: Constraints in the area of professional products/capital goods:

- Tailor made solutions;
- Professional business partners".

The go on to state that regarding the issues for the review of the labelling Directive:
"Coherence with other activities

- Resource Efficiency Roadmap/Environmental Footprint (EFP), 7th EAP, Eco Label, Green Public Procurement.

General preference for Energy Label in comparison to EFP Energy Label allows for transparent consumer information on individual environmental parameters

- A potential "one figure EFP" bears risks:

a) Highly complex for ErP;
b) Misleading product information
c) Subsequent market distortion & unfair competition".

Clearly the issue of scope (ELD89, 90, 91) touches upon the objectives of the labelling directive, its effectiveness and the pragmatic issues regarding how much be addressed within available and future capacity constraints. It is clear from then literature (see Sections 5, 6 and 8) that the existing energy labelling scheme has produced sufficient savings to comfortably justify its development and that there is plenty of scope to expand it's coverage while achieving cost-effective returns; however, the precise degree to which it should be expanded before the returns no longer justify the scope extension does not appear to have been assessed thus far.

6.1.4 Standardisation (ELD92 to 98)

The evaluation tender document poses the following questions about standardisation:

"92. Should harmonised standards be developed under the energy labelling Directive (so far the harmonised standards developed under the Ecodesign Directive are applied)?
93. Has standardisation fulfilled its role foreseen in the Directive in contributing to realising the energy labelling policy?
94. How could the standardisation process be improved (mainly speed up), if possible without changing the internal procedures of the Standardisation Bodies?
95. What types of standards, test and measurement standards, performance standards, and horizontal standards have been developed?
96. Has the standardisation process been effective enough to produce standards supporting the energy labelling?
97. Have standards been harmonised at global level?
98. Which challenges have the Standardisation Bodies faced in developing standards?"

In general, there is very little in the literature that explicitly directly addresses these questions except the following contributions to Consultation Forum discussions.

ORGALIME (2012)

"YES to a better use of standardisation

- Better synchronisation between the development of implementing measures and (measurement & test) standards;
- Horizontal standardisation mandate welcome, but:
- Better use of ongoing standardisation work necessary;
- Studies to better portray ongoing standardisation work;
- Better use of standards in line with New Legislative Framework".

The standardisation process, according to della Faille de Leverghem (2012) from CEN/CNELEC, worked as follows up until M/495 (II)
"• Work rather smooth
• Linear process:
IR - specific mandate - standards work
• BUT little involvement of TC until IR was published"

He goes on to suggest the following improvements
"1) Actual TC work can start after Annex B is updated

- TCs have only 18 months to actually develop ENs
- Publicise draft Annex B earlier (as soon as IR is ready)

2) Annex A content overlaps with EPBD work

- Synergy with EC before future Annex A updates

3) TCs will need advice for "EN – IR" link (Annex Z)

- Consider NA Consultants

4) Coordination energy- and time-consuming

- Specific funding

5) TC experts need funds

- Full financial support for TC involvement from all DGs"

In addition the issue and degree of global standards harmonisation is considered in Waide et al (2010) and Waide et al (2013). These sources find that there is a varying degree of harmonisation of international test procedures with many parts of the world using primarily international standards developed through IEC, ISO and ITU but with very significant exceptions, especially among the technologically advanced economies of North America, Japan, Korea and Taiwan. This lack of harmonisation not only increases producer costs by raising product testing costs but also leads to separate product development pathways in many cases that further adds to product development costs and slows technology transfer. Crucially it also inhibits international benchmarking of policy settings and encourages inward looking MEPS and labelling development processes that are not fully informed by best practice elsewhere.

Chapter 12 includes a more thorough discussion of standardisation issues that apply to both labelling and Ecodesign.

6.2 Options for improvement

Waide (2013) proposes for both the Ecodesign and labelling Directives:

"Strengthen investment in the design and implementation of the Ecodesign and energy labelling Directives if it is to realise their impressive potential for cost-effective energy and carbon savings. Bolster administrative and technical resources by increasing the number of desk officers administering the development of energy labelling and Ecodesign measures and by raising the budget available to sustain technical support for preparatory studies, data collection, standardisation development, forecasting, monitoring and evaluation. It may also be possible to address part of the administrative capacity shortfall by farming out some functions to other agencies or partners.

Consider adoption of a binding administrative schedule that fully clarifies well in advance all the regulatory design, standardisation and consultative procedures and indicates to stakeholders when they will have an opportunity to engage in or comment on the regulatory development process and when the process will conclude.

Develop (and frequently revise) an associated regulatory development plan clearly indicating the regulatory development resource requirements, provisional estimated outcomes in terms of energy savings, environmental impacts and economic effects and the impact on the share of total product energy use subject to energy labelling and Ecodesign measures.

Enhance the strength of monitoring and compliance activities by ensuring adequate resources are committed to compliance at the Member State level and that synergies are explored that would facilitate greater cooperation among national market surveillance authorities. Given the low level of compliance activity seen to date in the EU it may be appropriate for the Commission to be given a coordination role and for legal obligations on the scale of compliance activity to be established.

Other recommendations:

Efforts should be made to work with the standardisation processes in the peer economies to share the developmental burden, enhance international harmonisation and facilitate policy benchmarking and trade.

The EU should consider options to share regulatory development efforts for demanding or green-field (new) product categories with administrations in peer economies."

Other suggestions for improvement include:

1. Use Best Not Yet Available Technology (BNAT) to determine future labelling classes (Kueper, 2013) (Note, this has been done historically in the case of cold appliances (Waide et al 2000, and tumble dryers (VHK 1995) amongst other products, but is not always done as a matter of principle).
2. Broad implementation of the label for products relevant to private and industrial consumers (BMWI/BMU, 2012).
3. Making best not yet available technology visible on the label (BMWI/BMU, 2012).
4. Displaying only energy classes that are allowed on the market (BMWI/BMU, 2012).

BMWI/BMU (2012) also call for:

- "Reliability of working plans and timeframes

a) In this regard we appreciate that the working document on the working plan 2012 - 2014 provides a comprehensive time table of adoption of implementing measures. We propose to update this timetable regularly.

b) The proposals submitted by Germany will not delay the drafting of ongoing and planned implementation measures.

- Establishing a sound data basis;
- Counteracting Rebound-Effects: Establish degressive standards where appropriate;
- Strengthen focus on technology independent requirements".

Siderius (2013) makes a number of suggestions on how to improve the joint Ecodesign and labelling development process as discussed in section 11.

6.3 References

- Arditi et al (2013) "Revising EU energy label: evolution or revolution?" eceee summer study 2013 proceedings
- BMWI/BMU (2012) "The Ecodesign and Energy Labelling Directive: Best Performing Products and Continuous Improvement to Higher Energy Efficiency" Federal Economics Ministry (BMWi) and the FederalEnvironment Ministry (BMU), Germany 2012
- CECED (2012) "Which future for ecodesign and labelling?" Presentated by CECED at the 19 April 2012 Consultation Forum.
- CSES (2012) *Evaluation of the Ecodesign Directive*, {http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/review/index_en.htm}

- della Faille de Leverghem, (2012) "Ecodesign standardisation: State of play in CEN and CENELEC" Alexandre della Faille de Leverghem, Programme Manager –CEN-CENELEC Management Centre, presented at Ecodesign Consulation Forum, April 2012.
- EC (2012) Ecodesign Consultation Forum meeting on horizontal issues. Agenda Point 2: Presentation of the state of the regulatory work on the new implementing Ecodesign and Energy Labelling measures, Adam Romanowski, DG ENER, C3, 19 April 2012
- EC (2012a) MINUTES of the Consultation Forum on horizontal issues - 19/04/2012
- EC (2012b) Ecodesign Working Plan 2012-2014
- ECOS (2012) "Environmental NGO priorities", presented at Consultation Forum meeting on horizontal issues
- Gronroos-Saikkala, I. (2013) "Horizontal matters" Presented at Consultation Forum, March 2013
- Kueper et al (2013) "Ideas on the way forward for the Ecodesign and the Energy Labelling Directive"
- ORGALIME (2012) "ECO DESIGN & ENERGY LABEL DIRECTIVES: An industry point of view"
- Sigrid Linher, Environment Manager, ORGALIME, presented at Consultation Forum, 19 April 2012
- Siderius, H.P. (2013) "Speeding up adopting ecodesign and energy labelling measures – analysis, challenges and solutions" eceee 2013 proceedings
- Toulouse and Arditi (2012) "Priorities for the improvement of the EU Ecodesign & Energy Labelling policies" Presented at the Consultation Forum on 05/03/12 by Stéphane Arditi" (EEB, coolproducts campaign) and Edouard Toulouse (ECOS)
- Waide et al (2010) *Opportunities for Success and CO_2 Savings from Appliance Energy Efficiency Harmonization* Waide, P. Harrington, L. Scholand, S. for CLASP, http://www.clasponline.org/Resources/Resources/StandardsLabelingResourceLibrary/2011/Opportunities-for-appliance-EE-harmonization
- Waide, P. (2013) *International Comparisons of Product Policy*, http://www.coolproducts.eu/resources

  Waide et al (2013) *SEAD Technical Management Organization: Draft final report*, 12 August 2013 Unpublished report prepared for CLASP and the Super Efficient Appliance Deployment program by Paul Waide of Waide Strategic Efficiency Limited, Lloyd Harrington of Energy Efficient Strategies and Chris Granda of Grasteu Associates.

7 Market effects of Energy Labelling

7.1 Introduction

In this chapter we examine the market effects of energy labelling, including the effects on the structure, organisation and financial flows of a market. Energy labelling aims to increase the energy efficiency of the labelled products, but could potentially also have unforeseen or unwanted effects on:

- Market sizes;
- Costs and profit margins;
- Costs or administrative burden for firms;
- Competitiveness of operators (from a Member State, EU and international perspective);
- Market structure (interaction between different parts of the value chain);
- Choice of products on the market;
- Unfair competition through non-compliance (free-riders).

Other potential effects of energy labelling that are being analysed in parallel by other studies are the a) impacts on R&D and innovation, and b) the impacts on third country legislation. As these analyses progress their findings will be included in the project findings.

The same issues are addressed for Ecodesign in chapter 9.

7.2 Insights to date

7.2.1 Market size and market breakdown

Energy labelling was first introduced in 1994 on domestic refrigerators and freezers, and then shortly afterwards on household washing machines and dishwashers. It has since expanded to include eight other products.

Market data that is directly aligned with this regulation is not collected in an integrated and comprehensive way, but more on an ad-hoc basis through surveys and inferences from ProdCom and other statistics. A recent tender (EACI/IEE/2013/002 'Energy-related Product Database') is seeking to rectify this, at least in part, but the results are not available for this evaluation. Consequently, there are some limitations to the robustness of the data used here.

Table 15 presents EU market size and value data for all product groups with either an existing Energy Labelling and/or Ecodesign regulation, and other selected product groups. The data is taken from the ProdCom database (see also chapter 4 for more on the ProdCom database), with assumptions made to select the ProdCom product codes relevant for each product group.

This approach offers comprehensive coverage across the product groups, but due to the product specific characteristics that are distinguished in the delegated acts on Energy Labelling and Ecodesign the match between the regulated products and the ProdCom codes is not always strong. In addition, there is sometimes overlap of regulated products within ProdCom categories, notably for household washing machines and household tumble driers where in our table washer-dryers are included only within the household washing machine category, but include products with dryer functions regulated under the dryer delegated act.

The market size is inferred using an apparent consumption approach, which calculates the EU market size by taking EU production, and then adding imports and subtracting EU exports. but not in the ProdCom data.

It is clear from the market data that the two Directives apply to many billions of products that are sold in the EU each year and markets whose total value can be measured in tens of billions of euros. The largest markets (by value) affected by energy labelling in terms of euros are those for televisions, non-directional household lamps and air-conditioners and comfort fans. In terms of units sales volumes the most important markets are for non-directional household lamps, televisions and vacuum cleaners.

Overall, looking at the data over the full period of which it is available (2003 - 2012 – data not shown but analysed), there is little discernible impact on market size due to the Energy Labelling or Ecodesign regulations. This is unsurprising given the many other variables and economic trends that affect market size and growth and the particular difficulties of attributing any impacts. This is a particular problem in the most recent years of economic recession and financial crisis are assumed to have much more dominant impacts.

Table 15 Estimated market size of Energy Labelled and Ecodesign regulated product groups in 2012

Product group name	ELD since	ED since	EU market size (million units)	EU market value (million euros)	Trend EU market value (2003-2012 or period for which data is available)	Market breakdown – products sold by energy label class (2012) Only for labelled products and where relevant data is available									
						A+++	A++	A+	A	B	C	D	E	F	G
Boilers and combiboilers, Lot 1				4121.6	-3%										
Water heaters, Lot 2			26.2	1335.4	32%										
Computers and servers		2013	85.6	26445.8	11%										
Imaging Equipment (Copiers, Multi-functional devices, Printers, Fax machines)		2012 (VA)	33.8	4683.8	-20%										
Televisions	2010	2013	78.4	13117.2	-25%	2020	2017	8%	31%	21%	10%	1%			
External Power Supplies		2009	157.3	1443.6	17%										
Tertiary lighting (fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps)		2009		12278.3	28%										
Air conditioners and comfort fans	2002	2012		5537.0	-9%				63%	19%	12%	5%	1%	0%	0%
Residential ventilation and kitchen hoods Lot 10			13.6	1067.7	36%										
Electric motors		2009	498.8	1461.7	8%										
Industrial fans (driven by motors with electric input between 125W and 500kW)		2011	76.5	2247.4	17%										

Product group name	ELD since	ED since	EU market size (million units)	EU market value (million euros)	Trend EU market value (2003-2012 or period for which data is available)	**Market breakdown – products sold by energy label class (2012)** Only for labelled products and where relevant data is available									
						A+++	A++	A+	A	B	C	D	E	F	G
Circulators (glandless standalone and integrated)		2009	18.1	978.8	41%										
Water Pumps		2012	104.7	2902.8	16%										
Commercial refrigerators and freezers, Lot 12				5747.0	10%										
Household refrigerating appliances	1994	2009	24.6	4986.1	-6%	4%	18%	50%	26%	2%	0%	0%	0%	0%	0%
Household Washing Machines	1995	2010		4743.8	-8%	0%	2%	30%	65%	3%	0%	0%			
Household Dishwashers	1997	2010	9.1	2125.3	6%	3%	7%	28%	62%	0%	0%	0%			
Household Tumble Driers	1995	2012		125.6	-26%				21%	47%	31%	1%			
Vacuum Cleaners	2013	2013	42.7	1835.3	12%										
Complex set-top boxes		2010 (VA)		10793.5	-26%										
Simple set-top boxes		2009	45.4	2100.8	406%										
Non-directional household lamps	1998	2009		8573.8	10%										

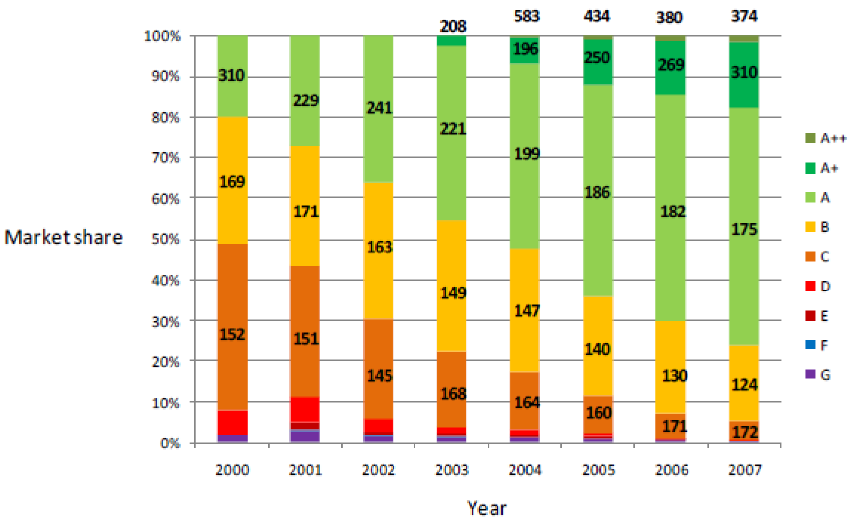
Source: Ecofys based on ProdCom database. Labelling breakdowns from TopTen (2013 [Televisions]), CLASP (2011b [Air conditioners in 2007, EU-5, DE, FR, UK, IT, PL], 2013c [Household refrigerators, washing machines, dishwashers], Vlehan (2013 [Tumble driers - NL only]). Data presenting a breakdown of the household lamp market by energy label classes do not seem to exist. Market analyses for the lighting sector are prepared on the basis of lamp technology, i.e. Halogen, CFL, LED, rather than energy label classes. Labelling for vacuum cleaners has not been active for long enough to have visible market impact.

Note: Standby and off mode electrical power consumption of household and office equipment are not included as they are not an independent product. Directional lamps, LEDs and related equipment are not included as they are not a product group within ProdCom.

Data on the market breakdown for labelled products shows different spreads of sales across the energy classes. For televisions the A category takes 31% of the market and A+ 8% although this was not supposed to become active until 2014. This implies that manufacturers are exceeding the original efficiency improvement expectations. For domestic refrigerators over 70% of products are above A class, with 50% sold as A+. At the other end of the scale classes C and D are effectively empty. This points to a situation of the market starting to outgrow the labelling classes. A similar situation appears to exist for household tumble driers, with data suggesting almost the entire market is concentrated in the top 3 available classes (A-C), this may be ripe for a class extension to A+++. Household washing machines and dishwashers have similar market breakdowns to each other, with a high concentration of sales in the A+ and A classes. This points to some improvement space remaining in the top two classes (A++ and A+++), but also highlights the increasing redundancy of the empty bottom classes.

This redundancy of the bottom energy classes, where they become empty of products, is a clear sign of the market success of Energy Labelling, whereby both manufacturers and consumers have moved the market towards more energy efficient products. The effectiveness and efficiency issues associated with empty classes and concentration of the market in the top classes is discussed further in chapter 5.

The development of energy classes over time is presented in Figure 4 for refrigerators. This demonstrates how the market will slowly graduate to the higher energy classes as prices decline over time.



Source: GfK market data

(a) Average prices deflated to 2005 prices using the consumer price index

Figure 4 Evolution of energy class market shares and average prices[(a)] for fridges, from Salmons et al (2011)

7.2.2 Costs and profit margins

Efficient products are, as would be expected, often more expensive on average than less efficient products (see an example for refrigerators in Figure 4). This reflects the consumers' willingness to pay for more energy efficient products, and the more expensive technology required. This relationship does not always hold completely. Sometimes less efficient products can be more expensive, i.e. the price differential between classes B and C evident in figure 6, where since 2003 products in class B have had lower average prices than class C. This can be explained by consumers buying products with additional functions and features which push up the price and can reduce efficiency.

A number of studies have found that policy interventions have accelerated the rate of improvement of product energy efficiency, without affecting the long term downward trend in prices. Weiss et al (2010) observed learning rates for energy demand products (domestic appliances) of 18% on average, +/- 9%, meaning that for every doubling of production an 18% price decrease was observed. There was some observed variation in these rates, both within products and over time, signalling that learning is not necessarily consistent over time. The biggest variation was between consumer electronics and white goods, with consumer electronics recording higher average learning rates of 26% +/- 3% and refrigerators only 9% +/-3%. Over time it is noted that prior to the first EU regulations some energy efficiency improvement was noted, but after the first EU energy labels were introduced in 1994 progress sped up significantly.

Other evidence suggests that policy interventions only have a short-run impact on average market prices, which return to their long term trajectory as manufacturers adjust their product ranges, i.e. new low-cost, premium product definitions and specifications, in response to shifts in demand, new energy efficiency labelling classes or standards and in response to new (more efficient) products entering the market (Salmons et al, 2011).

Due to a general lack of available data on unit production costs, the majority of the empirical studies in the literature on experience curve effects and the impact of policy interventions have used average prices. Consequently, there is no robust evidence regarding the actual impacts of policy interventions on production costs, or on the profits of producers (Salmons et al, 2011).

7.2.3 Administrative burden for European firms

Administrative costs and burdens for European firms can arise during the rulemaking phase as well as after the regulation has been implemented. A firm can decide to be actively involved in the rulemaking process or delegate this to the industry association that represents its sector. Depending on the degree of involvement in the rulemaking process costs will arise. In the CSES evaluation of the Ecodesign directive (2012) one mid-sized company was quoted to have 4 FTE working on monitoring the Ecodesign process, which would represent significant administrative costs. The degree of involvement of a firm in the rulemaking process is most likely dependent on the size of the firm and the stakes.

After the implementation of the energy label costs arise from the ensuring compliance with the requirements.

It is assumed that the EU manufacturers and retailers will pass the bulk of any cost increase onto consumers (Defra, 2009b). This obviously then has implications for firms sales and internal competitiveness, with those firms that are able to most efficiently and effectively deal with the changes receiving a relative benefit. Normally this would be expected to favour larger firms over SMEs, as larger firms have greater staff and technical and financial capacity to manage and adapt to any changes.

7.2.4 Competitiveness of operators

For competition within the EU market all operators must comply with the same requirements. As a consequence, the impacts of energy labels on competitiveness are broadly neutral. Their key impact on competitiveness derives from how consumers alter their product purchase decisions, and the extent to which they favour more efficient products. This will provide the potential for market benefits to the firms that are able to most cost-effectively produce more energy efficient products, which will be a factor of the innovation activity in firms, as well as the ease of attaining high label classes, i.e. low ambition levels of energy classes are relatively easier for all to achieve. This specific innovation issue is being investigated in another study, parallel to this evaluation.

In international markets energy labelling could potentially impact the global competitiveness of EU firms in a variety of ways. The changes to production costs and profit margins and the administrative burden of the directive described above can both impact on the ability of EU firms to compete on price. These changes may be positive or negative depending on their net effect.

By stimulating innovation among firms, i.e. firms competing to produce products in higher energy classes, the regulation can potentially confer a first-mover market advantage to EU firms, making them more competitive. An example of this is for compact fluorescent light bulbs where EU firms became market leaders. However, there is also a risk that static labelling systems lead to complacency which has the opposite effect. In the opinion of some, the lighting sector also provides an example of this in the case of LED lighting where EU firms are falling behind due to their focus on compact fluorescent bulbs and the relative simplicity of the technology which has opened up the market to new players, for example Samsung.

Looking at recent import and export data (see Table 16 for a summary of latest data) we can see that EU producers have significant market shares by either value or unit for each Energy Labelled product. The same is not true for products with Ecodesign measures where the market is almost entirely serviced by imports in the product groups: computers and servers, imaging equipment, external power supplies and simple set-top boxes.

Table 16 Imports and exports of Energy Labelled and Ecodesign regulated product groups in 2012

Product group name	**EU market value 2012 (million euros)**	**EU production value 2012**	**Trend EU production value (2003-2012** or period for which data is available**)**	**EU export value 2012**	**Trend EU export value (2003-2012** or period for which data is available**)**	**Imports to EU market value 2012**	**Trend imports to EU value (2003-2012** or period for which data is available**)**	**Imports share of EU market 2012**	**Change % point**
Boilers and combiboilers, Lot 1	4121.6	4825.7	-7%	994.4	159%	290.3	115%	7.0%	4%
Water heaters, Lot 2	1335.4	1309.4	20%	216.8	3%	210.2	4%	15.7%	8%
Computers and servers	26445.8	3404.9	-109%	4043.4	17%	26374.1	52%	99.7%	31%
Imaging Equipment	4683.8	1815.3	-114%	1866.2	28%	2770.0	-22%	59.1%	7%
Televisions	13117.2	12858.9	-29%	2031.4	-19%	2017.3	-20%	15.4%	5%
External Power Supplies	1443.6	378.8	2199%	809.7	189%	1874.5	50%	129.8%	28%
Tertiary lighting	12278.3	11128.3	-3%	3375.7	82%	3303.9	85%	26.9%	20%
Air conditioners and comfort fans	5537.0	4875.5	-9%	1344.1	90%	2033.4	64%	36.7%	-1%
Residential ventilation and kitchen hoods Lot 10	1067.7	1176.9	21%	247.1	33%	137.8	760%	12.9%	11%
Electric motors	1461.7	1049.0	-53%	749.1	84%	1161.8	62%	79.5%	27%
Industrial fans (driven by motors with electric input between 125W and 500kW)	2247.4	3052.5	11%	1290.2	136%	1011.0	112%	45.0%	4%
Circulators	978.8	1143.6	35%	222.0	256%	57.2	416%	5.8%	4%
Water Pumps	2902.8	5317.8	6%	2795.9	179%	2432.4	190%	83.8%	8%
Commercial refrigerators and freezers, Lot 12	5747.0	6773.6	11%	1577.7	20%	1512.6	22%	26.3%	0%

Product group name	EU market value 2012 (million euros)	EU production value 2012	Trend EU production value (2003-2012 or period for which data is available)	EU export value 2012	Trend EU export value (2003-2012 or period for which data is available)	Imports to EU market value 2012	Trend imports to EU value (2003-2012 or period for which data is available)	Imports share of EU market 2012	Change % point
Household refrigerating appliances	4986.1	4028.1	-30%	1001.9	39%	1549.9	62%	31.1%	21%
Household Washing Machines	4743.8	4641.6	-23%	883.9	-33%	986.1	259%	20.8%	15%
Household Dishwashers	2125.3	2237.9	-12%	520.8	90%	408.2	680%	19.2%	17%
Household Tumble Driers	125.6	179.1	-57%	113.8	-18%	52.5	152%	41.8%	37%
Vacuum Cleaners	1835.3	1128.0	-7%	446.0	6%	924.6	31%	50.4%	7%
Complex set-top boxes	10793.5	5321.8	-138%	6924.3	63%	12395.9	19%	114.8%	44%
Simple set-top boxes	2100.8	360.0	218%	168.0	71%	1908.8	438%	90.9%	5%
Non-directional household lamps	8573.8	7885.1	-11%	2281.2	58%	2320.5	62%	27.1%	15%

Source: Ecofys based on ProdCom database.

Note: Standby and off mode electrical power consumption of household and office equipment are not included as they are not an independent product. Directional lamps, LEDs and related equipment are not included as they are not a product group within ProdCom.

Imports greater than 100% imply that the EU is either building up stocks of the products or importing and then exporting the same product.

Looking at the trends over the 2003 - 2012 period it is possible to observe a few key market trends related to the competitiveness of EU firms in the labelled product groups:

- **The EU is producing less but exporting more in the relevant product markets:**
    - EU production value (EU products sold in the EU or exported) has declined in many product groups in the latest period for which data is available but…
    - EU export value has increased in almost every product group over this period;
- **Imports are growing in almost every sector:**
    - Either by value or share of the EU market, typically by both these measures.

This analysis of market data is inconclusive on the specific competitiveness effects of energy labelling, which is natural given the wide variety of potential causes of any changes. What is clear is that EU firms have a slowly declining competitive position within the EU market itself. This is a result of a wide range of global trends, not least the continuing shift of industry from the developed to developing world, globalisation of trade and increasing offshore production by firms, meaning that more and more products are produced outside of the EU. It has also created an opportunity for EU firms with new consumer classes developing in global markets, leading to growth in exports.

Overall the EU has a positive trade balance in around half of the product markets listed in the table, but a total deficit of over 30 billion euros per year, due primarily to a deficit of over 20 billion euros/year on computers. The overall trade deficit has increased by almost 10 billion euros over the period 2003 - 2012, again driven largely by the computer product group. Changes in trade balances across product groups varied, with 8 of the 21 groups recording an improvement and the other 13 with an increasing trade deficit, so the negative trend is not universal.

There is a large gap in average product value (not shown) between EU products and imported products, with EU products being more expensive in every case, sometimes by a factor of 10 or more, though typically less. This highlights the different market segments and cost structures EU and non-EU firms have, and may also explain some part of the decline in competitiveness.

The direct role of labels within the overall market and competitiveness trends would appear to be negligible. It is unclear if labelling helps EU firms by driving product innovation that can then be sold globally and/or which establishes a reputation for quality and efficiency; or if Labelling imposes a cost burden that negatively impacts global competitiveness.

Indirect benefits will arise to firms through consumers' energy savings increasing their disposable income for other purchases, which is related to the rebound effect, i.e. some part of the energy saving from greater efficiency will be taken to fuel further consumption.

Further indirect benefits to industry were found by Thema et al (2013) who looked at the impacts of EU energy efficiency policies on the EU ETS and industrial competitiveness. They found that energy efficiency policies in general (including both Energy Labelling and Ecodesign) provide benefits which stem from the resulting lower overall energy demand. This leads to a lower need for emissions permits from generators, which has two cost reduction effects, firstly as generators have less costs to pass through to all energy users and secondly, that the cost of emissions permits is reduced, which benefits the part of industry that is also subject to emission trading.

In summary, Energy Labelling can be argued to have a small beneficial impact on wider industry through the indirect benefits of demand reduction.

7.2.5 Market structure

Energy labelling is a market pull mechanism aiming to stretch the boundaries of energy efficiency and increase innovation. The products labelled with the EU energy label often have complicated supply chains involving many tier 1 and tier 2 suppliers. Tier 1 suppliers supply their components, products or services direct to manufacturers, while tier 2 suppliers are a step further removed from the manufacturers, supplying the tier 1 suppliers. Increased focus on energy could potentially lead tier 1 or 2 suppliers that are unable to deliver more energy efficient components receiving less demand for their products.

7.2.6 Choice of products on the market

Energy labelling does not directly restrict the choice of products on the market as the Ecodesign regulations do. Energy labelling gives information to the consumer based on which the consumer can make a better informed purchasing decision. Indirectly this can lead to 'self-restriction' by producers who can discontinue producing products that will be rated in the lowest energy classes.

7.2.7 Unfair competition through non-compliance (free-riders)

There are two ways of non-compliance of products with the EU energy label requirements: 1) missing or incomplete information displayed on the product or 2) wrongly labelled products. Waide (2010) estimates that globally the share of expected energy savings lost because of non-compliance in standards and labelling programmes is in the range of 10-15%. Non-compliance and market surveillance issues are described in more detail in Chapter 2. Here some examples are given to discuss the market effects of non-compliance.

Fraunhofer (2009) performed a survey to determine the compliance with the Energy Labelling Directive, investigating the extent to which products were labelled correctly in all EU Member States, Norway and Iceland. Results showed that 61% of all products were labelled correctly, 28% of the product were mislabelled (incomplete/misplaced/wrong format) and 11% were not labelled at all. High non-compliance rates were found especially for electric ovens and air conditioners. Similar results for missing or incomplete information have been found in more recent market surveys for TVs undertaken by Topten (2013), with an EU average of 21% non-compliance.

Wrongly labelled products are products that are given an energy efficiency score that does not match their actual performance. There is a lack of coherent data on verification and non-compliance of energy labelling practices to accurately assess the extent to which actual performance deviates from the performance as shown on the energy label.

To which extent non-compliant products have a competitive advantage over compliant product is not possible to analyse because of the lack of data. The consumer survey of Fraunhofer (2009) shows that energy consumption is the third most important parameter in consumer purchasing decisions just after product price and product quality. Therefore a missing, incomplete or misplaced energy label could have a significant impact on the purchase decision of a consumer.

7.3 References

- CLASP, 2011b, Cooling benchmarking study, Part 1: mapping component report
- CLASP, 2013c, Estimating potential additional energy savings from upcoming revisions to existing regulations under the Ecodesign and Energy Labelling Directives: a contribution to the evidence base
- CSES, 2012, Evaluation of the Ecodesign Directive, report for DG Energy
- DEFRA, 2009b, Saving energy through better products and appliances: a report on the analysis, aims and indicative standards for energy efficient products 2009-2030
- EC, 2013, ProdCom database
- Fraunhofer, 2009, Survey of Compliance Directive 92/75/EEC (Energy Labelling) - Final Report, Fraunhofer ISI, GfK Marketing Services, BSR Sustainability, Karlsruhe, January 2009
- Salmons et al, 2011, Impacts of innovation on the regulatory costs of energy-using product policy, report for DEFRA [UK]
- Johannes Thema, Felix Suerkemper, Katharina Grave, Adrian Amelung, 2013, The impact of electricity demand reduction policies on the EU ETS: Modelling electricity and carbon prices and the effect on industrial competitiveness, Energy Policy 60 (2013) 656-666 2013TopTen, 2013, European TV market 2007-2012: Energy efficiency before and during the implementation of the Ecodesign and Energy Labelling regulations, Annete Michel, Sophie Attali, Eric Bush
- Vlehan, 2013, Jaaroverzicht 2012
- Waide, 2010, How much energy could we save through compliance?
- Weiss M, Junginger M, Patel MK, Blok K (2010) A review of experience curve analyses for energy demand technologies. Technological Forecasting & Social Change 77: 411–428

8 Objectives of Ecodesign implementing measures

8.1 Introduction

The two main objectives of the Ecodesign Directive are to:

- Ensure the free movement of energy-related products within the EU;
- Improve the overall environmental performance of these products and thereby protect the environment.

Achieving these objectives will contribute to the security of energy supply. In achieving these objectives, care should be taken that

- The competitiveness of the EU economy is not harmed;
- Interests of industry, consumers, and other stakeholders are preserved.

In this chapter the focus is not on the Directive itself, but on the implementing measures that have been finalised to date, with specific objectives per measure formulated in order to achieve overall Ecodesign objectives. To date, 16 product groups have been regulated. Four more groups are in the final stages of the regulation process (incl. heaters, water heaters, not shown in the table below, vacuum cleaners, pc's and servers) and for two product groups Voluntary Agreements have been endorsed.
An overview table of product groups and their expected savings according to the outcome of the EC regulation process is shown in Table 17 (source: EC). The savings are compared to earlier estimated savings by Irrek (2010).

It should be noted that the study by Irrek (2010) was conducted when only a very limited amount of implementing measures was finalised. However, the study is interesting because it examined the interrelationship between product groups savings, taking out overlaps (e.g. motors present in other product groups), and accounting for a rebound effect. Therefore, it serves to put the EC numbers in perspective. In case a range of savings (min – max) is given for the Irrek (2010) numbers the measure was not implemented yet at the time of the report.

It was observed that often project 2020 savings are mentioned in the final regulation itself. However, in several cases this was not found. In such cases one has to resort to the Impact Assessment. This can be a problem if it is not clear which of the options examined have finally been chosen.

Table 17 Projected annual electricity savings by 2020 [TWh] for regulated product groups (sources: EC, preparatory studies, Impact Assessments), savings by Irrek (2010), electricity consumption in the starting year and 2020, % savings for Ecodesign and BAT (Best Available Technology). For groups in italics energy labelling also applies, savings in this case are combined Ecodesign and Energy Labelling savings.

Product group	EC projected savings 2020 (TWh)	Electricity savings (Irrek2010) -min	Electricity savings (Irrek 2010) - max	Energy consumption starting year (TWh)	BAU consump-tion 2020 (TWh)	Ecodesign savings (%)	BAT savings (%)
Electric motors, Lot 11	135	83.4	83.4	1067	1252	10.8%	52.5%
Domestic lighting (non-directional), Lot 19	*39*	*25.6*	*31.7*	*112*	*134.7*	*29.0%*	*35.3%*
Televisions, Lot 5	*28*	*22.3*	*22.3*	*60*	*132*		
Tertiary Lighting, Lot 8-9	*38*	*32.1*	*32.1*	*200*	*260*	*14.6%*	*19.2%*
Standby and off-mode losses, Lot 6[28]	36	27.9	27.9	54	90	40%	
Ventilation fans, Lot 11	34	34.7	47.7	390	629	5.4%	8.7%
Directional lighting, Lot 19-part2	*25*	*78.9*	*81.5*				
Circulators in buildings, Lot 11	23	18.2	18.3	50	55	41.6%	51.5%
Vacuum cleaners, Lot 17	19	25.1	25.1	18	34		
Imaging equipment, Lot 4	15	2.3	2.3	45.1	51.9	28.9%	-
PCs and servers, Lot 3	12.5 to 16.3	5.5	7.6	53.1	96		
Room air conditioning appliances, Lot 10	*11*	*10.1*	*24.7*	*30*	*74*		
External power supplies	9	7.2	7.2	17	31		
Simple set-top boxes, Lot 18a	9	7.2	7.2	6	1	-	-
Complex set-top boxes, Lot 18	6.5	2.6	4.6	6	10	65.0%	120.0%
Domestic refrigerators and freezers, Lot 13	*6*	*3.6*	*3.6*	*122*	*83*	*7.2%*	*16.9%*
Laundry driers, Lot 16	*3.3*	*0.3*	*1.3*	*20.7*	*31.3*	*10.5%*	*16.0%*
Electric pumps, Lot 11	3.3	2.3	5.2	109	136		
Domestic dishwashers, Lot 14	2	*combined with washing machines*		*26*	*33.7*	*5.9%*	*15.0%*

[28] Including networked standby

Product group	EC projected savings 2020 (TWh)	Electricity savings (Irrek2010) -min	Electricity savings (Irrek 2010) - max	Energy consumption starting year (TWh)	BAU consump-tion 2020 (TWh)	Ecodesign savings (%)	BAT savings (%)
Domestic washing machines, Lot 14	*1.2*	*15.1*	*15.1*	*35*	*37.7*	*3.2%*	*14.0%*

In addition to the product groups that concern mainly electricity savings 2 measures were adopted recently that involve savings from various energy carriers and are expressed in primary energy. These are given in the table below. For comparison: the measure with the largest electricity savings (motors) represent primary energy savings of 486 PJ.

Table 18 Projected annual electricity savings by 2020 [TWh] for regulated product groups (sources: EC, Regulations)

PRODUCT GROUP	EC projected 2020 savings/yr (PJ_{prim})	Energy consumption starting year (PJ_{prim})	BAU consumption 2020 (PJ_{prim})	Ecodesign savings (%)
Space and combination heaters (lot 1)	1900	12089	10688	18%
Water heaters and hot water storage tanks (lot 2)	450	2156	2243	20%

For most of the product groups in Table 18 as well as for heaters and water heaters the available literature was examined in order to find answers to the questions posed for this topic. A few measures for which the regulation is final but that have not gone into effect yet (e.g. laundry dryers) have not been discussed.

The level of detail with which energy savings in different product groups can be estimated below depends on:

- The amount of time that the implementing measure has been in place. Of measures recently adopted or in the final stages of the regulation process only evidence on the level of ambition has been gathered;
- The availability of suitable sources of information, especially considering evidence of effects after the measure had entered into force;
- The importance of the product group for achieving the overall savings

With the evidence found each of the product groups are discussed in the next sections. After that, an overview of product group findings is given.

8.2 Electric motors

8.2.1 Introduction

Product sector, consumption, significance

Electric motors systems are the single largest electrical end-use and are responsible for around 40% of all global electricity consumption. In the European Union (EU), electric motor systems are by far the most important type of load in industry, using about 70% of the consumed electricity. In the tertiary sector, although not so relevant, electric motor systems use about one third of the consumed electricity. It is their wide use that makes electric motors particularly attractive for the application of efficiency improvements.

The recognition of motors as a major electricity consumer has led to a series of successful SAVE studies showing the energy saving potential for these products. The recent EuP study on motors

(Lot 11: Electric motors 2008) highlighted the importance of introducing Minimum Efficiency Performance Standards (MEPS) relating to these products in Europe.

8.2.2 Policy context

Regulation date and scope

The importance of motors as a major consumer of electricity in industry and commerce has been recognised for a long time, and almost all the major economies have some kind of voluntary or mandatory regulatory scheme regarding motor efficiency. Most of these economies have mandatory minimum efficiency levels for motors sold in the respective countries and labelling schemes for the promotion of higher efficiency motors.
Until recently, several different energy efficiency levels/classes were in use around the world, increasing potential confusion and creating market barriers.
With the purpose of harmonising the different energy efficiency classification schemes for induction motors in use around the world, the International Electrotechnical Commission (IEC) introduced, in 2008, a new classification standard – IEC60034-30. The standard defines three levels of energy efficiency:

- IE3 – Premium efficiency (equivalent to NEMA Premium)
- IE2 – High efficiency (equivalent to EPAct/EFF1)
- IE1 – Standard efficiency (equivalent to EFF2)

A fourth level, IE4 – Super Premium efficiency, is also introduced but not defined, since there is no sufficient market and technological information available to allow standardization. The next revision of the standard will incorporate this efficiency level.

Table 19 Overview of Minimum Energy Performance Standards (MEPS) Worldwide (LOT 30 2013[29])

Efficiency Levels	Efficiency Classes	Testing Standard	Performance Standard
	IEC 60034-30	IEC 60034-2-1	MEPS
Premium Efficiency	IE3	Low Uncertainty	USA Europe 2015* (>7,5kW), 2017 Canada Korea 2015
High Efficiency	IE2		USA Mexico Canada Australia New Zealand Brazil Korea China Europe Switzerland
Standard Efficiency	IE1	Medium Uncertainty	China Brazil Costa Rica Israel Taiwan Switzerland

* IE3 or IE2 + VSD

North America (USA, Canada and Mexico) has been the leading region in promoting both high-efficiency and Premium-efficiency motors around the world.

In 1992, the US Congress approved the Energy Policy Act (EPAct), which set minimum efficiency requirements (similar to IE2) for motors manufactured or imported for sale in the USA. These mandatory standards became effective in October 1997.

Meanwhile, many utilities and industry associations were promoting motors with a higher efficiency than EPAct mandatory levels. Therefore the National Electrical Manufacturers Association (NEMA) felt a need to define a classification scheme for premium higher efficiency motors. In June 2001, NEMA granted such "better-than-EPAct" motors special recognition by creating a label designated NEMA Premium.

In order to further improve the market penetration of Premium Efficiency motors, the US Congress approved Energy Independence and Security Act of 2007 (EISA), which was enforced in December 2010. It not only sets higher minimum efficiency mandatory levels but also broadens the scope of existing standards to include some motor types that were previously excluded. With the adoption of these new requirements, the sales of premium efficiency motors (IE3) are expected to exceed 70% by 2013 (Boteler, 2008).

European Union

In 1998 a voluntary agreement supported by the European Committee of Manufacturers of Electrical Machines and Power Electronics (CEMEP) and the European Commission was established

[29] http://www.eco-motors-drives.eu/Eco/Documents_files/EuP-LOT-30-Task-1-May-2013.pdf

and signed by 36 motor manufacturers, representing 80% of the European production of standard motors. In this agreement three motor efficiency levels were defined as:

1. EFF1 (similar to IE2).
2. EFF2 (similar to IE1).
3. EFF3 (below standard).

Based on this classification scheme there was a voluntary undertaking by motor manufacturers to reduce the sale of motors with EFF3 efficiency levels (standard efficiency).
The CEMEP/EU agreement was a very important first step to promote motor efficiency classification and labelling, achieving a significant market transformation. Low efficiency motors were essentially removed from the EU motor market which, at the time, was a positive development. However, the penetration of high and premium efficiency motors in 2009 was still very modest.

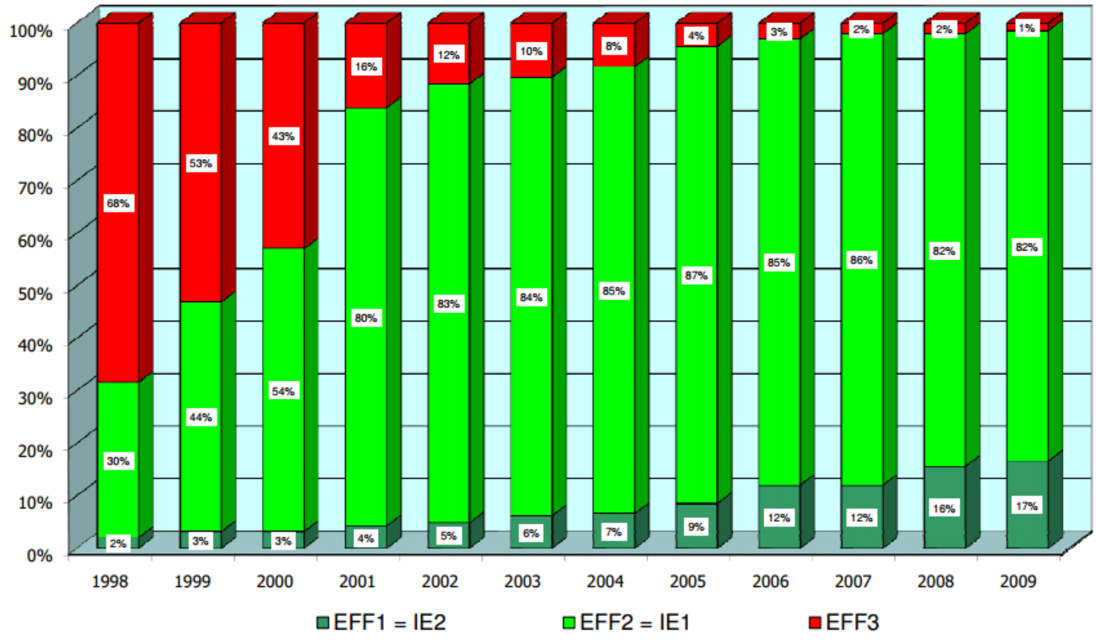


Figure 5 Total EU motor sales since the start of the CEMEP/EU Voluntary Agreement in 1998 (de Almeida, Fonseca, Ferreira, & Fong, 2008)[30]

ED measures and timing
With the aim of improving the penetration of high-efficiency electric motors in the European market, the European Commission started developing mandatory efficiency requirements for motors sold within the European Union. At the time, the EU was one of the only major economies which had not enforced regulation regarding motor efficiency. Efficiency levels were based on the IEC60034-30 classification standard.
Minimum efficiency requirements were set in Commission Regulation (EC) No 640/2009 (European Comission, 2009), as follows:

1. From 16 June 2011, motors shall not be less efficient than the IE2 efficiency level.

[30] http://www.cemep.org/index.php?id=21

2. From 1 January 2015, motors with a rated output of 7.5-375 kW shall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level and be equipped with a variable speed drive.
3. From 1 January 2017, all motors with a rated output of 0.75-375 kW shall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level and be equipped with a variable speed drive.

These requirements apply to 2-, 4- and 6-pole, single speed, Three-Phase, and induction motors in the above mentioned power ranges, rated up to 1000V. and on the basis of continuous duty operation. The following types of motor are excluded:

- Motors designed to operate wholly immersed in a liquid;
- Motors completely integrated into a product (e.g. pump or fan) where the motor's energy performance cannot be tested independently from the product;
- Motors specifically designed to operate:
  - At altitudes exceeding 1000 meters
  - Where ambient air temperatures exceed 40°C;
  - In maximum operating temperatures above 400°C;

Where ambient air temperatures are less than –15°C (any motor) or less than 0°C (air-cooled motors);

  - Where the water coolant temperature at the inlet to a product is less than 5°C or exceeds 25°C;
  - In potentially explosive atmospheres as defined in Directive 94/9/EC;
- Brake motors.

Since then, and to avoid loopholes created by the definition of operating conditions, an amendment to the regulation was proposed by the EC. The amendment will change the operating conditions to 60ºC (ambient air temperature) and 4000 m (altitude) for motors included in the regulation.
A new preparatory study (Lot 30: Special motors, 2012) is being carried out to evaluate the possibility of extending the scope of the Regulation to motors outside the current power range and to technologies other than induction motors. Electronic controllers, such as VSDs and soft-starters are also subject of the study.

8.2.3 Achievement of objectives

Ambition of measure in terms of scope
For the year 2010, the preparatory study (Lot 11: Motors) estimated that an installed base of 110 million motors exists in Europe, leading to an electricity consumption of 1119 TWh in the EU27, and corresponding to electricity costs of 97.2 billion Euro, and 513 Mt of CO_2 emissions.
The impact assessment (Lot 11: Electric motors 2008) added a regulatory option, which was not considered in the preparatory study, to tackle the high potential savings of variable speed control, especially in centrifugal load applications. This scenario gives the user the option of buying an IE3 motor or an IE2 motor equipped with a Variable Speed Drive (VSD) and was later adopted by the regulation. The potential savings of implementing measures were estimated at 135 TWh in the impact assessment.

Saving estimations: comparison with IA
Irrek et al., 2010 considered the identified potential savings in the Impact Assessment to be overestimated due to overlap with other measures (pumps, fans, compressors), corrections to the BAU scenario electricity consumption evolution, and to rebound effects. The study estimated the savings at 83.4 TWh per year in 2020. However, the impact assessment had already considered an overlap of around 30% between the motor measure and other measures.

Because the savings achievable by the use of VSDs are very large they contributed the most to the calculated potential savings in the Impact Assessment report. Estimated savings of 135TWh compare to only 18 TWh resulting from improving the efficiency of the motor.

However, expectations regarding market introduction of VSDs diverge. The impact assessment estimated that two thirds of the total motors sold would be equipped with a VSD after the regulation was enforced. However, motor manufacturers (CEMEP) expect that only between 30% - 40% of users will prefer buying an IE2 motor equipped with a VSD instead of an IE3 motor alone. Therefore, it is not yet clear if the objectives of the implementing measures will be achieved because of the uncertainty in the effective market penetration of VSDs after 2015.

8.3 Domestic lighting

8.3.1 Introduction

Product sector, consumption, significance
Preparatory study (LOT19: Domestic Lighting) (2009) outlines a 'domestic lighting' product system according to standard EN 12665, which defines a “lamp” as a “source made in order to produce an optical radiation, usually visible” and a ”luminaire” as an “apparatus which distributes, filters or transforms the light transmitted from one or more lamps”.

Lighting is the third main consumer of electricity following heating and cold appliances, and represents around 10% of the residential electricity consumption. The impact assessment estimated the electricity consumption of domestic lighting to be around 112 TWh in 2007, with 2.9 tons of mercury emission. In absence of new or amended policies estimated consumption by 2020 would be 135 TWh.

8.3.2 Policy context

Regulation date and scope
Ecodesign requirements for non-directional domestic lamps were introduced in Commission Regulation (EC) No 244/2009 implementing Directive 2005/32/EC of the European Parliament and of the Council. It entered into force on 13 April 2009.

The focus of this regulation has been on Non Directional Lighting Sources (NDLS) that are most commonly used in the domestic market and cover incandescent lamps, halogen lamps, CFLs (Compact Fluorescent Lamps) with integrated ballast, and white LED (Light Emitting Diode) lamps with integrated power supply. The regulation introduces the phasing out of incandescent bulbs and puts functionality requirements on remaining lamps.

ED measures and timing:
The enforcement of the Ecodesign measures includes several stages. Some of the requirements are:

- Sept 2009: Frosted and clear 100 watt incandescent bulbs are phased out.
- Sept 2010: Clear 75 watt incandescent bulbs are phased out.
- Sept 2011: Clear 60 watt incandescent bulbs are phased out.
- Sept 2012: Clear 40 and 25 watt incandescent bulbs are phased out.
- Sept 2013: Stricter requirements for compact fluorescent lamps and LED lamps.
- Sept 2016: Stricter requirements for halogen lamps.

The Ecodesign measures are based on the Energy Efficiency Index (EEI). EEI is calculated as the ratio of the rated power measured at nominal input voltage corrected by certain correction factors as specified in the regulation divided by a reference rated power at nominal input voltage (Bertoldi et al., 2012).

The regulation also includes mandatory requirements to indicate mercury content on CFL packaging and reference to a website with information on procedures in case of accidental breaking. It also includes functionality requirements such as:

- Lamp survival factor (lifetime in hours);
- Lumen maintenance, which is the ratio of the luminous flux emitted by the lamp at a given time in its life to the initial (100 hour) luminous flux;
- Number of switching cycles before failure;
- Starting time;
- Lamp warm-up time;
- Color rendering;
- Lamp power factor.

Article 7 of the regulation stipulates that the Regulation shall be reviewed in light of technological progress no later than five years after entry into force. The result of this review shall be presented to the Consultation Forum.

Stage 6 requirements of the regulation are set to enter into force in September 2016. The Stage 6 requirements bring stringent efficiency requirements for clear lamps and would, with some exceptions, phase out many halogen light bulbs. However, it is not the intention of the regulation to phase out halogen lamps as this product group is a popular replacement of the incandescent lamps. Therefore, the Commission is currently reviewing the Stage 6 requirements before the predetermined review date 13 April 2014 to explicitly deal with the appropriateness of the Stage 6 measure. The review study on the Stage 6 requirements of Commission Regulation (EC) No 244/2009 is looking into at least two scenarios: keeping the stage 6 requirements in force or abolishing the stage 6 requirements. In particular, it investigates impacts on market and economy, employment, environment and health, as well as possible replacement technologies. Concerning the environmental impact, the draft report of the review study (LOT 19 Review Study on the Stage 6 requirements of EC No 244/2009) concludes that if the Stage 6 requirements are abolished, 5-7 TWh of annual energy savings would not be realized by 2020.

In addition to the efficiency requirements, requirements have been set on minimum lifetime, power factor (thereby generating additional savings) and performance (thereby avoiding significant impact on the functionality from the user's point of view, as the Ecodesign Directive requires).

8.3.3 Achievement of objectives

Ambition
Fluorescent light bulbs have been identified as the technology with the lowest life cycle costs as well as the Best Available Technology at the time of the preparatory study and the Impact Assessment.

Therefore, if the ambition of the measure would be strictly checked against the banning of the market of all products with higher life cycle costs than the product with the lowest life cycle cost, it would have to be rated as lacking in ambition. However, this would ignore the fact that with the banning of incandescent lamps a big step has been made.

Scope
The scope of coverage for non-directional domestic lamps includes incandescent, halogen, compact fluorescent (CFL) and light-emitting diode (LED) lamps. CLASP (2013 c) states that the exemptions identified in Article 1 of the ecodesign regulation still appear to be appropriate, particularly as many of these lamps such as fluorescent lamps and high intensity discharge (HID) lamps are covered under other regulatory measures. In an additional remark, CLASP (2013 c) mentions the attempts to promote incandescent lamps as space heating appliances, and to promote sales of incandescent lamps intended for industrial applications to the household market. It is possible that this issue may raise issues of scope and definitions in the implementing measure.

Market changes due to regulations
In general, there is a market transition in the EU for lighting products where products divert from inefficient lighting to energy-efficient, lower life-cycle cost alternatives. Since September 2009, due to the gradually increasing requirements of the regulation, inefficient incandescent technologies are being removed from the market. In parallel the halogen and CFLs increase their market share. In terms of performance improvement, the halogen lamps, CFLs and lastly LEDs present different levels of technological potential (CLASP, 2013 c).

Table 20 presents Europroms data of lamp shipments, which takes the European production, adds imports and deducts exports. These values are representative of the net shipments to the EU-27 during the time period shown. It is important to note the 50% decline in incandescent lamps (with code 3150 1300) between 2007 and 2011.
CLASP (2013 c) provides a projection for market sales and stock for non-directional domestic lighting in response to the various stages of regulation EC No 244/2009. The study estimates that in 2012, approximately 60% of the incandescent market will shift to halogen and 40% will use CFL, with just 2% switching to LED. Thus, in general, the model assumes that halogen lamps tend to be the first choice of consumers in response to the regulation, followed by CFL and LED. However, this is expected to change over time as LED technology evolves and prices are reduced. Sales of LED retrofit lamps are expected to surpass CFLs in 2016, driven in part by their superior performance (i.e., energy label class A+ and eventually A++), and their low environmental impact.

Table 20: Europroms Data of Lamp Shipments to EU-27 Market (CLASP, 2013 c)

	Tungsten halogen filament lamps (> 100V; excluding ultraviolet & infra-red lamps, for motorcycles and motor vehicles)	Tungsten halogen filament lamps (<= 100V; excluding ultraviolet & infrared lamps, for motorcycles and motor vehicles)	Filament lamps (=< 200W and >100V including reflector lamps excluding ultraviolet and infrared lamps, tungsten halogen filament lamps - sealed beam lamp units	Fluorescent hot cathode discharge lamps (excluding ultraviolet lamps, with double ended cap)
Europrom code	**3150 1293**	**3150 1295**	**3150 1300**	**3150 1530**
2007	316,962,882	336,267,402	1,249,624,271	626,794,478
2008	305,165,578	283,925,388	1,002,973,419	687,213,940
2009	253,324,976	278,684,530	946,708,491	694,851,823
2010	373,093,981	437,569,916	839,454,245	548,527,265
2011	455,305,429	397,355,253	524,834,077	456,632,274

Saving estimations: comparison with IA

The preparatory study (LOT19: Domestic Lighting) (2009) provided a baseline scenario building on the technical, environmental and economic analysis, for estimating the future evolution of the environmental impact related to incandescent lamps, halogens and CFLs. This study showed that even without any legislation, as the natural expansion of both CFLs and halogens is assumed to replace incandescent lamps, the market share of the latter was likely to fall significantly until 2011, and more slowly between 2011 and 2020. Compared to 2006, about 25% of the incandescent lamps are predicted to be replaced by some other (most often more efficient) lamp technology. In the Business-as-Usual scenario of the preparatory study the total electricity consumption would increase despite the slow replacement of incandescent lamps with more efficient lamps (CFLi and HL-MV-LW (halogen lamp, mains voltage, low wattage) due to the increasing use of lamps. Thus, in 2020, the electricity consumption (during the use phase) for the baseline scenario would reach a level of 134.7 TWh due to the use of these six lamp types whatever the sector. The regulation is expected to increase the market penetration of energy efficient products leading to estimated energy savings of 39 TWh in 2020.

CLASP (2013 c) has developed a market forecast which takes into account the existing ecodesign regulation and the two new labelling categories that were adopted in December 2012. It should be noted that the CLASP scenario does not consider the potential impacts of any new regulatory measures. Figure 6 presents the projection of non-directional lamp sales under current regulation. It is projected that with a rapid decline the incandescent lamp shipment drops down to zero in 2021. Halogen is the more popular replacement for incandescent, but it starts to decline around 2015 and trends downward in response to Stage 6 in September 2016, which requires halogen lamps to achieve energy label B rating. CFLs peak in 2012 and then decline as the most suitable sockets for CFLs will then have long-life CFLs installed. Additionally it is expected that consumers will not to fully embrace the CFL technology due to their warm-up time, mercury content and other issues. Therefore, LEDs start to gain market-share, surpassing CFLs on a unit basis in 2015 and halogens in 2017. It should be noted that LEDs have a very long service life. Therefore, once LEDs are installed the socket is not available for replacement in the domestic setting for approximately 20 years. Consequently it is expected that will lead to a peak in LED replacement lamp sales around 2020 and a gradual decline and levelling off by 2030 at around 200 million LED lamp sales per annum.

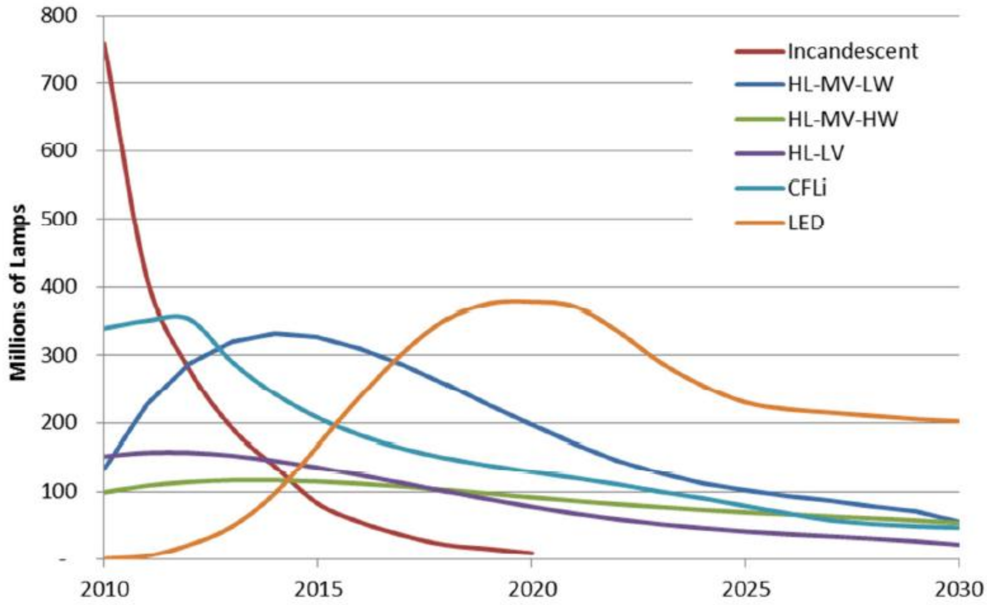


Figure 6: Projected Non-Directional Lamp Sales in EU-27 Countries (CLASP,2013 c)

Based on the projected sales CLASP (2013 c) provides the results of the stock model across the EU-27. It is said that although the volume in shipments of incandescent lamps is high in 2010, due to the short service life of incandescent lamps the relative proportion of stock is actually quite low. Lamps that have a longer service life such as CFLi and LED lamps occupy the sockets in the stock model for longer periods of time. CFLs have the largest share (44%) of the sockets in 2010, closely followed by halogen lamps. By 2020, LEDs dominate the installed stock and constitute 80% of the sockets by 2030.

Table 21: Projected Non-Directional Lamp Stock in EU-27 Countries (millions) (CLASP, 2013 c)

Year	2010	2015	2020	2025	2030
Incandescent	1,017	148	16	0.0	0.0
HL-MV-LW	435	1118	935	484	282
HL-MV-HW	338	427	378	288	224
HL-LV	650	663	459	248	139
CFLi	1,937	1,883	1,149	707	412
LED	0.7	341	1,991	3,475	4,500
Total	4,377	4,580	4,928	5,202	5,556

Note: HL-MV-LW: halogon lamp mains-voltage low wattage lamps, HL-MV-HW: halogen lamp mains-voltage high wattage, HL-LV: halogen lamp low-voltage (non-directional), CFLi integrally ballasted compact flourescent lamp.

CLASP (2013) provides the energy consumption and energy savings estimates associated with the EC No 244/2009 regulation based on the wattages and the average annual operating hours associated with the various technologies. Study shows *"the resulting energy consumption for non-directional lighting is calculated as 111.9 TWh in 2010 for the EU-27. This number aligns well with the estimate in the Preparatory Study, which calculated that the energy consumption of non-directional lamps used in all sectors (i.e., not only the domestic sector) was approximately 112.5 TWh in 2007.*
At that time, 112.5 TWh represented approximately 4% of EU27 total electricity consumption."
Table 22 presents the estimated energy consumption for non-directional lighting sources in Europe by CLASP study.

Table 22: Energy Consumption for Non-Directional Lamp Stock, EU-27 (CLASP,2013 c)

EU-27 projection	2010 (TWh/yr)	2015 (TWh/yr)	2020 (TWh/yr)	2025 (TWh/yr)	2030 (TWh/yr)
Stock annual consumption, BAU	111.9	106.8	89.1	81.5	79.6

Thus, the results of the CLASP study indicate that in 2020 already a substantial decrease (46 TWh) in energy consumption can be achieved with existing ecodesign regulation.

8.4 Televisions

8.4.1 Introduction

Product sector, consumption, significance

The chief functionality a television provides to a user is to receive and reproduce picture and sound of a TV-broadcast or video signal in a certain quality (e.g. standard resolution and color) over a period of time (e.g. 60.000 hours display lifetime). As regards this main function, an important technical feature is the display. The TV-display is of great economic importance in the television business. According to the preparatory study (LOT5: Televisions, 2007), picture size and quality are the primary sales features despite the price, which in turn indicates the primary user benefit of a television set. Technology is mostly a secondary sales aspect except regarding the form and weight feature (e.g. Flat Panel versus Cubic), and particular quality issues such as maximum luminance, highest colour reproduction and response time.
Televisions are characterized by rapid technological and market change, including the development of new types of televisions. The formerly dominating Traditional CRT (Cathode Ray Tube) televisions completely disappeared and were replaced by flat panel televisions, including mainly LCD (Liquid Crystal Display) and also Plasma televisions. This development was to a large extent drawn by the change from analogue to digital TV broadcasting, the trend to high resolution displays, and went hand in hand with a trend to larger screens. LED backlight LCD is dominating the market. Current driving forces to market development are trend towards internet connectivity, 3D or ultra-high definition TVs. It is expected that in the mid-term OLED (Organic Light Emitting Diode) will start the next fundamental market change (Michel et al. 2013).

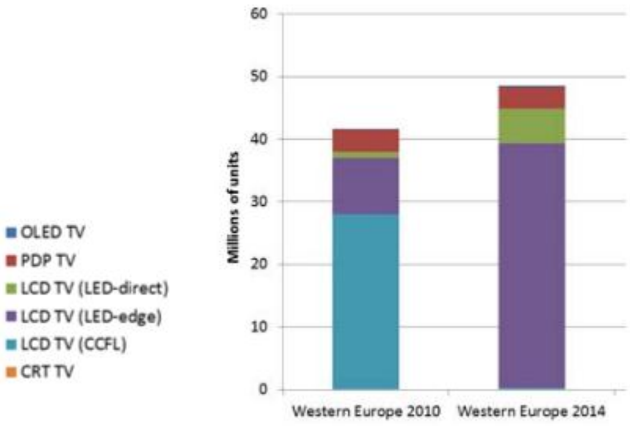


Figure 7: Units sold of the different types of TV (DisplaySearch, 2011)

Energy consumption among TV models varies significantly. According to the preparatory study the power consumption of medium size TVs up to 84 cm (33 inch) lies in a range between 100 and 200 Watts; large-size TVs feature an increasingly wider spectrum of power consumption with maximum values ranging from 200 to 400 Watts for 107 cm (42 inch) display size and very large TVs of 165 cm (65 inch) have power consumption in on-mode of 550 to 700 Watts as shown in Figure 8 (LOT5: Televisions, 2007).

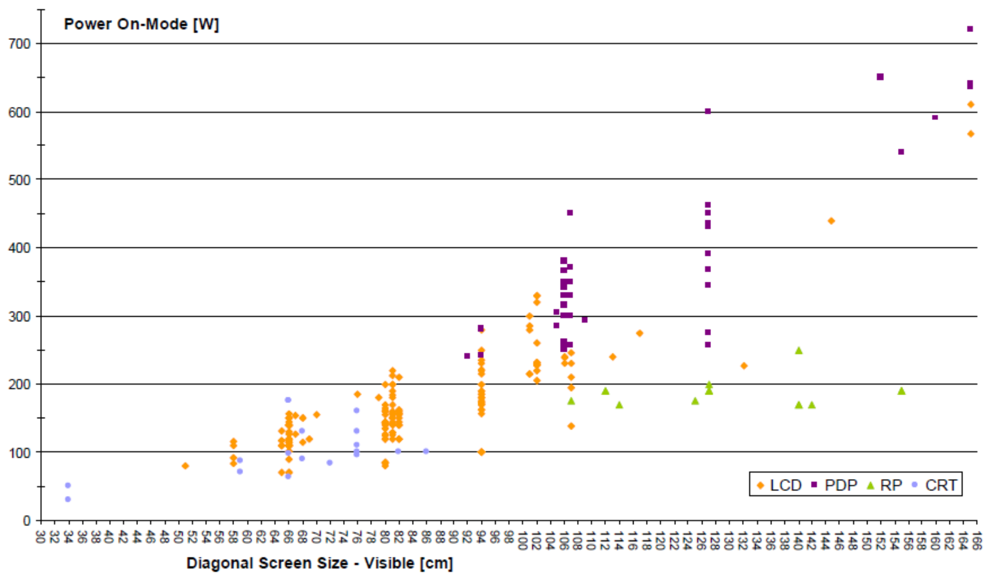


Figure 8: TV power consumption by screen size (LOT5: Televisions, 2007).

The preparatory study predicted that the total stock of televisions would increase from 35 million units sold annually with a total of 303 million sets in 2005 to 47 million units sold annually with an accumulated total of 429 million television sets in households in 2020. Accumulated electricity savings for the period 2005 - 2020 are estimated at 83 TWh, generating accumulated electricity cost savings of € 12.5 billion.

Despite Ecodesign requirements and energy labelling being adopted to increase energy efficiency of televisions, a significant growth in energy consumption was expected. Without Ecodesign requirements, energy consumption was expected to reach 132 TWh in 2020. With Ecodesign requirements, growth in energy consumption was expected to be limited to 104 TWh in 2020 (28 TWh reduction). An important consideration related to the effects of the Ecodesign requirements for TV sets concerns the role of LED-based technology. At the time when the preparatory study and the impact assessment were carried out, LED-backlit LCD televisions were considered to be a niche market. Since then, the rapid development and uptake of this technology has led to an improved energy efficiency not anticipated by the impact assessment (CSES 2012; Michel et al. 2013).

8.4.2 Policy context

Regulation date and scope
Televisions were identified as a candidate for eco-design measures in the 2005 Ecodesign Directive and the preparatory study was completed in August 2007. The draft regulation was first discussed at the consultation forum in October 2008 and the Implementing Measure for televisions was adopted in July 2009 under Commission Regulation EC/642/2009.

ED measures and timing
The ecodesign regulation sets minimum energy performance requirements for televisions with different levels for Full HD resolution and all other resolutions:

- Starting on 20 August 2010, the on-mode power consumption of a television with visible screen area A (expressed in square decimetres, dm^2) shall not exceed the levels shown as Tier 1.
- Starting on 1 April 2012, the on-mode power consumption shall not exceed the levels shown as Tier 2 in Table 23 (CSES 2012; CF paper TV's and displays, 2012).

Table 23: Television Ecodesign on-mode power requirements from Regulation 642/2009 (CF paper TVs and displays, 2012)

<table>
<tr><th>Regulatory Tier</th><th>Product</th><th>Full HD resolution</th><th>All other resolutions</th></tr>
<tr><td rowspan="2">Tier 1
(20 Aug 2010)</td><td>Television sets</td><td>20 Watts+A×1.12 ×4.3224 Watts/dm²</td><td>20 Watts+A×4.3224 Watts/dm²</td></tr>
<tr><td>Television monitors</td><td>15 Watts+A ×1.12 ×4.3224 Watts/dm²</td><td>15 Watts+A×4.3224 Watts/dm²</td></tr>
<tr><td rowspan="2">Tier 2
(1 Apr 2012)</td><td>Television sets</td><td colspan="2">16 Watts+A×3,4579 Watts/dm²</td></tr>
<tr><td>Television monitors</td><td colspan="2">12 Watts+A×3,4579 Watts/dm²</td></tr>
</table>

8.4.3 Achievement of objectives

Market changes due to regulations
Total energy consumption related to televisions is being affected by a number of parameters, which include:

- The growing number of televisions in EU households (higher penetration rates);
- The increasing viewing time per day;
- The increasing average size of TV screens;

- The introduction of new and more energy efficient types of televisions.

The annual sales of televisions in the EU24[31] grew from 34.7 million in 2006 to 56.0 million in 2010 (Michel et al. 2013).

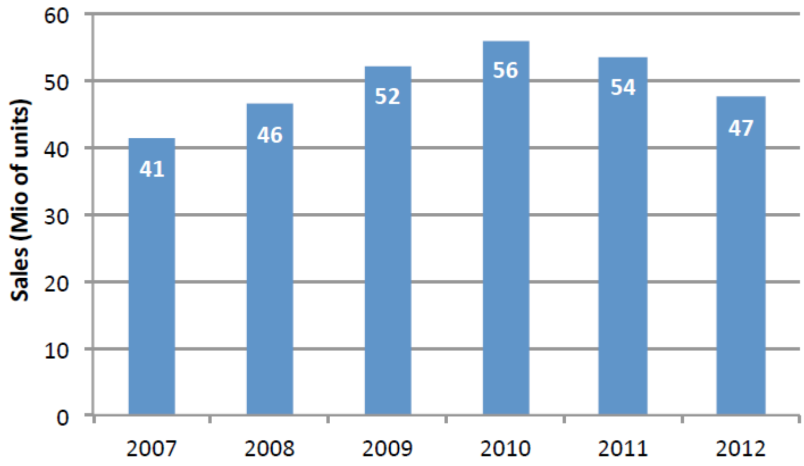


Figure 9: Total annual TV sales in the EU24 (Michel et al. 2013).

The developments in the market have been quite different from what was expected in the preparatory study. CRT televisions were expected to retain a share of around 15% in 2010. However, new types of televisions, especially LED-backlit LCD televisions but also regular LCD televisions and, less so, plasma televisions - all more energy efficient than CRT televisions – already cover 100% of the market at the moment. Similarly, while the preparatory study expected annual television sales in Europe to be around 36.5 million in 2010, it far exceeded it, reaching at total 56 million.

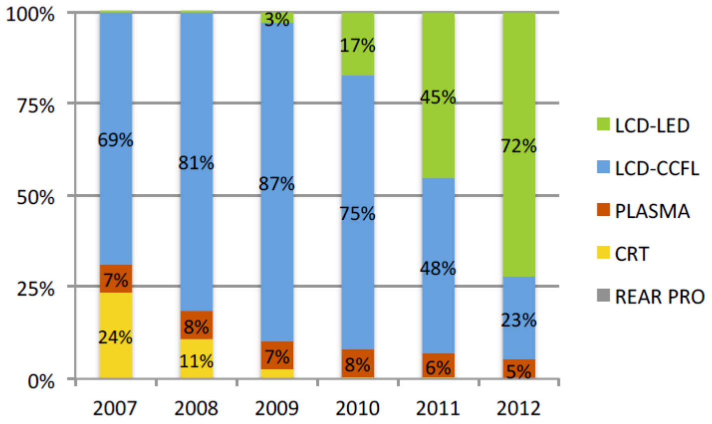


Figure 10: Sales shares of different TV technologies in the EU24 (Michel et al. 2013).

In addition to higher unit sales, the average display size increased as well, as shown in the diagram below. Between 2007 and 2012 the sales generally shifted to larger screen sizes.

---

[31] EU-24 includes Germany,Denmark, United Kingdom, Itlay, Poland, Spain, Austria, Belgium, Bulgaria, Estonia, Finland, France, Greece, Hungary, Ireland, Latvia, Lithuania, Netherlands, Portugal, Czech Republic, Romania, Slovakia, Slovenia and Sweden.

Figure 11 shows a constant decrease of the sales proportion of small TVs (screen diagonal <30''), and a constant increase for the two largest size categories (screen diagonal between 40 and 50'' and 50 to 60''). Especially TVs between 40 and 50'' became increasingly popular (15% to 31%), mainly because of LCD displays have light weight and a narrow floor footprint which make them easy to place in most domestic lounges in comparison with the most popular CRT primary TV of 28 to 32 inch display size, which required a similar wall area but have a much larger footprint (CSES, 2012; Michel et al. 2013).

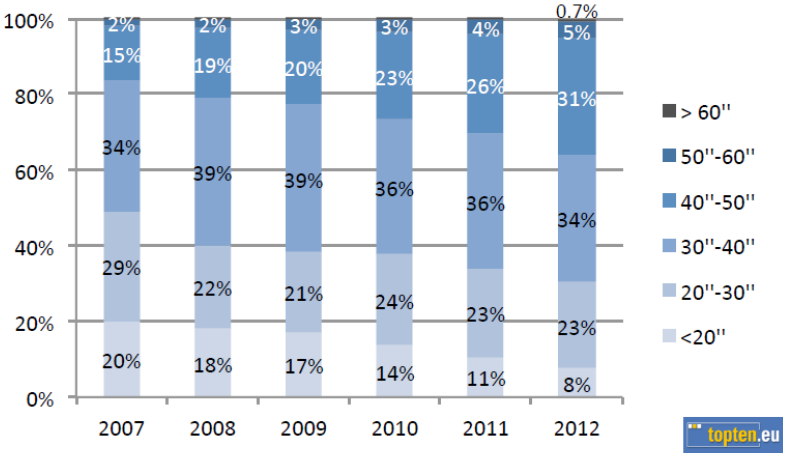


Figure 11: TV sales in the EU24: percentage of different screen size categories. Sales of Cathode Ray Tube televisions are not completely included. (Michel et al. 2013)

A trend of increasing average screen size would tend to increase energy consumption, but, the technological improvements more than off-set the increased size, with a noticeable decline in average energy consumption per unit television starting in 2008. This trend is shown in Figure below, which presents the sales-weighted average energy consumption of televisions sold in Europe based on a measurement method of 4 hours of on-mode and 20 hours of stand-by per device per day.

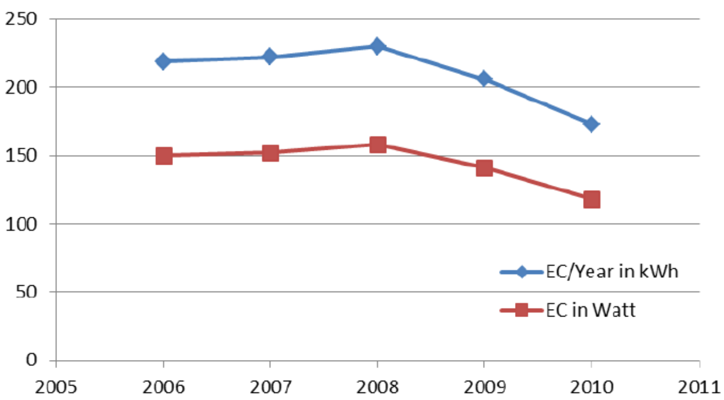


Figure 12: Average energy consumption per television in EU, 2006 – 2010 (Heyder, 2011)

Furthermore, for the first time in 2010 there was a decrease in the total energy consumption for televisions. The increased energy efficiency of TVs has managed to off-set the negative effect caused by higher number of sales, increased viewing time and larger screen sizes.
The improvement of energy efficiency concerns TV sets of all screen sizes. The following chart shows a sharp decrease of energy consumption for every screen size in the period 2006 - 2010. Already by 2008 the average 32 inch LCD Television sets were meeting the 2010 requirements and by 2010 the 2012 requirements (CSES, 2012).

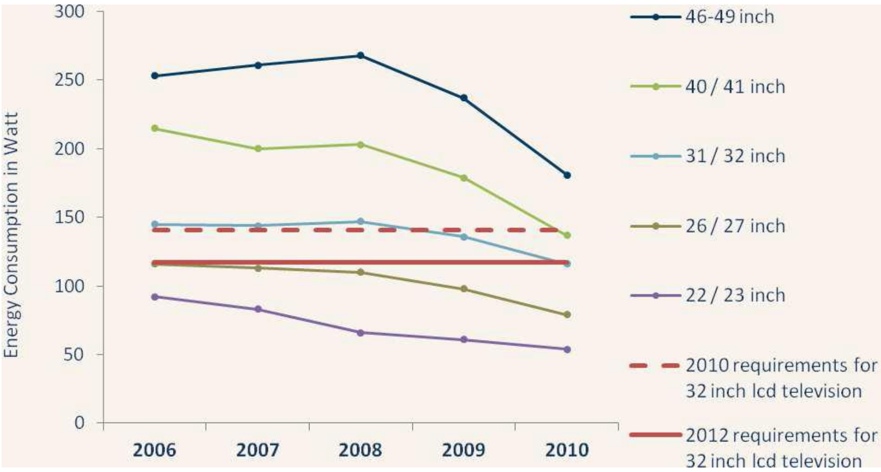


Figure 13: Average energy efficiency of TV sets by screen size, 2006-2010 (CSES 2012)

After 2008 the average power of TVs decreased continuously. From 2008 to 2012 the average on-mode power of TVs sold in the EU-24 decreased by 55% despite an increased average screen size. In 2008 the average TV sold in the EU reached an on-mode power of 156W and by 2012 the average on mode power was 70W.

The developments of energy efficiency for televisions have been rather positive and have exceeded the expectations in the preparatory study. Energy consumption per television dropped by around 25% in the period 2008 - 2010 and managed to offset the similar increase in the volume of sales, screen size and viewing time. If this trend continues the total energy consumption in 2020 will be lower than in 2005 rather than double the amount of 2005 as forecasted in the baseline scenario in the preparatory study. Still, it is too early to say if it will be possible to meet the targets set under the policy scenario.

Saving estimations: comparison with IA
Different studies (Michel et al. 2013, CSES 2012, Coolproducts for a Cool Planet[32]) seem to indicate that due in large part to the unpredicted accelerated pace of rapid technological change for televisions, the regulatory levels established in the Ecodesign Regulation have had a lesser impact than originally foreseen.

[32] http://www.coolproducts.eu/resources/documents/EnergySaving-in-Practice.pdf

The average market provides lower life cycle costs to consumers than the level of the Ecodesign regulation, because the average market is more efficient and leads to lower electricity costs than the level of the Ecodesign limit, while more efficient TVs are not more expensive than less efficient ones. Thus, as far as televisions are concerned the direct effects of the Ecodesign requirements appear relatively limited (CSES, 2012; Michel et al. 2013).

8.5 Tertiary lighting

8.5.1 Introduction

Product sector, consumption, importance

The number of lighting points in the tertiary sector (1.6 billion in the EU) and the high number of yearly burning hours resulted in a yearly power consumption of 200 TWh in 2005. This was predicted to rise to 260 TWh by 2020 (EC, 2010) which can be decreased to 222 TWh by ecodesign regulations. It is therefore expected that even slight improvements in the energy efficiency of tertiary sector lighting could have dramatic effects in terms of savings.

8.5.2 Policy context

Regulation date and scope

Preparatory work on EU measures for the efficiency of tertiary sector lighting in the context of Ecodesign has been on-going since 2006. Two separate "preparatory studies" covering “public street lighting products” on the one hand and “office lighting products” on the other hand were carried out. After completion of the studies it was decided to integrate the work on public street lighting and high-intensity discharge lighting products, and on fluorescent and office lighting products into one single discussion on “tertiary” sector lighting products. The reason for choosing these technologies was that these are the main technologies used in street and office lighting respectively.

Commission Regulation (EC) No 245/2009 entered into force on 13 April 2009. It includes technologies typically used in office and street lighting. Thus, the scope of coverage for regulation EC No 245/2009 relates to lamp types and components that are primarily used in highway, office, and industrial lighting applications. Fluorescent lamps without an integrated ballast (single- and double-ended lamps) include: rod-shaped fluorescent lamps, compact fluorescent lamps, circular lamps and U-shaped lamps. High intensity discharge (HID) lamps are often used in street lighting, and outdoor and indoor sports lighting and industrial area lighting. The most common HID-lamps are metal halide lamps (MH), high-pressure sodium lamps and high pressure mercury lamps. The scope also includes ballasts that are used to operate fluorescent and HID lamps as well as luminaires for these lamps. The impact assessment was prepared when LED technology was only initially entering the market. There were few applications using LED technology, particularly in general illumination. Therefore, LED technology was excluded from the market forecasts and modelling efforts in preparation for the regulation.

ED measures and timing

The ecodesign requirements concern products for general lighting and include all fluorescent lamps without integrated ballasts and high intensity discharge lamps, ballasts and luminaires. There are three main stages, where in each stage requirements are defined. Some requirements are (Bertoldi et.al, 2012):

- The regulation established minimum efficacy requirements for T5 and T8 lamps.
- T8 halophosphate lamps were banned in 2010; linear T10 and T12 halophosphate lamps are banned from 2012 on.
- In the second stage (2012) lamp efficacy requirements for high-intensity discharge lamps have been introduced.
- In a third stage (2017) fluorescent lamps without integrated ballast shall be designed to operate with ballasts of energy efficiency class of at least A2.
- Lamp performance requirements (minimum colour rendering index and minimum lamp lumen maintenance factors) are introduced in three stages.
- Energy performance requirements are introduced for ballasts for both fluorescent and high intensity discharge lamps.
- Phasing out of high pressure mercury lamps starting with the largest wattages.
- Luminaire energy performance requirements are introduced in three stages

No later than 5 years after the entry into force (13 April 2014) the regulation shall be reviewed by the Commission in view of the progress of the lighting technology.

Additionally, limits on the lamp survival factor are set together with other functionality requirements, such as lamp lumen maintenance factors and colour rendering index.
Lamp mercury content is part of the information requirements.

To help in guiding users on the best available technology for specific applications (such as office or public street lighting) indicative benchmarks are given. For example, on lamp mercury content, utilisation factor and light pollution from luminaires.

8.5.3 Achievement of objectives

Ambition of measure in terms of scope

Commission Regulation 245/2009 on the ecodesign sets requirements for fluorescent lamps without integrated ballast, for high intensity discharge (HID) lamps, and for ballasts and luminaires able to operate such lamps. CLASP (2013 c) study argues that the scope of coverage of the implementing measure seems adequate from the point of view of fluorescent and HID lamps and ballasts and luminaires that operate such lamps. However, it does not include all HID lamp base types, certain halogen lamps or LED technology. The HID lamp base types and halogen lamps that are not included in the scope of the present implementing measure are low volume products and are expected to remain so. This is not the case for LEDs. LEDs are entering the tertiary lighting market today as both replacement lamps and dedicated luminaires. Navigant Consulting (2012) conducted a study for the US Department of Energy. They estimated that for the Commercial and Industrial sectors LED market penetration rate would increase from 0% to approximately 70% between 2010 and 2030 in the North American market, taking into account first-cost, electricity, maintenance, and payback periods.

CLASP (2013 c) applied these estimated market penetration rates to the annual shipments of lighting service in Europe. Figure 14 depicts the rate of penetration of LEDs relative to the other light sources, which are grouped into fluorescent and HID lamps. It would therefore be appropriate to review the scope of coverage associated with this regulation, taking into consideration products that are covered under the recent labelling regulation for lighting products, Regulation EU No 1194/2012.

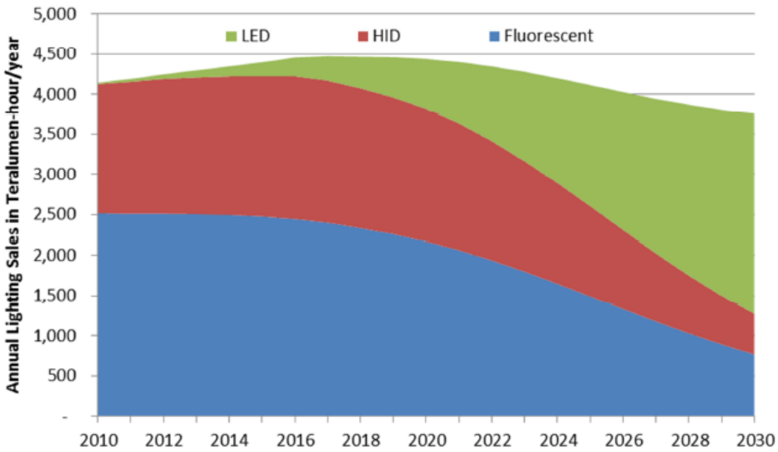


Figure 14: Annual EU tertiary lighting sales in Teralumen-hours/year (CLASP,2013 c)

Market changes due to regulations

CLASP (2013 c) presented an assessment model based on the lamp shipment estimates from the preparatory study. The model then estimates lamp shipments using the same categories to the year 2030 by considering the potential impact of the different stages of the regulation. For T8 lamps, three subcategories of products were identified – one group based on the halo-phosphor, one group based on the 700-series rare-earth phosphor and one group based on the 800-series rare-earth phosphor. CLASP results suggest that due to stage 1 of the regulation T8 halo-phosphor lamps phased out starting in September 2010. This was substituted with the shipments of fluorescent lamps to the Europe. As shown in Figure 15, the T8 market is pushed to the 800-series phosphor, which is more efficacious than the 700-series (and also provides better colour rendering).

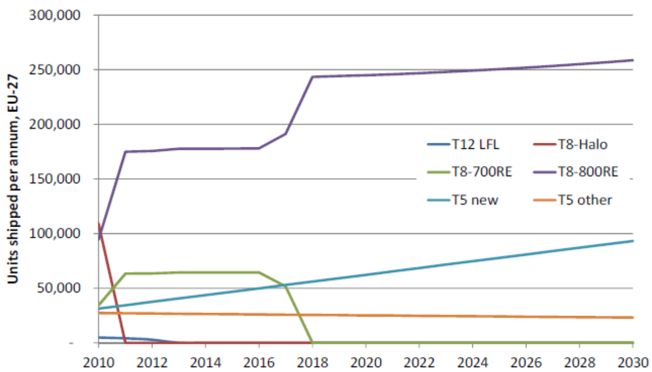


Figure 15: Interim Step Projection of Fluorescent Lamp Shipments in Europe (CLASP, 2013 c).

Saving estimations: comparison with IA

Table 24 presents the electricity consumption of installed stock estimated based on four scenarios. The first two scenarios are from impact analysis providing estimated consumption in tertiary sector with and without ecodesign implementation measures. Additionally, the table presents two scenarios from CLASP (2013). The BAU scenario presented here assumes the following: (1) all stages of regulation EC No 245/2009 are implemented and (2) LED technology penetrates the market at the rate forecast in a 2012 US DOE study (Navigant Consulting, 2012).

According to the two scenarios in Impact Assessment (LOT 8-9) energy savings of 38 TWh can be achieved by regulations according to EC No 245/2009. CLASP (2013) suggests that the new tertiary lighting model has approximately 3 to 7% higher electricity consumption compared to the Impact Assessment Sub-Option 2 (which is the representation of current regulation). Thus, energy saving of 22.4 TWh is expected due to the impact of ecodesign regulation EC No 245/2009 and the new energy labelling regulation EU No 1194/2012. Furthermore, additional energy saving of 23.6 TWh can be achieved due to the anticipated improvements in LED-based lamps from the innovation and research efforts of lighting manufacturers.

Table 24: Electricity consumption (TWh) of installed stock for tertiary lighting, EU27

Projection basis	2010	2015	2020
EC-baseline (no legislation) (Impact assessment Lot 8-9)	218	238	260
Current regulation (Sub-option 2 in Impact Assessment Lot 8-9)	218	220	222
BAU without LED (CLASP, 2013 c)	225.5	228.6	237.6
BAU with LED (CLASP, 2013 c)	219	218	214

Across the EU, tertiary lighting is projected to consume 214 TWh of electricity in 2020. The energy savings estimate from Scenario 2 is 14.5 TWh in that year, or approximately 6.8%. By 2030, the baseline energy consumption is 166 TWh of electricity and the energy savings estimate from Scenario 2 is 14.8 TWh, or 8.9% of the baseline.

CLASP (2013 c) presented a review of the European market of metal halide lamps (MH). It was found that the technological achievement in MH has superseded the expected levels mentioned in EU No 245/2009. The study states *"There is a wide range of performance values for MH lamps. The table below offers some examples of commercially available, high-efficacy MH lamps taken from a European manufacturer's catalogue. For the wattages shown, Table 25 presents the requirement for that lamp (clear and not-clear), the reported efficacy in the catalogue and the percentage difference between the two values. It should be noted that some of the lamps offered in the European market in 2012 already exceed the benchmark performance levels presented in Table 20 of Annex V in regulation EC No 245/2009."*

Table 25: Metal Halide (MH) Requirements in EC No 245/2009 for 2017 and Potential for Improvement (CLASP,2013 c)

MH Lamp Wattage	245/2009 2017 Requirements	Manufacturer Catalogue Best Products 2012	Improvement Over 2017 Requirements
20W clear	70 lm/W	110 lm/W	57%
35W clear	70 lm/W	129 lm/W	84%
50W clear	70 lm/W	104 lm/W	49%
100W clear	85 lm/W	105 lm/W	24%
150W not clear	80 lm/W	106 lm/W	33%
250W clear	85 lm/W	113 lm/W	33%

8.6 Standby and off-mode losses

8.6.1 Introduction

Product sector, consumption, significance

The definition of standby and off-mode in the Working document on possible ecodesign requirements for standby and off-mode electric power consumption of electrical and electronic household and office:

- "Off mode" means a condition of equipment with the following characteristics: The equipment is connected to a mains power source and provides no function. A mere indication of the off mode condition is also considered off mode.
- "Standby" means a condition with the following characteristics: The equipment is connected to a mains power source and provides one or more of the following functions;
  - Reactivation function, or reactivation function and a mere indication of enabled reactivation function;
  - Information or status display, depending on energy input from the mains power source to work as intended.

Standby energy is one of the largest individual end uses of electricity in the residential sector and accounts for approximately 10% of electricity use in Europe, Australia and in California and 1% to 2% of global electricity consumption. IEA expects the energy use from standby and off mode losses to increase to 15% of energy consumption in the residential sector in 2030 (CSES 2012). According to the preparatory study (Lot 6: Standby and off-mode 2008) outlines that standby functionalities and off-mode losses occur for the majority of electrical and electronic household and office equipment products and the total electricity consumption has been estimated to be 47 TWh in 2005, corresponding to 19 Mt CO_2 emissions. Without further action this would increase to 49 TWh in 2020.

8.6.2 Policy context

Regulation date and scope

For more than a decade, it has been recognized that the energy consumption in low power modes for electrical and electronic products is an important issue because it represents permanent loads (sometimes up to 24 hours per day) of a huge number of products.

A timeline of international standards for reducing standby and off-mode losses is provided in Figure 16. ENERGY STAR® was the first program to address standby power efficiency with its launch in 1992. Then the One Watt Initiative (1-watt Plan) was released by the International Energy Agency (IEA). The One Watt Initiative (1-watt Plan) is an energy saving initiative by the IEA to reduce standby power use by any appliance to not more than one watt in 2010, and 0.5 watts in 2013, which has given rise to regulations in many countries and regions. The One Watt Initiative was launched by the IEA in 1999 to ensure through international cooperation that by 2010 all new appliances sold in the world use only one watt in standby mode. This plan was endorsed by the G8 leaders meeting at Glen Eagles in 2005. From this time, several governments have been working cooperatively to tackle the issue through programs such as 4E, APEC and the Asia Pacific Partnership program. Additionally governments in Europe, Asia, North America and Australia have moved to reduce standby power waste through regulation and voluntary codes to address energy waste in low power modes. For example, the Republic of Korea has had great success, first introducing voluntary measures in 2005, with mandatory warning labels in 2008 along with efficiency regulations for an expanding range of electronic appliances setting challenging but achievable low power mode requirements (Maia Consulting, 2012).

Figure 16: Timeline introduction of standby and off-mode standards worldwide (Maia Consulting, 2012)

The Energy-using Products Study Lot 6 prepared a new regulation to limit the standby and off-mode power consumption of non-networked household electronic and electrical equipment, which was applied since January 2010.

The regulation for "standby and off-mode" entered into force on 7 January 2009. A draft guidelines updated was published in October 2009.

An amendment including "Networked standby losses of energy using products" has also been proposed later on under Lot 26. The proposal for ecodesign requirements on networked standby was notified to the WTO on 11 January 2013.
The objective of the eco-design requirements for "standby and off-mode" is to ensure lowest possible energy use for small and large household appliances and electronic products in passive standby and off-modes.

Regulation date and scope
The measure for standby is horizontal i.e. the requirements apply to all products - even those for which specific requirements are not yet defined. They may be replaced by specific requirements defined in implementing measures for certain product groups.
The main requirements were:

- Max 1 W power for passive standby and off-mode starting from January 2010;
- Max 0.5 W from January 2013.

Draft guidelines have also been prepared with a view to Article 13 (1a) of the Directive 2008/28/EC (amendment to the Ecodesign directive) to facilitate implementation of the regulation, particularly for SMEs. The suggested guidelines are not intended to provide any legal interpretation of the regulation.

8.6.3 Achievement of objectives

Ambition of measure in terms of scope
The effect of ecodesign requirements of standby functionalities and off-mode losses is expected to lead to an estimated energy savings of 35 TWh in 2020, compared to a business-as-usual scenario.

Market changes due to regulations
According to CSES 2012 and comparing to the the situation when the preparatory study was carried out - at which point the majority of products on the market did not meet the requirements – significant improvements seem to have taken place, with 18% not meeting the off-mode requirements and 29% the standby requirements for 2010. In relation to the 2013 limits, in 2010 around half of the products did not meet the requirements and had to be improved. Thus, significant additional improvements can be expected.

Saving estimations: comparison with IA
In 2013, the European Union has become the first region to move beyond the 1 Watt threshold, introducing regulation for off and passive standby power mode at 0.5W or below. While standby power waste has not been completely erased, great results are expected to be already achieved with a large reduction in energy consumption. However, no estimates have been found regarding the magnitude of the savings in the future.
According to CSES 2012 the evidence available suggests that the role of the Ecodesign requirements on standby varies among the different types of electrical appliances and the attention given by the relative industry prior to the Ecodesign Directive. However, overall, the data available does indicate that significant improvements in energy efficiency have taken place from the time of the preparatory study to the most recent studies.

8.7 Ventilation fans

8.7.1 Introduction

Product sector, consumption, significance
A fan is defined as a rotary bladed machine that is used to maintain a flow of a gas (typically air) and which is driven by an electric motor. The regulation has an extended product approach, including motor, drive and fan.
Fans that fall within the scope of the measurement include fans of power range 125 W to 500 kW.

Fans that fall outside the scope are:

- Fans designed to operate with an electric motor below 125 W but driven by a motor above 125 W primarily serving other functionalities;
- Fans for vacuum cleaners (the 8000rpm criterion). These will be covered by future ecodesign measures.

According to the impact assessment (Lot 11: Ventilation fans, 2010) the total electricity consumption of fans driven by motors with an electric input power between 125 W and 500 kW is 410 TWh per year, rising to 660 TWh in 2020 if current Union market trends persist. The cost-efficient improvement potential through design is about 34 TWh per year in 2020, which corresponds to 16 Mt of CO_2 emissions.

8.7.2 Policy context

Regulation date and scope
Ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW were introduced in Commission Regulation (EC) No 327/2011 implementing Directive 2009/125/EC of the European Parliament and of the Council.

ED measures and timing
The ecodesign requirements for circulators set out in Regulation 327/2011 /EC are:

- First tier: from 1 January 2013, ventilation fans with an electric motor input power between 125 W and 500 kW shall not have lower target energy efficiency than as defined in Table 26.
- Second tier: from 1 January 2015, all fans with an electric input power between 125 W and 500 kW shall not have lower target energy efficiency than as defined in Table 27.

Insufficient time has passed since the enforcement of the Tier 1 regulation to draw conclusions on its impact on the pump market.

8.7.3 Achievement of objectives

Insufficient time has passed since the enforcement of regulation to draw conclusions on its impact on the pump market.

Table 26 First tier minimum energy efficiency requirements for fans from 1 July 2013

Fan types	Measurement category (A-D)	Efficiency category (static or total)	Power range P in kW	Target energy efficiency	Efficiency grade
Axial fan	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	36
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	56
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
Centrifugal forward curved fan and centrifugal radial bladed fan	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	37
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	42
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
Centrifugal backward curved fan without housing	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	58
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
Centrifugal backward curved fan with housing	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	58
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	61
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
Mixed flow fan	A,C	static	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	47
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
	B,D	total	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	58
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
Cross flow fan	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 1.14 \cdot \ln(P) - 2.6 + N$	18
			$10 < P \le 500$	$\eta_{target} = N$	

Table 27 Second tier minimum energy efficiency requirements for fans from 1 January 2015

Fan types	Measurement category (A-D)	Efficiency category (static or total)	Power range in kW	Target energy efficiency	Efficiency grade
Axial fan	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	40
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	60
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
Centrifugal forward curved fan and centrifugal radial bladed fan	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	42
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 2.74 \cdot \ln(P) - 6.33 + N$	47
			$10 < P \le 500$	$\eta_{target} = 0.78 \cdot \ln(P) - 1.88 + N$	
Centrifugal backward curved fan without housing	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	62
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
Centrifugal backward curved fan with housing	A, C	static	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	61
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	64
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
Mixed flow fan	A,C	static	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	50
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
	B,D	total	$0.125 \le P \le 10$	$\eta_{target} = 4.56 \cdot \ln(P) - 10.5 + N$	62
			$10 < P \le 500$	$\eta_{target} = 1.1 \cdot \ln(P) - 2.6 + N$	
Cross flow fan	B, D	total	$0.125 \le P \le 10$	$\eta_{target} = 1.14 \cdot \ln(P) - 2.6 + N$	21
			$10 < P \le 500$	$\eta_{target} = N$	

8.8 Directional lamps, and LED lamps and related equipment

8.8.1 Introduction

Product sector, consumption, significance

Preparatory study (LOT19: Domestic Lighting) (2009) states that there is an increasing use of lamps and luminaries and further is expected due to growing welfare, which causes increasing living space per capita and installation of more light sources; shift from one or two lamps to lines of lighting points as a result of shift to reflector halogen down-lighting and the expanding use of lighting in Central and Eastern EU to a level similar to the rest of EU. According to the impact Assessment (LOT 19) the volume of sales of directional lights is approximately 330 million units per year in the EU. For directional lights, the combined effect of ecodesign requirements (EU No 1194/2012) and labelling regulations (EU NO 874/2012) is expected to result in annual electricity savings of 25 TWh by 2020, compared with the situation where no measures were taken.

A 'Directional Light Source' (DLS) which are called in popular terminology reflector lamps or spot lights, and which direct most of their light (at least 80%) in an angle of 120° or smaller. Directional lamps utilize many types of light sources such as halogen-incandescent (HI), halogen infrared-reflecting incandescent (HIR), compact fluorescent (CF), xenon, metal halide (MH), ceramic metal halide (CMH) and light emitting diode (LED). Directional lamps are used for floodlight, spotlight, downlight, task and general illumination applications in European shops, hotels and homes.

In addition to definitions of lamp and luminaire (see section 8.3.1), preparatory study (LOT19: Domestic Lighting) (2009), also provides the definition of "LED-applications" as follows:

"A 'retrofit LED lamp' in this study has been defined as a self-ballasted lamp, incorporating a LED light source and any additional elements necessary for a stable operation of the light source; it is provided with a lamp cap conform IEC 60061-1, which cannot be dismantled without permanent damage.
A 'LED-luminaire' is a luminaire incorporating one or more LED light sources and all additional elements necessary for stable operation of the light sources and in which no LED light source or other element can be replaced or changed by the consumer.
A 'LED-module' is a combination of two (or more) seperate parts i.e. a LED light source and a part containing all additional elements necessary for a stable operation of the accompanying LED light source. This LED module is not intended to be sold as such to an end consumer but only to luminaire manufacturers and specialized installers."

Impact assessment states that The EU-27 annual electricity consumption of DLS in 2007 is around 30 TWh/year. It is projected to grow to over 50 TWh/year in 2020. Over the same period, the related carbon emissions will grow by a factor of 4, i.e. from around 5 Mt CO_2 eq./year to close to 20 Mt CO_2 eq./year.

8.8.2 Policy context

Regulation date and scope
According to Article 1 of the regulation (EU) No 1194/2012, ecodesign requirements are established for directional lamps, light emitting diode (LED) lamps and equipment designed for installation between the mains and the lamps, including lamp control gear, control devices and luminaires. Besides, product information requirements for special purpose products are established. LED modules marketed as parts of luminaires that are placed on the market in less than 200.000 units per year are excluded from the directive.

A labelling regulation (EU) No 874/2012, for electrical lamps and luminaires applies from 1 September 2013. The scope of the regulation includes all light sources, in particular incandescent lamps, halogen lamps. fluorescent lamps, high-intensity discharge (HID) lamps and LED lamps and LED modules.

ED measures and timing:
Commission Regulation (EU) No 1194/2012 with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment was published in the Official Journal of the European Union on 14 December 2012. The ecodesign regulation entered into force on 3 January 2013.

The ecodesign requirements will become effective in three stages. Similar to the application in incandescent lamps, the regulation introduces requirements on the maximum allowable Energy Efficiency Index (EEI). The EEI is calculated as the ratio of the rated power measured at nominal input voltage corrected by certain correction factors as specified in the regulation divided by a reference rated power obtained from the useful luminous flux of the lamp.

A revision of requirements shall take place no later than three years after its entry into force.

At the present time, the maximum luminous intensity is stated in candelas with the majority of directional lamps. With the regulation it will be compulsory to mention of the useful luminous flux in lumens, which is common in the case of non-directional lamps.

Stage 1 (from 1.9.2013):

- For mains-voltage incandescent lamps where luminous flux greater than 450 lm, EEI <1,75;
- For other incandescent lamps, EEI < 1,20 (if luminous flux greater than 450 lm, then EEI< 0,95);
- For other lamps (e.g. LEDs and compact fluorescent lamps) EEI< 0,50.

Stage 2 (from 1.9.2014):

- For mains-voltage incandescent lamps, EEI <1,75;
- For other incandescent lamps, EEI < 0,95;
- For high-intensity discharge lamps, EEI < 0,50;
- For other lamps, EEI < 0,50;

- The no-load power of a lamp control gear intended for use between the mains and the switch for turning the lamp load on/off shall not exceed 1,0 W.

Stage 3 (from 1.9.2016):

- For incandescent lamps, EEI < 0,95;
- For high-intensity discharge lamps, EEI < 0,36;
- For other lamps, EEI < 0,20;
- The no-load power of a lamp control gear intended for use between the mains and the switch for turning the lamp load on/off shall not exceed 0,5 W.

Table 28 provides an overview of the efficiency requirements and energy clases that will be required for directional lamps.

Table 28: Most frequent cases that will be affected by the new Regulation and the presumed minimum energy classes required for directional lamps (based on SEVEn7 website)

	Mains voltage incandescent and halogen lamps	Other incandescent and halogen lamps	Other lamps (LED lamps and compact fluorescent lamps)
Phase 1 September 2013	Phasing out of inefficient directional incandescent lamps with the useful luminous flux above 450 lm, to be replaced by halogen lamps, compact fluorescent or LED lamps.	Phasing out of inefficient halogen lamps, stricter criteria for lamps with the useful luminous flux above 450 lm, probably to be replaced by efficient halogen or LED lamps.	Setting of the minimum efficiency for directional compact fluorescent lamps, directional LED lamps and other directional lamps.
	More than 450 lm: min. D, other unlimited.	Ess than 450 lm: min. C, more than 450 lm: min. B	min. A (and, in part, B)*
Phase 2 September 2014	Phasing out of all inefficient directional incandescent lamps, to be replaced by halogen lamps, compact fluorescent and LED lamps.	Phasing out of all inefficient halogen lamps, to be replaced by LED and efficient halogen lamps.	Same requirements as in Phase 1.
	all min. D	min. B	min. A (and, in part, B)*
Phase 3 September 2016	Tightening up of the minimum efficiency, probable replacement in the form of compact fluorescent lamps and LED lamps.	Same requirements as in Phase 2.	Further tightening up of requirements, which will probably only be met by directional LED lamps and some discharge lamps.
	min. B*	min. B	min. A+ (and, in part, A)*

* The minimum energy classes and replacements are approximate, since individual lamps can, owing to their specific design, have different requirements or exceptions.

The Regulation brings in functionality requirements and determines the maximum power input of control devices and their standby mode, allowed decreases in the luminous flux, the maximum lamp starting time, the number of switching cycles, lamps warm up and colour rendering. It also requires compatibility between LED lamps and the equipment that operates them.

8.8.3 Achievement of objectives

Ambition of measure in terms of scope

As of 1 September 2013 mandatory quality criteria for LED-lamps and modules in the European market have gone into effect for the first time. This is a significant step, as LEDs clearly offer great energy savings potential but it depends on consumers to have these savings delivered. The requirements on LED lamps in the regulation should ban from the market products that are likely to disappoint consumers and turn them off from future LED lamp purchases.

As regards to the achievement of the objectives in terms being on track with expected energy savings in 2020, insufficient time has passed since the enforcement of regulation to draw conclusions on its impact on the market.

8.9 Circulators in buildings

8.9.1 Introduction

Product sector, consumption, significance
A "circulator" is defined as an impeller pump with a rated hydraulic output power from 1 W to 2,500 W, designed for use in heating systems or in secondary circuits of cooling distribution systems, and are always sold as an integrated pump: motor assembly.
The circulator market is somewhat unusual in that circulators are almost exclusively manufactured and sold within the EU. The preparatory study (Lot 11: Circulators in buildings, 2008), showed an annual market of 14 million circulators in the EU which can be divided as:

- 5.5 million small standalone circulators;
- 1 million large standalone circulators;
- 7.5 million product-integrated circulators.

According to the impact assessment the total stock of circulator units was responsible for an annual electricity consumption of 50 TWh in 2005 in the EU27 corresponding. Without further action this would increase to 55 TWh in 2020.
It is estimated when the energy labelling and performance requirements for circulators reach their full impact, they are estimated to save 23 TWh per year (corresponding to an annual reduction of 11 Mt of CO_2 emissions or the annual electricity consumption of Ireland) within the EU by 2020.

8.9.2 Policy context

Regulation date and scope

The European Commission published a Regulation with ecodesign requirements (641/2009) for circulators in 22 July 2009. The focus of this regulation has been of circulators typically used in buildings. This regulation shall be reviewed before 1 January 2017.

ED measures and timing

The regulation for circulators in buildings (Regulation 641/2009/EC) entered into force 12 August 2009. The ecodesign requirements for circulators set out in Regulation 641/2009/EC are:

- From 1 January, 2013, glandless standalone circulators, with the exception of those specifically designed for primary circuits of thermal solar systems and of heat pumps, shall have an energy efficiency index (EEI) of not more than 0.27;
- From 1 August, 2015, glandless standalone circulators and glandless circulators integrated in products shall have an EEI of not more than 0.23.

The EEI is the ratio between annual consumption of the appliance and a standard consumption of a typical similar model.

Additionally, information concerning disassembly, recycling, or disposal at end-of-life of components and materials, shall be made available for treatment facilities.

8.9.3 Achievement of objectives

Ambition of measure in terms of scope

When the energy labelling and performance requirements for circulators reach their full impact, they are estimated to save 23 TWh per year (corresponding to an annual reduction of 11 Mt of CO_2 emissions) within the EU by 2020.

The Regulation does contain a loophole, as it does not specify whether circulators placed on the market without pump housing are covered or not, despite the initial intention of the Regulation. An amendment was issued in July 2012 that clarifies it: "A circulator is composed of two main parts, one part which consist of the motor, motor control (terminal box) and the impeller, a second part which is the 'pump housing'. The pump housing is a casting that includes the volute (outer part) of the pump, which is connected to the pipework of a heating or secondary circuit of a cooling distribution system". This amendment will not impact the expected savings as the products now included were intended to be covered from the start.

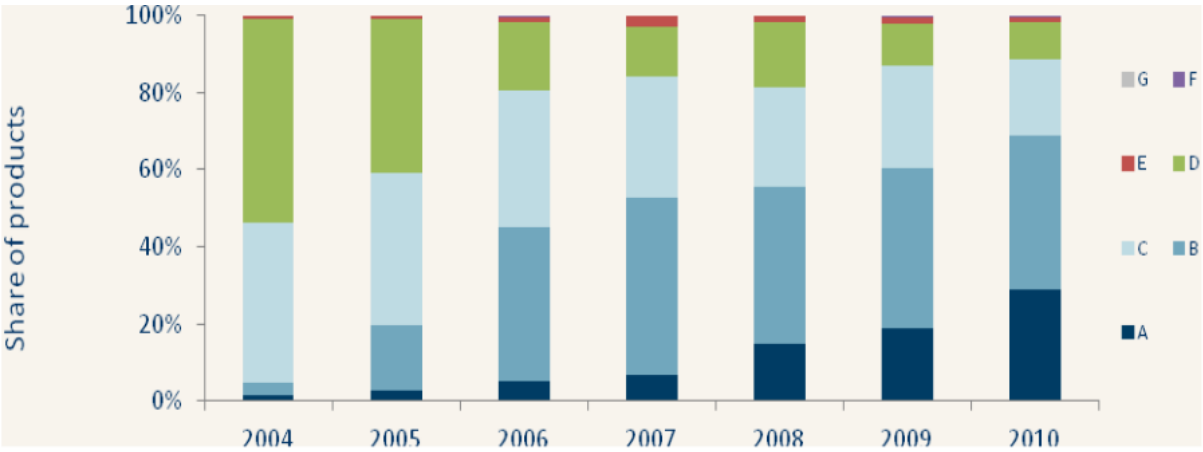


Figure 17: Market share of circulators of different efficiency classes 2004-2010 (source: Europump[33])

Market changes due to regulations

The high efficiency circulator market was already in place before the enforcement of the Regulations, driven by a voluntary initiative implemented in 2005. Through the development of a voluntary classification and energy labelling scheme industry players were able to reduce the share of inefficient circulators significantly. Class A circulators increased their market share from around 5% in 2006 to almost 30% in 2010. Because market movement towards higher efficiency products had already started before the enforcement of minimum energy performance standards, significant differences from the anticipated scenarios from the preparatory study, are not expected.

8.10 Vacuum cleaners

8.10.1 Introduction

Product sector, consumption, significance

A vacuum cleaner is an appliance that removes dry material (dust, fibre, threads) from the surface to be cleaned by an airflow created by a vacuum developed within the unit. The material thus removed is separated in the appliance and the cleaned suction air is returned. Vacuum cleaners (VCs) are made in a variety of shapes and sizes for domestic and commercial use and for different applications.

According to the impact assessment (LOT 27 Vacuum cleaners, 2010), the total stock of vacuum cleaners of 288 million units was responsible for an annual electricity consumption of 18 TWh in 2005 in the EU27. Without further action this would increase to 34 TWh in 2020. The increase is mainly due to continuing rise in population, dwelling size and (above all) the increase in power consumption. The aim of the proposed regulation was to reverse the expected increase in energy consumption of these appliances.

[33] http://europump.net/energy-policy/ecodesign/circulators

It is estimated that the combined effect of the new ecodesign requirements set out in draft Commission Regulation implementing Directive 2009/125/EC and the labelling scheme set out in this draft delegated Regulation would lead to a reduction of 19 TWh in 2020.

8.10.2 Policy context

Regulation date and scope
The European Commission published a Regulation with ecodesign requirements (666/2013), as well as a Regulation with labelling requirements (665/2013) for vacuum cleaners in 13 July 2013. The focus of this regulation has been on vacuum cleaners typically used in households and commercial premises. This regulation shall be revised within five years after its entry into force.

ED measures and timing
Vacuum cleaners shall comply with the following requirements:

- As of September 2014, the annual energy consumption shall be less than 62.0 kWh/year with a rated input power of less than 1600W.
- In 2017, this must be further reduced to an annual energy consumption shall be less than 43.0 kWh/year with a rated input power of less than 900W.

Regulation 666/2013 further specifies that the manufacturer must compile a Technical File which must include specific documentation, as well as measurement and calculation methods.
The energy labels for the various vacuum cleaners are provided in Annex II of Regulation 665/2013. The provisions include minimum requirements on energy efficiency, cleaning performance and dust re-emission. In addition to the labelling, manufacturers are also required to provide a product fiche of the vacuum cleaner with information about the energy efficiency class, the annual energy consumption, the dust re-emission class, the sound power level, etc.

Information requirements include:

- Information relevant for non-destructive disassembly for maintenance purposes, in particular in relation to the hose, suction inlet, motor, casing and cable;
- Information relevant for dismantling, in particular in relation to the motor and any batteries, recycling, recovery and disposal at end-of-life.

8.10.3 Achievement of objectives

The regulations entered into force on 12 August 2013. The standards will be binding from 1 September 2014 onwards.

8.11 Imaging equipment

8.11.1 Introduction

Product sector, consumption, significance
In the preparatory study (Lot 4) focuses on the product category called office imaging equipment. The product category is defined as follows:

"Office Imaging Equipment is a commercially available product which was designed for the main purpose of producing a printed image (paper document or photo) from a digital image (provided by a network/card interface) through a marking process. Office Imaging Equipment is also a commercially available product which was designed for the main purpose of producing a digital image from a hardcopy through a scanning/copying process."

The preparatory study identified electricity consumption and indirect energy in the form of paper use as the most important environmental impacts. According to the impact assessment, it is estimated that the commitments undertaken by the signatories to the voluntary agreement will generate savings in 2020 of 15 TWh.

8.11.2 Policy context

Regulation date and scope
The Impact Assessment (LOT 4) (2013) stresses that, in recent years there has been an improvement in the imaging equipment sector on voluntary basis. At the stage of Impact Assessment it was estimated that no sufficient evidence was available to develop policy proposals, and that some of the environmental impacts are already addressed under the Energy Star Programme. A voluntary agreement has therefore been suggested, although the Commission states that regulation would also be taken into consideration.

Digital Europe presented a revised proposal for a Voluntary Agreement on Imaging Equipment on 15 February 2011. The final Voluntary Agreement (LOT 4 Voluntary Agreement) on imaging equipment has been recognised by the Commission in February 2013.

The products that are covered in the voluntary scheme include:

- Standard-size copiers;
- Multifunctional devices;
- Printers and fax machines that use electrophotography;
- Solid ink and high performance ink jet marking technologies.

Definition of imaging equipment covered by the voluntary scheme is identical to the equipment covered by the requirements of the ENERGY STAR programme.

As of November 2012 there are sixteen signatories to the voluntary scheme that have agreed to substantially improve the energy efficiency of their printers, copiers and multifunctional devices. These companies, in total, represent 90% of the EU market for Imaging Equipment.

VA measures and timing
The requirements of the voluntary scheme are based on the requirements of the ENERGY STAR programme. Requirements include:

- A minimum of at least 90% of the imaging equipment placed on the EU market after 1 January 2012 (regardless of their origin) would comply with the minimum efficiency requirements of the agreement;
- All printing products should comply with the requirements on cartridges;
- All new products should comply with the requirements on recycling;

- All new printing products should offer the capability of duplex printing, including several pages of a document on one sheet of paper as a standard feature.

The agreement will be revised in 2013 to be harmonised with the new version 2 of the ENERGY STAR programme requirements.

8.11.3 Achievement of objectives

The Independent Inspector Report (ERA, 2013) against the requirements of the Voluntary Agreement on Imaging Equipment was issued by the independent inspector, ERA Technology Limited, on 30 April 2013. The report covers the Third period, which is from 1 January to 31 December 2012. According to the inspection report 97% of products in scope are compliant with ENERGY STAR 1.1. The other requirements of Annex C of the Voluntary agreement (such as the provision of general information, authorised signature and manufacturer's declaration) has reached 100% compliance rate already in the Second reporting period.

No estimates are available of realized or projected energy savings. In terms of ambition level of the Voluntary Agreement it could be considered that the fact that only 90% of the equipment needs to comply with the requirements can indicate a slightly low ambitious target.

In 2012 the European Consumer Voice in Standardization (ANEC), the European Consumer Organization (BEUC) and the environmental organizations European Environmental Citizens Organization for Standardization (ECOS) and The European Environmental Bureau (EEB) outlined a review note on the evaluation of Voluntary Agreements. This evaluation (ANEC, et al. 2012) concludes that the level of ambition of Voluntary Agreement for Lot 4 is very low. This is due to the fact that the performance requirements of the VA refer to the US ENERGY STAR requirements in version 1.1. which provides almost no added value over the business as usual development of the market. Their conclusion is based on the data that in 2011 ENERGY STAR version 1.1. was already outdated as 80% of copiers and 100% of multifunction devices have reached to ENERGY STAR 1.2 performance levels.

ANEC et al. (2012) mentioned that among the requirements of the VA the lifecycle perspective is not fully taken into account. The preparatory study highlighted from the start the significance of manufacturing stage as regard global energy requirement and Global Warming Potential, but no requirements were set accordingly.

8.12 PCs and servers

8.12.1 Introduction

Product sector, consumption, significance
Preparatory study (LOT3: Personal computers (desktops & laptops) and servers) (2007) defines computer according to Energy Star Program Requirements for Computers[34] as a *'device which performs logical operating and processes data. Computers are compose of, at a minimum: (1) a central processing unit (CPU) to perform operations; (2) user input devices such as a keyboard, mouse, digitizer or game controller; and (3) a display screen to output information. For the purposes of this specification, computers include both stationary and portable units, including desktop computers, gaming consoles, integrated computers, notebook computers, tablet PCs, desktop-derived servers and workstations.'*
The impact assessment estimated the electricity consumption of computers between 2011 and 2020 was about 93 TWh, which corresponds to 43 Mt of CO_2 emissions, and in 2020 at between 12,5 TWh and 16,3 TWh, which corresponds to 5,0-6,5 Mt of CO_2 emissions.

8.12.2 Policy context

Regulation date and scope
The proposed requirements cover desktops, notebook computers, thins clients and worksations (but not servers) and set the Energy Star specifications as minimum performance requirements. According to the new proposal, servers are also included in the scope.
Energy Star is one of the most important voluntary initiatives regarding some of the products covered by this product group. It is widely used both in the USA and the EU, it is agreed within a wide group of stakeholders, and the definitions are well developed and constantly being updated.

The European Code of Conduct (ECC) is promoted by the Institute for Environment and Sustainability Renewable Energies at the Joint Research Group of the European Commission (JRC). It was created in response to increasing energy consumption in data centers and the need to reduce the related environmental, economic and energy supply impacts. It was developed with collaboration from the British Computer Society, AMD, APC, Dell, Fujitsu, Gartner, HP, IBM, Intel, and many others. The ECC is not applicable to this product group, but is an initiative worth mentioning as its main goal is to inform and stimulate data centre operators and owners to reduce energy consumption in a cost-effective manner without debilitating the critical function of data centers.

Initially, the preparatory study did not include servers (workstations and thin clients). It was proposed to include these products in the scope of the regulation because it is possible that these may be introduced in the domestic sector over the coming years. It was proposed to include servers in the scope of the regulation as the applicable criteria exist under the ENERGY STAR programme. However due to the complexity of this product group (as well as Workstations) it is proposed to only apply requirements on the efficiency of the internal power supply as well as information requirements, as well as power management in the case of Workstations.

[34] ENERGY STAR® Program Requirements for Computers DRAFT 3. Version 4.0

This approach has been chosen as the technical parameters of internal power supplies are essentially the same across all products covered under the Regulation and in all cases offer a significant saving potential.

The requirements are proposed to be revised not later than 3.5 years after the entry into force, taking into account the development within the ENERGY STAR system.
The requirements being proposed now do not apply to displays (included in the former proposal and now on Lot 5), blade systems and components, server appliances, multinode servers, computer servers with more than four processor sockets, game consoles and docking stations.

8.12.3 Achievement of objectives

Ambition of measure in terms of scope
The adopted measure applies to desktop computers, integrated desktop computers and notebook computers.

Saving estimations: comparison with IA
No data has been found regarding the energy savings to be realized under this implementing measure.

8.13 Room air conditioning appliances

8.13.1 Introduction

Product sector, consumption, significance
An air conditioner is an appliance designed to maintain the temperature of indoor air at a given temperature level for a given heat load to be extracted.

The impact assessment (LOT 10 Room air conditioning aplliances, local air coolers and comfort fans, 2010) calculated a total electricity consumption of the stock of air conditioners of 30 TWh/yr in 2005. This corresponds to emissions of around 14 Mton CO_2 (0.3% of the total CO_2 emissions in the EU27). This includes indirect CO_2 emissions from energy use and direct emissions from refrigerant leakage.

Sales of air conditioners are expected to grow from 4.7 million units in 2005 to some 9 million units in 2020 and to 10.3 million units in 2030. This assessment is based on expectations for main market drivers such as increased household income (stimulates affordability), increased demand for personal thermal comfort, lower purchase prices (stimulates purchase decisions, also in non-residential sectors), hotter climates (stimulates demand). It includes a correction for reduced sales in the period 2008 - 2010, reflecting the effects of the economic downturn. The current market trends are expected to lead to a continued increase in sales, energy consumption and environmental impact.

For the year 2020, assuming no change in policy measures, the electricity consumption is assumed to increase to 73 TWh/yr, corresponding to electricity costs of 45 billion Euro and 37 Mt of CO_2 emissions. It is estimated that through awareness campaigns and the continuation of the current energy label for air conditioners the average energy efficiency of air conditioners would continue rising slightly until by 2030 all current split package appliances will be present in (current) class A, with an average EER (Energy Efficiency Ratio) of around 3.5. The share of inverter appliances (capable of running at variable speeds) is expected to be some 90%.

With the implementation of ecodesign measures expected savings amount to approximately 11 TWh/yr from air conditioners in 2020 and approximately 15 TWh/yr in 2030.

8.13.2 Policy context

Regulation date and scope
Ecodesign requirements for room air conditioning appliances were introduced in Commission Regulation (EC) No 206/2012 implementing Directive 2009/125/EC of the European Parliament and of the Council. It entered into force on 6 March 2012.

The focus of this regulation has been on air conditioners and comfort fans typically used in households and small commercial establishments. The regulation establishes Ecodesign requirements for the placing on the market of electric mains-operated air conditioners with a rated capacity of less than or equal to 12kW for cooling or heating if the product has no cooling function. It also covers comfort fans with an electric fan power input less than or equal to 125W.

ED measures and timing
The adopted ecodesign requirements regard two tiers of introduction; 2013 and 2014. They include:

- A bonus for products using low global warming refrigerant fluids;
- Minimum energy performance requirements for split, double duct and single duct air-conditioners;
- The requirements cover the seasonal cooling and heating performances;
- Requirements for maximum indoor and outdoor sound levels;
- Information requirements to be provided in product documentation and on manufacturer websites;
- Tolerance levels for verification:
    - 8% for splits;
    - 10% for single and double ducts.

The labelling requirements include:

- A-G energy labels with a new design;
- Gradual introduction of additional classes (A+ to A+++) from 2013;
- Energy rating of the cooling and heating functions;
- Indication of the annual or hourly energy consumption;
- Indication of sound levels;
- Separate energy labels for split, double duct and single duct products.

8.13.3 Achievement of objectives

Ambition of measure in terms of scope
Sales of air conditioners are expected to grow from 4.7 million units in 2005 to some 9 million units in 2020 and to 10.3 million units in 2030. The combined effect of ecodesign requirements and energy labelling of air conditioners is expected to result in annual electricity savings of 11 TWh by 2020, compared to the situation if no measures are taken. The regulations entered into force on 1 January 2013.

Market changes due to regulations
Not enough time has passed since the enforcement of the regulation to draw conclusions on its impact on the room air conditioning appliances.

8.14 External power supplies

8.14.1 Introduction

Product sector, consumption, significance
External power supplies include most stand-alone AC/AC and AC/DC devices with a rated power up to 250 Watts.
The impact assessment (LOT 7: Battery chargers and external power supplies 2007) estimated the electricity consumption due to losses for power conversion and no-load amounting to 17 TWh, corresponding to 6,8 Mt of CO_2 emissions. In the absence of measures this consumption is predicted to increase to 31 TWh in 2020.

8.14.2 Policy context

Regulation date and scope

Commission Regulation (EC) No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies (EPS) entered into force on 26 April 2009. The requirements should be revised during 2013, but so far no date has been defined.
The Regulation covers products with the following characteristics:

- Converts AC Power from mains into low voltage DC or AC output;
- Only one DC or AC output voltage at a time;
- A separate device that constitutes the primary load;
- Contained in a physical enclosure separate from the device;
- With removable or hard wired male/female connection, cable, cord, etc.;
- Rated output power less than 250W;
- Intended for use with electrical and electronic household and office equipment in EC No. 1275/2008.

The regulation establishes ecodesign requirements related to electric power consumption in no-load condition and average active efficiency of external power supplies and shall not apply to:

(a) Voltage converters;
(b) Uninterruptible power supplies;
(c) Battery chargers;
(d) Halogen lighting converters;
(e) External power supplies for medical devices;
(f) External power supplies placed on the market no later than 30 June 2015 as a service part or spare part for an identical external power supply which was placed on the market not later than one year after the Regulation has come into force, under the condition that the service part or spare part, or its packaging, clearly indicates the primary load product(s) for which the spare part or service part is intended to be used with.

ED measures and timing
The requirements were introduced in two stages to provide an appropriate time-frame for manufacturers to redesign their products. The first stage came into effect on 27 April 2010 and the second stage on 27 April 2011. The requirements are presented in Table 29**Error! Reference source not found.**.

Table 29 Requirements under Regulation 278/2009 for external power supplies

<table>
<tr><th></th><th></th><th>Stage 1
27 Apr 2010</th><th colspan="3">Stage 2
27 Apr 2011</th></tr>
<tr><td rowspan="3">1.1</td><td rowspan="3">No Load Power Consumption ≤</td><td rowspan="3">0.5 W</td><td>AC-AC output exempt Low Voltage</td><td>AC-DC output exempt Low Voltage</td><td>Low voltage: AC-AC/DC output < 6V and > 550mA</td></tr>
<tr><td>0.5W for Po < 51W</td><td>0.3W for Po ≤ 51W</td><td>0.3W for Po ≤ 51W</td></tr>
<tr><td>0.5W for Po > 51W</td><td>0.5W for Po > 51W</td><td>n/a for Po > 51W</td></tr>
<tr><td rowspan="4">1.2</td><td rowspan="4">The average active efficiency ></td><td rowspan="2">0.5 * Po, for Po< 1W</td><td colspan="2">AC-AC/DC output exempt Low Voltage</td><td>Low voltage: ACAC/DC output < 6V and ≥ 550mA</td></tr>
<tr><td colspan="2">0.48 * Po + 0.140, for Po ≤ 1W</td><td>0.497 * Po + 0.067, for Po ≤ 1W</td></tr>
<tr><td>0.09. * In(Po) + 0.5, For 1W ≤ Po ≤ 51W</td><td colspan="2">0.063 * In(Po) + 0.622, for 1W < Po ≤ 51W</td><td>0.075 * ln(Po) + 0.561, for 1W < Po ≤ 51W</td></tr>
<tr><td>0.85, for Po > 51W</td><td colspan="2">0.87 for Po > 51W</td><td>0.86 for Po > 51W</td></tr>
</table>

- The requirements from 2011 were harmonized with the European Code of Conduct[35] for power supplies and the US Energy Star[36] requirements. The EU Code of Conduct has been prepared by the European Commission, following the discussions and decisions of the ad-hoc working group composed by independent experts, Member States representatives and representatives of industry. With the actions resulting from the EU Code of Conduct it was predicted to result in savings of about 5 TWh per year from 2010 onwards.

[35] Code of Conduct: http://www.phihong.com/assets/pdf/Code_of_Conduct__EPS_Ver4__March_09.pdf
[36] EnergyStar Requirements: http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/eps_spec_v2.pdf

8.14.3 Achievement of objectives

Ambition of measure in terms of scope
CLASP (2013 c) suggests that *'the scope of coverage for Regulation 278/2009 requires revision because several types of EPS are omitted from the current definition. Regulations currently being proposed in the US encompass a more comprehensive scope, including seven product classes, of which not all are covered in the EU. This suggests that the European regulation could also be expanded.'*

Market changes due to regulations
CLASP (2013 c) mentions that The EPS market is projected to grow in the coming years because besides the traditional applications such as communications, computers, consumer electronics, the market is offering new apllications that were not considered in the preparatory study such as tablet computers, smart phones, and gaming devices, that require higher wattage EPS than simple mobile phones. The communications segment is projected to maintain the largest unit market and will be dominated by the mobile phone industry, which uses inexpensive, commoditised low-wattage power supplies.
The table below shows the projected levels of sales and stock of external power supplies and a BAU projection of energy consumption to 2030.

Table 30: Projected Sales, Stock and BAU Energy Consumption to 2030, External Power Supplies (CLASP 2013 c)

EU-27 Projection	2010	2015	2020	2025	2030
Sales (million units)	381	*387*	*391*	*395*	*397*
Stock (million units)	*1,758*	*1,784*	*1,807*	*1,826*	*1,840*
Stock annual energy consumption, BAU (TWh)	*7.3*	*7.4*	*7.5*	*7.6*	*7.7*

Saving estimations: comparison with IA
Regulation No 278/2009 of 6 April 2009 predicted lifecycle energy savings of 118 PJ and electricity savings of 9 TWh by 2020. The Ecodesign requirements for external power supplies have recently entered into force but the impact of the Directive is currently not clear. Sufficient data have not been identified to highlight any changes in the energy efficiency of external power supplies before and after the Ecodesign requirements have entered into force (CSES 2012). CLASP (2013 c) projected three illustrative policy scenarios with updates to the ecodesign regulations adapted from the draft Code of Conduct on Energy Efficiency of External Power Supplies that was being developed in late 2012in order to determine the energy savings potential for EPS.

Table 31-Three Illustrative Policy Scenarios for External Power Supplies (CLASP 2013 c)

Scenario	Tier 1	Tier 2
1	CoC Tier 1 from 2015	CoC Tier 2 from 2016
2	CoC Tier 1 from 2014	Modified CoC Tier 2 (Tier 2+) from 2016, no-load ÷ 1.025; efficiency x 1.025
3	Modified CoC Tier 1 (Tier 1+) from 2014 no-load ÷ 1.025; efficiency x 1.025	Modified CoC Tier 2 (Tier 2++) from 2016, no-load ÷ 1.05; efficiency x 1.05

Across the EU, with more than 1.8 billion units installed by 2020, EPS are projected to consume 7.5 TWh of electricity in 2020. The energy savings estimate from Scenario 2 is 1.71 TWh in that year, or approximately 23%. By 2030, the baseline energy consumption is 7.66 TWh of electricity and the energy savings estimate from Scenario 2 is 1.93 TWh, or 25%.

8.15 Simple set-top boxes

8.15.1 Introduction

A set-top box is a device that connects a television to some external signal, and which turns that signal into content that is displayed on the screen (CLASP, 2013). The signal source might be a satellite dish antenna, cable television, a telephone line, broadband over power line, an Ethernet or optical fiber cable, or a VHF or UHF antenna. In Europe, a distinction is made between simple set-top boxes (SSTB's) and complex set-top boxes (CSTB's). Simple set-top boxes have the primary function of converting digital input into analogue output signals. Functionality of simple set-top boxes can vary. Apart from the capability of decoding signals they can be equipped with a hard disk, recording functionality and with a second tuner. Complex set-top boxes are discussed in the next section.

The shipments of SSTB in Europe and the magnitude of the installed stock are principally linked to the rate of transition to digital terrestrial television (DTT) broadcasting in Europe (CLASP, 2013 p. G-7). The phase-out of analogue TV signals requires either the use of a (simple or complex) set-top box or the use of a TVs with integrated TV tuners. Therefore, with the replacement of the existing stock of televisions with new televisions the need for set-top boxes (in any case SSTBs) will diminish and eventually disappear.

Energy consumption from SSTBs was estimated to be 2 TWh in 2005, according to the Impact Assessment. Without a regulation in place this was expected to increase to 14 TWh in 2014, after which it would decline. The Ecodesign measure was expected to curb this consumption to 5 TWh (in 2014), or save 64% with respect to BAU.
It should be noted that 6 out of the expected 9 TWh of savings per year in 2014 was expected to come from reducing power consumption in the standby mode.

At the time of the preparatory study (finished in December 2007), data was available showing that the power consumption of a simple set-top box varied from 6 to 23 W in the on-mode and 1 to 17 W in the standby mode (preparatory study, p. 16-17).

8.15.2 Policy context

The quick increase of market share of SSTBs prompted the EU to start the SSTB regulation process. There was already a Code of Conduct (CoC) for set-top boxes in Europe, but this was voluntary. Commission Regulation (EC) No. 107/2009 on the ecodesign requirements for simple set-top boxes entered into force in February 2009. Some of the requirements are:

- One year after the regulation has come into force (February 2010), the maximum allowed power consumption is 5 W for on mode, and 1W for standby and off-mode. Decoding of HD signals is allowed to consume 3 W extra in the on-mode.
- Three years after the regulation has come into force (February 2012), the limit will still be 5 W for on-mode, but 0.5 W for standby and off-mode. Presence of a hard disc will allow for an additional 6 W, a second tuner for 1 W, and the option to decode HD signals for 1 W.

8.15.3 Achievement of objectives

In response to the analogue switch-off, TV manufacturers started to ship a large proportion of their TVs with integrated digital TV tuners (IDTVs) in 2006. According to experts at DigitalEurope by December 2012 approximately 250 million IDTVs had been shipped to the EU-27 (CLASP 2013). Many of these TVs have replaced analogue cathode ray tube (CRT) TVs and basic SSTBs providing no hard disc drive (HDD) recording functions. This has caused the decline in SSTB sales figures start in 2010 and 2011, reflecting the impact of these IDTV shipments (CLASP 2013).

In Table 32 sales and stock data from the preparatory study are compared to sales and stock data from the CLASP report. While in the preparatory study both sales and stock of simple set-top boxes was expected to peak in 2014 with 56 million set-top boxes, the CLASP data shows that the peak occurred as early as 2009 with 37 million SSTBs, and has declined in the next two years. The stock has continued to increase up until 2011. Thus, the peak of sales occurred before the measure went into effect.

On the one hand it is likely that direct actual savings due to the sales of more efficient equipment compared to BAU will be lower than expected, because the sales themselves are lower than expected. On the other hand, two trends had an increasing effect on realized savings. Firstly, it is likely that the efficiency of equipment sold before the measure went into effect was already affected by the upcoming legislation. Secondly, sales in the period 2008 – 2009 have been higher than expected.

Table 29 only compares only projected sales and stock data with an estimate of realised sales and stock data. It was already mentioned that power and energy consumption of SSTBs can vary strongly depending on their functionality. To what extent project average power consumption compare to realised average power consumption is not known. The overall stock is in any case expected to consume more as the stock of SSTBs is significantly (36%) higher than assumed before.

Table 32 Sales and stock data simple set-top boxes, preparatory study and CLASP (2013). Data in italics are future projections

	Preparatory study (2007)		CLASP (2013)	
Year	sales	stock	sales	stock
2000	1	3.1		
2001	1.5	4.6		
2002	2.5	7.1		
2003	4.2	11.3		
2004	6.2	16.5		
2005	9.7	24.7		
2006	12.5	34.7		
2007	*16.5*	*47*	20	48.8
2008	*19.5*	*60.5*	24.5	73.5
2009	*23*	*73.8*	37.2	110.5
2010	*28.5*	*89.8*	26.5	137
2011	*36.5*	*109.8*	12.3	149.3
2012	*35*	*125.1*		
2013	*48*	*150.1*		
2014	*56*	*177.6*		
2015	*14*	*155.1*		
2016	*12*	*132.1*		
2017	*6*	*90.1*		
2018	*2*	*36.1*		
2019	*1*	*23.1*		
2020	*0*	*11.1*		

Concluding remarks regarding simple settop boxes are the following.

- The ambition level seems appropriate, limiting excess consumption in the on and the standby mode.
- Whether the scope was appropriate can be debated. Basically, the scope of SSTBs is very limited. Settop boxes with a little more than basic functionality are considered to be Complex Settop Boxes (discussed in the next section).
- In the USA there is Energy Star certification for settop boxes. The distinction between simple and complex STBs is not made. This raises the question as to whether the SSTB and CSTB distinction is necessary.
- Whether the project energy savings in 2014 have been reached is not entirely clear. What is clear is that technology and market have moved faster than anticipated, with a faster stock growth and faster decline in sales than anticipated. It shows the difficulty of regulating new technologies. However, the efforts on SSTBs should be seen as part of an integral effort to curb the energy consumption of electronic equipment, including its standby consumption.

8.16 Complex set-top boxes

8.16.1 Introduction

Product sector, consumption, importance
The Preparatory Study (Lot 18: Complex Set Top Box) (2008) mentions that the main trend in set top boxes has been towards converged products where multiple functions are combined in a single multi-function device. Thus the product group within LOT 18 covers digital convertors for TVs, including certain additional features.

The Preparatory Study (Lot 18: Complex Set Top Box) (2008) provides the following definitions *"CSTBs are STBs which allow conditional access… Conditional access means an active system that enables the CSTB to process an apply targeted data from a service provider."*
The main distinction between a Complex Set Top Box (CBST) and Simple Set Top Box (SSTB) is those additional features; a CSTB has the ability to allow conditional access (e.g. to pay TV, video on demand and other conditional services). Additional functionalities listed here in a similar manner as described in the voluntary agreement on CSTBs:

- Access to additional RF channels (enabling the access to multiple channels simultaneously, e.g. for watching and recording);
- Advanced Video Processing present (ability to decode video beyond a certain compression efficiency [beyond MPEG-2]);
- DVR (Digital Video Recording) present;
- DOCSIS 3.0 or VDSL functionality;
- Capable of HD (High Definition resolution);
- Return path functionality present (2-way communication between user and provider);
- Multi-decode and multi-display functionality (being able to watch multiple channels simultaneously).

As technology is evolving the scope of CSTBs is likely to change. An example of current developments is the router functionality, which allows for receiving and distributing internet signals.

8.16.2 Policy context

Regulation date and scope

Complex set top boxes belong to the consumer electronic product group and meet the criteria of representing significant volume of sales and trade, having a significant environmental impact and presenting significant potential for improvement in terms of their environmental impact without entailing excessive costs. Therefore, the product group represents a priority in ecodesign policy. A Voluntary agreement was approved by the Commission on 22 November 2012 in relation to CSTBs. This agreement has been in place since July 2010.

The CSTB industry recognises that the energy consumption of CSTBs is influenced by the services offered, the number of features provided and by the components used. The signatories to the voluntary agreement represent all actors of the complex set top boxes market including manufacturers, software and middleware providers as well as TV service providers. Furthermore, they represent large majority of the relevant economic sector as stipulated in point 3 of Annex VIII to Directive 2009/125/EC.

The agreement requires that:

- At least 90% of the CSTBs each signatory places on the EU market must comply with agreed minimum energy efficiency requirements;
- Each signatory must provide information to an Independent Inspector, and if a signatory fails to provide adequate information it risks forfeiting its signatory status; and
- Its effectiveness will be regularly assessed by the European Commission and the Ecodesign Consultation Forum which consists of representatives of Member States, industry and NGOs.

8.16.3 Achievement of objectives

The Independent Inspector's report mentions that the average energy use of CSTBs reaches only half (78 kWh/year) of the maximum consumption level allowed under the VA (150 kWh/year). This puts into question the level of ambition of the VA requirement in the first place.

NGOs have frequently asked about commitments on environmental aspects of TV decoders other than energy-related. ANEC et al (2012) mentions that, the signatories of the VA have repeatedly refused to explore this dimension despite some clear recommendations formulated by the EC in a letter dated 11 February 2011, to align with standard IEC 62430 on "Environmentally conscious design for electric and electronic products"

8.17 Domestic refrigerators and freezers

8.17.1 Introduction

Product sector, consumption, importance

The EU domestic refrigerating market is generally considered to be saturated. The market is primarily a replacement market except where population and thus number of domestic fridges are increasing. Based on Eurostat population projections, CLASP (2013 c) suggests that the number of households in the EU27 is projected to increase by 11.6% between 2012 and 2030. Under stable economic conditions domestic refrigerator sales is driven by changes in the number of households. However, CLASP (2013 c) states that according to Eurostat data domestic domestic refrigerators and freezers sales have declined over the last few years in EU. This decline is most probably due to the global economic crisis that began in 2008. It is unlikely that the number of domestic refrigerators per household has declined during this period, but instead people are keeping hold of their existing appliances for longer and thus effectively increase the average refrigerator lifespan (CLASP, 2013 c).

Domestic refrigerators and freezers are regulated by the Energy Labelling Directive (2003/66/EC) and minimum efficiency requirements (Directive 1996/57/EC) since 1994 and 1996. According to impact assessment (2009) despite a 15% stock growth since 1996, the absolute energy consumption of domestic 'cold appliances' in 2009 is 15% lower than in 1990.

8.17.2 Policy context

Regulation date and scope
Commission Regulation 643/2009 on the ecodesign requirements for domestic refrigerating appliances entered into force on 12 August 2009. The ecodesign regulation and energy labelling regulations have an overlapping scope of coverage. A number of exclusions are also set out in Article 1 of implementing measures (CLASP, 2013 c).

The Regulation 643/2009 shall be reviewed no later than five years after its entry into force (i.e. by 12 August 2014). The reviews must, assess potential future minimum performance requirements. In addition, both the ecodesign and energy labelling regulations require reviews to assess verification tolerances and the possibilities for removing or reducing the values of existing correction factors. The ecodesign revision article (7) also requires the Commission to assess the need for adopting specific ecodesign requirements for wine storage appliances no later than two years after the entry into force of the regulation (i.e. 12 August 2011). This deadline has now passed and the assessment has been included into a separate work-stream under the ecodesign work plan for 2012-2014.The assessment is, with six other product groups, on the indicative priority list. Apart from the issue of wine coolers, the scope of both implementing measures is still adequate (CLASP, 2013 c).

ED measures and timing
The minimum performance requirements and proposed energy labelling scale are built on an "energy efficiency index" (EEI), which is the ratio between annual consumption of the appliance and a standard consumption of a typical similar model. Minimum energy efficiency performance requirements include:
Compression-type refrigerating appliances:

- From 1 July 2010: EEI < 55 (label class A or better);
- From 1 July 2012: EEI < 44 (label class A^+ or better);
- From 1 July 2014:EEI < 42 (label class A+ or better according to labelling in effect from 1 July 2014).

Absorption-type and other-type refrigerating appliances:

- From 1 July 2010: EEI < 150 (label class F or better);
- From 1 July 2012: EEI < 125 (label class E or better);
- From 1 July 2015: EEI < 110 (label class D or better).

Absorption-type refrigerating appliances are noiseless and serve a niche market.

8.17.3 Achievement of objectives

Ambition of measure:
According to the internet survey carried out by CLASP (2013 c) in 2012, there has been a significant improvement in energy efficiency of refrigerators available in the market since 1993.

Although the survey was based on a limited data set (200 models on sale in six EU countries) this provides an indication that in the case that this improvement continues in the same manner into the future, by the time a new EU Ecodesign regulation is developed and effective (e.g. in 2016) the average EEI would have moved on from today's market average 41 to 32 i.e. to the A++ level. This would mean that the market in 2016 will be 22% more efficient than today's apparent average based on a limited survey. This trend suggests that the energy efficiency levels acquired by the market exceeds the levels set by the requirements of the regulation. This issue is also pointed out by Attali and Bush (2013) where they suggest that implementing measure for household cold appliances resulted in very limited market change due to the reason that the technological achievement has already surpasses the requirements of the regulations at the time of their implementation. Molenbroek (2012) also pointed out that Tier 1 requirements were nothing more than Business As Usual. In this study it was also pointed out that even though Tier 2 requirements appear to be appropriate, they could also be lacking in ambition by the time they go into effect, as prices of energy efficiency equipments tends to decrease over time. An illustration of this effect from this study is given below, for refrigerators and televisions.

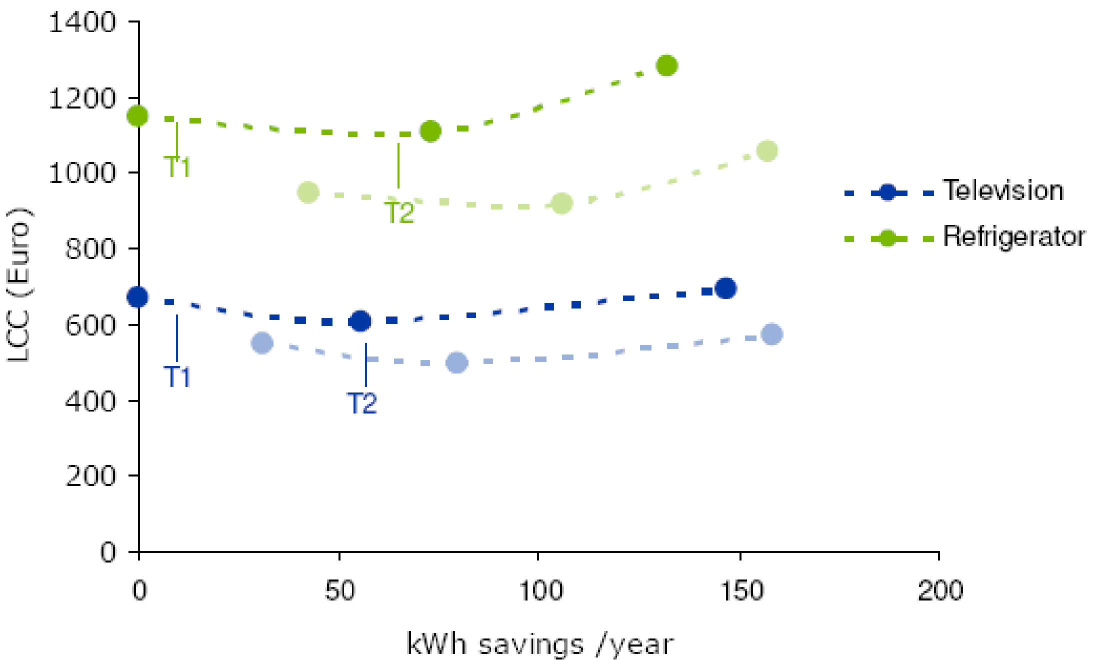


Figure Life cycle costs for televisions and refrigerators, together with how the life cycle cost curve could look like 7 years later (lighter colors used). T1 and T2 are Tier 1 and 2 requirements.

In terms of scope

The current scope of the regulation does not need revision except the requirements for wine storage appliances. Commission planned to address the specific Ecodesign requirements for wine storage appliances no later than 12 August 2011 (two years after regulation enters into force). It is now further planned that this issue will be addresses in the work plan for 2012 - 2014 (Clasp, 2013 c).

Market changes due to regulations

At the time energy labelling for domestic refrigerating appliances was first developed in the EU (the GEA study of 1993), the average appliance was on the class D and E threshold and had an EEI of 100. According to the Impact Assessment (LOT 13 Household Refrigerating appliances) (2005) the market has shifted to products with high energy efficiency, thus efficiency classes A, A+ and A++ has accounted for the bulk of the market, almost 80% as shown in Table 33. The current labelling classification is from A to A+++, as the ecodesign regulation removed models less efficient than A from the market in July 2010, leading to a ban on 20% of products, which were in classes B and C. Thus, since 2010, the domestic refrigerating appliances energy label has had only four classes. In July 2014, the ecodesign regulation will remove models less efficient than A+ from the market, retaining only three classes.

The pick up of A+++ products in 2012 in the market suggests that new technologies penetrate into the market, which is likely to be supported by the latest Energy Labelling Regulation (Commission Delegated Regulation 1060/2010) Also, in 2012 a significant fraction of A has been found on the market, which has to be phased out by July 2014. It is unlikely that removal of this class in two years would happen without introduction of the second Tier of the Ecodesign Regulation. Therefore, impact due to Ecodesign can be expected.

Table 33: Market share (%) of domestic refrigerators by energy efficiency classes in 2005 and 2012

EEI Classes	A+++	A++	A+	A	B	C	D	E	F	G
EEI	22	<30	<42	<55	<75	<90	<100	<110	<125	>125
In 2005 (Impact Assessment, 2007)	0	1	18	61	19	1	0	0	0	0
In 2012 (CLASP, 2013 c)	4	18	50	26	1	0	0	0	0	0

Saving estimations: comparison with IA

In Table 33 the the energy consumption projections by CLASP (2013 c) and in the impact assessment are compared in order to estimate the achievement of energy savings potential. The energy consumptions are based on the stock models used in the respective studies. The CLASP projection, referred to as the 'Business as Usual' (BAU) scenario, starts from the assumption that energy efficiency of refrigerators will continue to improve in the coming years, even without further minimum energy performance requirements. The BAU scenario also takes into account the fact that the effectiveness of the label will slowly decline as saturation occurs in the top three label classes (i.e., A+ through A+++). The comparison between the impact assessment and the CLASP analysis suggests that the 2020 ecodesign energy saving target is likely to be met at a slightly lower level by 2020. However, the different consumption levels for 2005 suggest difference in calculation methods or starting data, which makes it difficult to state this with certainty.

Table 34: Stock model energy consumption (TWh) of domestic refrigerating appliances.

Projection	2005	2010	2015	2020	2025
Current regulation (sub-option EE42-13 of the Impact Assessment)	122	105	90	77	64
BAU (CLASP, 2013)	103.8	92.1	79.7	70.6	65.0

The CSES study has concluded before that 'The development in the market started long before 2005 when the Directive was introduced - although one also needs to consider the fact that certain requirements for those appliances were in place even before 2000. In that respect, the Ecodesign requirements can be seen as a continuation that helped sustain and reinforce the pace of the market transformation' (CSES 2012, p. 51).

8.18 Electric pumps

8.18.1 Introduction

Product sector, consumption, significance

A electric pump is defined as a pump used for clean water duty of three categories: single stage end suction water pumps, vertical multistage water pumps and submersible multistage pumps. The preparatory study (LOT11: Electric pumps, 2008) shows that water pumps are placed on the European Union market in large quantities. Their energy consumption in the use phase is the most significant environmental aspect of all life-cycle phases, with their annual electricity consumption amounting to 109 TWh in 2005, corresponding to 50 Mt in CO_2 emissions. In the absence of measures to limit this consumption, it is predicted that energy consumption will increase to 136 TWh in 2020.

8.18.2 Policy context

Regulation date and scope
Water pumps forming parts of electric motor systems are essential in various pumping processes. There is a total cost-effective potential for improving the energy efficiency of these pumping systems by approximately 20% to 30%. Even though the main savings can be achieved by motors, one of the factors contributing to such improvements is the use of energy-efficient pumps.

Pumps for clean water movement were included in the first Ecodesign Working Plan, as they were one of the product groups with substantial potential for improvement. They were included in Lot 11 along with motors and fans.

Following the preparatory study the EC issued a Regulation (547/2012), setting minimum performance requirements for pumps. These minimum efficiency requirements are represented by an index called 'minimum efficiency index' or MEI.

ED measures and timing
The MEI is a dimensionless figure that is derived from a complex calculation based on the efficiencies at Best Efficiency Point (BEP), 75% BEP and 110 BEP, and the specific speed. The value ranges from 0 to 1 with the lower value being less efficient.

- From 1 January 2013, water pumps shall have a minimum efficiency index of MEI ≥ 0.1;
- From 1 January 2015, water pumps shall have an even stricter minimum efficiency index of MEI ≥ 0.4.

"Water pump" is defined as the hydraulic part of a device that moves clean water by physical or mechanical action and can have different designs as follows:

- End suction own bearing (ESOB);
- End suction close coupled (ESCC);
- End suction close coupled inline (ESCCi);
- Vertical multistage (MS-V);
- Submersible multistage (MSS).

Two preparatory studies on electric pumps are being carried out to assess the possibility of enlarging the scope of pumps under regulation:

- Lot 28 – pumps for private and public wastewater;
- Lot 29 - pumps for private and public swimming pools, ponds, fountains and aquariums, as well as clean water pumps larger than those regulated under Lot 11.

8.18.3 Achievement of objectives

Insufficient time has passed since the enforcement of regulation to draw conclusions on its impact on the pump market.

8.19 Domestic dishwashers

8.19.1 Introduction

Product sector, consumption, importance
Similar to domestic washing machines, dishwashers are placed on the EU market in large quantities. The environmental impact of household dishwashers is to a large extent related to the consumption of electricity and water during use, and remains significant despite on-going improvements. The impact assessment (2010) (LOT 14 Household dishwashers) emphasizes that technical cost-effective solutions exist that could lead to significant improvements for energy and environmental impact of this product group. In 2005 the electricity consumption of domestic dishwashers was 26 TWh.

8.19.2 Policy context

Regulation date and scope
The Ecodesign requirements for household dishwashers are laid down in Commission Regulation 1016/2010, which entered into force on 1 December 2010. The regulation establishes the requirements for "*electric mains-operated household dishwashers and electric mains-operated*

household dishwashers that can also be powered by batteries, including those sold for non-household use and built-in household dishwashers". This regulation shall be revised within four years (i.e. before December 2014).

ED measures and timing
The Ecodesign requirements for dishwashers include, from 1 December 2011:

- For all household dishwashers, except household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (EEI) shall be less than 71 (label A or better according to the new labelling scheme);
- For household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (EEI) shall be less than 80 (label B or better);
- For all household dishwashers, the Cleaning Efficiency Index (IC) shall be greater than 1,12.

From 1 December 2013 on the following requirements apply:

- For household dishwashers with a rated capacity equal to or higher than 11 place settings and household dishwashers with a rated capacity of 10 place settings and a width higher than 45 cm, the Energy Efficiency Index (EEI) shall be less than 63 (label A+ or better);
- For household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (EEI) shall be less than 71 (label A or better);
- Requirements on the Drying Efficiency Index, depending on capacity.

From 1 December 2016 on the following requirements apply:

- For household dishwashers with a rated capacity of 8 and 9 place settings and household dishwashers with a rated capacity of 10 place settings and a width equal to or less than 45 cm, the Energy Efficiency Index (EEI) shall be less than 63 (label A+ or better) .

8.19.3 Achievement of objectives

Ambition of measure in terms of scope
The scope of coverage of the ecodesign and energy labelling implementing measures include all types of domestic dishwashers and therefore is considered to be appropriate.

Market changes due to regulations
Compared to other household appliances such as refrigerators and washing machines, dishwashers have a lower saturation level. By 2012, approximately 40% of households in the EU27 owned a dishwasher. CLASP (2013 c) suggests that ownership rates vary widely between countries and ownership is substantially lower in the 12 new Member States (NMS12) than in the original 15 from before the 2004 EU expansion (EU15). Moderate increases in dishwasher ownership are expected in the EU15, but faster growth in the NMS12 market, reaching an overall EU27 average household ownership level of just above 60% in 2030.

CLASP (2013 c) mentions that the dishwasher market has witnessed a transition towards higher energy efficiency and lower water consumption. On an additional note, there has also been a trend toward consu``mers purchasing larger machines (as well as manufacturers improving the dishware capacity of trays) to accommodate a larger number of place settings.
Figure 20a shows dishwashers sales by energy label class, in the Netherlands from 2006 – 2012 and an estimated value of the EU-27.

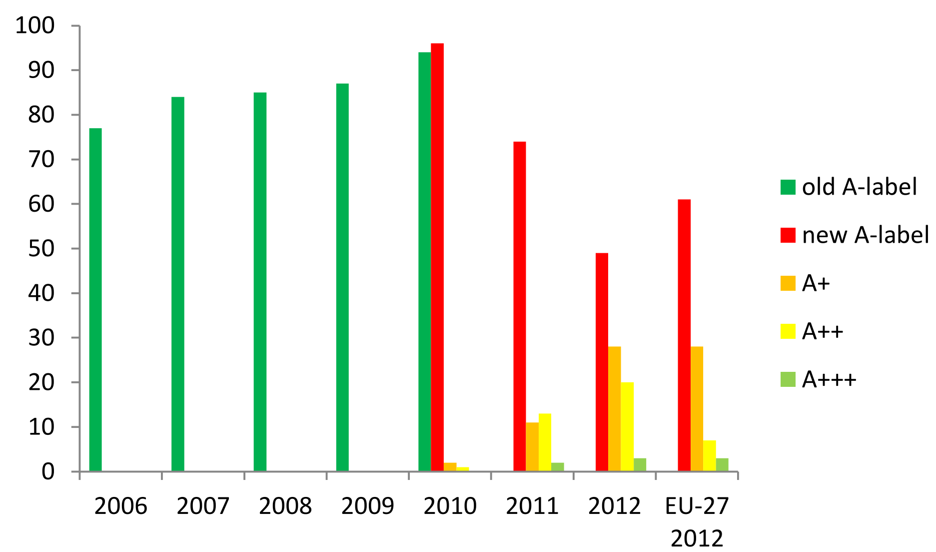


Figure 20a. Dishwasher sales in the Netherlands (2006 – 2012) and and estimate of EU-27 sales in 2012 by energy label class (VLEHAN 2012 and CLASP (CLASP 2013 c).

The Dutch data from 2006 – 2010 depict the old A-label slowly going to saturation. From 2010 the new label is shown, showing a strong decline of the A label in favour of new label classes. Keeping in mind that A-labels will be banned from the market starting Dec. 2013 the current strong trend in the Netherlands will need to be kept up, and for the EU-27 as a whole removal will have to be somewhat faster.

CSES concluded that Tier 1 did not have much effect of the market, as all dishwasher sales had already reached A-label before the requirements came into effect. From the data presented here it is at least shown that efficiency levels are improving from 2010 - 2012. It cannot be stated to which extent this is caused by the new labels and to which extent by introduction of Tier 2 Ecodesign requirements.

CLASP (2013 c) provides a projection model for the proportion of sales of dishwashers by energy label class. The projection is based on the expected effect of current Ecodesign and energy label measures, but assumes no new policy instruments are introduced. Thus, Figure 18b suggests that products with performance class A will have phased out entirely by 2025 as a result of the Ecodesign and energy label requirements.

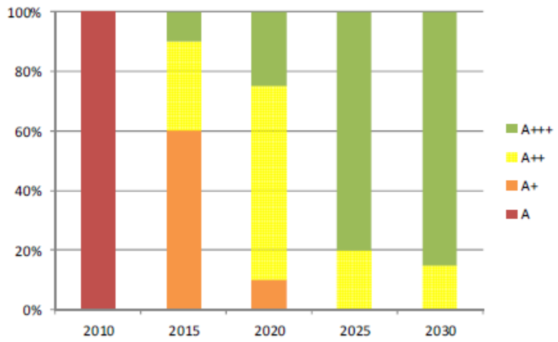


Figure 18b Estimated proportion of dishwasher sales by energy label class (CLASP, 2013 c)

CLASP (2013 c) projects that the improvement in the energy efficiency of units sold will affect the energy efficiency of the overall stock as the older least energy efficient products are phased out from the market. Figure 19 presents both the annual average energy consumption of new units and the stock average in the 'Business as Usual' (BAU) scenario.

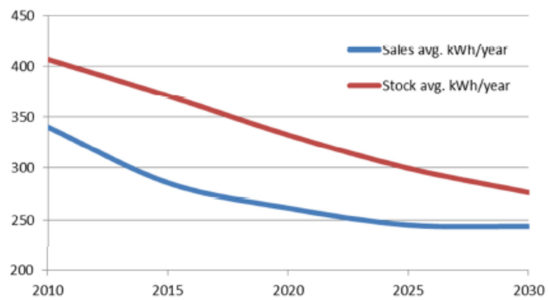


Figure 19 Estimated stock and sales average annual energy consumption of dishwashers, EU-27 (CLASP, 2013)

CSES already reported that the first Tier for dish washing machines did have much effect on the market as the market was already overwhelmingly dominated by class A appliances, slowly increase until almost 100% in 2010 (in the old labelling system, before the introduction of A^+ - A^{+++})). With the introduction of the new labelling system (June 2010) differences in A – A+++ classes became visible.

Savings estimations: comparison with IA

In Table 35 the energy consumption projection of CLASP study (2013 c) and the impact assessment (2010) (LOT 14 Household dishwashers) are compared in order to assess if the energy savings potential will be realized. The energy consumption levels over time are based on the stock models in each reference source. The CLASP projection is referred to as the BAU scenario. It takes into account the effect of current ecodesign and energy label measures, but assumes no new policy instruments are introduced. The analysis by CLASP suggests slightly higher energy consumption figures compared to the ecodesign energy saving estimates by 2020. However, the energy consumption in 2010 between the two scenario's already differs substantially, making comparison of 2020 figures difficult.

Table 35 Stock model energy consumption (TWh) of domestic dishwashers

Projection	2010	2015	2020	2025
Current regulation (proposal B of Impact Assessment)	26.7	28.6	31.7	35.0
BAU (CLASP, 2013 c)	33.4	36.7	39.3	41.1

8.20 Domestic washing machines

8.20.1 Introduction

Product sector, consumption, importance

The impact of domestic washing machines on energy use and environment are significant due to two main properties of the product group. Firstly, they are placed on the EU market in large quantities. According to the preparatory study (LOT 14 Household washing machines) (2007), the ownership of domestic washing machines reached 90% in 2000. Secondly, preparatory study (LOT 14 Household washing machines) (2007) mentioned that the environmental impact of domestic washing machines is mainly related to the consumption of electricity and water during use. In 2005 the electricity consumption of domestic washing machines was 35 TWh/yr.

8.20.2 Policy context

Regulation date and scope

The ecodesign requirements for household washing machines are laid down in Commission Regulation 1015/2010, which entered into force on 1 December 2010. It shall be revised within four years (i.e. before December 2014).

ED measures and timing

The minimum ecodesign requirements for domestic washing machines include: prohibition of domestic washing machines that have EEI higher than 68 in December 2011, followed by prohibition of washing machines that have EEI higher than 59 from 2013 onwards; introduction of a cold washing option from December 2011; updated calculation of EEI to reflect the use of 60° and 40° programmes and part load.
Limits on water consumption are also set with different levels for the two phases, 2011 and 2013.

8.20.3 Achievement of objectives

Ambition of measure in terms of scope

CLASP (2013 c) *suggests that the scope of coverage for household washing machines is adequate. The regulation does however not include washer-dryer combinations. These represent about 2.5% of the units sold in the EU. It could therefore be considered whether it would be worthwhile, from an energy saving point of view to include these products in a revised regulation.*

Market changes due to regulations
The European washing machine market is generally considered to be saturated. In the future, the washing machine market is expected to be driven primarily by the replacement of old appliances. By 2005, it was estimated that approximately 10% of new washing machine sales in the EU-15 were contributing to increasing the stock while 90% were replacing existing appliances. In the twelve New Member States household washing machine ownership reached a rate of around 70% by 2000. It has since grown to 90%, as in the EU-15 countries (Bertoldi, 2009). In this saturated market, the future sales percentage going into increases in the net stock will largely depend on the growth rate of the number of households across the EU-15.

CLASP (2013 c) provides a projection model for energy consumption based on the expected installed stock of domestic washing machines in EU-27. The projection is compared with the figures in 2010 as provided by GfK (2011). Thus, Figure 20 shows that the products with performance class A and B, approximately 65% of the sales in 2010, has phased out as a result of the ecodesign and energy label requirements.

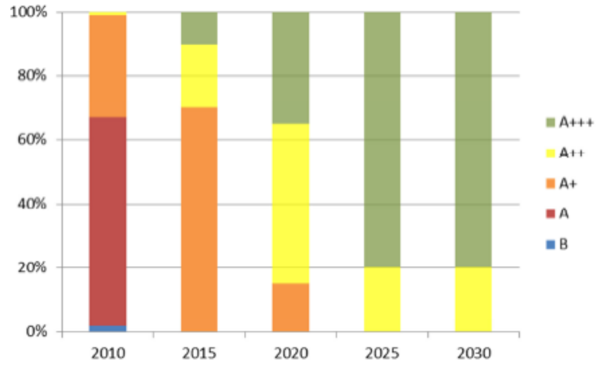


Figure 20 Estimated sales of washing machines by energy efficiency class (CLASP, 2013)

CLASP (2013 c) states that *"as the new, more energy-efficient products are installed into the stock of washing machines in Europe and the least energy-efficient products are retired from the market, the efficiency of the stock will gradually increase as the older (less efficient) units are replaced."*

Figure 21 illustrates this effect for the market under current regulations showing annual energy consumption of new units versus the stock average energy consumption.

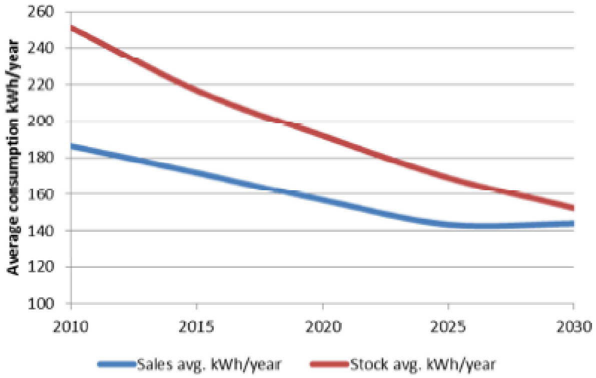


Figure 21: Estimated stock and sales average annual energy consumption (CLASP, 2013).

Saving estimations: comparison with IA

In Table 36 the energy consumption projections by CLASP (2013 c) and in the impact assessment (Lot 14) are compared in order to estimate the achievement of energy savings potential. The energy consumption levels are based on the stock models in the respective studies. The CLASP projection is referred to as the 'Business as Usual' (BAU) scenario. It takes into account the fact that energy efficiency of washing machines will continue to improve in the coming years. The analysis by CLASP suggests slightly higher energy consumption figures compared to the ecodesign energy saving estimates by 2020.

Table 36: Stock model energy consumption (TWh) of domestic washing machines

Projection	2010	2015	2020	2025
Current regulation (sub-option A of Impact Assessment)	36.8	37.3	36.6	35.7
BAU (CLASP, 2013)	47.5	43.3	40.8	38.9

The most significant environmental aspects of washing machines are energy and water consumption in the use phase. Regarding energy, the influence of the power consumption in low power modes such as left-on mode and off mode are of secondary importance. Areas of possible technology improvement include improved motor efficiency, temperature-time trade-off, improved mechanical action in the wetting phase, sophisticated electronic process controls and sophisticated electronic water and temperature controls. Further improvements are still possible in all five of these areas, and if exploited would result in further reduction in energy consumption (CLASP, 2013).

8.21 Space and combination heaters

8.21.1 Introduction

Product sector, consumption, importance

A significant energy saving impact is expected by introducing regulations towards heaters in EU due to the significant number of their sales and the appliances' environmental impact. According to the impact assessment study (LOT 1 Space and combination heaters) (2013) the volume of sales for heaters, about 6.6 million units per year. The annual energy consumption of heaters corresponds to about 16% of the total gross energy consumption of the EU-27 in 2006. Energy savings are possible because there are technical solutions which reduce the fuel or electricity consumption of heaters, compared to the market average, implying a wide disparity in the performance of products available on the market.

The combined effects of the Ecodesign and Energy Labelling Regulations (813/2013 and 811/2013, respectively) is expected to result in estimated annual primary energy savings of about 1 900 PJ (about 45 Mtoe) by 2020, corresponding to around 110 Mt CO_2 emissions, and a reduction in annual nitrogen oxides emissions of some 270 kt SOx equivalent.

8.21.2 Policy context

Regulation date and scope
The Commisision Regulation 813/2013 on the ecodesign requirements for space heaters and combination heaters have been published in the Official Journal of the EU in September 2013.

The scope of the proposed regulation for space and combination heaters covers boilers and heat pumps, both space heaters and combination heaters, with a rated heat output up to 400 kW, and cogeneration with an electrical capacity up to 50 kW. The heaters covered use gas or oil fuel, including from biomass), electricity and ambient/waste heat.

Exceptions are, among others:

- Heaters specifically designed for using predominantly biomass fuels;
- Heaters using solid fuels;
- Heaters for drinking or sanitary water;
- Heaters for heating and distributing gaseous heat transfer media such as vapour or air;
- Cogeneration space heaters with a maximum electrical capacity of 50 kW or more.

ED measures and timing
The requirements put in force by the implementation measures cover parameters for energy efficiency, emissions of nitrogen oxides (NOx) and sound power level. The first requirements will apply as of 26 September 2015. Table 37 provides an overview matrix of requirements applied per product group.

Table 37: Appliance parameters subject to minimum requirements per heater group

Appliance parameters subject to minimum requirements	Efficiency	NOx	Sound power
Gas/oil boilers	x	x	
CHP	x	x	
Electric heat pumps Gas/oil heat pumps	x	- x	x
Electric boilers	x		

The requirements for energy efficiency will be imposed in two steps. Two years after the implementation measure is in forceall appliances will be required to match minmum efficiency requirements. The requirements will become more stringent for some appliance groups as of September 2017. Table 38 provides the minimum allowable limits for seasonal space heating energy efficiency of heaters depending on the technology and rated heat ouptput. Energy efficiency requirements for space heaters and for the space heating function of combination heaters are set on the basis of seasonal space heating efficiency, which considers the energy inputs to satisfy the space heating demand for a designated heating season under defined conditions. Seasonal space heating energy efffIcency defined in the Labelling regulation (EU 811/2013) as "*the ratio between the space heating demand for a designated heating season, supplied by a space heater, a combination heater, a package of space heater, temperature control and solar device or a package of combination heater, temperature control and solar device, and the annual energy consumption required to meet this demand, expressed in %.;*"

Table 38: Minimum seasonal space heating energy efficiency

Appliance type	From 26 September 2015	From 26 September 2017
Fuel boiler space heaters[a] with rated heat output ≤ 70 kW and fuel boiler combination heaters with rated heat output ≤ 70 kW, with the exception of type B1 boilers with rated heat output ≤ 10 kW and type B1 combination boilers with rated heat output ≤ 30 kW	86%	unchanged
Fuel boiler space heaters with rated heat output > 70 kW and ≤ 400 kW and fuel boiler combination heaters with rated heat output > 70 kW and ≤ 400 kW	Full load 86%, part load 94%	unchanged
Type B1[b] boilers with rated heat output ≤ 10 kW and type B1 combination boilers with rated heat output ≤ 30 kW	75%	unchanged
Electric boiler space heaters and electric boiler combination heaters	30%	36%
Cogeneration space heaters	86%	100%
Heat pump space heaters and heat pump combination heaters, with the exception of low-temperature heat pumps	100%	110%
Low-temperature heat pumps	115%	125%

(a) 'fuel boiler space heater' means a boiler space heater that generates heat by burning fossil fuels and/or biomass fuels, and which may be equipped with one or more additional heat generators using the Joule effect in electric resistance heating elements;

(b) 'type B1 boiler' means a fuel boiler space heater incorporating a draught diverter, intended to be connected to a natural draught flue that evacuates the residues of combustion to the outside of the room containing the fuel boiler space heater, and drawing the combustion air directly from the room; a type B1 boiler is marketed as type B1 boiler only;

The definitions regarding to efficiency of boiler space heaters, boiler combination heater s and cogeneration space heaters is based on the use of conversion coefficienct (CC). Annex III of EU 813/2013 states;

"*Seasonal space heating energy efficiency of boiler space heaters, boiler combination heaters and cogeneration space heaters. The seasonal space heating energy efficiency shall be calculated as* *the seasonal space heating energy efficiency in active mode, corrected by contributions accounting for temperature controls, auxiliary electricity consumption, standby heat loss, ignition burner power consumption (if applicable) and, for cogeneration space heaters, corrected by adding the electrical efficiency multiplied by a conversion coefficient CC of 2.5*."

Labelling regulation (811/2013) states:
"Cogeneration manufacturers suggested an alternative efficiency calculation method to ensure a level playing field with heat pumps. However, this suggestion is not supported as renewable technologies should in principle be able to reach higher labelling classes than other technologies and as it would overrate electric energy efficiency of cogeneration space heaters".

Energy efficiency requirements for the domestic hot water heating function of combination heaters are set on the basis of load profiles, namely a certain sequence of water draw-offs representing the function of water heating. The water heating energy efficiency of combination heaters shall not fall below the following values in Table 39.

Table 39: Requirements for water heating energy efficiency

Declared load profile	From 26 September 2015	From 26 September 2017
3XS	22%	32%
XXS	23%	32%
XS	26%	32%
S	30%	32%
M	30%	36%
L	30%	37%
XL	30%	38%
XXL	32%	60%
3XL	32%	64%
4XL	32%	64%

The requirements for limiting NOx emsisions comes into force in September 2017 for cogeneration space heaters, heat pump space heaters and heat pump combination heaters. The limit values of NOx are defined for each appliance group and fuel type.

The Labelling Regulation (EU 811/2013) states that "*this Regulation should introduce a new labelling scale from A++ to G for the space heating function of boiler space heaters, cogeneration space heaters, heat pump space heaters, boiler combination heaters and heat pump combination heaters. While classes A to G cover the various types of conventional boilers when not combined with cogeneration or renewable energy technologies, classes A+ and A++ should promote the use of cogeneration and renewable energy sources. Furthermore, a new A-G labelling scale should be introduced for the water heating function of boiler combination heaters and heat pump combination heaters*".

According to the ANNEX II of the Labelling Regulation (EU 811/2013), the seasonal space heating energy efficiency class of a heater shall be determined on the basis of its seasonal space heating energy efficiency as set out in Table 40.

Two labels are described in the Labelling Regulation (EU 811/2013). First one is the product labels and fiches for standalone space heaters and combination heaters. The second one, a so called package label, is proposed to provide information on packages of heaters combined with solar devices and temperatre controls. The package labels and fiches based on product fiches from suppliers should ensure that the end-user has easy access to information on the energy performance of packages of heaters combined with solar devices and/or emperature controls. The most efficient class A+++ may be reached by such a package.

The Labelling Regulation (EU 811/2013) introduces responsibilities for dealers for combination heaters. It is suggested that suppliers of boilers provide a sheet that enables dealers to assess the seasonal space heating energy efficiency (and water heating energy efficiency of fossil fuel combination boilers) of combinations of boilers with other parts and/or a second boiler, as offered to the end-user. Entries related to solar collectors, temperature controls and storage tanks will be provided by the supplier of these parts in the corresponding fiches. The fiche is to be completed by the dealer, as relevant for the combination offered, and is part of the offer to the end-user.

A special energy labelling scale has been made for heat pumps for low-temperature systems, such as underfloor heating. This is due to the fact that the output temperature plays a significant role for the energy efficiency of the heat pumps. The requirements have been determined for underfloor heating with a design flow temperature of 35°C, corresponding to "low temperature" in the EN14825 standard. The comprehensive energy label is designed for radiator systems with design temperatures of 55°C (Rasmussen, 2011). For low-temperature heat pumps the energy efficiency class limits are calculated by adding 25 to the values in second column in Table 40. The third column shows the possible energy efficiency classes that can be reached by different heaters and their packages. The regulation intends to provide incentives for improving the energy efficiency beyond ecodesign requirements and to foster the market penetration of highly efficient technologies with cogeneration and renewable energy sources.

Table 40: Seasonal Space heating energy efficiency classes

Seasonal space heating energy efficiency class	Column(1) Seasonal space heating energy efficiency of heaters with the exception of low-temperature heat pumps and heat pump space heater for low-temperature applications η_s in %	Column(2) Seasonal space heating energy efficiency classes of low-temperature heat pumps and heat pump space heaters for low-temperature application η_s in %	Corresponding technology options according to Column(1)
A^{+++}	$\eta_s \geq 150$	$\eta_s \geq 175$	The best heat pumps, new and renewable heating technologies, heaters combined with solar thermal equipment (Package boiler)
A^{++}	$125 \leq \eta_s < 150$	$150 \leq \eta_s < 175$	
A^{+}	$98 \leq \eta_s < 125$	$123 \leq \eta_s < 150$	Best micro cogeneration, heat pumps
A	$90 \leq \eta_s < 98$	$115 \leq \eta_s < 123$	Fuel boilers
B	$82 \leq \eta_s < 90$	$107 \leq \eta_s < 115$	
C	$75 \leq \eta_s < 82$	$100 \leq \eta_s < 107$	
D	$36 \leq \eta_s < 75$	$61 \leq \eta_s < 100$	
E	$34 \leq \eta_s < 36$	$59 \leq \eta_s < 61$	Electric boilers
F	$30 \leq \eta_s < 34$	$55 \leq \eta_s < 59$	
G	$\eta_s < 30$	$\eta_s < 55$	

The water heating energy efficiency class of a combination heater shall be determined on the basis of its water heating energy efficiency.

8.21.3 Achievement of objectives

Ambition level

The Ecodesign regulation has set requirements in a technology specific manner, with minimum required efficiencies varying per technology. This leave little room for setting stringent efficiency requirements, as the range of efficiency per technology is limited. The ambition level for Ecodesign requirements can therefore be called low. However, more stringent requirements would have implied banning of certain technologies and was considered to be unfeasible, as this would violate a few preconditions: *"The ecodesign requirements should not affect the functionality or affordability of space heaters or combination heaters from the end-user's perspective." (*Ecodesign Regulation 813/2013).

In contrast, the Energy Labelling Regulation has set labelling requirements that enables cross-technology comparison, even though one technology (low-temperature heat pumps) has different labelling requirements.

As regards to the achievement of the objectives in terms being on track with expected energy savings in 2020, insufficient time has passed since the enforcement of regulation to draw conclusions on its impact on the market.
As this is the measure with the highest expected yearly savings for 2020 to date, with the largest portion of savings probably due to the energy labels and with novel features such as involvement of installers for the package label, it is recommended to closely monitor its application and effect in the Member States.

8.22 Water heaters and hot water storage tanks

8.22.1 Introduction

Product sector, consumption, importance
Water heaters and hot water storage tanks are among widely used products in the European Union. The majority of the available technology today is conventional water heaters using electricity or gas. Additionally new technologies such as heat pumps, integrated solar water heaters and packages combining water heaters and large solar devices are rapidly entering the market. According to the impact assessment (LOT 2 water heaters and storage tanks) (2013), the water heaters and hot water storage tanks are responsible for about 3% of the total gross energy consumption.

A water heater is defined as a product connected to an external supply of drinking water to generate heat and transfer this water to desired temperature levels. The hot water is typically used for cooking, cleaning, bathing and space heating.

According to the Regulation EU 814/2013 the annual energy consumption related to water heaters and hot water storage tanks was estimated to have been 2156 PJ_{prim} (51 Mtoe) in the Union in 2005. The mentioned energy consumption in 2005 corresponds to 124 Mt CO_2 emissions. Unless specific measures are taken, annual energy consumption is expected to be 2243 PJ in 2020. Annual emissions of nitrogen oxides related to water heaters and hot water storage tanks were estimated to have been 559 kt SO_x equivalent in the Union in 2005. Unless specific measures are taken, annual emissions are expected to be 603 kt SO_x equivalent in 2020. The combined effect of ecodesign requirements and energy labelling of water heaters is expected to result in estimated annual energy saving of about 450 PJ by 2020, corresponding to 26 Mt CO_2 emissions, and a reduction of 130 kt SO_x equivalent compared to what would happen if no measures were taken.

8.22.2 Policy context

Regulation date and scope
The Commisision Regulation 814/2013 on the ecodesign requirements for water heaters and hot water storage tanks have been published in the Official Journal of the EU in September 2013. The Commission Regulation 812/2013 provides the labelling requirements for water heaters and hot water storage tanks and it is published in the Official Journal of the EU in February 2013.

The scope of the proposed Ecodesign Regulation covers water heaters and hot water storage tanks, namely conventional water heaters, heat pump water heaters and solar water heaters with a rated heat output of up to 400 kW and hot water storage tanks with a storage volume of up to 2 000 litres. The water heaters covered use gas or oil fuel, including from biomass, electricity and ambient/waste heat.

Exceptions are, among others:

- Water heaters specifically designed for using predominantly biomass fuels;
- Water heaters using solid fuels;
- Water heaters designed for making hot drinks and/or food only.

9 size classes are used to distinguish water heate systems. The familiar denomination S-M-L (small-medium-large) is used for the size classes, downwards extended to XS and XXS and upwards extended to XL, XXL, 3XL and 4XL. The minimum energy efficiency and emission assessment are defined by these size classes.

ED measures and timing
The proposed requirements for water heaters, storage tanks, include provisions for energy efficiency, storage volume, sound power level, nitrogen oxide emissions and product information. The first requirements will apply as of 26 September 2015.

Table 41 provides an overview matrix of requirements applied per product group.

Table 41: Appliance parameters subject to minimum requirements per water heater group

Appliance parameters subject to minimum requirements	Efficiency	NOx	Sound power
Gas/oil water heaters	x	x	
Electric water heaters	x		
ElectricDHW heat pumps	x		x
Gas/oil DHW heat pumps	x	x	
Storages	x		

The requirements for energy efficiency will be imposed in three steps. Two years after the implementation measure entered into force all appliances will be required to match minimum efficiency requirements. The requirements will become more stringent for the appliance groups as of September 2017 and for some groups as of September 2018. The energy efficiency requirements and storage volume requirements of the regulations are provided in Table 42 and Table 42 respectively. Required efficiency levels are provided for load profile where it is defined as a given sequence of a combination of useful water flow rate, useful water temperature, useful energy content and peak temperature as specified in EU 814/2013 Annex III.

Table 42: Minimum required water heating efficiency for water heaters

Declared load profile	Minimum Required Water Heating Efficiency from September 2015	Minimum Required Water Heating Efficiency from September 2017	Minimum Required Water Heating Efficiency from September 2018
3XS	22%	32%	unchanged
XXS	23%	32%	unchanged
XS	26%	32%	unchanged
S	26%	32%	unchanged
M	30%	36%	unchanged
L	30%	37%	unchanged
XL	30%	37%	unchanged
XXL	32%	37%	60%
3XL	32%	37%	64%
4XL	32%	38%	64%

The requirements for limiting NO_x emsisions come into force in September 2018 for water heaters. The limit values of NO_x are defined according to fuel type used for water heating.

The explanatory memorandum to Regulation (EU 812/2013) explains the application of labels as: "*Two years after the entry into force of the Regulation, a scale from G to A for conventional water heaters will be introduced (for small load profiles, G-A for electric water heaters; for medium to large load profiles, G-C for electric water heaters, C-A for gas water heaters), while actual solar water heaters and heat pump water heaters are not sufficiently efficient yet to reach classes beyond A. Four years after the entry into force of the Regulation, a further class A+ will be added on top of the labelling scale to encourage the development of more efficient solar water heaters and heat pump water heaters.*
Classes A++ and A+++ can only be reached by packages with large solar devices….For hot water storage tanks an efficiency scale G-A will be introduced from two years after the entry into force of the Regulation. Four years after its entry into force, a further class A+ will be added on top of the labelling scale to encourage the development of superinsulated storage tanks."

Similar to space heaters a modular approach is used for labelling of water heaters and hot water storage tanks. The energy labelling requirements are suggested in form of a product label for water heaters and hot water storage tanks. Additionally a package label and fiche will provide information on the energy performance of water heaters in combination with solar devices. The most efficiency class A+++ may be reached by such a package. Thus, the labelling requirements aim to be a dynamic incentive for manufacturers to improve energy efficiency and to accelerate the market take-up of energy efficient stand-alone water heaters and hot water storage tanks and also packages of water heaters and solar devices.

According to the ANNEX II of the Labelling Regulation (EU 812/2013) the water heating energy efficiency class of water heater are determined on the basis of its water heating energy efficiency (η_{wh} in %) and are categorised according to its declared load profile as provided in Table 43.

Table 43: Water heating energy efficiency classes of water heaters, categorised by declared load profiles, η_{wh} in %

	3XS	XXS	XS	S	M	L	XL	XXL
A+++	$\eta wh \geq 62$	$\eta wh \geq 62$	$\eta wh \geq 69$	$\eta wh \geq 90$	$\eta wh \geq 163$	$\eta wh \geq 188$	$\eta wh \geq 200$	$\eta wh \geq 213$
A++	$53 \leq \eta wh < 62$	$53 \leq \eta wh < 62$	$61 \leq \eta wh < 66$	$72 \leq \eta wh < 90$	$130 \leq \eta wh < 163$	$150 \leq \eta wh < 188$	$160 \leq \eta wh < 200$	$170 \leq \eta wh < 213$
A+	$44 \leq \eta wh < 53$	$44 \leq \eta wh < 53$	$53 \leq \eta wh < 61$	$55 \leq \eta wh < 72$	$100 \leq \eta wh < 130$	$115 \leq \eta wh < 150$	$123 \leq \eta wh < 160$	$131 \leq \eta wh < 170$
A	$35 \leq \eta wh < 44$	$35 \leq \eta wh < 44$	$38 \leq \eta wh < 53$	$38 \leq \eta wh < 55$	$65 \leq \eta wh < 100$	$75 \leq \eta wh < 115$	$80 \leq \eta wh < 123$	$85 \leq \eta wh < 131$
B	$32 \leq \eta wh < 35$	$32 \leq \eta wh < 35$	$35 \leq \eta wh < 38$	$35 \leq \eta wh < 38$	$39 \leq \eta wh < 65$	$50 \leq \eta wh < 75$	$55 \leq \eta wh < 80$	$60 \leq \eta wh < 85$
C	$29 \leq \eta wh < 32$	$29 \leq \eta wh < 32$	$32 \leq \eta wh < 35$	$32 \leq \eta wh < 35$	$36 \leq \eta wh < 39$	$37 \leq \eta wh < 50$	$38 \leq \eta wh < 55$	$40 \leq \eta wh < 60$
D	$26 \leq \eta wh < 29$	$26 \leq \eta wh < 29$	$29 \leq \eta wh < 32$	$29 \leq \eta wh < 32$	$33 \leq \eta wh < 36$	$34 \leq \eta wh < 37$	$35 \leq \eta wh < 38$	$36 \leq \eta wh < 40$
E	$22 \leq \eta wh < 26$	$23 \leq \eta wh < 26$	$26 \leq \eta wh < 29$	$26 \leq \eta wh < 29$	$30 \leq \eta wh < 33$	$30 \leq \eta wh < 34$	$30 \leq \eta wh < 35$	$32 \leq \eta wh < 36$
F	$19 \leq \eta wh < 22$	$20 \leq \eta wh < 23$	$32 \leq \eta wh < 26$	$27 \leq \eta wh < 30$	$27 \leq \eta wh < 30$	$27 \leq \eta wh < 30$	$27 \leq \eta wh < 30$	$28 \leq \eta wh < 32$
G	$\eta wh < 19$	$\eta wh < 20$	$\eta wh < 23$	$\eta wh < 27$	$\eta wh < 27$	$\eta wh < 27$	$\eta wh < 27$	$\eta wh < 28$

The energy efficiency class of a hot water storage tank shall be determined on the basis of its standing loss.

8.23 Overview of product group findings – energy aspects

The introduction to this chapter showed the expected yearly consumption levels of policy and BAT (Best Available Technology) as well as savings per product group. This was followed by a more in-depth discussion of the product groups.

The product group sections have provided insights into the ambition level of the measure, the appropriateness of the scope and insights into factors that influence the reaching of the objectives (the expected savings).

In the table below in this section an overview of findings per product group is presented. The qualitative and sometimes quantitative facts gathered on the product groups are transferred into a scoring system per product group for each of the parameters, ambition, scope and 'on track with energy savings'. The scoring was done as follows:

Scoring on ambition level

Ecodesign aims at setting the MEPS at the LCC (Lowest Life Cycle Cost) level. The question on ambition level could therefore be: have the MEPS been set at the LCC level? If they have been, they can be rated as appropriate. If they have been set above or below the LCC level, they are either overambitious or not ambitious enough. However, determination of life cycle costs is not so straightforward as it may seem at first sight: (1) Life cycle costs tend to change (mostly lower) over time. Therefore, the ambition of the measure has to do with the time lapse between the initial study and the measures going into effect. (2) The LCC curve is very flat, giving large uncertainty in where the minimum exactly is. (3) Data quality at the time of the study affects the LCC that is determined. All these factors make it less straightforward to determine an ambition level.
Another way to judge ambition level would be to compare policy level savings with BAT-savings (as can be read from the table in the introductory section). BAT savings only have to do with efficiency and not with cost. A third way would be to judge whether the policy scenario actually implies a faster rate of efficiency improvement than could be expected otherwise, without policy (autonomous improvement, Business As Usual).
Lastly, information on ambition level can be gained by comparing requirements with those in countries outside the EU[37].
Given these considerations and given the information available it turns out to be difficult to apply a standardised method for determination ambition level of a measures. In the end, the judgement was done on a case by case basis.

Requirements which are barely an improvement over Business As Usual are symbolised with (-) indicating a low ambition level of the implementation measure. If the regulation requirements are likely to give improvement beyond BAU, in a way as intended (around the LLC level) it is symbolised with (+/-) indicating a moderate ambition level. When the regulation targets were positioned beyond LCC at the time of study, more towards the BAT levels, then the high ambition level is indicated by (+).

Scoring on scope
The second impact criterion considers the scope of the implementation measure. Ideally, regulations are made for as wide a scope in a product group as possible, thereby maximising energy savings. On the other hand, as the characteristics of these subgroup deviates too much from the characteristics of the main product it may be more practical to define separate requirements and define a separate group, or make an exemption if it concerns a subgroup with small sales volumes. The parameter ‘scope’ intends to give an indication on whether the definition of the product group is appropriate, not too wide, not too small. In case information is lacking the cell for a particular product group is left empty. In case information is there it is rated as follows:
(-) indicates that the scope is narrower than should and could have been the case, ideally.
(✓) indicates the scope is appropriate;
(x) indicates that there are or have been issues with the scope. This can be a minor or a major issue and is explained further in the comments.

[37] More information is expected to be collected over the course of this project from another EC project.

Scoring on 'Energy savings on track for 2020'

The third impact criterion concerns whether the objectives of implementation measure are likely to be achieved by 2020. With this perspective this study compared the estimated current savings (up-to-date savings) with the expected savings from the Impacts Assessments. Updated estimates of energy savings were often not available. In these cases, qualitative arguments found to increase or decrease expectes savings were discussed and used for scoring on this parameter. The scoring system applied is as follows:

(- -) no significant achievement for energy saving objectives to be expected;

(-) limited achievement of objectives to be expected;

(0) moderate achievement which is more or less in line with expected savings in impact analysis to be expected;

(+) significant achievement to be expected, where it is likely to exceed expected savings in 2020;

(++) highly significant achievement of objectives, where there is a strong indication that considerably higher savings will be achieved in 2020.

In this scoring, no distinction is made on whether anticipated savings are due to Ecodesign or due to circumstances not anticipated at the time of study. In case something can be said about this, a comment on it is made.

Table 44: Overview of product groups and impact of ecodesign impact criteria. Explanations of the scoring is given in the text.

Product group	Ambition level (-, 0, +)	Scope appropriate? (x,✓, ✓✓)	On track in terms of energy savings? (--, -, 0, +, ++)	Comments
Electric motors, Lot 11	+	x / ✓✓	-	The impact assessment estimated that two thirds of the total motors sold would be equipped with a VSD after the regulation was enforced. However, motor manufacturers (CEMEP) expect that only between 30% - 40% of users will prefer buying an IE2 motor equipped with a VSD instead of an IE3 motor alone Scope: x for amendment needed to fix small scope issues related to altitude and temperature. ✓✓ for incorporating VSDs.
Domestic lighting (non-directional), Lot 19	- / 0	x	+	Ambition: strictly speaking lower than LCC but nonetheless big step to ban incandescent lamps 2016 requirements on halogen lamps currently under review. Energy savings due to LED developments and Ecodesign Scope issue: special purpose lamps serve as a loophole, exploited by retailers for selling incandescent bulbs.
Televisions, Lot 5	-	✓	+	The developments of energy efficiency for televisions have been rather positive and have exceeded the expectations in the preparatory study. However a large part of the improvement was due a accelerated pace of rapid technological change for televisions. The efficiency development clearly overtakes the Ecodesign regulation .The average market provides lower life cycle costs to consumers than the level of the Ecodesign regulation. Due to the rapid technological development, the requirements set in the Implementing Measures have been criticized for not being ambitious enough.
Tertiary Lighting, Lot 8-9	-/0	x	+	HID technology evolved faster than anticipated Scope was appropriate but with emerging LED technology needs reconsideration Energy savings due to Ecodesign, Energy labelling and anticipated LED developments.
Standby and off-mode losses, Lot 6	0	✓	0	The data available does indicate that significant improvements in energy efficiency have taken place from the time of the preparatory study to the most recent studies.
Ventilation fans, Lot 11	0	✓	0	
Directional lighting, Lot 19-part2				
Circulators in buildings, Lot 11	0	x	0	Regulation did not specify whether circulators placed on the market without pump housing are covered or not. An amendment is now adopted to include such circulators.
Vacuum cleaners, Lot 17	0	✓		The regulations entered into force on 12 August 2013.
Imaging equipment, Lot 4				
PCs and servers, Lot 3	0	-		The requirements do not apply to displays (included in the former proposal), blade systems and components, server appliances, multinode servers, computer servers with more than four processor sockets, game consoles and docking stations. No data has been found regarding the energy savings to be realized under this implementing measure.

Product group	Ambition level (-, 0, +)	Scope appropriate? (x,✓, ✓✓)	On track in terms of energy savings? (--, -, 0, +, ++)	Comments
Room air conditioning appliances, Lot 10	0	✓		Not enough time has passed since the enforcement of the regulation to draw conclusions on its impact on the room air conditioning appliances.
External power supplies	0	x	-	The scope of coverage for Regulation 278/2009 requires revision because several types of EPS are omitted from the current definition.
Simple set-top boxes, Lot 18a				
Complex set-top boxes, Lot 18				
Domestic refrigerators and freezers, Lot 13	-/0	✓		Ambition: Tier 1 no better than BAU, Tier 2 closer to LCC Scope: wine coolers still to be regulated
Laundry driers, Lot 16				
Electric pumps, Lot 11	0	-		Two preparatory studies on electric pumps are being carried out to assess the possibility of enlarging the scope of pumps under regulation (LOT 28 and LOT 29) Insufficient time has passed since the enforcement of regulation to draw conclusions on its impact on the pump market.
Domestic dishwashers, Lot 14	-/0	✓	0	Tier 1 not much effect. Tier 2 likely to have effect on market, together with new energy label.
Domestic washing machines, Lot 14	-/0	✓	0	Tier 1 not much effect. Second Tier likely to have effect on market
Space and combination heaters, Lot 1	-	✓		Ecodesign ambition level rated '-', although it is acknowledged that much more may not have been possible, given the fact that requirements are made EU wide and given the differences between the Member States.
Water heaters and hot water storage tanks, Lot 2				

Observations on ambition level
Looking at the table a few concluding remarks can be made on the ambition level of measures. A number of measures seemed to be lacking ambition in Tier 1 requirements but Tier 2 requirements are generally more effective (televisions, white goods). Several other requirements are rated as being sufficient in ambition, based on the literature available and the data presented in it. It should be noted that the effect of decreasing life cycle costs over time (from the study until the measure goes into effect) has not been taken into account in detail, even though it is recognised that an ambition level at the time of study may not be the ambition level at the time of a measure going into effect.

Observations on scope
The 'x's marked in the scope column indicate that issues with scope have been found after the measure took effect. This happened in several cases, and is in several cases corrected already (motors, circulators). In case of motors scope is also rated as ✓✓, as it is the first time that a more systems oriented approach was taken.

Observations on achievement of objectives in energy consumption and saving level:
The last column on 'being on track with energy savings in 2020' should be interpreted with great care. For motors this parameters is rated as '-', not on track, as there are indications that the projected sales levels of VSDs will not be reached.
A number of groups are rated as '+', such as lighting groups, television, standby- and offmode. This means that the projected energy consumption in 2020 is likely to be lower than anticipated in the policy scenario, due to various causes. One such cause could be that market transformation due to Ecodesign (and Energy labelling) is more effective than anticipated. However, another cause can be that technology is moving faster than anticipated, and that efficiency levels increase more than anticipated in the BAU as well as in the policy scenario. This has happened with lighting (emerging of LED technology, faster than anticipated development of HID technology) and with televisions (emergence of LED based television).

8.24 Overview of product group findings – other environmental aspects

As a first step in the legislative process for Ecodesign regulations a preparatory study is carried out that assembles necessary evidence to enable the determination of whether and how which Ecodesign requirements should be set for a particular product. The preparatory study provides the necessary information to prepare for the next phases in the policy process.
The Ecodesign Directive clearly states that the entire life-cycle of the product is to considered when performing the preparatory study:

"The approach set out in the Commission's Communication of 18 June 2003 entitled 'Integrated Product Policy — Building on Environmental Life-Cycle Thinking', which is a major innovative element of the Sixth Community Environment Action Programme, aims to reduce the environmental impacts of products across the whole of their life cycle, including in the selection and use of raw materials, in

manufacturing, packaging, transport and distribution, installation and maintenance, use and end-of-life. Considering at the design stage a product's environmental impact throughout its whole life cycle has a high potential to facilitate improved environmental performance in a cost- effective way, including in terms of resource and material efficiency, and thereby to contribute to achieving the objectives of the Thematic Strategy on the Sustainable Use of Natural Resources." (Ecodesign Directive, 2009)
To help contractors carry out the preparatory study, and to ensure that all studies are performed following the some methodology, the Commission established in 2004/05 a well-defined approach to the development of implementing measures – the Methodology for the Eco-design of Energy Using Products (MEEuP). This sets out a common method to gather information to help evaluate whether and to which extent a product fulfils certain criteria that make it eligible for implementing measures under the Directive.

The methodology has since been revised, to extend the Ecodesign Methodology to Energy-related Products (MEErP), that is, products that do not necessarily use energy themselves, but have an impact on the energy consumption of other products (e.g. windows, heating controls).

For policy makers and stakeholders that have concerns over the validity of the MEErP for other impacts besides energy consumption during the use phase, the new MEErP expands the sections on the environmental indicators, providing key numbers, trends, main sources of the impacts and how the parameter was included in Ecodesign studies so far (MEErP, 2011).

The method involves the use of a simplified reporting tool (EuP EcoReport) that helps translate information gathered during the first stages of the preparatory study into environmental impacts. The MEErP, and particularly the Ecoreport tool, provide the appropriate balance between a very thorough and time consuming conventional life cycle analysis and the need for a practical tool that helps identify the key environmental impacts and phases.
Although the methodology is simplified it does cover all the life cycle stages of the products under consideration, namely:

a) Raw material selection and use;
b) Manufacturing;
c) Packaging, transport, and distribution;
d) Installation and maintenance;
e) Use; and
f) End-of-life, meaning the state of a product having reached the end of its first use until its final disposal.

And, for each phase, the following environmental aspects are assessed where relevant:

a) Predicted consumption of materials, of energy and of other resources such as fresh water;
b) Anticipated emissions to air, water or soil;
c) Anticipated pollution through physical effects such as noise, vibration, radiation, electromagnetic fields;
d) Expected generation of waste material; and

e) Possibilities for reuse, recycling and recovery of materials and/or of energy, taking into account Directive 2002/96/EC.

Although implementing measures so far have focused its requirements on energy consumption and energy efficiency in the use-phase there are some examples of other requirements being set for other parameters and phases:

- For washing machines, limits are set on the water consumption.
- Regulations on lighting include requirements on survival factors, lumen maintenance and number of switching cycles before failure which have implications in the replacement rate and consequently on resource efficiency.
- The indication of mercury or lead content is also part of the information requirements for some products, such as lamps, televisions.
- Information relevant for non-destructive disassembly for maintenance purposes is mandatory for vacuum cleaners and for disassembly, recycling, or disposal at end-of-life for vacuum cleaners, circulators and imaging equipment.
- For Room Air Conditioners, The preparatory study also identified possible refrigerant leakage as a significant environmental aspect in form of direct greenhouse gas emissions, representing on average 10-20 % of the combined direct and indirect greenhouse gas emissions. As refrigerants are addressed under Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases no specific requirements on refrigerants are set in this Regulation. However, a bonus is proposed under the ecodesign requirements to steer the market towards the use of refrigerants with reduced harmful impact on the environment. The bonus will lead to lower minimum energy efficiency requirements for appliances using low global warming potential (GWP) refrigerants.
- To help in guiding users on the best available technology for specific applications indicative benchmarks are sometimes given. One example is for lamps where benchmarks figures are given for a number of parameters such as lamp mercury content, utilisation factor and light pollution from luminaires.

Because we are dealing with energy related products it does seem coherent that implementing measures mainly address the use-phase impacts, most importantly, energy use, as this represents, in varying degrees, the most important contribution to the environmental impacts of the covered products. However, it should be noted that as products become more energy efficient in the use phase, the impacts of other phases grows in importance.
The text of the Ecodesign Directive itself does emphasize the importance of improving energy-efficiency during the use-phase as it *is the most cost-effective way to increase security of supply and reduce import dependency*. Cost-effectiveness, particularly to consumers, has been a major concern of the European Commission when introducing implementing measures and, in fact, addressing the energy consumption of products in the use-phase has presented itself as the most appropriate solution both economically and environmentaly.

8.25 Voluntary Agreements

8.25.1 Introduction to VAs under Ecodesign

Various voluntary agreements to stimulate efficiency of appliances have been agreed upon in the past such as the voluntary agreements on motors and circulators. These were voluntary agreements prior to the enforcement of the Ecodesign Directive.

The Ecodesign Directive allows for voluntary agreements replacing product regulation, provided certain conditions in Annex VIII of the Ecodesign Directive are met. The basic condition is that a voluntary agreement should carry a significant level of environmental ambition and the objectives can be delivered faster and in less costly manner than a mandatory regulation. One such requirement is that self-regulatory action must represent a large majority of the relevant economic sector and the requirements on monitoring and reporting have also been formulated. The requirements are mentioned in Annex VIII of the Ecodesign Directive as follows:

Openness of participation
"Self-regulatory initiatives must be open to participation of third country operators, both in the preparatory and in the implementation phase."

Added value:
"Self-regulatory initiatives must deliver added value (more than business as usual) in terms of the improved overall environmental performance of the product covered."

Representativeness:
"Industry and their associations taking part in a self-regulatory action must represent a large majority of the economic sector, with as few exceptions as possible. Care must be taken to ensure respect for competition rules. "

Quantified and staged objectives:
"The objectives defined by the stakeholders must be set in clear and unambiguous terms, starting from a well-defined baseline. If the self-regulatory initiative covers a long time-span, interim targets must be included. It must be possible to monitor compliance with objectives and (interim) targets in an affordable and credible way using clear and reliable indicators. Research information and scientific and technological background data must facilitate the development of these indicators."

Involvement of civil society
"With a view to ensuring transparency, self-regulatory initiatives must be publicised, including through the use of the Internet and other electronic means of disseminating information. The same must apply to interim and final monitoring reports. Stakeholders including Member States, industry, environmental NGOs and consumers' associations must be invited to comment on a self-regulatory initiative."

Monitoring and reporting:
"Self-regulatory initiatives must contain a well-designed monitoring system, with clearly identified responsibilities for industry and independent inspectors. [...] The plan for monitoring and reporting must be detailed, transparent and objective. It must remain for the Commission services, assisted by the Committee referred to in Article 19(1), to consider whether the objectives of the voluntary agreement or other self-regulatory measures have been met".

Cost-effectiveness of administering a self-regulatory initiative:
"The cost of administering self-regulatory initiatives, in particular as regards monitoring, must not lead to a disproportionate administrative burden, as compared to their objectives and to other available policy instruments."

Sustainability
"Self-regulatory initiatives must respond to the policy objectives of this Directive, including the integrated approach, and must be consistent with the economic and social dimensions of sustainable development. The protection of the interests of consumers, health, quality of life and economic interests must be integrated."

Incentive compatibility
"The cost of administering self-regulatory initiatives, in particular as regards monitoring, must not lead to a disproportionate administrative burden, as compared to their objectives and to other available policy instruments."

In the case that these requirements are fulfilled the Ecodesign Directive (recital 18 mentions that the Voluntary agreements can be recognized by the Commission and preference should be given to VAs..

Draft guidelines on self-regulation measures had been prepared by the European Commission (European Comission, 2013). The Guidelines aim at facilitating the establishment and implementation of the self-regulation measures, at ensuring consistency in their structure and in their content and at ensuring uniform interpretation of the applicable principles and rules. For example, it states that market coverage of signatories to the self-regulation measures should be at least 70%. On monitoring and reporting it gives more detail on the role and tasks of the Independent Inspector. Basically, the independent inspector is responsible for checking of and reporting on the compliance of the signatories with the requirements of the self-regulation measure, and carrying out and reporting on the results of audits.

8.25.2 The experience with the recognised VAs

To date, among the four Voluntary Agreements that have been prepared by industry, two VAs are recognised by the EC. Only VAs that are recognised will be discussed here. These are the VAs on Imaging Equipment and CSTBs.

For CSTBs, the signal quality and whether the signal is high or standard definition lies among the parameters that marginally affect the power consumption of the CSTBs. Such parameters are in addition to the equipment's manufacturing specific properties (e.g. relevant modes and the presence of power management facility). It is important that VA enables the service providers to join the VA, whereas Ecodesign regulations can only target manufacturers and importers. The Digital Interoperability Forum (DIF) (2012) reports that there is a need for enhancing energy efficiency requirements reconciled with dynamic innovation in response to consumer demand for new services and functionalities. Moreover, the economic lifetime of CTBs is even shorter than their technical lifetimes which converge to roughly 3 to 4 (Preparatory study Lot 18: Complex set-top boxes, 2008).

Therefore, the ability to come with updates of the VA increases the chance to follow technological and market developments faster. Thus, the participation of the large majority of the industry to VA and its flexibility over a Ecodesign implementation measure are the two major factors for giving priority to a self-regulatory mechanism such as a VA over an implementation measure. However, the same factors have also been among the main criticisms of stakeholders toward industry in case of CSTBs: it was hard for stakeholders following to keep track of the different versions of VA and the changes in the requirements. In other words: what is considered to be an advantage by some (ability for quick updates) is considered a disadvantage by other (not being able to keep track of the contents of the agreement).

The imaging industry is an innovative industry with a long track record on environmental improvements. The preparatory study (2008) concluded that these devices have large sales volumes and a significant environmental impact which could be improved by design. It was estimated that no sufficient evidence was available to develop policy proposals at this stage, and that some of the environmental impacts are already addressed under the Energy Star Programme. It also became clear during preparatory study (2008) that the imaging industry has the challenge to formulate energy efficiency requirements that are not only relevant and significant for achieving environmental efficiency, but also applicable to the wide range of different imaging products present in the market. A voluntary agreement has therefore been suggested for the product group of imaging equipment.

The average process length for Ecodesign Regulations is supposedly 55 months, in practice there is a wide variation and the process can take longer (also see Chapter 10 on Criteria and Procedures). From the preparatory study until recognition of the VA for Imaging equipment the process took 75 months (assuming that the preparatory study took planned 32 months from contract date to its finalization date on January 2009. From the finalization of the preparatory study an additional 45 months was required for the recognition of VA on February 2013). For CSTBs the process took 51 months from the preparatory study until recognition of the VA (assuming that the preparatory study took planned 32 months from contract date to its finalization date on December 2008. From the finalization of the preparatory study an additional 19 months was required for the recognition of VA on July 2010).

In the consultation forum meeting in 9 October 2012 the VA on CSTBs was criticised by stakeholders to change too fast (European Comission, 2012). On the other hand, the VA on Imaging equipment was criticized by their slow response to input from stakeholders. For Member States and civil society stakeholders, it is difficult and not cost-effective to follow a very incremental process including frequent meetings and new versions of the VA, compared to a regulatory process where a limited number of meetings is held (ANEC, et.al. 2012). It is hard to say from this data whether the ecodesign objectives can be reached faster through a VA.

European Consumer Voice in Standardization (ANEC), the European Consumer Organization (BEUC) and the environmental organizations European Environmental Citizens Organization for Standardization (ECOS) and The European Environmental Bureau (EEB) outlined a review note on the evaluation of Voluntary Agreements. This evaluation (ANEC, et.al. 2012) presents the status of VAs with regards to the requirements of a VA in terms of added value, monitoring and reporting and cost effectiveness, etc. The evaluation concludes that the level of compliance of VAs with the several of the key admissibility criteria defined in Ecodesign Directive was not achieved at a satisfactory level.

Both VAs have efficiency requirements imposed that should hold for 90% of the products put out on the market. Independent Inspectors needs to verify this 90% (and other issues). The requirement of 90% already indicates a low ambition level. Additionally in terms of the added value, the evaluation by European Consumer Voice in Standardization and environmental NGOs (ANEC, et.al. 2012) concludes that the level of ambition of Voluntary Agreement for imaging equipment is very low. Due to the fact that the average energy use of CSTBs reaches only half (78 kWh/year) of the maximum consumption level allowed under the VA (150 kWh/year), the level of ambition of the VA requirement is questionable (ANEC, et.al. 2012). On the other hand Cassels (2012) mentiones that in general the VAA aims at improving the energy efficiency of CTBs beyond business as usual. Tier 1 requirements correspond to the recommendation of the preparatory study, but introduced one year later. However, Cassels (2012) also notes that Tier 2 levels are less ambitious in terms of timing and levels than the recommendations in the preparatory study.

The VAs are also criticized by not providing quantified and staged objectives (ANEC, et.al. 2012). In the case of CSTBs the sudden additions of new allowances for additional product functionalities and the wide scope of such allowances hinders the relevance of the staged objectives. It is also mentioned that both VAs lack in solid scientific, technological background and market data to support the requirements or the allowances in the VAs.

Below, we present facts and opinions presented by stakeholders on the various VAs.

Ecodesign Consultation Forum on Vas concluded by industry, Brussels, 2012
The EC recognised efforts made by the signatories to establish VAs and to ensure their correct implementation. It noted many benefits and potential of VAs but it also noticed a room for further improvements particularly in recognition of VAs by the commission, harmonization of rules for VAs, cooperation and involvement of stakeholders. The EC stressed that many of the faced challenges resulted from the lack of experience in the application of self-regulation measures.

ANEC and MS representatives from Belgium and the Netherlands emphasized their concerns about the ambition level of the VA on CSTBs. Furthermore they stressed that reporting should be carried out in a regular and consistent manner including the market coverage data, particulary when changes in the market share between companies are reported.

CSES 2012
The reported opinions of stakeholders on the effectiveness of VA, were found to be significantly different across stakeholder groups: 'The majority of Member States (and environmental groups) do not consider Voluntary Agreements appropriate. From the point of view of industry representatives, there is in general a more positive approach towards Voluntary Agreements (71% among industry associations) because of the flexibility that they provide in comparison with Implementing Measures.'

Cassels 2012
One of the industry groups that has developed a voluntary agreement (the VA on CSTBs) prepared a position paper. It gives a mixed picture but ends with a cautious 'heads-up' for voluntary agreements over implementing measures.

8.25.3 Concluding notes

Voluntary Agreements may be endorsed in place of legally binding measures to meet the objectives of the Ecodesign Directive. According to Ecodesign, VAs should be given priority if it is expected to reach objectives faster. Currently two VA have been recognized by the European Commission: CSTBs and imaging equipment.

The VA are the preferred option in the cases where such an option is likely to deliver the policy objectives faster and in less costly manner than the mandatory requirements. VAs tend to be proposed with complex products with fast technological development, so that the technology and market change will be reflected in the different version of VA. However, in practice, VA processes are not necessarily fast which also puts the cost efficiency into question. According to some stakeholders VAs are not fully in line with the requirements of Annex VIII of the Ecodesign Directive.

On the other hand, one major challenge of VAs in industry lies in the fact that they concern highly innovative and complex products requiring rapid changes in the VA results stakeholders complain about the difficulties in the process. Most of the cases stakeholders mention that there is a lack of transparency in VA process and VAs lack clear level of ambition, or that ambition is even very difficult to determine. This is a significant challenge in itself given that the uncertainty in rapid technological development contradicts with requirements for clarity and adequacy in policy objectives and VA preparation process. The Commission is reviewing its guidelines on self-regulation measures to provide clearer and more comprehensible rules in 2013.

The lack of single harmonized set of rules for all VAs has been recognized by European Commission. It is mentioned in the consultation forum meeting from 9 October 2012 (European Commission, 2012) that a single set of rules are required particularly for auditing, monitoring and reporting processes. Due to the lack of such a common understanding the Independent inspection reports vary between the two VAs both in terms of report format and content. In the case of CSTBs more data was available and it is presented in the report. This provided more transparency on energy consumption of the CSTBs put on the market. For imaging equipment, no data was available in the Independent Inspection report.

The flexibility of a VA is a benefit and a challenge for the industry at the same time. It provides the ability to follow technological developments more quickly. However, it also reduces transparency of the VA process for stakeholders. It seems transparency in monitoring is a key factor to evaluate the validity of recognition of the VAs compared to implementation measures.

8.26 References

- Attali S., Bush E., Michel A., Toulouse E.; 2013; Can Europe Continue deciding on product policies (MEPS, labels, etc) without monitoring the market; ECEEE summer study proceedings
- ANEC, BEUC, ECOS and EEB, 2012, Ecodesign Voluntary Agreements Fail to Impress.
- Bertoldi, Atanasiu, 2009, EC Joint Research Centre, Institute for Energy, 'Electricity Consumption and Efficiency Trends in European Union', Status Report 2009.
- Cassels, S; Mattei, A., 2012, Ecodesign Self-Regulation: a Price Too High?, Electronics Goes Green Conference, Berlin.
- CLASP, 2013c, Estimating potential additional energy savings from upcoming revisions to existing regulations under the Ecodesign and Energy Labelling Directives: a contribution to the evidence base
- Commission Regulation (EC) No 244/2009 of 18 March 2009 Implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps. http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:076:0003:0016:en:PDF
- Commission Regulation (EC) No 245/2009 of 18 March 2009 Implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:076:0017:0044:EN:PDF
- Commission Regulation (EC) No 643/2009 of 22 July 2009 Implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for household refrigerating appliances. http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0053:0068:EN:PDF
- Commission Regulation (EU) No 1016/2010 of 10 November 2010 Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household dishwashers. http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:314:0001:0016:EN:PDF

- Commission Regulation (EU) No 1015/2010 of 10 November 2010 Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines. http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:293:0021:0030:EN:PDF
- Commission Regulation (EU) No 1194/2012 of 12 December 2012 Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:342:0001:0022:EN:PDF
- Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaries http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:258:0001:0020:EN:PDF
- Commission Delegated Regulation (EU) No 811/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:239:0001:0082:EN:PDF
- Commission Delegated Regulation (EU) No 812/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:239:0083:0135:EN:PDF
- Commission Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:239:0136:0161:EN:PDF
- Commission Regulation (EU) No 814/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:239:0162:0183:EN:PDF
- Digital Interoperability Forum (DIF),2012, Evaluation of the Ecodesign Directive (2009/125/EC): Draft final report.
- ERA Technology Limited, 2013, Imaging Equipment Voluntary Agreement-Report of the Independent Inspector – Third Compliance Period (1 January – 31 December 2012)
- European Commission, 2013, Guidelines on the self-regulation measures concluded by industry under the Ecodesign Directive 2009/125/EC, 22 January 2013.
- European Commission, 2012, Minutes of the Ecodesign Consultation Forum on voluntary agreements concluded by industry (09/10/2012)
- GfK Presentation, 2011, Latest Trends in Major Domestic Appliances Efficiency in Europe, Russia, and Ukraine, Oksana Shvedyuk,GfK Ukraine, 6 July 2011.
- IEC 60061-1: Lamp caps and holders together with gauges for the control of interchangeability Part 1: Lamps caps, 2005,

- LOT 1 Impact Assessment (2013) Impact Assessment, Commission Staff Working Document Accompanying document to the Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters, and supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling for space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device.
- LOT 2 Impact Assessment (2013) Impact Assessment, Commission Staff Working Document Accompanying document to the Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks, and supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of water heaters. Hot water storage tanks and packages of water heater and solar device
- LOT 4 Preparatory Studies (2008) Preparatory Studies for Eco-design Requirements of EuPs Lot 4, Imaging Equipment, Final Report on Task 8 "Scenario, Policy, Impact, and Sensitivity Analysis" Study for European Comission, by Fraunhofer Institute for Reliability and Microintegration, IZM (Tender no. TREN/D1/40 lot 4-2005)
- LOT 8-9 Impact Assessment (2009) Full Impact Assessment, Commission Staff Working Document Accompanying document to the Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council. http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2009/sec_2009_0324_en.pdf
- LOT 13 Impact Assessment (2009) Full Impact Assessment, Commission Staff Working Document Accompanying document to the Proposal for a Commission Regulation implementing Directive 2005/32/EC with regard to Household Refrigerating Applicances. http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2009/sec_2009_1020_en.pdf
- LOT 14 Preparatory Studies (2007) Preparatory Studies for Eco-design Requirements of EuPs Lot 14, Domestic Washing Machines and Dishwashers, Final Report Tasks 1-2, Study for European Commission, by ISIS (Tender no. TREN/D1/40-2005)
- LOT 14 Impact Assessment (2010) Full Impact Assessment, Commission Staff Working Document Accompanying document to the Draft Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the council with regard to ecodesign requirements for Household Dishwashers. http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2010/sec_2010_1356_en.pdf
- LOT 18 Preparatory Studies (2008) Preparatory Studies for Eco-design Requirements of EuPs (II), Final report, Lot 18: Complex set-top boxes. Study for European Commission, by Bio Intelligence Service, performed in cooperation with Institut Zuverlassigkeit und Mikrointegration. (Contract TREN/D3/390-2006/Lot18/2007/S07.75202). http://www.eceee.org/ecodesign/products/complex_set_top_boxes/FinalReport_Lot18

- LOT 19 Preparatory Studies (2009) Preparatory Studies for Eco-design Requirements of EuPs, Final report, Lot 19: Domestic lighting. Study for European Commission, by Paul van Tichelen VITO, performed in cooperation with bio Intelligence Service, Energy Piano and Kreios. (Contract TREN/07/D3/390-2006/S07.72702). http://www.eup4light.net/assets/pdffiles/Final_part1_2/EuP_Domestic_Part1en2_V11.pdf
- LOT 19 NDLS Stage 6 Review Study (2013) NLDS Stage 6 Review – Draft Intermediate Report, Review Study on the Stage 6 Requirements of Commission Regulation EC No. 244/2009, Draft Intermediate Report, Study for European Commission, by VHK, performed in cooperation with VITO. (SPECIFIC CONTRACT No ENER/C3/2012-418 LOT 2/01/SI2.645913 Implementing Framework Contract No ENER/C3/2012-418-Lot 2) http://www.endseurope.com/docs/130605f.pdf
- LOT 19 Impact Assessment (2012) Impact Assessment, Commission Staff Working Document Accompanying document to the Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment
- Navigant Consulting, Inc., (2012) Solid-State Lighting Research and Development Multiyear Program Plan for 2012; prepared for: Lighting Research and Development, Building Technologies Program, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_mypp2012_web.pdf
- Rasmussen, P. (2011) Energy Labelling and Ecodesign requirements for heatpumps, Danish Technological Institute, energy Styrelsen. http://www.google.nl/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CCoQFjAA&url=http%3A%2F%2Fwww.eceee.org%2Fecodesign%2Fproducts%2Fboilers%2FApp%2520A%2520Energy%2520labelling%2520andecodesign%2520requirements%2520for%2520heat%2520pumps%2520comparing%2520SCOP%2520with%2520NEF.docx&ei=ugeOUrGlO8OBhQfW6IDwBA&usg=AFQjCNFgc27XkFmvuYgNCVBCRg279iiNhw&bvm=bv.56988011,d.d2k
- Voluntary Industry Agreement to improve the energy consumption of Imaging Equipment Placed on the EU Market, Version 4.0, 3rd December 2012. http://www.eurovaprint.eu/fileadmin/eurovaprint_files/pdfs/Lot4_VA-version_4.pdf
- Commission Regulation (EC) No 666/2013 of 18 July 2013 Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for requirements for vacuum cleaners. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:192:0024:0034:EN:PDF
- LOT 17 Preparatory Studies (2009) Work on Preparatory Studies for Eco-Design Requirements of EuPs (II) Lot 17 Vacuum Cleaners, Final Report, Study for European Commission, by Intertek (Tender no. TREN/D3/390-2006)
- Commission Regulation (EC) No 206/2012 of 6 March 2012 Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for requirements for r conditioners and comfort fans. http://ec.europa.eu/energy/efficiency/labelling/doc/en_impact_assesment.pdf

- LOT 10 Preparatory Studies (2009) Preparatory study on the environmental performance of residential room conditioning appliances (airco and ventilation), Final Report, Study for European Commission, (Tender no. TREN/D1/40-2005/LOT10/S07.56606)
- Lot 11 - 'Circulators in buildings (2008) Full Impact Assessment, Commission Staff Working Document Accompanying document to the Draft Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the council with regard to ecodesign requirements for circulators. http://ec.europa.eu/energy/efficiency/ecodesign/doc/legislation/sec_2009_1016_part1.pdf
- Commission Regulation (EC) No 641/2009 of 22 July 2009 Implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for requirements for conditioners and comfort fans.
- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0035:0041:EN:PDF
- LOT 11 Preparatory Studies (2008) EUP Lot 11: Circulators in building, Final Report, Study for European Commission, by AEA Energy & Environment (TREN/D1/40-2005/LoT11/S07.56639)
- Michel A., Attlai S., Bush E., European TV market 2007-2012: Energy efficiency before and during the implementation of the Ecodesign and Energy Labelling regulations, 2013
- CSES and Oxford Research, Evaluation of the Ecodesign Directive (2009/125/EC) Final Report, 2012
- Commission Regulation (EC) No 642/2009 of 22 July 2012 Implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for requirements for televisions.
- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0042:0052:EN:PDF
- LOT 5 Preparatory Studies (2007) EuP Preparatory Studies "Televisions", Final Report, Study for European Commission, by Öko-Institut and Fraunhofer IZM (Tender no. TREN/D1/40 lot 5-2005)
- Heyder, Thilo, Market Trends on the TV Market and their impact on Energy Consumption, GfK Retail and Technology,2011
- Coolproducts, 2010. Energy Savings in Practice: Potential and Delivery of EU Ecodesign Measures, December 2010. Weblink: http://www.coolproducts.eu/resources/documents/EnergySaving-in-Practice.pdf
- DisplaySearch, 2011. "Quarterly Advanced Global TV Shipment and Forecast Report, Fourth Quarter,2010", January 2011.
- Commission Regulation (EC) No 547/2012 of 25 June 2012 Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for requirements for water pumps. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:165:0028:0036:EN:PDF
- LOT 11 Preparatory Studies (2008 Appendix 6:Lot 11 - Water Pumps (in commercial buildings, drinking water pumping, food industry, agriculture). g, Final Report, Study for European Commission, by AEA Energy & Environment (TREN/D1/40-2005/LoT11/S07.56639)
- Code of Conduct on Energy Efficiency of External Power Supplies, Version 5 - 19 September 2012 –DRAFT

- Commission Regulation (EC) No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies, OJ L 93, 7.4.2009, p. 3. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:093:0003:0010:EN:PDF
- LOT 7 Preparatory Studies 2007 Battery chargers and external power supplies Final
- Report, Study for European Commission, by Bio Intelligence Service, Fraunhofer IZM and CODDE (TREN/D1/40-2005/LOT7/S07.56433)
- de Almeida, A. T., Fonseca, P., Ferreira, F., & Fong, J. (2008). EuP Lot 11 Motors, Ecodesign Assessment of Energy Using Products. ISR-University of Coimbra for EC-DG-TREN.
- Boteler, Rob. Motor Efficiency North American Standards and Regulations. Motor Summit 2008. Zurich, Switzerland, 2008.
- LOT 11 Preparatory Studies (2008) EUP Lot 11 Motors, Final Report, Study for European Commission, by ISR- University of Coimbra
- Commission Regulation (EC) No 640/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for Electric motors http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0026:0034:en:PDF
- LOT 30 Preparatory Studies 2012 EuP Lot 30:Electric Motors and Drives ,Draft Report, Study for European Commission, by ISR-University of Coimbra and ATKINS (ENER/C3/413-2010) http://www.eco-motors-drives.eu/Eco/Documents_files/EuP-LOT-30-Task-1-1-Dez-2012.pdf
- Irrek et al., Task 3 Report: Outlook on the estimated GHG emissions reductions
- Analysis of impact of efficiency standards on EU GHG emission (Ecodesign Directive), European Commission, Contract 070307/2008/506876/SER/C5, Wuppertal Institute for Climate Environment and Energy, Ökopol, RPA (2010)
- LOT 3 Preparatory Studies 2009 Personal Computers (desktops and laptops) and Computer Monitors,Final Report, Study for European Commission, by IVF Industrial Research and Development Corporation (TREN/D1/40-2005/LOT3/S07.56313) http://extra.ivf.se/ecocomputer/downloads/Eup%20Lot%203%20Final%20Report%20070913%20published.pdf
- Commission Regulation (EC) No 617/2013 of2 6 June 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for computers and computer servers http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:175:0013:0033:EN:PDF
- LOT 11 Preparatory Studies 2008 EuP Lot 11:Fans for ventilation in non residential buildings, Final Report, Study for European Commission, by Fraunhofer Institute Systems and Innovation Research
- Commission Regulation (EC) No 327/2011 of 30 March 2011 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:090:0008:0021:en:PDF

- LOT 6 Preparatory Studies 2008, EuP Preparatory Study Lot 6 Standby and Off-mode Losses, Final Report, Study for European Commission, by Fraunhofer Institute (TREN/D1/40 Lot 6 - 2005)
- Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:en:PDF
- Maia Consulting, Staying Connected: Unravelling energy waste issues in network standby, 2012
- SEVEn7 website Ecodesign of directional lamps, http://www.svn.cz/en/themes/ecodesign-of-directional-lamps?browser=standard, Last visitied on 03.12.2013

9 Market effects Ecodesign

9.1 Introduction

In this chapter we examine the market effects of Ecodesign, which are the effects on the structure, organisation and financial flows of a market. Ecodesign directly impacts on the actions of producers and the products that can be sold, by removing the least efficient products from the market, it therefore has the potential to impact upon:

- Market sizes;
- Costs, profit margins and prices;
- Costs or administrative burden for firms;
- Competitiveness of operators (from a Member State, EU and International perspective – including trade flows);
- Market structure (interaction between different parts of the value chain);
- Choice of products on the market;
- Unfair competition through non-compliance (free-riders).

Other potential effects of Ecodesign that are being analysed in parallel by other studies are the a) impacts on R&D and innovation and b) the impacts on third country legislation. As these analyses progress their main findings will be included in this chapter.

The same issues are addressed for Energy Labelling in chapter 8.

9.2 Insights to date

9.2.1 Market size

Following the Ecodesign directive in 2005 (2005/32/EC) the first implementing regulations on Ecodesign were laid out in 2008. Today (August 2013), 18 product groups have implementing measures, while other measures are approaching completion. As demonstrated in Table 14, Table 15 in chapter 8, these product groups represent billions of products sold each year, and markets worth over 100 billion euros.

The largest markets impacted by Ecodesign in terms of euros are those for computers and servers, televisions, tertiary lighting, and complex set top boxes. In terms of units most important markets are for tertiary lighting, non-directional household lamps and electric motors.

9.2.2 Costs, profit margins and prices

Ecodesign implementing measures aim to remove the most inefficient products from the market. As a result of these requirements a selection of existing products will have to be improved which will involve investment for the manufacturer. The amount of investment needed is dependent on the flexibility of the production process and the stringency of the standard.

The rulemaking process for Ecodesign involves a preparatory study in which a bottom-up engineering approach is used to determine, by techno-economic analysis, at which place to set the minimum energy performance standard (MEPS). The preparatory study takes into account the effect on the costs and profits to the manufacturer which can have the following forms (Salmons et al, 2011):

- Increased administration costs, due to monitoring and reporting requirements, certification costs, etc;
- Decreased unit profitability of existing products due to the inability to fully pass-on increased unit production costs to consumers in product prices;
- Additional investment costs involved in the development and production of new products (that were not previously deemed profitable – i.e. had negative net present value [NPV]);
- Changes in the mix of products sold;

The preparatory study assumes that the costs to the manufacturer are directly passed on into the price of a product. Salmons et al (2011) find that the distribution of the short-run regulatory cost between producers and consumers is not clear.

A recent study of the American Council for an Energy Efficient Economy (Delaski and Nadel, 2013) shows that in the US the expected price increases during the rulemaking process were on average overestimated compared to actual price increases by a factor ten. Salmons et al (2011) indicate that preparatory studies and impact assessments usually do not take into account the learning effects that decrease the costs of innovative technologies, which could possibly be an explanation for the overestimation of the costs.

This demonstrates that there is evidence that production cost increases from improving energy efficiency are significantly over-estimated by manufacturers and in the preparatory studies. Learning and economy of scale effects, alongside increased flexibility in most manufacturers production processes allow for faster and cheaper production changes.

Work by Ecofys (Molenbroek et al, 2012) highlighted the level of ambition of the standards can often be dated due to the length of the process and the lag in official data availability. This leads to standards being prepared on a least life-cycle cost basis, but this basis turns out to be 5-7 years out of date when the standard is introduced. With normal efficiency and cost improvements in the intervening period this means that the current least life cycle cost level is considerably lower.

The evaluation study by CSES (2012) also found evidence for this and suggested that the levels for standards should be stricter and adjusted over time to anticipate and account for a normal improvement rate. This work suggests in each case that the Ecodesign implementing regulations often impose only small increases in production costs and additional burdens on manufacturers.

To which extent the additional costs are actually passed on to the consumer is unclear although Salmons et al (2011), expect that the setting of MEPS only leads to an increase of product price in the short run, while in the medium to long run no effects on prices are expected. The evidence on fridges presented in Figure 4 suggests that these effects are low in comparison to the cost reduction trends that predominate.

9.2.3 Administrative burden for European firms

Section 7.2.3 addresses the cost and administrative burden of both the Energy Labelling and Ecodesign Directives on firms.
The previous evaluation of Ecodesign (CSES, 2012) assessed this issue more directly and concluded that given adequate lead times for the Ecodesign regulation to come into effect, the impact on manufacturers is not excessive. Given sufficient time manufacturers can incorporate necessary changes into their normal industrial design and production cycles at minimal cost. Through the restrictions it places on products the Ecodesign implementing measures may also create niche market opportunities for SME and other firms. In this case the benefits for some can outweigh the costs.

9.2.4 Competitiveness of operators

Section 7.2.4 addresses the impacts on the competitiveness of operators for both the Energy Labelling and Ecodesign Directives.

Ecodesign specifically targets the least efficient products. Consequently, producers of these products will be negatively impacted by the implementing measures. The effect on their overall competitiveness will be a factor of the extent to which they have the knowledge and capacity to adapt their product range and strategy to the new market. In this case SMEs would be expected to be most vulnerable to changes due to their typically lower capacity and smaller product ranges. Although the evidence tends to support the view that the Ecodesign process is long enough and well signalled so that firms have sufficient time to adapt within normal production cycles and timeframes, therefore with minimal cost disadvantages.

Table 45 presents a summary of the competitiveness and employment impacts of the implementing measures as anticipated in their impact assessments. In summary, these show that across the full range of product groups very low competitiveness impacts were anticipated and of the anticipated impacts there was a split between both positive and negative impacts, with the implementing regulations expected in many cases to stimulate markets and create jobs. In general there appeared to be little evidence that SMEs would disproportionately lose out from the changes.

Table 45 Summary of estimated competitiveness and employment effects of Ecodesign measures taken from impact assessments

PRODUCT GROUP	Summary of estimated competitiveness and employment effects
Boilers and combiboilers, Lot 1	-
Water heaters, Lot 2	-
PC:s and servers, Lot 3	No significant impacts on the competitiveness of industry and employment, and in particular in the SMEs sector due to the small absolute costs related to product re-design and re-assessment;
Imaging equipment, Lot 4	No significant impacts on the competitiveness of the industry and employment, and in particular in the SMEs sector due to the small absolute costs related to product re-design and re-assessment.
Televisions, Lot 5	Low risk for having negative impacts employment, in particular SMEs.
Standby and off-mode losses of EuPs, Lot 6	Low risk for having negative impacts employment, in particular SMEs.
Battery chargers and external power supplies, Lot 7	No impact on employment in the EU
Tertiary Lighting, Lot 8–9	A lower risk for having negative impacts employment, in particular in SMEs
Room air conditioning appliances, Lot 10	It is estimated that the Ecodesign measure will not lead to direct job losses. Extra job creation is not expected for the EU, nor outside EU. No major impacts on employment in manufacturing or in installation sectors are expected.
Electric motors, Lot 11	Positive employment impact is expected, particularly for SMEs. 39000 new extra jobs are expected.
Ventilation fans, Lot 11	No negative impact on employment;
Circulators in buildings, Lot 11	Positive impact on employment
Electric pumps , Lot 11	Almost no impact: all sub-options create 100 extra jobs
Domestic refrigerators and freezers, Lot 13	Increase in employment of 15000
Domestic washing machines, Lot 14	Increase in employment of 2030
Domestic dishwashers, Lot 14	Increase in employment of 3010
Laundry driers, Lot 16	-
Vacuum cleaners, Lot 17	Positive impact on employment, in particular for SMEs.
Complex set-top boxes, Lot 18	No significant impacts on the competitiveness of industry and employment, and in particular in the SMEs sector due to the small absolute costs related to product re-design and re-assessment;
Simple set-top boxes, Lot 18a	The proposed Ecodesign requirements for SSTBs have no impact on employment or trade.
Domestic lighting (general lighting equipment), Lot 19	Possibly negative impact on jobs, especially for SMEs, not quantified
Directional lighting Lot 19 part 2	Increase in employment of 46000

Source: Ecofys (2013)

Ecodesign may be anticipated to work in favour of EU firms by removing the least efficient, cheapest products from the market. As these products can be most competitively produced by firms with low labour costs they have tended to be sourced through imports. The regulation forces producers to produce more technologically advanced products, reducing the relative labour cost advantage of some international competitors.

As with Energy Labelling it is understood that the direct competitiveness impacts of Ecodesign are negligible in comparison to the wider economic trends that are visible in the data, more so for Ecodesign given that the short period for which most measures have been active has directly coincided with the financial crisis.

A case can be made for competitiveness benefits to EU firms of strong Ecodesign regulations as this spur to producers can help make them global leaders, with a reputation for efficiency and quality, and ready to take advantage of other markets globally as the long-term energy and climate challenge demands similar policies in other countries.

In terms of tangible benefits to stakeholders, the market effects are difficult to quantify, with financial benefits being clearest for end consumers through the energy saved by the measures (Molenbroek 2012). The benefits for business and industry stakeholders are mostly indirect, through consumers' savings on energy bills then being spent on their products and also the small overall reduction in energy costs highlighted by Thema et al (2013) and explained further in section 8.2.4. Industry stakeholders will have benefited most tangibly from their use of products regulated by the Directive, i.e. lighting, imaging equipment, water pumps, motors, circulators, fans and air conditioners. No estimates of actual savings were found.

9.2.5 Market structure

No clear evidence related to changes in the market structure of producers, i.e. changes within the value chain, due to Ecodesign has been found. Similar supply chain effects to those highlighted in section 8.2.5 could be expected with low efficiency suppliers losing market share.

9.2.6 Choice of products on the market

Impacts on market structure in terms of products and consumer choice have been more evident. This is a simple result of the least efficient products being forced to change or be removed from the market. The most notable example of this change is for lighting and the phase-out of incandescent light bulbs which caused a major, and forced, market shift into halogen, compact fluorescent and LED bulbs.

The light bulb example also highlights a further difficulty for regulation, predicting how the market choice will develop and which products are necessary to regulate. As the original impact assessment for lighting was carried out with the assumption that LED lighting would only play a very limited market role for the foreseeable future, while in reality LEDs now have significant market share and compete directly with regulated products. This could be a result of the influence of the EU industry in the assessments with a skewed focus on CFL bulbs over LEDs, mirroring the major EU industry players investments and innovation rather than the global reality.

9.2.7 Unfair competition through non-compliance (free-riders)

Data on products non-compliant with the Ecodesign implementing measures is available to only a limited degree from the literature. One estimate, from a working document of the Consultation Forum (ECEEE, 2012), estimates non-compliance at around 10-20% of all products. This is of similar proportions to the non-compliance with Labelling observed in section 7.2.7.

Non-compliance at this level could have important market distortion impacts, based on the assumption that the non-compliant products were less energy efficient and able to undercut compliant products on price. Yet the evidence presented in section 10.2.2 shows that improved energy efficiency has only a limited impact on production costs and prices.

Nevertheless, high levels of non-compliance would provide disincentives to firms that produce compliant products and also reduce the benefits that they can derive from the regulation. An EPEE position paper (EPEE, 2010) stated that non-compliance could put compliant firms out of business and estimated losses to compliant firms of over 500 million euros a year in just the Lot 10 product category of residential ventilation and kitchen hoods. While in the context of the evidence of section 10.2.2 these claims seem somewhat exaggerated, it is likely that at least some negative impact will be experienced by compliant firms.

9.3 References

- CSES, 2012, Evaluation of the Ecodesign Directive
- Delaski, A., Nadel, S., (2013) Appliance standards: comparing predicted and observed prices
- ECEEE, 2012, Working document on the review of the Ecodesign Directive 2009/125/EC – Agenda Point 3 - for the Consultation Forum meeting of 19 April 2012
- Ecofys (2013) Forthcoming for DG Energy
- EPEE, 2010, Market surveillance in the European Union: position paper
- Molenbroek et al, 2012, Economic benefits of the EU Ecodesign Directive, Ecofys
- Salmons et al, 2011, Impacts of innovation on the regulatory costs of energy-using product policy, report for DEFRA [UK]
- Johannes Thema, Felix Suerkemper, Katharina Grave, Adrian Amelung, 2013, The impact of electricity demand reduction policies on the EU ETS: Modelling electricity and carbon prices and the effect on industrial competitiveness, Energy Policy 60 (2013) 656-666 2013
- Waide, 2010, How much energy could we save through compliance?

10 Criteria and procedures of Ecodesign

10.1 Current procedures and criteria

Setting Ecodesign implementing measures is a multi-stakeholder process that aims to set effective standards, while building consensus amongst stakeholders. In the working plan phase the target product groups are identified. The product groups are then analysed in a preparatory phase leading to a draft implementing measure. The preparatory phase is followed by an adoption phase in which the implementing measure is adopted by publication in an Official Journal. In this section chapter, the available evidence regarding the strengths and weaknesses in the process for developing implementing measures will be described. To start with, an outline of the current process is provided). The timelines for the various steps provided in figure 24 are 'Commission estimates' (Siderius 2013), although it is not mentioned whether this is an estimate of the average or the norm. The total time from the start of a preparatory study (step 3) to adoption and publication in this article is 47 months, whereas the average is reported to be 49 months based on the first 16 published measures. The total time from the contracting of a preparatory study (step 2) to adoption and publication is 55 months. Other EC sources report 41 months starting from step 2 (the norm, Hodson 2011).

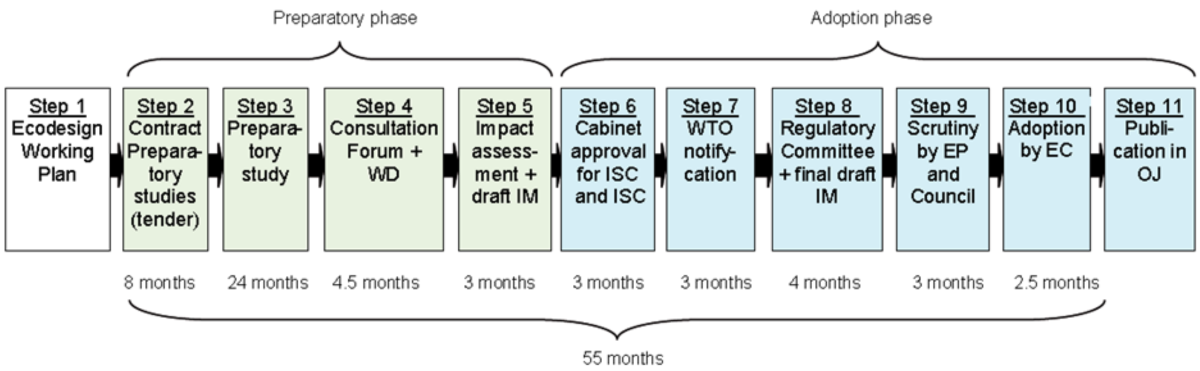


Figure 22: The Ecodesign regulatory process and timeline (Siderius, 2013).

Step 1: Ecodesign Working Plan

In accordance with the criteria set out in article 15 of the Ecodesign Directive[38] the European Commission develops a working plan. The working plan sets out for the following three years an indicative list of product groups that are considered priorities for the adoption of implementing

[38] Products groups that are targeted through the working plan must meet the following criteria: 1) have a significant volume of sales and trade, indicatively more than 200,000 units per year all over Europe, 2)have a significant impact on the environment and 3) have a high potential for improvements in terms of their environmental impact.

measures. In December 2012 the second working plan of Ecodesign was established, covering the period 2012 - 2014[39].

Step 2 & 3: Preparatory study

Through a tendering procedure an external expert is hired to conduct a preparatory study for a product group targeted in the Working Plan. A preparatory study is a technical and financial analysis of the market of a product group. It is targeted in the Working Plan. A preparatory study is performed by an external expert and aims to capture the current and future technology and market developments of a product group. The analysis in the preparatory study serves as the quantitative basis on which the appropriate level of ambition for the implementing measure or voluntary agreement can be established. The study must be carried out in line with the Methodology for the Ecodesign of Energy-related Products (MEErP). Industry stakeholders and experts are heavily involved to understand the environmental impact and the costs of technologies in detail.

Step 4: Consultation Forum

The Consultation Forum invites Member States' representatives and all interested parties (industry, including SMEs and craft industry, trade unions, traders, retailers, importers, environmental protection groups and consumer organisations) concerned to comment on the preparatory study's findings and proposed implementing measures. In this step the Commission takes over the responsibility for the documents from the external expert that carried out the preparatory study.

Step 5, 6, 7: Draft Implementing Measure, Impact Assessment, Interservice Consultation

Based on the feedback in the consultation forum phase as well as the findings from the preparatory study a draft implementing measure is proposed. The draft Implementing Measure will be subjected to an impact assessment. During the Interservice Consultation the draft implementing measure is sent to other relevant EU bodies to ensure that all aspects of the matter in question are taken into account. After the Interservice Consultation of the Draft Implementing Measure the World Trade Organisation (WTO) is notified of the upcoming regulation as well.

Step 8: Regulatory Committee

The Regulatory Committee is an assembly of one representative for each EU Member State and one delegate of the European Commission. The Committee is consulted by the Commission during the periodic modifications of the working plan (step 1) and votes on draft implementing measures.

Step 9, 10, 11: Scrutiny, Adoption and Publication in Official Journal

After scrutiny by the European Parliament and the Council, the implementing measure can be adopted and published.

[39] SWD (2012) 434 final
SWD(2012) 434 final

10.2 Areas for improvement

In the available literature a number of recommendations for improvement of the procedures and criteria are put forward. The recommendations are all aimed to improve the effectiveness and efficiency of the Ecodesign directive. The three (interrelated) key areas for improvement identified are 1) delays in the regulatory process, 2) limited data availability and quality and 3) low ambition of the implementing measures. All three improvement areas are strongly interrelated and will be discussed in this section.

10.2.1 Delays in the regulatory process

The process time of developing implementing measures is one of the key performance parameters of Ecodesign. Based on the article from Siderius 2013, the timeline from the start of the preparatory study to the publication of an implementing measure in the Official Journal is 47 months, or about 4 years. It should be noted that this is already longer than the norm quoted by the EC, but it is used as reference timeline for this discussion. Since 2010 none of the implementing measures have this planning, nor will probably any of the implementing measures that are now being developed, measures were, on average, 8 months late in 2008, and 9 months late in 2010. For 4 products the publication date was even 18-28 months later than the targeted date of adoption (Siderius, 2013).

Delay in the process leads to considerable uncertainty, which in turn leads to difficulties for Member States and industries to participate in the progress and prepare for the implementing measure. Also, the stretching of deadlines leads to an inefficient process where old issues can be raised again. In addition, no clear pathway exists to the next steps of the process. Delays and the possibility to disregard deadlines without consequences make the process susceptible to delaying tactics.

In Siderius 2013 an overview is given for the 16 product groups for which implementing measures have been adopted (status August 2013). The figure demonstrates that the average time for adopting an implementing measure has been increasing over time and was up to 76 months, nearly 2 years longer than planned, for the implementing measures adopted in 2012.

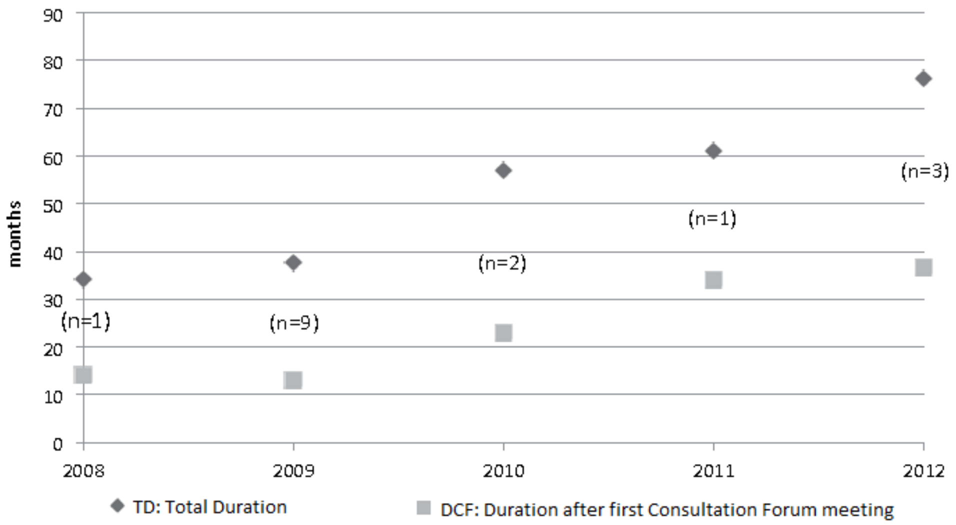


Figure 23 Duration of Ecodesign process by publication year for products with published measures (n=16) (Siderius 2013).

From the product that indicated as priority for the period 2005-2008 three processes were still on-going at the time the article was prepared: lot 1 - space and combination heaters, lot 2 - water heaters and lot 3 - personal computers (desktops & laptops) and servers personal. These processes had been on-going for on average 87 months (≈ 7.5 years) at that time (by the end of 2012). Meanwhile, the implementing measures for space and combination heaters and water heaters have been published in the Official Journal in August 2013. The measures for personal computers and servers have been published June 2013.

A number of underlying reasons for delays in the process have been identified (Siderius, 2013; CSES, 2011). These are discussed below:

Little room for delay in the preparatory study

The preparatory study is performed by an external expert and has strict deadlines, which means that there is little delay in this step itself. However, lack of available data or low industry cooperation can result in a low quality preparatory study, which in turn can cause considerable delays in the later phases of the rulemaking process. Also the lack of agreement on the testing standard for environmental performance testing has led to insufficient preparatory study results in the case of e.g. space and water heaters.

Delays between the preparatory study and Consultation Forum

The original estimate by the Commission assumed that at the end of the preparatory study phase, the Consultation Forum phase could follow quickly. In practice, the first Consultation Forum meeting on average takes place 10 months after the preparatory study has been completed.
A reason for this delay is that the Commission has too few staff to adequately process the results of the preparatory study and continue in the Consultation Forum phase. Another reason is that many stakeholders only start their thinking on the topic once the Consultation Forum meeting is

announced. Although the preparatory study is publicly available to all stakeholders, many industry and Member state experts only "wake up" once the Consultation Forum phase starts. This may lead to the need for additional meetings to be able to gather and process all stakeholder inputs.

Delay by Regulatory Committee/Scrutiny/during scrutiny and adoption
The last steps before adoption are straightforward, and should be fairly quick compared to the preparatory phase. However, experience shows that the adoption of a measure can sometimes take a long time as was the case for e.g. household air conditioners and boilers and water heaters.

Delay through amending of existing regulations
In addition to these delays in specific phases, delay in any phase of the process can occur when Commission staff is being sidetracked by other tasks, such as the amending of existing regulations. For example, the Regulations on electric motors, circulators, networked standby and 2 lighting regulations have been amended.

It must be noted that the US Department of Energy (DOE) was also confronted with serious delays in their standard setting procedures around 2006 (Siderius, 2013). The proposed rulemaking timeline of three years was not met in most cases. The following reasons were presented:

- The priority setting process resulted in stopping the work on products that were not highest in priority;
- The open nature of the process resulted in inefficiency as sharing of drafts and commenting was on-going without clear timeframes;
- The robustness of the procedure had a trade off with the complexity and the amount of time it consumed;
- The inter-governmental consultation (review by other government bodies then the DOE) could add 1 year to the total process;
- The sequential nature of the process made it impossible to recover delays.

We recognise the same delay factors as in the Ecodesign process e.g. the intra-governmental reviews (impact assessment and Interservice Consultation) and the open and sequential nature of the process. After the review the US managed to achieve the three year target, indicating that this is a reasonable timespan for target setting.

10.2.2 Limited data availability and quality

Currently market data is primarily assessed during the preparatory studies. The lack of quality or even unavailability of data affects the quality of the preparatory studies, which in turn affects the speed of the regulatory process (previous section) as well as the ambition of the standards (next section). In some cases detailed market information is available commercially, but very expensive to acquire on the already strained preparatory study budgets. Manufacturers selling their products in the EU do not have an obligation to provide technical characteristics or sales numbers to any centralised European system.

Furthermore, the suggested MEErP procedure for compiling market data is relatively rudimentary; ProdCom usually gives too superficial results to perform the required level of analysis (Attali and Bush,et al, 2013). Siderius (2013) indicates that contracting under-qualified consultants for preparatory study work has led to a number of weak preparatory studies, resulting in delays and inefficiencies later on in the process.

10.2.3 Low ambition of standards

Evidence exists that some implementing measures (e.g. 2010 - household cold appliances, 2010 - televisions) have led to very limited market change (Attali and Bush, 2013), as at the time of their implementation the standards had already been surpassed by technology. There are many reasons why the standard setting can lead to weak standards, including a low quality preparatory study, long periods of time between the preparatory study and the implementation of the implementing measure, obstructive behaviour of stakeholders or even practical concerns such as lack of staffing at the European Commission (Siderius, 2013).

Kueper (2013) and BMWi & BMU (2013) indicate that current life cycle costing procedures, as put forward in the MEErP methodology, do not take into account learning effects, which could in practice lead to more ambitious MEPS. Also the indication of best available technology (BAT) and best not yet available technology (BNAT) could lead to a better long term planning for market actors preventing a permanent revision in short term intervals.

It is also noted that it is possible to have a conflict between the setting of standards at lowest life cycle cost and other crtieria in the Ecodesign Directive. An example of this is the case of light bulbs, where the setting of standards at the LLCC level, CFLs, was deemed to be in conflict with the requirement of having no significant impact on the functionality from the user's perspective.

10.3 Options for improvement

In this section a number of improvement suggestions as found in the literature is presented. These improvement option aims to improve the performance of the Ecodesign procedures and criteria on the topics discussed above.

10.3.1 European product database

Several authors (CSES, 2011; Arditi & Toulouse, 2012) suggest the development of a central database containing specific product data to increase data availability and quality. We note that the call for tender from the European Executive Agency for Competitiveness & Innovation (EACI/IEE/2013/002 - "Energy-Related Product Database") is expected to fill this demand. Kueper (2013) and Attali and Bush (2013) applaud the action of the Commission and urge the Commission to develop free, publically available and regularly updated product market data so that decisions are made based on sound and indisputable information.

Attali and Bush (2013) also propose a legal obligation for manufacturers to submit their product data to a centralized database as is being done in other nation's jurisdictions such as the US. The information should be bundled into an annual report that provides an overview of the key parameters per product as well as per Member State.

10.3.2 Complexity and contentiousness analysis

Siderius (2013) analyses the dependency between the technical complexity as well as the contentiousness and the time it takes to develop and adopt an implementing measure for a product group. Technical complexity is the extent to which a product has a large variation in product types, user options, features, interdependent subsystems, etc. for which it is difficult to set or measure an efficiency metric. The contentiousness refers to the political sensitivity of addressing the efficiency of a product. As technical complexity and contentiousness increase the process time also increases.

Therefore Siderius (2013) suggests assessing the technical complexity and contentiousness of a product group as part of the preparatory study (see also Figure 24 - step 3). This assessment can be used to develop further planning that puts additional emphasis on the phases were bottlenecks are expected. This assessment can be used to develop further planning that puts additional emphasis on the phases where bottlenecks are expected. The following four timelines are proposed after the preparatory study has been completed (Siderius, 2013):

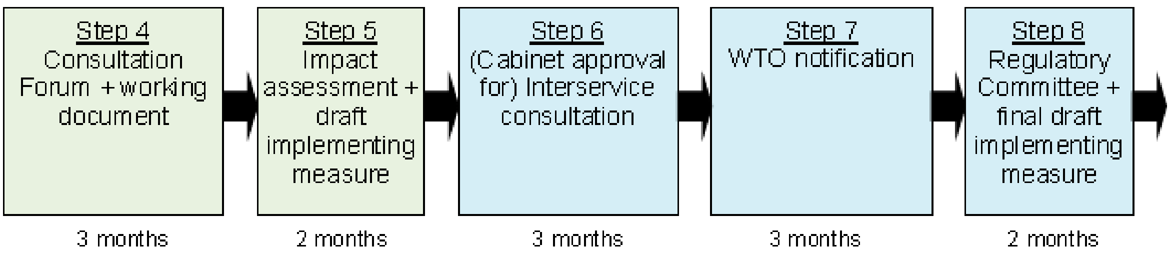


Figure 24: Category 1 - Low complexity, low contentiousness (13 months)

Category 1: In case of a product with low complexity and low contentiousness, the preparatory study should already contain building blocks for a draft implementing measure. Examples of these products are external power supplies, simple set top boxes and cold appliances. In the working document for the Consultation Forum already an advanced draft of the implementing measure could be presented. In this case the planning can be straightforward and steps 4 and 8 could be shortened, and the planning should be strictly kept. With the first Consultation Forum meeting 2 months after the start of step 4, step 4 would take 3 months overall. Total process time until the Regulatory Committee would then be 11 months after the Consultation Forum meeting.

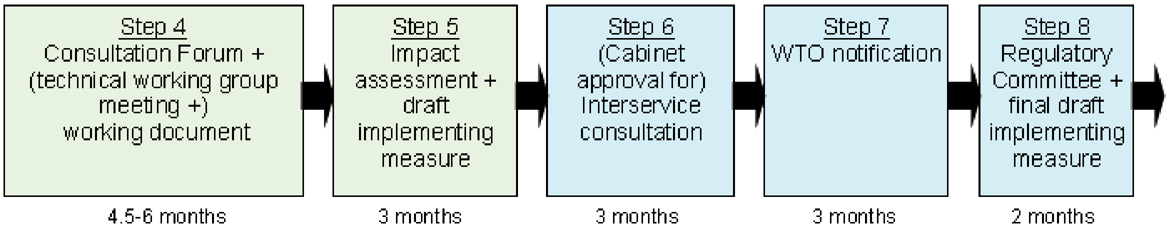


Figure 25: Category 2 - high complexity, low contentiousness (total 15.5 – 17 months)

Category 2: In case of a product with high complexity, such as (networked) standby, LED lighting and commercial refrigeration, the Commission should at least be prepared to ensure further technical assistance. In order not to let the technical complexity increase contentiousness, a thorough preparation of the Consultation Forum meeting is necessary: the working document should aim at explaining how the technical complexity is reduced and mapped into the proposed regulation, especially assumptions made to simplify aspects should receive attention. If necessary a technical working group meeting can be arranged after the Consultation Forum meeting. The process time for step 4 might need to be increased to 6 months. In principle the (technical) complexity should have been dealt with in step 4 so that the process time of step 8 can be reduced.

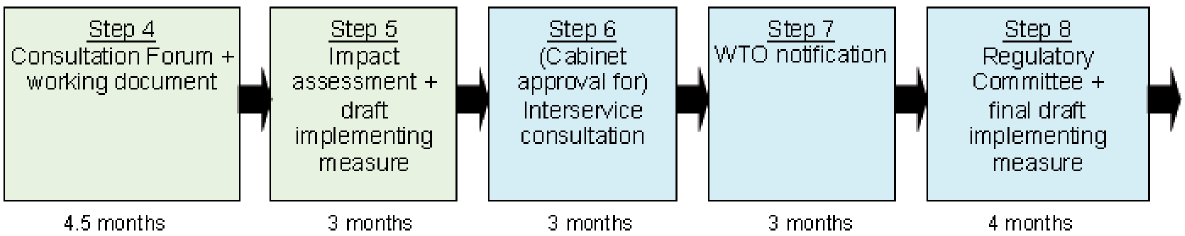


Figure 26: Category 3 - low complexity, high contentiousness (total 17.5 months)

Category 3: Because complexity and contentiousness are related, the first task, preferably done in the preparatory study phase, is to distinguish which issues are in the technical realm and which represent political sensitivities that are contentious. The critical aspect is not to let contentious issues spread into the technical realm, suggesting complexities that are in reality different political opinions. More technical research will not solve these issues but only delay the process. Also it should be acknowledged that (some) contentious issues cannot be solved at the Consultation Forum meeting. Examples of products in this category are water heaters, general lighting, electric motors and tumble driers.

In general the timing of the original approach should be suitable to deal with these types of processes. Contentious issues might be better resolved through bilateral discussion and informal meetings than through more Consultation Forum meetings.

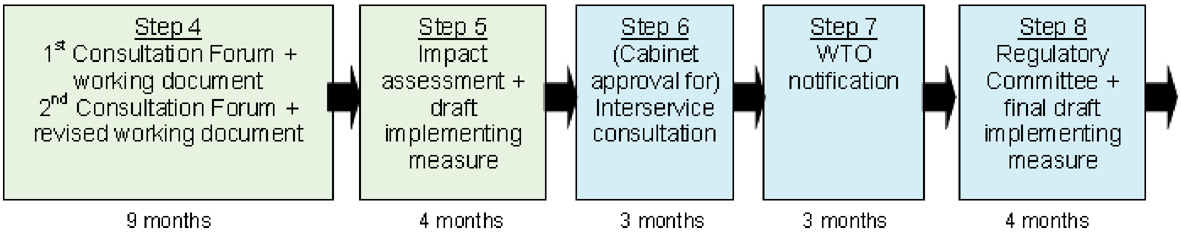


Figure 27: Category 4 - high complexity, high contentiousness (total 23 months)

Category 4: The case of high complexity and high contentiousness is the category that also the category that processes in category 2 and 3 tend to drift into when not properly managed. Examples of category 4 products are (combi)boilers and solid fuel small combustion installations. As for category 3 it is important to try to distinguish between the issues that are technical complex and those that are (politically) contentious. The first can be resolved with further (technical) research, the second not. Unfortunately, also the discussion on what are technical issues and what political can be contentious.

Product groups in this category will probably need a prolonged step 4 with two Consultation Forum meetings, where the first is used to get more clear what the issues are and which are of technical nature and which are politically contentious, and where the second meeting can be used to resolve the (main) technical issues. Also in this case technical support for the Commission is necessary. An additional criterion for this technical support is that the consultant is seen as "politically" acceptable by (almost) all stakeholders.

10.3.3 Stricter deadlines for process steps

A number of authors (Arditi and Toulouse, 2012; Siderius, 2013; BMWi and BMU, 2012) call for stricter and more streamlined process steps in the Ecodesign process. Siderius notes that, although the current flexible way of working increases the consensus amongst stakeholders, it also generates a significant amount of missed potential through the process uncertainty for public and private stakeholders. Not meeting deadlines leads to further delays through e.g. an increased chance of changes in staff at the EC and Member States, increased susceptibility to delaying tactics and difficulties in expert capacity planning. Siderius (2013) argues that less stringent standards can be acceptable for certain subcategories if this reduces the complexity and speeds up the process. Should a delay be unavoidable, it must be ensured that all stakeholders are informed of the new planning including deadlines.

10.3.4 Shorter periods between process steps

Since large delays occur after the Consultation Forum meeting, a suggestion is to keep the (last) Consultation Forum meeting (in step 4), step 5 and the start of the Interservice Consultation (in step 6) as close together as possible (see Figure 24).

In principle stakeholders, including Member State experts, should provide their (main) comments and suggestions at or shortly after the Consultation Forum meeting. This means that they should have the working documents well in advance, e.g. 6 weeks prior to the meeting. The other side of the coin is that the Commission can be strict in the deadline for comments: comments issued later than 1 week after the Consultation Forum meeting will not be taken into account for the draft implementing measure that will be sent to the interservice consultation. In this way it is clear for stakeholders that there is one opportunity to send comments to influence the draft implementing measure. Of course some comments will need bilateral clarification and discussion, but tying step 4 from the Consultation Forum meeting, step 5 and 6 till the start of the interservice consultation in a controlled time window, e.g. 4.5 months, prevents the emergence of several consultation cycles (Siderius, 2013).

10.3.5 Staffing and planning at the European Commission

Several authors (Arditi & Toulouse, 2012; Siderius, 2013; CSES, 2011) indicate that there is a lack of resources and staff at the European Commission working on Ecodesign (and Energy Labeling). The suggested improvement options are

- Increasing the number of staff;
- Better timing; identify beforehand events that could disturb the process e.g. elections of the European Parliament, a new Commissioner or summer holiday period;
- Capacity planning; plan not too tight, e.g. up to 80%.

It will be up to the Commission to evaluate to what extent these options are feasible and could remove bottlenecks.

10.3.6 Increased ambition of implementing measures

The MEErP methodology which entails a bottom-up engineering approach used to determine, by techno-economic analysis, the optimal place to set the Ecodesign implementing measures. The concept of the life cycle costing analysis, which analyses the full costs of an appliance over the lifetime of a product and plots this against the environmental efficiency of the product, is shown in Figure 28.

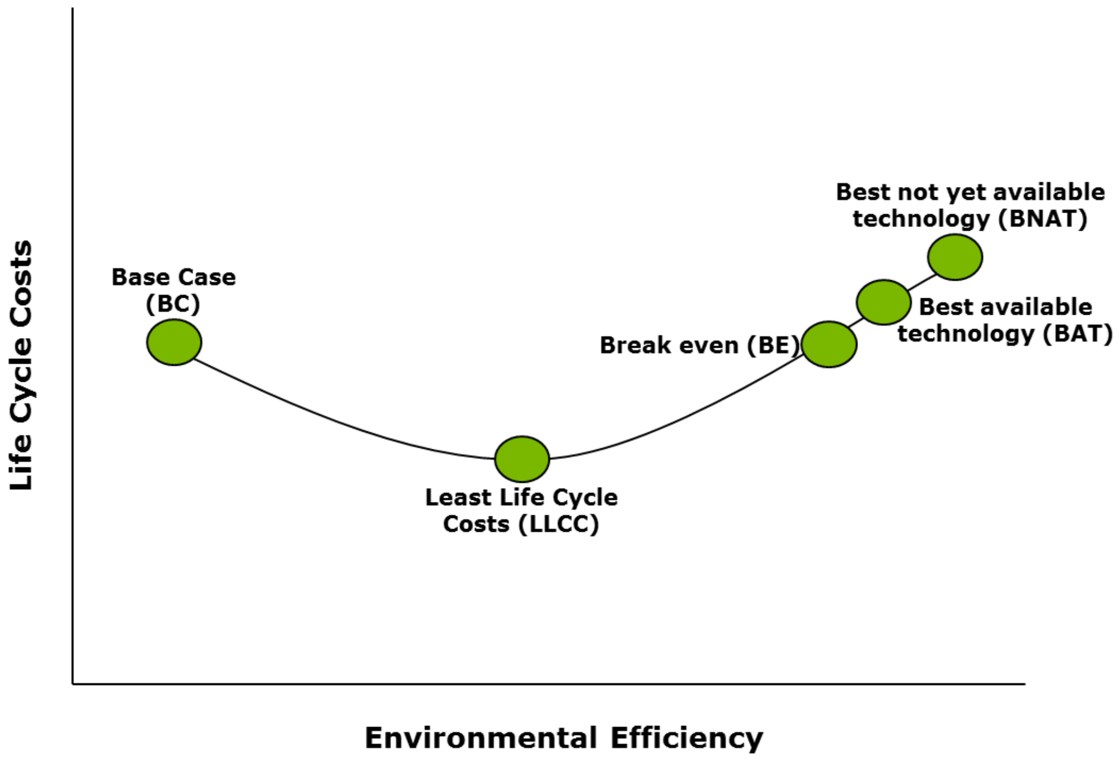


Figure 28 Illustration of the optimal level for environmental efficiency assessed against life cycle costs

Arditi and Toulouse (2012) note that there can be a considerable time between the end of the preparatory study and the implementation of the tier 1 Ecodesign requirements. For this reason the Tier 1 requirements should be set directly at the level of Least Life Cycle Costs (LLCC).

Several authors indicate that standards should be set at levels beyond least life cycle costs. Kueper (2012) notes that learning effects[40] are not taken into account in preparatory study analysis, but that these in practice will increase the environmental efficiency level at which the lowest life cycle costs are achieved. Therefore it is proposed that learning effects should be applied in preparatory studies, which will lead to more ambitious standards.

The revised MEErP already identifies the Break Even point (BE), or the point at which no additional costs to the end user occur. Although Annex II of the Ecodesign directive currently states that the MEPS should be set at the LLCC point, the identification of the BE point will help in gaining creating a clearer picture and help evaluate the appropriateness of the LLCC approach (Kueper, 2013).

[40] Learning effects - The effect that the costs of production will decrease with every doubling of produced capacity.

BMWi & BMU (2012) and Arditi and Toulouse (2012) state that the long term planning could be strengthened by strengthening the role of best available technology (BAT) and best not yet available technology (BNAT) benchmarks. The identification of these points can serve as a starting point for future revisions of the minimum energy performance standards.

In Japan best available technology is used as the appropriate level of future standard setting. Instead of discussing the stringency of the standard, as is done in the case of Ecodesign, the timing of when the BAT standard becomes applicable is relevant. Another difference is that instead of setting a minimum performance standard for all products it sets a minimum energy performance standard for the average sales of a manufacturer or importer. This average target system is similar to the CO_2 emission targets for passenger cars in the European Union. The European and Japanese MEPS seem to have achieved similar results, although the Japanese system can is more flexible and has lower regulatory costs. A potential risk could be that firms may not be so forthcoming in sharing their innovations, although this does not seem to have happened so far (Lane et al, 2013).

Implementing measures which push the energy performance boundaries to a level beyond what is considered cost effective (BE) could be an approach to achieve even further energy savings. These standards are called technology Forcing Standards (TFS). The appropriateness of TFS for energy performance standards is analysed by Lane et al (2013) who conclude that it holds a high risk. Instead it is suggested that high performance levels (BAT, BNAT) are used in other ways to encourage ambition as of a suite of policies that support innovation in energy efficiency.

10.3.7 Increased focus on non-energy impacts

Arditi and Toulouse (2012) indicate that there should be an increased focus on non-energy impacts. The authors indicate that the work from the JRC commissioned by DG Environment on resource efficiency metrics for products is an interesting first step and they encourage all DG's of the Commission and Member states to support this work and help securing a quick implementation. Arditi and Toulouse (2012) put forward three suggestions to increase the focus on energy impacts:

- The use of horizontal measures for non-energy aspects should be investigated and included in the next Ecodesign Working Plan. For instance a horizontal Ecodesign measure covering electronics and IT products could set requirements on the recyclability, recoverability of critical material, easy dismantling, and use of chemicals such as flame retardants.
- Ecodesign preparatory studies should analyse in more detail the main drivers of the lifetime of products (e.g. metal connectors for lightbulbs, bearings for washing machines, etc.).
- Technical advisory committees open to stakeholders should be established to develop measurement standards and metrics to help decision-makers move forward with non-energy aspects. This could be the role of the in-house or JRC experts supporting the development of implementing measures. Standardisation could be involved: the horizontal Ecodesign mandate M/495 to CEN and CENELEC could already include related work for a list of agreed non-energy aspects.

10.4 References

- Attali S., Bush E., Michel A., Toulouse E.; 2013; Can Europe Continue deciding on product policies (MEPS, labels, etc) without monitoring the market; ECEEE summer study proceedings
- Arditi S., Toulouse E.; 2012; Priorities for the improvement of the EU Ecodesign and Energy labelling policies
- BMWi and BMU; 2012; the Ecodesign and Energy Labelling Directive: best performing products and continues improvement to higher energy efficiency; Technical background paper on the joint concept from the Federal Economics Ministry (BMWi) and the Federal Environment Ministry (BMU), Germany
- ECEEE, 2012, Working document on the review of the Ecodesign Directive 2009/125/EC – Agenda Point 3 - for the Consultation Forum meeting of 19 April 2012
- Kueper et al.; 2013; Ideas on the way forward for the Ecodesign and the Energy Labelling Directive
- Hodson P.; 2011; Energy efficient products - Introduction to Ecodesign, presentation 13 April 2011
- Lane K., Brocklehurst F., Siderius HP., Ellis M.; 2013; The role of technology-forcing standards and innovation to dramatically accelerate product energy efficiency; ECEEE summer study proceedings
- Siderius HP.; 2012; The Ecodesign and energy labelling process – challenges and solutions
- Siderius HP.; 2013; The Speeding up adopting Ecodesign and energy labelling measures – analysis, challenges and solutions; ECEEE summer study proceedings

11 Effectiveness of standardization

11.1 Introduction

In this chapter we examine the effectiveness of standardisation for Ecodesign. Testing and standards underpin the MEPS set under the Ecodesign implementing measures. Therefore, it is crucial to ensure that the process is effective and efficient. The evaluation reviews four main areas relevant to standards:

- The standardisation process;
- Test procedures;
- Harmonisation at global level;
- Implemented standards for specific products.

After presenting a variety of evidence and analysis on each of these issues a selection of options for improvement are outlined. Many of the same issues are also addressed for Energy Labelling in chapter 6.
Please note that the word 'standard' is used in the sense of a technical standard (sometimes called test standard) issued by a standardisation organisation. When discussing harmonisation at a global level the harmonisation of minimum energy performance standards (MEPS) is also discussed. They are then referred to as 'regulatory standards'.

11.2 The standardisation process

A key role for standards
The evaluation of the Ecodesign directive (CSES, 2012) evaluation described that harmonised standards[41] developed by the European standardisation bodies have a key role in the implementation of the Directive. Test and performance standards can be used by manufacturers to show compliance with the Implementing Measures adopted under this Directive for specific product groups. In the case of generic eco-design requirements harmonised standards may also be developed to guide manufacturers. Stover et al (2013) also find that a lack of standards and regulations can be a barrier to greater energy efficiency as it creates a situation of uncertainty for consumers and contractors. Other standards provide tools for integrating environmental aspects in product design from a life cycle perspective, templates for information supply along the chain and treatment facilities so as to minimise the impact on the environment during the use and end of life management phases respectively.

[41] A harmonised standard is a European standard elaborated on the basis of a request from the European Commission to a recognised European Standards Organisation (CEN, CENELEC or ETSI) to develop a European standard that provides solutions for compliance with a legal provision (from www.cencelenec.eu).

Mandate to European Standardisation Organisations

The Commission mandated the European standardisation bodies (mandate M/341) to draw up a standardisation programme to develop an inventory of existing relevant standards and the additional standards to be developed. The two organisations provided an initial inventory with an indicative work programme extending over a four year period until 2010. In the period 2010 - 2011 additional mandates for most of the products covered by Implementing Measures were issued.

Horizontal mandate and technical updates

With a view to better streamline and organise the process, the European Commission decided to issue a draft horizontal mandate aiming to provide a long term view of the expected standardisation work and to facilitate the earlier involvement of the standardisation bodies in the decision process, starting from the preparatory studies. The Commission (2011 d) issued a horizontal Standardisation mandate to CEN, CENELEC and ETSI under Directive 2009/125/EC relating to harmonised standards in the field of Ecodesign. The objective of this 'horizontal' mandate is to ensure an effective standardisation process in the Ecodesign field, by providing European Standardisation Organisations (ESO) with a long-term overview of the expected standardisation work, which should lead to early involvement of standardisers in the Ecodesign decision-making process and close cooperation between ESOs and the Commission. Subsequently, individual updates to the mandate are issued related to implementing measures under the Energy Labelling and Ecodesign Directives. Some of the discussions within the Ecodesign Directive Working Group meetings relate to the effectiveness of the standard mandates, the differences between the horizontal mandate and the individual product related updates.

Purpose of horizontal mandates and individual updates

A point of discussion concerned the different purposes of the horizontal Ecodesign mandate and the individual product related updates. Concerns were raised about the horizontal mandate in that it could not include all technical details and that it could transfer too much power to ESOs. Within the discussions it was made clear that the horizontal mandate is not meant to delegate decision making powers to ESOs but to ease the coordination. Annex A of the Mandate lists the individual product groups for which the Ecodesign Directive mandates standardisation work, their current status, expected standardisation work and target dates. This can be updated if necessary, i.e. targets changed, products added; and is scheduled for review approximately every 3 years. The mandate could be also seen as a means for the MSAs to more systematically follow the standardisation issues through better coordination between the ESO and the Commission. All stakeholders should also be kept informed about the developments in individual Technical Committees, and involve the Technical Committees also in the preparatory studies (ENTR, 2010).

Timing

Another issue is whether mandates may be prepared on time, i.e. prior to or soon after the introduction of new product related legislation. This is also referred to as a "chicken and egg" problem, as a standard cannot be finalised before the detailed specifications of a product related legislation are released. Therefore, the stakeholder discussions have focussed on how to shorten the timespan between finalizing the legislation and releasing a standard.

CENELEC informed that at least a one year period is needed due to the length of the legislative process. CENELEC therefore suggested mandating a standard at the implementing measure stage, which was not accepted by ECOS, since the legislation conditions and requirements may differ substantially from the implementing measure stage (ENTR, 2009). The EC representative acknowledged that it, in some cases, may be unavoidable to adopt the implementing measure before the harmonised standard is agreed, but considered that proactive work can significantly reduce the delays (standardisers therefore need to be informed in advance about coming work). Also international or third country standards have to be taken into account if adequate.

Intermediate use of other documentation and standards
Furthermore, during the period between the adoption of an implementing measure and the adoption of a harmonised standard, other documents/standards can be published in the EU Official Journal (OJEU) for information and used by national authorities as the state-of-the-art reference. Measurement methods described in professional guidance documents could be used by market surveillance authorities until a harmonised standard is published in the OJEU, but as a last resort option. MSA requested that the list of reference documents giving measurement methods for adopted implementing measures (where harmonised standard are lacking) is published before market surveillance for such measures starts.

Significance of limit values
One important requirement on a measurement method that is decided upon after the adoption of the implementing measure is that it should not change the significance of the implementing measures. For instance, any modification of the measurement method can change the actual value of energy efficiency requirements. The agreement was that measurement methods should never change the significance of limit values established in legislation. This should also be stated in the mandates to the European Standardisation Organisations (ESO) (ENTR, 2009).

11.3 Test procedures

Need for satisfactory test procedures
According to the IEA 4E (2012), a prerequisite for effective product standards and other product policies is a testing method that is satisfactory. Usually, this means that the test is reproducible, representative and non-technology specific. To have effective product testing the product standards also need to be sufficiently robust and future proof so that there are no exclusions and issues of definitions and scope after a period of time, say 5-10 years.

Furthermore, test methods are typically not designed to test actual use, this is a problem compounded by a lack of field data and a lack of effort to gather this data.

Delegation of test procedures

In Europe, when the Ecodesign Directive was adopted in 2005, the original intention (in the spirit of the EU 'New approach' agenda to simplify legislation [COM(2005)535]) was to fully delegate the development of technical measurement procedures to industry-led standardisation bodies CEN and CENELEC, and let them do the work independently. These were supposed to work as much as possible on the basis of international ISO/IEC standards. However, this initial approach has triggered some difficulties, including delays or inconsistent work schedules, insufficiently clear instructions, overlaps between some provisions in regulations and standards, lack of alignment in scopes and methodologies, etc.

Some steps have recently been taken to improve the situation: earlier association of those involved in standardisation in the regulatory process, the development of a horizontal standardisation mandate that clarifies the overall needs for measurement methods to support Ecodesign and Energy Labelling measures, a detailed technical annex to this mandate that can be updated frequently, and the participation of experts appointed by the European Commission to the standard development process. CEN and CENELEC have also established an Ecodesign coordination group to better streamline their responses to policy needs.

CEN and CENELEC may receive funding from the EU to carry out this work. Once a measurement procedure is completed, the Commission evaluates it and has the option to publish it, or not, as the harmonised standard reference that manufacturers are invited to use to benefit from a presumption of conformity. A more regular dialogue between the Commission and standardisation organisations is planned in order to anticipate and solve potential cases of rejection that could hamper the implementation of regulations. This is in part required to address the critique that the standardisation committees tend to be dominated by manufacturers with little representation upholding the integrity of the policy process. This results in overgenerous tolerances and retrospective changes to test procedures without corresponding changes in the regulation to maintain its integrity.

Need for control of test procedures

It is critical that regulatory authorities are able to exercise clear control over the test procedures developed and used in their energy efficiency regulations if the integrity of those regulations is to be maintained. A concern is that a lack of control over the test procedure development and maintenance of process and schedule can lead to significant delays in the development and issuance of regulations which may lead to lost savings and an effective weakening of intent (Waide, 2013).

The Commission should ensure that lack of adequate energy performance measurement standards is not a cause of delay in the regulatory schedule. Efforts should be made to work with the standardisation processes in peer economies to share the developmental burden, enhance international harmonisation and facilitate policy benchmarking and trade. Stronger efforts should be made to integrate the energy labelling specifications into green public procurement plans, potentially including clear targets or obligations across the EU and similarly, to leverage other economic instruments to accelerate the adoption of advanced and innovative technologies (Waide, 2013).

11.4 Harmonisation at global level

Diverging test standards
Energy efficiency regulatory standards and labels are based on energy consumption values obtained from test standards adopted by different countries. Geographic, climatic and cultural differences among countries exist which necessitate different regional test standards. Interest in making measurement methods better reflect local conditions and the appliances actually available on the market has led many countries to develop national standards. The differences in test conditions lead to different energy consumption values recorded and this makes it difficult to compare the results obtained from different test standards.

The need for harmonization
The use of well-established and agreed standards is of utmost importance in the matter of energy efficiency policies, for two reasons. Firstly, the legal basis of policy implementation has to be as strong as possible, for measurement methods and appliances definition as well as for efficiency threshold setting. Secondly, the technical issues are complex and must be handled at the highest level to get accurate and effective policies. One particular country rarely has the capacity to design original standards that would address the whole complexity of the technical and legal stakes for each particular appliance type. Even if it were, it would not be very efficient to work out a scheme completely independent from existing ones. Beside the fact that the work would then have been done twice, the lack of harmonization amongst national or regional policy measurement methods and thresholds is likely to weaken the global combined effect (IEA, 2009).

International cooperation on test procedures
Global harmonisation of test protocols and possibly regulatory standards would take a great amount of effort and a very long time (IEA, 2000). The net benefits of global regulatory standards are not clear. The potential gains by extending existing regulatory standards to new areas/regions may be offset by the regulatory standards being lower than they might otherwise be. Some experts feel harmonisation of testing procedures could be worthwhile. There is perhaps a greater need and net benefit in encouraging the development of "regional" regulatory standards, rather than global regulatory standards, given the different characteristics of products in each market (IEA, 2000).

Indeed, there is more international cooperation for test methods (i.e. test standards) to measure the performance of products because all the national or regional standards bodies that issue test methods are also members of the international standardisation bodies such as the International Standards Organisation (ISO) and the International Electro technical Commission (IEC). The national standardisation bodies send representatives to participate in international test standards development processes of interest to them and vote on the adoption of new or revised international test methods.

Example: testing fridges and freezers

As an example, the main differences in the major test procedures for refrigerators and freezers are for the choice of ambient temperature used for the steady state energy test, the interior design operating temperatures, the method of measuring the interior operating temperatures (average versus maximum in freezer), whether frozen food compartments are loaded or not and whether door openings are included or not. The current refrigerator and freezer test procedures have varying levels of reproducibility and repeatability but are not likely to be very accurate at reflecting actual average in use performance, even within a single economy's borders. ISO/IEC test procedure drives European designs to have very cold freezers and warm fresh food temperatures. The use of a maximum test pack temperature decouples the test condition from the average compartment temperature which is an important energy driver for refrigerators and results in poorer repeatability. Test packs can take weeks to stabilise to get one satisfactory result.

A global test procedure would require a much more extensive characterisation of the refrigeration system under a broad range of operating conditions coupled with an algorithm that is primed using data of actual local usage practice and conditions.

For refrigerators and freezers, the way forward, at least in the short term, is unclear and most likely difficult with respect to harmonisation. The differences in test procedures are so significant and the number of economies involved is so large and the existing energy regulations so extensive, that the prospects of alignment are small, at least in the short term. Furthermore, on a technical level all of the existing test procedures have many weak points and none is clearly superior to any other. There is also a huge amount of institutional (industry, government and regulator) inertia associated with existing test procedures for refrigerators in many economies (e.g. regulations for energy labelling and MEPS); this makes the prospects for changes somewhat remote in the short term until there is something available that is technically superior to the current offerings (Chobanova et al, 2009).

Obstacles to harmonization of standards

Public policies in a large number of OECD and non-OECD countries seek to steer producers and consumers towards relatively more energy-efficient goods. Most relatively energy-efficient appliances achieve high performance levels through combinations of features. These features are difficult to characterise succinctly under the product descriptions normally used for customs purposes. Therefore, it may be necessary and desirable to distinguish them according to a single criterion: their energy performance in use. While international standards for defining and testing for energy performance exist, they differ for each appliance and in practice are not universally applied. OECD (2006) noted the progress made at the regional and international levels to harmonise these standards. However, for products exhibiting large regional variation, differentiating more from less efficient models at the multilateral level — a necessary condition for co-ordinated tariff reductions in the WTO — is more difficult. However, work towards harmonising test procedures for measuring the energy performance of household and office electrical appliances would in itself help to lower non-tariff barriers affecting energy-efficient goods, which may be more important than lowering tariffs (OECD, 2006). OECD (2006) also made a list of the main obstacles to international standard harmonisation for energy efficient products:

- Differences in test procedures used to measure energy performance;
- Differences in how countries classify and describe the products for which energy performance standards are regulated;
- Difference in how energy performance or efficiency is defined;
- Differences in the ways in which the standards are specified (e.g. adjustment factors);
- Differences in the energy performance required of products;
- Differences in the scheduling of reviews of the regulations.

Even more, the process of global alignment would not end once the international reference would be established – the standard would likely be a moving target, requiring updating as technology has evolved. Countries could agree to assign the task of reviewing the technical criteria to a WTO Committee or technical working group. Such a body would presumably meet at regular intervals to consider the suitability of the current criteria (much as national standard-setting bodies responsible for updating specifications for energy-performance standards already do). Alternatively, countries could, for some products, decide that rather than duplicate work undertaken elsewhere, to agree to simply to reference an established, recognised international standard, either private or public. They could even agree that the product specifications will automatically change as the standard is updated, thus obviating the need to create an entirely new international body of technical experts.

Examples of regional harmonization of standards
Regions with notable regional harmonisation efforts include (OECD, 2006):

- Australia and New Zealand have a formal arrangement to develop common energy efficiency requirements for energy using products and apply harmonised test procedures.
- ASEAN countries are working together to develop a common regional endorsement energy label for energy-using products.
- Six countries in and around the Indian sub-continent have been co-operating through the auspices of the South Asian Regional Initiative programme to share experiences and possibly co-operate in the development of regional appliance efficiency requirements.
- Members of the ANDEAN pact countries are co-operating in a regional initiative to develop energy efficiency labels and standards for energy using appliances.

11.5 Implemented standards: product examples

11.5.1 Refrigerators

Focusing on a specific product category, test standards should adopt conditions, which reflect the existing in-field conditions to a reasonable extent, as well as procedures, which account for the effect of user behaviour on refrigerator energy consumption. The main factors affecting energy consumption for refrigerators during testing are the specified ambient temperature, compartment temperatures and the number and length of door openings.

Other differences in test standards such as loading, performance tests, methodologies adopted to determine compartment temperature and energy consumption also have an indirect impact on the measured energy consumption. However, these indirect effects are relatively less significant and difficult to quantify (Barthel, Götz, 2012).

A direct comparison of the results obtained from the various energy consumption test standards is not possible as test conditions are not the same. But conversion formulas have been developed, which take into account the different test conditions and by this allow an approximated conversion value. In the following tables the conversion factors are displayed. The columns represent the numerator while the row represents the denominator of the ratio. (e.g. for refrigerators, EISO/EAS/NZS= 0.6787).

Table 46 Conversion factors for refrigerators (Barthel, Götz, 2012)

For all refrigerators	AS/NZS	ANSI/AHAM	ISO	JISC[1]
AS/NZS	1,0000	1,0111	0,6787	0,5213
ANSI/AHAM	0,9890	1,0000	0,6713	0,5156
ISO	1,4734	1,4897	1,0000	0,9563
JISC[1]	1,9181	0,8122	1,0457	1,0000

Pros and cons of the IEC test procedure

Furthermore concerning refrigerating appliances, as specified from an Australian perspective, arguments in favour of moving to the new IEC test procedure are:

- The new international test method is likely to be broadly used internationally as it has been developed with broad global input;
- The new IEC test procedure has the option of measurement of energy consumption at a room temperature of 16°C as well as a processing efficiency test, which could be important at the next label alignment if we are to move the label energy closer to actual use;
- The new IEC method is close to the new US test method (US in fact provided many parts during the IEC development in order to help with longer term alignment), so the adjustments to the MEPS levels will be smaller and more certain.

Arguments against moving to the new IEC test procedure include:

- Early adoption of the new international test method may be negative as the method has not been used extensively at this stage. (Nevertheless, a lot of development tests have been done with respect to the energy test and the basic testing principles are fairly close to those currently in AS/NZS4474.1, even if there are technical differences);
- Freezer temperatures in IEC (-18°C) are quite cold and this will result in higher energy consumption. However, this does not necessarily mean that consumers should be encouraged to use this temperature in normal use;
- Fresh food temperatures in IEC (+4°C) are warmer than many organisation recommend for safe storage of food. However, this does not necessarily mean that consumers should be encourage to use this temperature in normal use;

- The performance tests in IEC have been fairly radically changed in 2011 without any significant testing, so they can be considered to still be in an early stage of development. (US do not have any mandatory performance tests) For example, there is no real equivalent to a pull down test, but the storage test should be more or less equivalent to the current temperature operation test once it is further refined. There is a brand new cooling test that may be able to replace pull down test but no labs have experience with this test and it is likely to require further refinement before any performance limits could be developed locally;
- There are some concerns that the IEC volume measurement method (although simpler and more transparent) may drive compartment designs in a way that is less useful for consumers.

At first glance, it would appear that adoption of the IEC standard could have drawbacks. However, there are some possible ways to adopt the IEC standard while addressing some of the concerns above. This is where some dialogue with industry and other stakeholders would be useful.

Early adoption of a standard always carries some risks. However, for the energy component of the test, the technical issues appear to be settled and accurate and the risks should be low. The risks with respect to performance requirements (or lack thereof) are greater but this could be addressed by retention of the current performance test as part of a medium term transition.

The issue regarding internal temperatures for energy tests is an important one and is more difficult to resolve. The temperatures selected in IEC was an international compromise – Europeans had to move from (what was effectively) a colder -22°C to -18°C, while Australia and the US had to move from a warmer -15°C to -18°C. The same is true for fresh food temperatures (but in the opposite direction), where Europe had to go colder from 5°C to 4°C while Australia had to go warmer from 3°C to 4°C. The US also had to go colder from 7.2°C for some product types and warmer from 3.3°C for other types. US freezers are not affected (already -17.8°C) and Japanese temperatures were not affected significantly (E3, 2011).

11.5.2 Washing machines

For washing machines the specific energy or water consumption is defined as the degree of electricity or water consumption per wash cycle, per year or per kg of laundry, or vice versa. In addition, the so-called functional performance is defined in comparison to a reference appliance. This relationship between an individual appliance and the reference appliance can also be expressed using an energy efficiency index (e.g. in the recent European Standard).

There are four main test standards for washing machines that have been almost worldwide. The IEC/EN and ANSI/AHAM standards are the most important reference standards. The EU and many other countries with mostly horizontal - axis washing machines have based their test standards on IEC, often with more or less significant modifications.

The harmonized AS/NZS standard in Australia/New Zealand and the Japanese JIS C standard also refer to early revisions of IEC 60456, but differ considerably from the original document nowadays, especially considering the vertical - axis washing technology dominating these markets. In North America and parts of South America with predominantly vertical-axis machines, test standards are based on the AHAM reference test standard.
Generally, European, African and most Asian countries including China, Russia as well as many newly industrialising countries, such as Thailand, tend to align their national test standards for appliances with those of ISO, with mostly minor modifications. The national test standards for Japan, Korea, India, Chinese Taipei, Australia and New Zealand, the Philippines and Sri Lanka are also often aligned with ISO/IEC but some significant differences exist for certain products. In the Americas, the United States uses its own test procedures, which are occasionally aligned to ISO/IEC tests. Canada and Mexico are essentially aligned with the United States regarding test standards. Most South American countries, including Brazil, use ISO/IEC test procedures but some (e.g. Venezuela) use variations of US test procedures.

Efficiency standards and labels are based on energy and water consumption values obtained from test standards. Because of differences within and between countries (e.g. due to traditional washing habits or customary garments) and the varying washing machine technologies, specifically adapted regional test standards are used. Consequently, it can be very hard or even impossible to compare the energy and water consumption values obtained from different test standards. In North America, for example, clothes are washed in warm or hot water, which is provided to the washing machines by distinct external appliances. By contrast, most washing machines in Europe use ambient-temperature water from the tap and heat it up using integrated electric heating rods. In Japan people tend to wash their clothes in cold water or residual water from a bath (OECD, 2006).

Furthermore, user - and situation specific factors, such as chosen washing temperature, size of the wash load and the respective washing water level account for differences between test conditions and reality. Hence, the energy consumption assigned through testing is only a rough indicator of the actual energy consumption of a particular unit. For that reason, test standards should adopt test conditions, which reflect the existing in-field conditions to a reasonable extent, as well as procedures, which account for the effects of user behaviour on energy and water consumption (OECD 2006).

Washing machines often run at low temperatures and with less than full loads, while energy labels are granted on the basis of the washing machine's performance also at the 60ºC cycle. A more accurate basis for an energy label has been set up as an average level of energy consumption based on half and full loads and different temperatures, based on previous comments that the 60°C full load cycle does not reflect typical household use.

Some of today's washing machines take loads of up to 8 kilogrammes –sometimes up to 12 kg, according to the information supplied by the manufacturers. There are few households that can actually fill the machine with that much laundry, even if it means greater energy efficiency. Many households choose appliances that have too much capacity for the household's needs, which is why half loads in washing machines are very common in small households.

The energy-labelling scheme should steer product development towards smaller-sized appliances aimed at the large number of small households today.

The detergents used in the energy efficiency tests of washing machines are not those normally used by households. The level of dirtiness presumed in the tests does not correspond to real life, either; in reality, clothes are washed fairly often and are not really dirty before washing. The test loads for the 'cotton cupboard-dry' cycle in tumble dryers are too large and fail to correspond to actual loads (TemaNord, 2007).

For washing machines, one problem is that there are many local and cultural factors which impact on the clothes washer performance and energy consumption: use of external hot water, water hardness, local detergent composition, program selection, wash temperature (possibly most important), typical load composition. While it is possible (even necessary) to specify all of these variables in an IEC or other international test procedure, this can move the test method away from "actual use", particularly in developing countries (Chobanova etal, 2009).

11.5.3 Televisions

TVs represent a success story in terms of how the work in one jurisdiction can be leveraged and applied more widely and ultimately have a significant impact globally, enabling regulations to be adopted faster and potentially on a consistent basis with existing test methods and metrics. However, the regulations reviewed for this paper found significant differences in efficiency levels for TVs between different jurisdictions, even when accounting for key functionality variables. India has voluntary energy labelling for TVs, China adopted mandatory labelling for flat panel TVs in March 2011, and the EU mandatory labelling has started 30 November 2011. The US does not have MEPS or mandatory energy labels for TVs, but a regulatory process is pending and ENERGY STAR has specified performance requirements. The methodological approach used in the Chinese, EU and Japanese regulations are similar because they establish energy thresholds that are related to screen size, but are different in how products are classified by technology type and function (Scholand, et al, 2011)

With a specific focus on televisions, Michel et al (2013) have compared the energy label and standard testing requirements for TVs on the EU and Chinese markets. They found that On-mode power of the European TV most energy efficient (A++) model is considerably lower than that of the Chinese model claiming highest efficiency. Whether this makes the European model a more energy efficient TV than the Chinese model however depends on the perspective: while according to the EU Energy Label the European TV model is more energy efficient than the Chinese model, on the Chinese Energy Label the latter reaches a better grade than the EU TV. The reason is to be found in the different definitions of TV energy efficiency. The EU Energy Label defines TV efficiency as a low power input for a given screen size, while in China the most energy efficient TVs are those with the highest brightness for a given power input. The following EU energy label standards problems have been discovered:

- The EEI and thus the energy class cannot be verified from the declared values.

- The minimum peak luminance ratio is not clearly defined. The standard favours dark factory settings with sometimes poor picture quality, and the home based improvement of the picture can increase the electricity consumption by up to 50%.
- The minimum peak luminance ratio is not clear, the Ecodesign regulation requires a 65% minimum at least, but also a 60% (including measurement tolerances) is considered as sufficient. Moreover, luminance values are not declared and therefore cannot be checked, the number of tuners is not clearly defined.
- "Home made" complex menus are not easy to retrieve once the settings have been changed, several changed settings can lead to differences in power and luminance of around 30%.
- A total of seven different documents are needed to define or to verify the declaration and compliance of TVs. Most documents and standards are not clearly referred to and not clearly defined.

11.5.4 LED light bulbs

As regards LEDs, Bennich et al (2013) also note that test methods and standards are not harmonised, and laboratories have little experience with LED testing. Quality and performance criteria are not fully defined. There are harmonisation activities among manufacturers as well as in the standardisation bodies (CIE, IEC), but these processes are slow or don't address all the issues, such as product quality and performance. The International Energy Agency´s Implementing Agreement on Efficient End-Use Equipment (4E) has therefore set up a special working group on Solid State Lighting to:

- Enable participating governments to share expertise and ensure coordination of international initiatives;
- Set several performance tier levels to address various priorities and needs;
- Work to harmonise SSL testing around the world, by developing an approach to compare and ultimately accredit laboratories to their ability to measure LED products;
- Asses existing SSL test procedures and build a testing system that is manageable, robust and acceptable;
- Launch an inter-laboratory comparison programme, aimed for a potential recognition by accreditation bodies as evidence of competence of laboratories.

11.6 Options for improvement

11.6.1 Alignment of standards and regulation

It is important to maintain tight alignment between ecodesign requirements and standardisation (Rambaldi/CECED, 2011). Feedback provided by stakeholders within the Ecodesign Directive evaluation (CSES, 2012) indicates that there are definitely problems arising from ambiguities in relation to some requirements in the implementing measures, especially when it is not possible to refer to an existing standard.

These ambiguities provide insufficient guidance to producers about what they have to do in their own internal conformity assessments. For example, a common comment arising from the survey of the Association of Swedish Engineering Industries, is that the process for generating specific requirements is not a problem as such. The question is more how firms are to interpret the requirements in ensuring conformity and how to get guidance for this interpretation. Horizontal requirements are seen by some industry representatives to be a particular problem. By definition, they cannot be as precise as a vertical measure applied to a given product category. The Regulation is then subject to many kinds of interpretation by stakeholders including market surveillance authorities.

Even if the intentions of the policy makers have been clearly understood by the manufacturers, they still have to spend a lot of time in assessing and anticipating the risk that they may be considered to be non-compliant through the interpretations of particular market surveillance authorities. Clear guidance is needed at a European level to reconcile these interpretations, especially in the case of horizontal measures. Guidelines published by the European Commission on difficult Implementing Measures (e.g. standby, TVs) and assistance compiled by the ADCO group on market surveillance both provide a means of addressing this problem, but are either not sufficiently extensive or have yet to be utilised by producers and surveillance authorities.

Some see a solution in making the Ecodesign Directive closer to the processes used for new Approach Directives and in a greater use of standards. This would mean that companies could be more involved in the work, the processes would be more familiar to the companies and global harmonisation of requirements could be achieved more quickly. Others, in contrast, believe that, in the environmental area, standards cannot replace regulation, since the former are largely determined by industry in practice and there is a need for a broader consensus with environmental targets which is ultimately a political decision. However to reinforce this process it is suggested that *right from the preparatory study, the requirements should focus on measurable criteria that can be enforced easily*. This would avoid the need for subsequent guidance documents, whose legal status always leaves room for doubt.

CEN/CENELEC (2012) reacted on the topic of manufacturer dominance on the standardisation creation by stating that "the voluntary nature of standardization and its dependence on the private sector's knowledge and usage makes it paramount for the system to be attractive for the market operators. CEN and CENELEC are working on finding means to make the system even more accessible to every category of stakeholder and to remain more inclusive than ever. Procedures are being simplified and transparency of the system is being reinforced. However, this will only prove to be useful if it is not an isolated effort from the ESOs". Yet it would still be wise to push for greater involvement of representatives from the public policy process, to improve the integrity of the standardisation outcomes.

When they exist, standards do make an important contribution to the successful implementation of the Directive. The case of boilers illustrates the problems that can arise in the development of requirements, when standards are not available.

On occasions, however, standards can be applied too rigidly. There are cases (e.g. vacuum cleaners) where, according to some stakeholders, the proposed Implementing Measure essentially just copies the standards and this is too prescriptive.

11.6.2 Advancing global harmonisation

The insights on global harmonisation point to the current situation where national standards are the norm, although there is a high degree of harmonisation within the EU through the CEN and CENELEC approval process. Global harmonisation is developing more slowly. International standards for defining and testing energy performance exist, i.e. ISO and IEC, but they are not universally and consistently applied.

Harmonisation itself is difficult for a variety of reasons not least the jurisdictional and administrative issues. Other important obstacles include differences in test procedures, classification of products, definitions of energy performance, the specification of standards (e.g. correction factors); required energy performance; and scheduling of reviews of the regulation. The most important of these barriers can be summarised as the problem of defining, what is considered realistic actual user behaviour across cultures and climates.

Improved global harmonisation, through the use of international standards would have two important advantages. Firstly, it would strengthen the legal basis of policy implementation, both for test methods and product definition. Secondly, approaching the complex technical issues at the highest possible level is likely to result in stronger and more accurate policies, as individual countries often lack the capacity to develop standards. As lessons learned and recommendations, Scholand et.al. (2011) provide the following suggestions:

- **Keep up with innovation:** As a practical matter, it can be difficult for international test methods to keep pace with product innovations. The process for developing an international testing method often takes several years, and by that time, manufacturers have innovated and developed next generation products using technologies and incorporating features that may not be able to be measured by the test method. For this reason, when drafting a test method, it is important that engineers and technical experts involved in the process ensure, as much as possible, that the method is flexible and able to accommodate newer versions of existing products. Furthermore, when adapting international test methods in to the various regulatory programmes around the world, regulators may need to make a deviation from or modification to some aspect of the test method that would otherwise not be applicable. Any of these deviations should be reported back to the international committee.
- **Extend dialogue:** Products that have not previously been regulated in any jurisdiction are easier to harmonise in various national regulatory programmes. Currently this happens through a range of formal or informal exchanges; however, it is clear from past experience that whenever dialogue is present in a timely manner, greater information exchange and harmonisation occurs. Therefore, the key to enhancing harmonisation is to extend and support the dialogue among all the major regulatory and standardisation bodies.

- **Prioritize international efforts:** Due to the fact that test methods underpin regulations yet take considerable time to develop, it is important that regulators interested in strengthening the leverage from international regulatory work should plan international efforts to develop coordinated test methods well ahead of their regulatory schedule. This will maximise the potential that commonly accepted test methods will be in place when regulations are reviewed. This step will increase the comparability and applicability of the regulatory analyses and hence facilitate it being leveraged more widely. Ultimately, if regulators are able to establish mechanisms to facilitate broader international information exchange and pragmatic programmatic coordination efforts, it will save on future regulatory programmatic costs, and improve outcomes leading to higher savings at less expense.

11.6.3 Other improvements to the standardisation process

Most stakeholders believe that there are important gaps in most categories of product (nearly all with the exception of motors and fans) and that the standards development process is quite slow. The transitional arrangements that have been put forward on a number of occasions have been helpful but are not ideal and cannot replace standards. It is clear that a more proactive approach is needed, Stover et al (2013) highlighted the need for this to avoid the problem of prescriptive, rather than performance-based, standards that quickly become obsolete. The process of standards development needs to start earlier on and be better integrated with preparatory studies. The draft horizontal mandate presented earlier in 2011 attempts to address this problem and appears to have the support of the standardisation community that is, in principle, in favour of early involvement in the process. Still, apart from greater global coordination, additional action is considered necessary:

- **Include environmental performance:** The assessment of the environmental (or even wider sustainability) characteristics of products are missing in the development of technical standards. Greater use could be made of the relatively new development of environmental characteristics for products in line with CEN TC350 standards (prEN15804) (CSES, 2012).
- **Coordinate EU action**: To coordinate Ecodesign technical work to avoid overlap or even conflict of activities between the CEN-CENELEC Management Centre (CCMC), the relevant Technical Committees and the EC services, "an efficient and smooth mechanism needs to be put in place to ensure proper communication. To this end, a 'CEN-CENELEC Ecodesign Coordination Group' was set up as a discussion, coordination and communication platform bringing together all parties involved by mandate M/495. The Group has been operational since April 2013" (CEN/CENELEC, 2013).
- **Simplify procedures:** This issue has also been raised in terms of the lengthy procedures in international and European standardisation (CEN/CENELEC, 2013, c): "the Commission identified certain shortcomings in the provisions for standardization under the General Product Safety Directive, particularly as regards complexity and lack of flexibility of the system as well as too lengthy procedures of mandating the European Standardization Organizations (ESOs)." CEN and CENELEC agree fully with the need to simplify, clarify and render the procedures for preparation of standardization requests to the European Standardization Organizations more transparent and flexible.

Therefore CEN and CENELEC welcome and, in principle, support the two legislative proposals from the European Commission for new regulations on Consumer Product Safety and on Market Surveillance of Products published earlier in 2013 since they propose a reform towards a more efficient system and an alignment of provisions regarding standardization with the Regulation on European Standardization (1025/2012) which came into force in January 2013. Further areas for improvement have been addressed by CEN/CENEL in their position paper.

- **Test and gather evidence on actual use:** Another angle in the improvement opportunities is that according to the EU energy labelling rules, tests applied to the measurement of energy efficiency must reflect actual use of the appliances by consumers. For example the test methods designed for dishwashers do not reflect actual use, as dishes in real households are less dirty than presumed in the test standard. Manufacturers can decide themselves on the design and temperatures of the cycles selected for energy labelling. The energy-labelled cycles and their names may vary from one model to another. To achieve the energy efficiency indicated on the energy label, users would have to know which particular cycle the energy label actually refers to. Work should be carried out to improve the evidence base on actual consumer use patterns through field work. This data could significantly improve the basis for standards and testing.
- TemaNord (2007) found in a survey that many interviewees believe that testing methods will be developed and streamlined further in the future, ensuring comparability of the results. However, there may be a risk that only a handful of laboratories will have the resources required for such tests, as large laboratories are taking over from smaller ones and carrying out tests for all parts of Europe. The suppliers interviewed suggested that the trend in testing methods was not necessarily the most favourable for consumers. Consumers are offered products with far too detailed specifications for normal household use.
- **Involve market surveillance authorities:** ORGALIME (2012) in its comments on MSA Package makes the recommendation that the Market Surveillance Authorities shall be encouraged to participate in national standardisation activities aimed at the development or revision of standards requested by the Commission. Thereby they could more easily fulfil their duty to keep up to date with developments in scientific and technical knowledge concerning the safety of products and hence adequately represent societal interests in standardisation work. A similar recommendation is also made by Swedish Trade Federation (Svensk Handel, 2009): to ensure that the authorities take part in the standardization process to an even greater extent than today. This increases understanding of companies' daily lives and hence an increase in quality of market surveillance is accomplished.
- **Greater involvement of public policy on standardisation committees:** although this may not necessarily speed the outcomes the greater involvement of public policy representatives will add greater integrity to the standardisation process and reduce opportunities for industry dominated committees to inappropriately undermine standards through lax testing procedures, weak tolerances and other technical details.

- **Involve consumer organisations:** CEN/CENELEC (2013, b) have also commented on the cooperation with consumer protection oriented NGOs, recognising e.g. ANEC being one of the societal stakeholders, and asking to define a mechanism that will help identify the specific mandates in which ANEC would like to participate, and to collaborate appropriately on priorities in a broader sense. They have also welcomed the intention to improve the relationships between the consumer movement at national level and standardisation bodies (and others).
- **Sharing of surveillance data:** Scholand, et al (2011) make the case that manufacturers may have one particular model that is sold across several markets, and sometimes under different brand names. If an enforcement agency finds a particular model to be in violation of its regulation, this information should be shared with other enforcement agencies in countries that have the same regulation. In Europe, the sharing of data on market surveillance across the European Union and the European Economic Area markets is the function of the Administrative Cooperation (ADCO) Working Group. Due to the fact that regulations are set at an EU level but enforced at a country level, a strong opportunity exists for ADCO to share data across the EU Member States to facilitate and lower the costs of enforcement. Looking beyond the EU market, as harmonisation becomes more prevalent in the market (with the aforementioned lower costs associated with the regulatory analysis), sharing of enforcement data between regulatory entities can also help to lower administrative costs and protect the markets from unscrupulous manufacturers or importers who seek to undercut the regulations.[This paragraph does not belong to the standardisation section, but to the market surveillance section].

11.6.4 Effectiveness of standards

For illustration purposes, as an example of a specific product group, ATLETE (2011) identified the following issues related to test reports, following an execution of a test of 82 refrigerating appliances: The test procedure needs to be shared by all market actors before any enforcement or verification testing begins. In addition, testing laboratories may have different interpretations of specific test conditions. Since without consistency in test methods it will be impossible to run an effective verification and enforcement programme the standard should be unambiguous. If necessary, interpretations should be prepared to clarify the still unclear conditions. On the other side a care should be taken by the national Authorities and test laboratories that a claim of "ambiguity" is not being used as a way out from too stringent testing conditions.
In particular, suggested improvements for the refrigerating appliances standard are:

- To shorten the time required for the completion of the verification process, the specific setting(s) used by the supplier for the measurement of the parameters at the basis of the labelling declaration and the compliance with the ecodesign requirements should be specified either in the labelling/ecodesign technical report or to the booklet of instructions or to any other technical documentation accompanying the products.
- Storage volume measurement is still critical, at least for some manufacturers and products configurations. The need for further clarification should be evaluated by the standardisation experts.

- The 2 star compartments identification is controversial and requires a further clarification.
- The use of “cold plates” (eutectic accumulators) should be ruled and the impact on the load plan and the appliance volume measurement described. The use of eutectic plates can be accepted but only in accordance with the already established standard conditions for the volume measurement:
    - The appliance storage volume should exclude the space needed for the plates;
    - The load plan should show the position of the plates, that cannot be placed directly over the stacks;
    - Rounding rules have to be both improved and better specified: not only for the declaration of the parameters but also in the intermediate calculations.
- The relation between the instruments uncertainty (usually described in the standards) and the measured values is apparently not clear at least for some manufacturers. A manufacturer claimed that the failing to comply – by 0.5C – with a storage temperature cannot be accepted because the accuracy of the measurement instrument is of the same order of magnitude. The answer of the ATLETE team was that storage temperature must be respected beyond the accuracy of the measurement instrument, once this accuracy is in accordance with the standard specifications.
- Devices designed specifically to underestimate energy consumption under test conditions should be clearly prohibited.

Another area linked to the standardisation process and energy label declarations has been analysed by Intertek (2012), in a study for DEFRA, which has focused on the correction factors used in energy labelling for refrigerating appliances: The latest energy label Directive 2010/30/EU, which replaced the original energy label framework Directive 92/75/EEC, states that:

"the provision of accurate, relevant and comparable information on the specific energy consumption of energy-related products should influence the end-user’s choice in favour of those products which consume or indirectly result in consuming less energy and other essential resources during use, thus prompting manufacturers to take steps to reduce the consumption of energy and other essential resources of the products which they manufacture."

On this basis the calculation of the energy efficiency index, itself used to indicate a level of efficiency performance to consumers via the class letter, should be as consistent and comparable between different types of products offering the same service to the consumer. There are multiple circumstances where correction factors can be useful including normalising any differences that occur due to testing procedures or evaluations that would not allow appropriate comparisons (due to design or functional differences) or misrepresent the comparative energy use.

11.7 References

- Bennich Peter, Borg Nils, Scholand Michael, 2013, On the bright side of life: International efforts to accept market adoption of LEDs while avoiding the pitfalls of CFLs, Eceee Summer Studies
- CEN/CENELEC, 2012, CEN-CENELEC proposals for amendments to the draft IMCO report on the EC draft Regulation on European Standardisation COM/2011/0315 final - COD 2011/0150, January 2012, http://www.cencenelec.eu/news/policy_opinions/PolicyOpinions/Reply201201.pdf
- CEN/CENELEC, 2013, EcoDesign, website accessed 7/2013, http://www.cencenelec.eu/standards/Sectors/EcoDesign/Pages/default.aspx
- CEN/CENELEC, 2013 b, ANEC Strategy 2014-2020 - CEN-CENELEC comments, 2013/03, http://www.cencenelec.eu/news/policy_opinions/PolicyOpinions/PPANECStrategy.pdf
- CEN/CENELEC, 2013 c, Position Paper - On European Commission's legislative proposals for Regulation on consumer product safety and Regulation on market surveillance of products, April 2013 , http://www.cencenelec.eu/news/policy_opinions/PolicyOpinions/PositionPaperGPSD.pdf
- Chobanova Bilyana, McNeil Michael, Letschert Virginie, Harrington Lloyd, Klinckenberg Frank, 2009, Global Carbon Impacts of Energy Using Products, Report for Defra/the Market Transformation Programme, Mersen, April 2009, http://efficient-products.ghkint.eu/spm/download/document/id/978.pdf
- CSES, 2012, Evaluation of the Ecodesign Directive, http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/review/index_en.htm
- E3, 2011, Paper 2: Roadmap for MEPS 3 in Australia and New Zealand, A stakeholder discussion paper prepared by Energy Efficient Strategies, 3. October 2011, http://www.energyrating.gov.au/wp-content/uploads/Energy_Rating_Documents/Library/Refrigeration/Domestic_Refrigeration/Paper-2-Roadmap-for-MEPS-3-in-Australia-and-New-Zealand.pdf
- Energy Charter, 2009, Policies that Work – Introducing Energy Efficiency Standards and Labels for Appliances and Equipment, Energy Charter Secretariat, Brussels, 2009, http://www.encharter.org/fileadmin/user_upload/document/EE_Standards_and_Labels_2009_ENG.pdf
- ENTR, 2009, Minutes of the 1st meeting of the Ecodesign Directive Working Group, Brussels, 8 September 2009, ENTR/B/1, LB-ME,D(2009)32923
- ENTR, 2010, Minutes of the 2nd meeting of the Ecodesign Directive Working Group, Brussels, 7 September 2010, ENTR/B/1, LB/as ARES(2010) 742028
- EPEE, Market Surveillance Best Practice Case Studies, European Partnership for Energy and the Environment, Brussels (undated, web accessed 7/2013), http://www.epeeglobal.org/epeedocs/internet/docs/EPEE_-_Market_Surveillance_Best_Practice_Case_Studies_v_7319.pdf
- European Commission, 2011 d, 2010-2013 Action Plan for European Standardisation, Ref. Ares(2011)754197, 8 July 2011, http://ec.europa.eu/enterprise/policies/european-standards/files/standards_policy/action_plan/doc/standardisation_action_plan_en.pdf

- European Commission 2011 e, Standardisation mandate to CEN, CENELEC and ETSI under Directive 2009/125/EC relating to harmonised standards in the field of Ecodesign, Brussels, 27 July 2011, M/495 EN, ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/M_495.pdf
- Scholand Michael, Waide Paul, Eide Anita, Klinckenberg Frank, Stone Christopher, 2011, Advancing standards and labelling globally by leveraging analysis of consumer products and commercial equipment, eceee 2011 Summer Study, http://proceedings.eceee.org/visabstrakt.php?event=1&doc=6-344-11
- IEA, 2000, Energy labels & standards, Energy efficiency policy profiles, International Energy Agency/OECD, Paris
- IEA 4E, 2012, Technology-Forcing Standards for Energy Efficiency, Efficient Electrical End-Use Equipment (4E) International Energy Agency, lead authors Kevin Lane and Fiona Brocklehurst, June 2012, http://www.iea-4e.org/files/otherfiles/0000/0196/4E_TFS_Report_public_final.pdf
- Intertek, 2012, Assessment of the applicability of current EC correction factors and tolerance levels for domestic refrigerating appliances, a research report for DEFRA, lead authors Jane Lee, Nicola King, Simon Leach, August 2012, http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17953
- Michel Anette, Busch Eric, Bo Hu, 2013, Finding the most energy efficient TV in China and in Europe: not such an easy job…, Eceee Summer Studies
- OECD, 2006, Can Energy-Efficient Electrical Appliances be considered "Environmental Goods"?, main Authors Ronald Steenblik, Scott Vaughan, Paul Waide, COM/ENV/TD(2003)35/FINAL, 19 May 2006, http://www.oecd.org/trade/envtrade/37321363.pdf
- ORGALIME, 2012, Position Paper – Efficient and effective Market Surveillance: a priority to preserve the benefits of the Internal Market and the competitiveness of legitimate manufacturers, Brussels, 30 October 2012, http://www.orgalime.org/sites/default/files/position-papers/Orgalime%20position%20on%20the%20Future%20of%20Market%20Surveillance%20-%2030-10-2012.pdf
- Rambaldi Matteo, CECED, 2011,a, Ecodesign and Market Surveillance, EC Stakeholders meeting – Effectiveness of the Ecodesign Directive, Brussels, 10.5.2011
- Alice Stover, Harvey Sachs, and Amanda Lowenberger, 2013, Cryptic barriers to energy efficiency, ACEEE Report Number A1352013
- TemaNord, 2007, Impact of energy labelling on household appliances, Nordic Council of Ministers, Copenhagen, Denmark, ISBN 978-92-893-1618-7

12 Summary of findings

The European Commission launched a review process to evaluate the effectiveness of the Energy Labelling Directive (2010/30/EU) and of the implementing measures adopted under the Directives 2010/30/EU and 92/75/EEC. In this review, specific aspects of the Ecodesign Directive (2009/125/EC) are also evaluated, as they could not be assessed thoroughly previously because the Directive has only been in force for two years.

The review of these two directives has to be based on the best factual information available. In this progress report, findings in the literature to date have been collected and assessed to help shed light on strengths and weakness of the existing regulatory framework. Conclusions of this work are summarised in the following sections, with section 13.1 addressing findings relevant to both the Energy Labelling and Ecodesign directives, section 13.2 findings for just the Energy Labelling Directive and section 13.3 for Ecodesign.

In this summarizing chapter reference is made to the original questions formulated in the tender specifications for this assignment related to both the Energy Labelling Directive and the Ecodesign Directive (e.g. ELD23, ED76).

12.1 Energy Labelling and Ecodesign Directives

12.1.1 Implementation and application

Implementation and enforcement of both the Energy Labelling and Ecodesign Directives is critical to their effectiveness in terms of reducing energy consumption. They were considered jointly, as they relate to similar obstacles.

Level of compliance - The available evidence suggests that many stakeholders consider market surveillance activities as ineffective and insufficient. Non-compliance cases abound, and amount to 10-25% of products tested, 20% of products in shops not being labelled and 15% not being labelled correctly. Similar levels of non-compliance are estimated for Ecodesign. The new energy labels have contributed to a lower level of partly and/or incorrectly labelled appliances. This is mainly due to the fact that the new energy labels are supplied in one piece which reduces the possibility for partial or wrong display of the label. Furthermore, shops are more inclined to display them on the appliances compared to the old label. (ELD 104, ED 61)

Challenges to the enforcement of energy labels and Ecodesign requirements relate primarily to the availability of resources and staff constraints. The lack of national laboratories and the cost of testing is also considered an obstacle.

The literature identifies a number of ways to improve enforcement. Options to enhance the availability of resources include making clear the benefits of compliance to society; and better Member State cooperation. Other options for improving enforcement include interaction with manufacturers at a higher level in their organisation to ensure the remedial actions are taken on a larger sale; better documentation and notification to retailers of shop visits by authorities; and the availability of templates for technical documentation and test reports. (ELD102, 107; ED 65)

Better planning and coordination of Member State actions could include sharing plans and results of market surveillance; jointly developing technical documentation and test reports; using foreign laboratories more often, or accepting their results. (ELD110; ED68)

An increased role of the European Commission and other EU bodies is also considered a key opportunity to ensure higher product compliance with energy labelling and ecodesign. Suggestions in this respect regard a better coordination of activities by individual authorities, ensuring a minimum level of surveillance on all national markets, and fostering cooperation and communication; registering non-compliance products; providing guidance for suppliers to inform authorities to ensure better product traceability, provision of templates and guidelines; ensuring that the product safety and market surveillance package adopted by the EC on 13 February 2013 will fully cover labelling and Ecodesign. (ELD 109; ED 67)

Information activities to enhance correct interpretation of labels by consumers and retailers have been undertaken, also including Ecodesign requirements, by national authorities, manufacturer associations, European projects under the Intelligent Energy Europe programme, and NGOs, resulting in leaflets, websites, brochures, posters and specialised or general articles. There is evidence however that the interpretation of energy labels could still be improved and that public education programmes could have a role in this. Most likely, this will hold for the interpretation of Ecodesign requirements as well. (ELD 114; ED71)

Article 4(c) of the Energy Labelling Directive regards advertisements for a specific model where energy-related or price information is disclosed. Observations suggest that the label class is properly displayed for models in the range of A to A+++. For televisions energy label displays in advertisements are less common, as many models still have a B label. (ELD116)

12.1.2 Relation to other EU policies

In this study, we evaluated the potential interaction between a range of EU policies, including the Energy Labelling Directive, Ecodesign Directive, Energy Efficiency Directive, Energy Performance of Buildings Directive, Construction Products Regulation, Tyre Labelling, Ecolabel, Energy Star, the F-gas regulation, the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Restriction of Hazardous Substances Directive (RoHS), Waste Electrical and Electronic Equipment Directive (WEEE), General Product Safety Directive (GPSD), Waste Framework Directive, and Marketing of Products Framework.

EU product policies complement each other in many ways:

- ED is embedded in the Marketing of Products Framework, which sets the general rules for conformity assessment, CE marking and market surveillance.
- ED and ELD share objectives, but use a different policy mechanism. ED pushes the market, while ELD provides for a market pull. In addition, ED concerns all life cycle phases and multiple environmental impacts, while ELD requirements concern energy consumption during the use phase.
- ED and ELD share objectives with Tyre labelling and EED, but address different products or aspects.
- ED and ELD share objectives with EED and EPBD, but implementation of ED/ELD is at the EU level, whereas EED and EPBD are implemented by the Member States.
- ED, ELD, Ecolabel and Energy Star share objectives and scope, and hold the potential of boosting synergies in the use of information, standards, methods or benchmarks.
- ED and ELD cover to an extent the same products as the F-Gas regulation, REACH, RoHS, WEEE, the Construction Products Regulation, the Waste Framework Directive, and Ecolabel, but have partly different objectives.

Conflicts between policies may also arise. They may include conflicts between:

- ED and ELD and environmental legislation (Ecolabel, RoHS, F-gas regulation, Construction Products Regulation), where minimum standards or label or information requirements may conflict. This is the case of CFLs. [Please replace this on the basis of the section with corrected wording in section 3.5.3.]
  An interesting case is the Waste Framework Directive that mentions Ecodesign requirements as an option for increasing product durability, but on a member state level. It remains unclear to what degree MS ecodesign activities will be possible and how they relate to EU Ecodesign.
- ED and ELD versus EED and EPBD. While scope and objectives overlap, ED and ELD have a product approach, whereas EPBD and EED tend to concern energy systems. This implies a potential conflict, for instance for technical building system requirements. If designed in the right way, even with the different approach the legislation could be complementary.
- Cases where ED and ELD conflict with health or safety-related legislation have not been identified so far. Conflicts may also arise where the EU and Member States are not aligned in their strategy. These issues will be explored in the remainder of the project. (ELD 119-122, ED 73-76)

Other negative interactions between policies are misfits, where mechanisms, procedures, timing, requirements, thresholds, standards or methods are not well aligned, and gaps. Gaps can occur when stakeholders try to shift problems and responsibilities to other legislation.
Perhaps the biggest potential conflict results from the need to assess the same product multiple times to meet the requirements of different policy instruments. Examples of these gaps and conflicts will be identified in the course of the project.

Interactions with EU ETS were also considered. ETS has the goal of achieving emissions reduction at least cost. When energy efficiency policy is successful, there would be less demand for emission permits and carbon prices could be depressed. A low carbon price can be seen as negative as the market signal to invest in low carbon technologies is smaller. However, there is also a benefit to industry, through reduced emissions and energy costs. Higher carbon prices could be created by setting tighter emission reduction caps within ETS if policy makers wish.

12.1.3 Scope expansion

This study included a first evaluation of the possibility to expand the scope of the Energy Labelling and Ecodesign Directives to non-energy-related product groups. To this end, a list with candidate product categories was produced by reducing and aggregating product categories listed in the ProdCom database. This database contains production data per product category and Member State and allows the EU to keep track of its economic activities. In a next step, a first evaluation was made of environmental impacts of these categories, based on the available literature.

Non-energy related products in the areas of food and drink, private transport, and housing were found to have the largest environmental impact, and as such may be considered to cover in an extended scope of the Energy Labelling and/or Ecodesign Directives. In the area of food and drink, meat and meat products have the largest impact followed by dairy products. Cars are the principle product group in the area of transport, while important product groups in the area of housing include buildings, domestic appliances and furniture. When considering an expansion of scope, feasibility (e.g. with respect to conformity assessment, administrative burden and cost), as well as enforcability of requirements is key.

12.2 Energy Labelling Directive

12.2.1 Objectives

There is clear evidence that energy labelling is needed and that it is effective at overcoming information barriers. There is equally clear evidence that it influences consumers and producers in such a manner that an accelerated market transformational effect takes place. Assessments have shown that the cost of developing and implementing energy labels is far beneath the value of the savings that they produce and thus that energy labelling is highly cost-effective from a societal perspective. In practice, energy labelling has a synergistic and complementary relationship with Ecodesign requirements and the thresholds developed for labelling purposes provide convenient tiers for future Ecodesign minimum requirements.

The two policy tools thus work to provide a market pull and push effect that facilitates a dynamic market transformation to occur; however, in some cases labelling is less efficient than it might be because of saturated upper classes and the maintenance of obsolete classes that may already be prohibited through Ecodesign requirements. Consumers are generally unaware of the existence of Ecodesign requirements and are equally unaware that some labelling classes are therefore prohibited.

The principal objectives of the labelling directive have largely been met in the case of products that have been issued with an energy label, nonetheless there is scope to make improvements. The biggest deficiency, however, has been the relatively limited number of products which have so far been subject to energy labelling. This situation has led to large numbers of energy using and energy related products, that collectively account for a substantial proportion of all product related energy consumption, not yet being subject to any kind of energy labelling requirement. In these cases the principal information failures that the directive aims to address will still apply and thus there is considerable untapped scope to increase energy savings from the labelling directive by speeding-up the rate at which labelling requirements are developed for products not yet subject to labelling.

In some cases there is also evidence that labelling thresholds are not always sufficiently ambitious to tap the full savings potential. When this has occurred it is usually associated with limitations in the technical information made available during the preparatory study.

While voluntary labels and national energy labels can work in conjunction with mandatory labels at the pan national level there is little evidence that they bring significant additional benefits. By contrast there is evidence that pan-national (i.e. EU wide) labelling is more effective than purely national labelling and that mandatory labelling is preferable to voluntary labelling for all but the most technologically dynamic or peripheral (i.e. less important from an energy savings perspective) products.

The case to expand labelling to include the full lifecycle energy impacts is not supported nor particularly refuted by the literature. Equally issues of whether or not it would be best to have separate frameworks covering energy labelling and environmental or lifecycle impacts have not been addressed by the literature.

Improvement options identified in the literature include:

- The rate at which new labelling regulations are developed (especially for products not yet subject to labelling) needs to be increased to capture a greater proportion of the savings potntial from energy related products.
- Preparatory studies should consider the application of learning curves to estimate and account for the expected rate of technological and production cost progress associated with higher efficiency design options and the use of this in the techno-economic and least life-cycle cost determinations. Couple these with an analysis of Best Not Available Technology to set the upper labelling threshold and ensure it is sufficiently challenging and robust over the longer term.
- Explore options to strengthen the technical foundations of the preparatory studies by: organising the development and maintenance of product energy and cost simulation tools to be used to examine proposed design changes; conducting product tear -down analyses to establish the bill of materials and associated production costs, establishing longitudinal

market and field data collection; farming out the impact assessments to a dedicated consultancy that applies the same approach across all product types; developing a long-term bottom-up energy consumption forecasting tool for products in the EU based on a stock modelling approach.

- Make efforts, independently of the preparatory studies, to benchmark EU product regulatory energy efficiency settings against those applied in peer economies and clarify reasons for the differences observed.
- Increase efforts to integrate the energy labelling specifications into green public procurement plans potentially including clear targets or obligations across the EU and similarly, to leverage other economic instruments to accelerate the adoption of advanced and innovative technologies.

12.2.2 Appropriateness

Cost-benefit analyses are of varying scope and quality and are insufficient to produce a clear account of the overall economic impacts of the labelling scheme. Nonetheless there is a clear consensus that: energy labelling has been cost effective; energy savings have been significant; costs have been modest and that there have been no discernible negative impacts on market volumes, product features or choice. Average product prices of labelled products have often declined substantially in real terms yet efficiency levels have considerably improved, with one author estimating that residential electricity consumption (the primary focus of labelling to date) will be 12% lower as a result. However, there is no recent comprehensive evaluation of energy labelling induced savings for affected products across the EU as a whole, and thus considerable inference and additional work will be needed to derive an overall cost benefit value.

A majority of consumers understand the main efficiency scale of the energy label and are able to use it to correctly distinguish between products. Comprehension of this scale seems to be unchanged despite the adoption of additional A+ to A+++ efficiency classes. While the overall comprehension levels are consistent with those found in comparable categorical labelling programmes outside the EU a significant minority of consumers (~20-30% for simple comparative ranking tests and higher, up to almost 50%, for more complex ranking tests) struggle to correctly rank product efficiency. Some design changes may have exacerbated this although there is evidence that comprehension increases with greater explanation, which suggests that savings could increase with greater public communication efforts. Research findings also generally favour keeping the labelling elements simple and focused to maximise comprehension and appeal. The adoption of language-free labels applied across the whole EU appears to have exacerbated comprehension failures.

There is evidence that many consumers are unable to interpret the meaning of the pictorial icons (comprehension varies considerably by icon type) which suggests there is a definite penalty to be paid for discarding text in national languages. Whether this is sufficiently compensated through the benefits of reduced application costs and improved retailer compliance is not clear.

Evidence confirms that consumers do use the label when considering a purchase and that it can be an important determinant on their decision. There is also some evidence that the priority given to energy performance by consumers has increased since the initial introduction of energy labelling and that energy performance is now a primary differentiating factor after product features and price; however, several studies report that consumers find the distinctions between A+/A++/A+++ classes less motivating than between C/B/A classes and are less willing to pay for higher efficiency when it is presented this way. Thus the addition of new efficiency classes on top of the A class appears to weakening the labels ability to influence consumer purchase decisions as consumers perceive the incremental savings to be less important. This, and the fact that international labelling experience cites many successful examples of recalibration of categorical energy labels of the same style as the EU's, indicate that recalibrating the A to G scale would produce greater energy saving and market transformation benefits than adding additional classes. It would also permit producers to make better profit margins on higher efficiency products.

Research on additional environmental factors is inconclusive. It suggests that many would welcome environmental labelling and seems to indicate that consumers would prefer a single combined environmental impacts indicator to multiple indicators, noting that many of the symbols that could be conceived to convey those indicators are poorly understood (perhaps in part because the underlying concepts are also not always understood). In general the research seems to imply that consumers would probably prefer this information presented in a separate label to within the energy label; however, there has only been a limited investigation into this issue. Thus, overall it is not clear whether the inclusion of environmental impact information in the energy label would dilute the impact of the energy aspects of the label or not, although it seemingly contradicts the evidence that favours minimising the number of indicators and amount of information displayed on the label if impacts are to be maximised. Furthermore, the literature reports that there are still unresolved methodological issues for some of the environmental indicators and that more work would be needed to develop a credible aggregate environmental impact indicator. For these reasons many of the stakeholders engaged in the energy labelling process have previously indicated it would be premature or undesirable to attempt to add such an indicator to the energy label.

Switching from labelling of in-use energy consumption to labelling of energy impacts over the entire lifecycle also faces some practicality issues and may not be desired by or be as motivating for consumers. A majority of consumers are interested in the impact of the product on their energy bills (albeit a substantial minority are equally or more interested in energy related environmental impacts) which is correlated to energy in use but less so to energy over the product lifecycle. Nonetheless, the literature is inconclusive on this point.

Although, when asked, most consumers express an interest in knowing the energy running costs of products experience has shown that there are both practical and comprehension constraints that may mitigate against adding this information to an energy label. In the worst case consumers have been found to confuse running cost information presented on energy labels with expected savings in energy bills and thus have been drawn to purchase less, rather than more, efficient products. The huge variation in tariffs across Europe also mitigates against this as does consumer scepticism about average annual energy (and hence operating cost) consumption for many appliance types with variable usage profiles.

In principle modifying the label to work with ICT can help address some of these information deficits and particularly those concerned with additional explanation in the national language, explanation of Ecodesign requirements (which most consumers are unaware of), running costs, lifecycle impacts and environmental costs. Potential techniques include the addition of QR codes than can be scanned by smart phones to access additional product information. However, while the potential is evident the viability of such mechanisms has not been proven through any field trials to date and hence remains speculative.

While the recast labelling Directive includes requirements on labelling through internet sales channels the limited amount of research available so far suggests there may be greater compliance failures in these channels than through conventional retail channels.

There is relatively little information in the literature on the value of the product fiches. There is also limited literature assessing the potential effects of extending labelling to non-household products; however: these products consume a considerable amount of energy and have large savings potentials, they also suffer from the same information failures and similar market barriers as do consumer products; their labelling is common outside of Europe; in the absence of EU labelling many industry associations have developed and adopted de facto energy labels for their products. All of these aspects suggest that the extension of energy labelling to cover all significant energy-related products should be a priority.

12.2.3 Criteria and procedures

The process for setting Energy Labelling requirements is very closely linked to that for setting Ecodesign requirements and is a multi-stakeholder process consisting of different steps that aim to set effective standards and labelling requirements, while building consensus amongst stakeholders. There is very little literature that considers the specific questions posed regarding the procedures applied for energy labelling. The literature, or stakeholder views expressed, that address this topic have always addressed both Ecodesign and labelling conjointly. For this reason the summary of criteria and procedures given for Ecodesign in section 13.3.3 is also pertinent for energy labelling.

It is apparent that the focus on prioritising products and Ecodesign measures has been a pragmatic necessity given the limited administrative resources and capacity available to the Commission and Member States and that a greater throughput (including more labelling regulations) could be achieved were these resources to be increased. Nor have any of these documents directly addressed whether or not it would be better to establish a separate working plan under the energy labelling Directive (ELD76) or whether it would be better to continue to tackle them under a single plan (as at present).

There is no literature that has directly commented on the appropriateness of the criteria paragraph 2 of Article 10 of the ELD (ELD77); however, the following observations are worth mentioning.

It might be appropriate to revise criteria b) to include products with the potential to have a wide disparity in performance and not limit it to those that already do. The experience with clothes dryers indicates why this is important, as when the label was first introduced all the products were classified as either a C or D (i.e. there was very little differentiation); however, the technical analysis of clothes dryers had shown that it was feasible to manufacture heat-pump dryers that had class A performance and some years after the labels introduction industry rose to the challenge and started producing heat-pump dryers that attained class A and more recently, much higher efficiency levels. This view is consistent with call of several stakeholders to adopt a principle of setting the highest labelling class to coincide with a thorough technical assessment of the best not-available technology (BNAT).

Clause c) seems to presume that voluntary agreements and self-regulation will be faster at achieving the policy objectives than mandatory labelling; however, it is worth noting that there is no evidence in the literature to support this presumption and that most voluntary agreements have either made use of an existing energy label (e.g. the CECED VAs for domestic cold appliances, washing machines and dishwashers) or have first involved the development of a voluntary energy label (e.g. the Eurovent, EVA and eu.bac self-generated labelling schemes which have been coupled to internal industry association agreements on energy efficiency). Energy labelling has thus proven itself to be a very helpful precursor to voluntary agreements which can then be framed in terms of fleet average performance levels or minimum performance levels compared to an established label performance threshold). Thus in principle the clause could be amended to state:
"(c) for products where there is reason to believe that relevant Union legislation and self-regulation, such as voluntary agreements, will achieve the policy objectives more quickly or at lesser expense than mandatory requirements the Commission may opt to not develop mandatory labelling requirements".

Unfortunately, there is no literature which comments on: the appropriateness of delegated acts or the options to modify these topics; the applicability of a potential horizontal labelling regulation or of a horizontal verification procedure. There is little call to amend the stakeholder engagement process other than to streamline it and to prohibit the opportunity for stakeholders to comment during the inter-services consultation period, which some stakeholders believe, should be a purely internal consultation process within the Commission.

There is broad consensus among private sector and NGO stakeholders on the need to increase resources to administer the labelling programme and evidence suggests that capacity constraints (in the Commission, the Member States and in terms of consulting resources) have been a principle cause of delay, failure to exploit opportunities from extending product coverage and sub-optimal outcomes. Despite recent improvements the EU regulatory development process for both labelling and Ecodesign has been found to be relying on much more limited resources than comparable programmes in peer economies and this has incurred substantial lost opportunity costs. The principal one of these has been the failure to extend labelling to a much broader set of energy-related products than it is currently applied to, including no energy-related products (windows, showers, etc.) and no commercial or industrial sector products.

Improvement options identified in the literature include:

- Strengthen investment in the design and implementation of the Ecodesign and energy labelling Directives. Bolster administrative and technical resources by increasing the number of desk officers administering the development of energy labelling and Ecodesign measures and by raising the budget available to sustain technical support for preparatory studies, data collection, standardisation development, forecasting, monitoring and evaluation. Address part of the administrative capacity shortfall by farming out some functions to other agencies or partners.
- Develop (and frequently revise) an associated regulatory development plan clearly indicating the regulatory development resource requirements, provisional estimated outcomes in terms of energy savings, environmental impacts and economic effects and the impact on the share of total product energy use subject to energy labelling and Ecodesign measures.
- Consider adoption of a binding administrative schedule that fully clarifies well in advance all the regulatory design, standardisation and consultative procedures and indicates to stakeholders when they will have an opportunity to engage in or comment on the regulatory development process and when the process will conclude.

12.2.4 Market effects Energy Labelling

Market size: The Energy Labelling and Ecodesign Directives together apply to many billions of products that are sold in the EU each year and markets whose total value can be measured in tens of billions of euros. The largest markets affected by energy labelling in terms of euros are those for televisions, non-directional household lamps and air-conditioners and comfort fans. In terms of unit sales volumes the most important markets are for non-directional household lamps, televisions and vacuum cleaners. From analysis of ProdCom market data there is no discernible impact of energy labelling on overall market size. Changes in market size and import-export positions are driven by much more powerful economic drivers, most recently the financial crisis. (ELD131)

Cost and profit margins: As policy interventions have accelerated the rate of improvement of product energy efficiency, without affecting the long term downward trend in prices, and have also only had a short-run impact on average market prices, the impact of Energy Labelling on prices is understood to be low. It is likely, but unproven, that this translates into similarly low impacts on the production costs and profits margins of producers. (ELD133)

Administrative burden for EU firms: EU manufacturers and retailers are assumed to pass onto consumers the bulk of any cost increases. Consequently, the introduction of Energy Labelling would be expected to favour larger firms over SMEs, as larger firms have greater staff and technical and financial capacity to manage and adapt to any changes. (ELD140)

Competitiveness: as all operators must comply with the same requirements on the EU market the competitiveness effect of energy labelling is broadly neutral, but is likely to favour the firms that are able to most cost-effectively produce more energy efficient products. In international markets the impacts of EU Energy Labelling appear to be negligible within the data, as other market trends and effects dominate. These over-arching trends point to a slow decline in EU firms market share within the EU as global competition and imports increase. There is logical, but limited evidence to date, that suggests positive impact on competitiveness for EU firms from Labelling as it provides an incentive for innovation. It also brings EU firms a reputation for efficiency that will be beneficial in the long term, as was the case for compact fluorescent light bulbs. EU exports are increasing across most labelled product groups, but this is thought to be a result of growing global consumer markets rather than a direct labelling or efficiency effect. Indirect benefits will arise to firms in the long-term through consumers' energy savings increasing their disposable income for other purchases. The Directive is also anticipated to provide indirect cost benefits to industry through its impact on energy prices and emissions trading markets. (ELD132)

Market structure: little evidence on Labelling driven impact on market structure was found. Suppliers of low efficiency products or components would be expected to lose market share. (ELD137)

Product choice: labelling supports trends towards more efficient products and can lead to self-selection by manufacturers to remove products in the lowest label classes. Other impacts are not evident. (ELD135)

Non-compliance: Globally the share of expected total energy savings lost because of non-compliance in standards and labelling programmes is in the range of 10-15%. Retail survey results have shown that almost 40% of products were mislabelled or not labelled at all, and that this is a particular problem for electric ovens and air conditioners. It is unclear the extent to which non-compliance transfers into market impact as product price and product quality remain the most important purchase criteria for consumers. (ELD134)

12.3 Ecodesign Directive

12.3.1 Objectives implementing measures

In this study, the ambition level of Ecodesign implementing measures was evaluated by product group. Straightforward conclusions on the level of ambition of Ecodesign implementing measures are difficult. The ambition is derived from lowest life cycle costs, but this is complicated, partly because lowest life cycle costs change over time. Alternative ways to identify the level of ambition is by comparison with Best Available Technology or standards in a third jurisdiction. Based on the available evidence, we found a high ambition level for electric motors. The ambition level is moderate for standby and off-mode losses, ventilation fans, directional lighting, circulators in buildings, vacuum cleaners, PC and servers, room air conditioning appliances, external power supplies, electric pumps and domestic dishwashers. Ambition was poor to moderate for domestic and tertiary lighting, domestic refridgerators and freezers, and domestic washing machines. (ED5, 6, 9)

The ambition level of the implementing measures is determined in part also by the scope of the product group it concerns. The scope can be considered appropriate for most product groups. For a number of product groups the scope is narrower than could have been the case, in particular PCs and servers and electric pumps. Requirements for PCs and servers do not apply to displays, blade systems and components, server appliances, multinode servers, computer servers with more than four processor sockets, game consoles and docking stations. Two preparatory studies on electric pumps are being carried out to assess the possibility of enlarging the scope of pumps under regulation (LOT 28 and LOT 29). As for tertiary lighting the scope used to be appropriate but with emerging LED technology it needs reconsideration. (ED6)

Iit was also evaluated if the objectives of implementation measures are likely to be achieved by 2020. Based on the limited information available, we tentatively conclude the following:

- For electric motors and external power supplies limited achievement of objectives to be expected.
- Moderate achievement which is more or less in line with expected savings in the impact analysis is anticipated for standby and off-mode losses, ventilation fans, circulators in buildings, domestic dishwashers, and domestic washing machines.
- Significant achievement exceeding expected savings in 2020 is anticipated for domestic lighting, televisions, and tertiary lighting. (ED1-4)

Ecodesign implementing measures have so far focused on requirements on energy consumption and energy efficiency in the use-phase, one exception being washing machines which also has requirements for water consumption. Implementing measures on imaging equipment also include reuse, recycling and end-of-life management requirements, but are only in the scope of a voluntary agreement. This may be justified because energy use represents, in varying degrees, the most important contribution to the environmental impacts of the covered products. However, as products become more energy efficient in the use phase, the impacts of other phases grows in importance. (ED12)

Voluntary agreements (VA) are the preferred option in the cases where such an option is likely to deliver the policy objectives faster and in less costly manner than the mandatory requirements. VAs tend to be proposed with complex products with fast technological development, so that the technology and market change will be reflected in the different version of VA. This flexibility has been acknowledged as the major benefit of the VAs by the stakeholders. (ED23)

However, in practice, VA processes are not necessarily fast which also puts the cost efficiency into question. Additionally stakeholder views reflect that VAs seem not to be fully in line with the requirements of Annex VIII of the Ecodesign Directive. (ED24, 26)

One major challenge of VAs in industry lies in the fact that they concern highly innovative and complex products requiring rapid changes in the VA results Stakeholders comment on the difficulties in the process. In most of the cases stakeholders mention that there is a lack of transparency in VA process and the VAs lack a clear level of ambition, or that the level of ambition is difficult to determine. The Commission are considering reviewing and possibly also revising its guidelines on self-regulation measures to provide clearer and more comprehensible rules in 2013 to overcome these major challenges. (ED27)

12.3.2 Market effects of Ecodesign

Market size - The Ecodesign Directive has even wider coverage than the Energy Labelling directive, affecting more product groups, in total affecting billions of products with al value of around 100 billion euros per year. The largest markets impacted by Ecodesign in terms of value are those for computers and servers, televisions, tertiary lighting and complex set top boxes. In terms of units sold, the most important markets are for tertiary lighting, non-directional household lamps and electric motors. As with Energy Labelling, there is no discernible impact of Ecodesign on overall market size as changes in market size and import-export positions are driven by much more powerful economic forces, such as the financial crisis. (ED29)

Cost and profit margin - A variety of evidence points to the cost impacts of Ecodesign measures being low, particularly in the long run. Studies and manufacturer estimates produced during preparation of the Directive have proved highly pessimistic, with real product price declines continuing despite new regulatory standards. Evidence also suggests that Ecodesign implementing measures are often out of date when they are implemented due to the delay in the process and failure to fully account for learning, process and innovation improvements over time. Impacts on profits are unclear, but are expected to be closely linked to costs and therefore also low. (ED31)

Administrative burden and price effect - Given adequate lead times for the Ecodesign regulation to come into effect, the impact on manufacturers is limited. As with Energy Labelling it is assumed that the EU manufacturers and retailers pass the bulk of any cost increase onto consumers. Consequently, Ecodesign legislation would be expected to favour larger firms over SMEs, as larger firms have greater staff and technical and financial capacity to manage and adapt to any changes, although it may also create niche opportunities for SMEs to exploit. (ED 33, 41)

Competitiveness, trade and stakeholder benefits - As all operators must comply with the same requirements on the EU market the competitiveness effect of Ecodesign is broadly neutral. The impact assessments in the preparatory process indicating that most competitiveness impacts would be small and could be both positive and negative for EU firms. The biggest impact will be felt by firms with products that are banned, or forced to change, by the regulation, and that do not have a more efficient product range that is compliant. On the whole, the length of the Ecodesign process provides sufficient time for all firms to adapt. In general there is little evidence that SMEs would disproportionately lose out from the changes. Ecodesign regulations may benefit EU firms in the EU market relative to low-cost international competitors as they may force producers to produce more technologically advanced products. This may reduce the relative advantage of cheap labour. As with Energy Labelling, the direct impacts of Ecodesign in international markets appear to be negligible within the data, as other market trends dominate. Benefits to market stakeholders are expected through energy savings on regulated products, particularly lighting, imaging equipment, water pumps, motors, circulators, fans and air conditioners. No estimates were found that quantify this impact. As for Energy Labelling, Ecodesign will have indirect benefits to firms through consumers energy savings increasing their disposable income for other purchases and the cost benefits to industry of lower energy and emissions costs. (ED 30, 38, 42).

Market structure: No clear evidence related to changes in the market structure of producers, i.e. changes within the value chain, due to Ecodesign has been found. (ED37)

Product choice: Impacts on market structure in terms of products and consumer choice have been more evident. This is a simple result of the least efficient products being forced to change or be removed from the market. The most notable example of this change is for lighting and the phase-out of incandescent light bulbs; this changed the market significantly and highlighted problems for regulators in forecasting these changes, i.e. too much focus on CFL bulbs and a lack of anticipation of the growth in the market for LED bulbs. (ED34, 35)

Non-compliance: is estimated at around 10-20% of all products. This is of similar proportions to the non-compliance with Labelling. The impact of this is thought to be negative, but given the low impact of Ecodesign on production costs and prices, it is not thought to be highly significant. (ED32)

12.3.3 Criteria and procedures

The process for setting Ecodesign requirements is a multi-stakeholder process consisting of different steps that aim to set effective standards and build consensus amongst stakeholders. In the working plan a selection of target product groups is based on the criteria in article 15 of the Ecodesign Directive. The process from preparatory study to publication of the measure in principle has an estimated timespan of 55 months (≈ 4.5 years) and consists of the steps depicted in Figure 29.

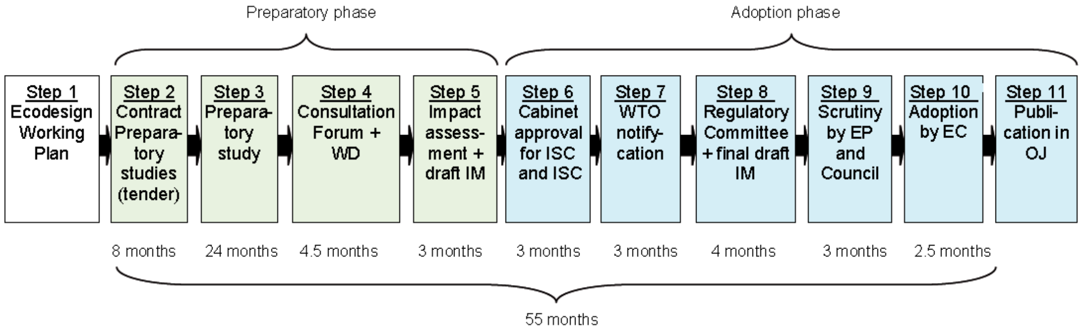


Figure 29: The Ecodesign regulatory process and timeline (Siderius, 2013)

The suggested areas for improvement in literature on the criteria and procedures are focussed on the four key themes: (ED 45)

1. Delays in the regulatory process.
2. Limited data availability and quality.
3. Low ambition of the implementing measures.
4. Insufficient focus on non-energy aspects.

The delays in the regulatory process can result from a false start to the rulemaking procedures because of poor quality preparatory studies through lack of available data or poor industry involvement. In practice the Consultation Forum starts on average 10 months after the finalisation of the preparatory study, causing delays in the process. This can be explained partly by staffing constraints at the Commission. Another reason is that many stakeholders only start their thinking on the topic once the Consultation Forum meeting is announced. The Inter-service Consultation, which in principle is an internal EU step, has been used by external stakeholders to re-open discussions from the Consultation Forum, leading to further delays in the process. The ability to disregard deadlines without consequences also leads to uncertainty in the process. When no clear timeline is available Member States, experts and industry all have difficulties in planning their capacity, leading to further delays and missed energy efficiency potential. (ED45, ED46 ED48, ED 51)

Potential solutions to reduce delays include:

- Performing a complexity and contentiousness analysis as part of the preparatory study and then based on this analysis adapt the subsequent steps to reserve more time for the expected bottlenecks.
- Ensuring that deadlines are met by all stakeholders and that the process steps and deadlines are clearly communicated.
- Reducing the time span between the different process steps.

Limited data availability and quality leads to weak preparatory studies, which in turn leads to delays and inefficiencies later on the process. The reason for this is that there are no obligations for companies to report data and commercial data is usually expensive. The European product database currently under development is potential solution to this. (ED45)

Evidence exists that *some implementing measures lack ambition* and have led to very limited market change as at the time of their implementation the standards had already been surpassed by technology. There are many reasons why the standard setting can lead to weak standards, including a low quality preparatory study, long periods of time between the preparatory study and the implementation of the implementing measure, obstructive behaviour of stakeholders or even practical concerns such as lack of resources from the European Commission. (ED45, ED46)

A potential solution to increase the ambition of the implementing measure could be:

- To include learning effects in the LCC calculations;
- To set the implementing measure at the break even (BE) point;
- To use best available technology (BAT) and best not yet available technology (BNAT) as target point for the revision of existing implementing measures.

Currently the focus of the Ecodesign rulemaking procedures is primarily on energy efficiency. Some stakeholders advocate that a stronger focus on non-energy aspects is needed (ED47, ED53, ED54):

The following options could increase the impact that Ecodesign has on non-energy impacts:

- The use of horizontal measures to regulate non-energy aspects (e.g. on recyclability or use of chemicals);
- Ecodesign preparatory studies should analyse in more detail the main drivers of the lifetime impact of products;
- Technical advisory committees, including experts from the joint research centre and open to other stakeholders, should be established to develop measurement standards and metrics to help decision-makers move forward with non-energy aspects.

12.3.4 Effects of standardisation

The 2012 evaluation of the Ecodesign directive evaluation already found that harmonised standards developed have a key role in the implementation of the Directive. Test and performance standards can be used by manufacturers to show compliance with the Implementing Measures adopted under this Directive for specific product groups. Where they exist, standards make an important contribution to the success of implementing measures. Problems tend to arise from ambiguities in some requirements in the implementing measures in particular when it is not possible to refer to existing standards. (ED80, 82)

Currently, national standards are the norm, although there is a high degree of harmonisation within the EU through the CEN and CENELEC approval process. Global harmonisation is developing more slowly. International standards for defining and testing energy performance exist, i.e. ISO and IEC, but they are not universally and consistently applied. Outside the EU there are other examples of regional harmonization e.g. in Australia and New Zealand; ASEAN countries; and in countries in and around the Indian subcontinent. Each of these regions generally take their lead from ISO and IEC standards. North America is the general exception to this as they tend to pursue their own standards.

The use of international standards would have two important advantages. Firstly, it would strengthen the legal basis of policy implementation, both for test methods and product definition. Secondly, approaching the complex technical issues at the highest possible level is likely to result in stronger and more accurate policies, as individual countries often lack the capacity to develop standards. However, global harmonisation of test protocols and regulatory standards would take a lot of effort and time. Other important barriers to harmonisation are the significant difference in testing procedures, classification of products, definitions of energy performance, the specification of standards (e.g. correction factors); required energy performance; and scheduling of reviews of the regulation in different jurisdictions. An important barrier is the problem of defining exactly what is considered realistic actual user behaviour across cultures and climates. (ED83)

In the EU, there are a number of important obstacles to the smooth drafting and adopting of standards. These include:

a. An interdependency in the development of standards and regulation;
b. The development of technical standards lacks an assessment of environmental characteristics of products;
c. An overlap or even conflicts in the activities of the CEN-CENELEC Management Centre (CCMC), the relevant Technical Committees and the EC services;
d. Standardisation committees tend to be dominated by manufacturers with little representation upholding the integrity of the policy process. This results in overgenerous tolerances and retrospective changes to test procedures without corresponding changes in the regulation to maintain its integrity;
e. Complex and inflexible international and EU procedures, and lengthy procedures of mandating the European Standardization Organizations (ESOs);
f. Test methods are generally lab based and have not been designed to test actual use, a problem compounded by a lack of field data and a lack of resources to gather this data;
g. Limited involvement of market surveillance authorities. Greater involvement of these authorities could help improve market surveillance (ED85).

Options to improve the standardization process include:

a. An earlier start of the process of standards development and a better integration with preparatory studies, including information on upcoming regulatory work to ESOs (ED 87);
b. Greater use of the relatively new development of environmental characteristics for products in line with CEN TC350 standards;
c. Set up of a 'CEN-CENELEC Ecodesign Coordination Group' to ensure proper communication between the CCMC, the Technical Committees and the EC services (realized in April 2013);
d. Greater involvement of public policy representatives in the standardisation committees;
e. Reform towards more efficient standardization procedures, as foreseen in the product safety and market surveillance activities package adopted by the EC in February 2013, and an alignment of provisions with the Regulation on European Standardization (1025/2012);
f. Better information regarding the user behaviour (including actual use field data) to which the labelled energy performance applies, and/or further harmonization of test standards with regard to testing conditions;

g. Greater involvement of market surveillance authorities, to keep up to date with developments in scientific and technical knowledge, as well as consumer organizations (ED86).

In addition efforts could be made to work with the standardisation processes in the peer economies to share the developmental burden, enhance international harmonisation and facilitate policy benchmarking and trade.

Annex A Detailed policy instrument mapping

The tables below summarize the policy instruments discussed in chapter 3.

Table 47 - Detailed policy instrument mapping: Ecodesign Directive 2009/125/EC

		Ecodesign Directive 2009/125/EC
Summary		
Objective		Establishing a framework for the setting of ecodesign requirements for energy-related products (subheading)
Product Scope	Theoretical	Energy-related products (Article 1.1/2)
	Practical / Implemented for the following products	http://www.eup-network.de/de/produktgruppen/uebersicht-oekodesign
	Scope exemptions	Means of transport for persons or goods (Article 1.3)
	Other requirements	the product shall represent a significant volume of sales and trade within the Community according to the most recently available figures (> than 200 000 units a year) ; the product shall, considering the quantities placed on the market and/or put into service, have a significant environmental impact within the Community, as specified in the Community strategic priorities as set out in Decision No 1600/2002/EC; and the product shall present significant potential for improvement in terms of its environmental impact without entailing excessive costs (Article 15.2)
Aspects considered	Environmental aspects	Improving the environmental performance of products, focusing on significant environmental aspects thereof without setting limit values (ANNEX I) Following parameters must be used, as appropriate, and supplemented by others, where necessary, for evaluating the potential for improving the environmental aspects: (a) weight and volume of the product; (b) use of materials issued from recycling activities; (c) consumption of energy, water and other resources throughout the life cycle; (d) use of substances classified as hazardous to health and/or the environment (e) quantity and nature of consumables needed for proper use and maintenance; (f) ease for reuse and recycling (g) incorporation of used components; (h) avoidance of technical solutions detrimental to reuse and recycling of components and whole appliances; (i) extension of lifetime (j) amounts of waste generated and amounts of hazardous waste generated; (k) emissions to air (l) emissions to water and (m) emissions to soil (ANNEX I) see also MEErP method
	Life cycle phases	Significant environmental aspects must be identified with reference to the following phases of the life cycle of the product: (a) raw material selection and use; (b) manufacturing; (c) packaging, transport, and distribution; (d) installation and maintenance; (e) use; and (f) end-of-life, meaning the state of a product having reached the end of its first use until its final disposal. (ANNEX I)

		Ecodesign Directive 2009/125/EC
	Other aspects	- no significant negative impact on the functionality of the product, from the perspective of the user; - health, safety and the environment shall not be adversely affected; - no significant negative impact on consumers in particular as regards the affordability and the life cycle cost of the product; -no significant negative impact on industry's competitiveness; - consequence of imposing proprietary technology on manufacturers - no excessive administrative burden shall be imposed on manufacturers (Articel 15.5)
Product-related policy mechanisms	Information / Labelling	Consumer information requirements possible
	Minimum standards / requirements	Product related requirements (Annex I) Possibilities for reuse, recycling and recovery of materials and/or of energy, taking into account Directive 2002/96/EC (ANNEX I, Part I, 1.2 e).
	Mandatory / voluntary	Mandatory
	Public Procurement	No
	Others	
Procedures	Additional legal acts in order to implement legislation	Ecodesign implementing measures or voluntary agreements or other self-regulation measures (Article 15+17)
	Decision making process	The Commission shall ensure that, in the conduct of its activities, it observes, in respect of each implementing measure, a balanced participation of Member States' representatives and all interested parties concerned with the product or product group in question, such as industry, including SMEs and craft industry, trade unions, traders, retailers, importers, environmental protection groups and consumer organisations. These parties shall contribute, in particular, to defining and reviewing implementing measures, to examining the effectiveness of the established market surveillance mechanisms and to assessing voluntary agreements and other self-regulation measures. These parties shall meet in a Consultation Forum. The rules of procedure of the Forum shall be established by the Commission (Article 18). Working programme => prep studies => consultation forum => Impact Assessment => Interservice Consultation => regulatory committee => parliament (can only reject) (comitology procedure on the basis of previous EU law; might be adapted to Lisbon Treaty procedure) Alternative: self-regulatory measures in general aligned with Energy Labelling process
	Actors and responsibilities	Comitology procedure: Commission, parliament, consultation forum, regulatory committee Obligated party: Suppliers MS: implementation, market surveillance, penalties See Art. 4,12,15,18,23
	Update	Commission: as appropriate => amending this Directive (Article 21).
References to other legislation		This Directive and the implementing measures adopted pursuant thereto shall be without prejudice to Community waste management legislation and Community chemicals legislation, including Community legislation on fluorinated greenhouse gases (Article 1.4). Presumption of conformity: Products which have been awarded the Community Ecolabel pursuant to Regulation (EC) No 1980/2000 (old Ecolabel regulation) shall be presumed to comply with the ecodesign requirements of the applicable implementing measure in so far as those requirements are met by the ecolabel (Article 9.3). Ecodesign parameters for products: (…) Possibilities for reuse, recycling and recovery of materials and/or of energy, taking into account Directive 2002/96/EC. (ANNEX I) (=old WEEE directive)

Table 48 - Detailed policy instrument mapping: Energy labelling Directive 2010/30/EU

		Energy labelling Directive 2010/30/EU
Summary		
Objective		Establishing a framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products (Article 1.1).
Product Scope	Theoretical	Energy-related products which have a significant direct or indirect impact on the consumption of energy and, where relevant, on other essential resources during use (Article 1.2).
	Practical / Implemented for the following products	The Commission should provide a priority list of energy- related products that could be covered by a delegated act under this Directive. Such a list could be included in the Working Plan referred to in Directive 2009/125/EC (7). See: www.eup-network.de/de/produktgruppen/uebersicht-energieverbrauchs-kennzeichnung
	Scope exemptions	- Second-hand products; - Any means of transport for persons or goods; - The rating plate or its equivalent affixed for safety purposes to products.
	Other requirements	
Aspects considered	Environmental aspects	Consumption of electric energy, other forms of energy and where relevant other essential resources during use (Article 4) => energy efficiency classes (labelling)
	Life cycle phases	Only use phase (Article 4)
	Other aspects	
Product-related policy mechanisms	Information / Labelling	Labelling (Article 10)
	Minimum standards / requirements	None
	Mandatory / voluntary	mandatory
	Public Procurement	Public procurement and incentives: Where a product is covered by a delegated act, contracting authorities which conclude public works, supply or service contracts as referred to in Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (1), which are not excluded by virtue of Articles 12 to 18 thereof, shall endeavour to procure only such products which comply with the criteria of having the highest performance levels and belonging to the highest energy efficiency class. Member States may also require the contracting authorities to procure only products fulfilling those criteria. Member States may make the application of those criteria subject to cost-effectiveness, economic feasibility and technical suitability and sufficient competition (Article 9).
	Others	
Procedures	Additional legal acts in order to implement legislation	Delegated acts (Article 10) Directive 2009/125/EC (Article 10.3.a)
	Decision making process	Working programme => prep studies => consultation forum => Impact Assessment => Interservice Consultation => delegated act (no regulatory committee) => parliament and council (can only reject) (on the basis of the Lisbon treaty) in general aligned with Ecodesign process
	Actors and responsibilities	Process for determining delegated acts: Commission, parliament, consultation forum, regulatory committee. Obligated parties: suppliers, dealers MS: implementation, market surveillance, penalties See Art. 3,5,6, 15

		Energy labelling Directive 2010/30/EU
	Update	Evaluation: Not later than 31 December 2014, the Commission shall review the effectiveness of this Directive and of its delegated acts and submit a report to the European Parliament and the Council (Article 14). The Commission should be responsible for adapting the label classifications with the aim of ensuring predictability for the industry and comprehension for consumers (21).
References to other legislation		Public procurement and incentives: Where a product is covered by a delegated act, contracting authorities which conclude public works, supply or service contracts as referred to in Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (1), (Procurement Directive) which are not excluded by virtue of Articles 12 to 18 thereof, shall endeavour to procure only such products which comply with the criteria of having the highest performance levels and belonging to the highest energy efficiency class (...) Paragraph 1 shall apply to contracts having a value equal to or greater than the thresholds laid down in Article 7 of Directive 2004/18/EC (...)(Article 9)

Table 49 - Detailed policy instrument mapping: Energy Efficiency Directive 2012/27/EU

		Energy Efficiency Directive 2012/27/EU
Summary		- Energy efficiency targets: Each Member State shall set an indicative national energy efficiency target, based on either primary or final energy consumption, primary or final energy savings, or energy intensity (Article 3.1) - EFFICIENCY IN ENERGY USE: Building renovation; long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private (Article 4). - Exemplary role of public bodies' buildings: comprehensive renovation of central government buildings (Article 5). - Purchasing by public bodies: only products, services and buildings with high energy-efficiency performance (Article 6). - Energy efficiency obligation schemes (Article 7). - Energy audits and energy management system (Article 8). - Metering: individual meters that accurately reflect the final customer's actual energy consumption (Article 9). - Billing information (Article 10). - Cost of access to metering and billing information (Article 11). - Consumer information and empowering programme (Article 12).
Objective		Establishing a common framework of measures for the promotion of energy efficiency within the Union in order to ensure the achievement of the Union's 2020 20 % headline target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date (Article 1.1). It lays down rules designed to remove barriers in the energy market and overcome market failures that impede efficiency in the supply and use of energy, and provides for the establishment of indicative national energy efficiency targets for 2020 (Article 1.1).
Product Scope	Theoretical	Products / equipment covered: Buildings; products that can be the object of public procurement; heating and cooling equipment; energy transformation, transmission and distribution
	Practical / Implemented for the following products	
	Scope exemptions	
	Other requirements	
Aspects considered	Environmental aspects	Energy efficiency
	Life cycle phases	
	Other aspects	
Product-related policy mechanisms	Information / Labelling	Member States shall take appropriate measures to promote and facilitate an efficient use of energy by small energy customers, including domestic customers. These measures may be part of a national strategy. For the purposes of paragraph 1, these measures shall include (...) (iii) information provision; (b) ways and means to engage consumers and consumer organisations during the possible roll-out of smart meters through communication of: (i) cost-effective and easy-to-achieve changes in energy use; (ii) information on energy efficiency measures. (Art. 12)
	Minimum standards / requirements	None
	Mandatory / voluntary	Mandatory activities for MS; but not specified in detail
	Public Procurement	Member States shall ensure that central governments purchase only products, services and buildings with high energy-efficiency performance, insofar as that is consistent with cost-effectiveness, economical feasibility, wider sustainability, technical suitability, as well as

		Energy Efficiency Directive 2012/27/EU
		sufficient competition, as referred to in Annex III (Article 6.1) Member States shall encourage public bodies, including at regional and local levels, with due regard to their respective competences and administrative set-up, to follow the exemplary role of their central governments to purchase only products, services and buildings with high energy-efficiency performance. Member States shall encourage public bodies, when tendering service contracts with significant energy content, to assess the possibility of concluding long-term energy performance contracts that provide long-term energy savings (Article 6.3)
	Others	Consumer-oriented: one or more of the elements listed under point (a) or (b): (a) a range of instruments and policies to promote behavioural change which may include: (i) fiscal incentives; (ii) access to finance, grants or subsidies; (...) (iv) exemplary projects; (v) workplace activities; (Art. 12)
Procedures	Additional legal acts in order to implement legislation	Delegated acts (Article 22)
	Decision making process	Committee procedure: The Commission shall be assisted by a committee. That committee shall be a committee within the meaning of Regulation (EU) No 182/2011 (Article 26.1). Online Platform: The Commission shall establish an online platform in order to foster the practical implementation of this Directive at national, regional and local levels. That platform shall support the exchange of experiences on practices, benchmarking, networking activities, as well as innovative practices (Article 25).
	Actors and responsibilities	Comitology: The Commission shall be assisted by a committee. That committee shall be a committee within the meaning of Regulation (EU) No 182/2011 (Article 26). Market surveillance, penalties: MS See Article 3, 13, 15 22, 23
	Update	By 30 June 2014, the Commission shall assess progress achieved and whether the Union is likely to achieve energy consumption of no more than 1 474 Mtoe of primary energy and/or no more than 1 078 Mtoe of final energy in 2020 (Article 3.2). Review and monitoring of implementation: By 30 April each year as from 2013, Member States shall report on the progress achieved towards national energy efficiency targets. By 30 April 2014, and every three years thereafter, Member States shall submit National Energy Efficiency Action Plans. (Article 24)
References to other legislation		Energy efficiency targets: (..) the measures adopted to reach the national energy saving targets adopted pursuant to Article 4(1) of Directive 2006/32/EC (old Energy Efficiency Directive) (..)(Article 3.1 c) ANNEX III: ENERGY EFFICIENCY REQUIREMENTS FOR PURCHASING PRODUCTS, SERVICES AND BUILDINGS BY CENTRAL GOVERNMENT (...)where a product is covered by a delegated act adopted under Directive 2010/30/EU (Energy Labelling Directive) or by a related Commission implementing directive, purchase only the products that comply with the criterion of belonging to the highest energy efficiency class possible in the light of the need to ensure sufficient competition; (..)where a product not covered under point (a) is covered by an implementing measure under Directive 2009/125/EC (Ecodesign Directive) adopted after the entry into force of this Directive, purchase only products that comply with energy efficiency benchmarks specified in that implementing measure; (..)purchase office equipment products covered by Council Decision 2006/1005/EC (Energy Star Decision) of 18 December 2006 concerning conclusion of the Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programmes for office equipment (1) that comply

		Energy Efficiency Directive 2012/27/EU
		with energy efficiency requirements not less demanding than those listed in Annex C to the Agreement attached to that Decision; (...) purchase only tyres that comply with the criterion of having the highest fuel energy efficiency class, as defined by Regulation (EC) No 1222/2009 (Tyre Labelling) of the European Parliament and of the Council of 25 November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters (2) (..) Compliance with these requirements shall be verified by means of the energy performance certificates referred to in Article 11 of Directive 2010/31/EU. (buildings directive)

Table 50 - Detailed policy instrument mapping: Energy Performance of Buildings 2010/31/EU (replacing 2002/91/EC)

		Energy Performance of Buildings 2010/31/EU (replacing 2002/91/EC)
Summary		- Minimum requirements to the energy performance of new buildings and new building units (Article 1.2 b). - Minimum requirements to the energy performance of: (i) existing buildings, building units and building elements that are subject to major renovation; (ii) building elements that form part of the building envelope and that have a significant impact on the energy performance of the building envelope when they are retrofitted or replaced; and (iii) technical building systems whenever they are installed, replaced or upgraded; (d) national plans for increasing the number of nearly zero- energy buildings; (e) energy certification of buildings or building units; (f) regular inspection of heating and air-conditioning systems in buildings; and (g) independent control systems for energy performance certificates and inspection reports (Article 1.2c)
Objective		This Directive promotes the improvement of the energy performance of buildings within the Union, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness (Article 1.1).
Product Scope	Theoretical	Buildings within the Union (Article 1.1); building units; building elements; technical building systems;
	Practical / Implemented for the following products	
	Scope exemptions	Possible optional exceptions named in Article 4.2.
	Other requirements	
Aspects considered	Environmental aspects	Energy performance
	Life cycle phases	Use phase
	Other aspects	
Product-related policy mechanisms	Information / Labelling	Energy certification of buildings or building units (Article 11-13)
	Minimum standards / requirements	Minimum requirements for buildings, building units, building elements and technical building systems (Article 1.2b and c, 4,6,7,8,9) => product- and system-related requirements Minimum requirements for inspection and control (Art. 1.2 f and g, 14,15,16) => procedural requirements Most standards to be set by MS, but: "by 31 December 2020, all new buildings are nearly zero-energy buildings; and (b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings." (Art. 9)
	Mandatory / voluntary	Mandatory
	Public Procurement	
	Others	MS are required to set up various policy measures, such as national plans or financial incentives, in order to improve energy performance of buildings and promote near-zero energy buildings (Art. 9,10)
Procedures	Additional legal acts in order to implement legislation	Adaptation to technical progress: by means of delegated acts (Art. 22)

		Energy Performance of Buildings 2010/31/EU (replacing 2002/91/EC)
	Decision making process	Most decisions to be taken by MS (see column R) Consultation: In order to facilitate the effective implementation of the Directive, Member States shall consult the stakeholders involved, including local and regional authorities, in accordance with the national legislation applicable and as relevant (Article 21).
	Actors and responsibilities	MS set minimum requirements for buildings and buildings elements; they may differentiate between new and existing buildings (Art. 4) MS ensure that new buildings meet minimum standards (Art. 6) and that existing buildings meet the standards in case of major renovation (Art. 7) MS set system requirements for technical building systems (Art. 8) MS ensure that near-zero energy building requirements are met (Art.9) MS are required to set up various policy measures, such as national plans or financial incentives, in order to improve energy performance of buildings and promote near-zero energy buildings (Art. 9,10) Delegated acts: power transferred to COM for a period of 5 years, will be automatically prolonged if Parliament and Council do not object; Parliament and Council have the right to revoke that delegation or to object to delegated acts (Art. 23-25). In developing delegated acts: Comittee procedure (Art. 26) MS: Penalties (Art. 27), transposition (Art. 28)
	Update	Minimum energy performance requirements shall be reviewed at regular intervals which shall not be longer than five years and, if necessary, shall be updated in order to reflect technical progress in the building sector (Article 4). Review: The Commission, assisted by the Committee established by Article 26, shall evaluate this Directive by 1 January 2017 at the latest, in the light of the experience gained and progress made during its application, and, if necessary, make proposals (Article 19). Article 22 Adaptation of Annex I to technical progress The Commission shall adapt points 3 and 4 of Annex I to technical progress by means of delegated acts in accordance with Articles 23, 24 and 25.
References to other legislation		The methodology for calculating the energy performance of buildings should take into account European standards and shall be consistent with relevant Union legislation, including Directive 2009/28/EC (u.a. ANNEX I). Member States shall report to the Commission all input data and assumptions used for those calculations and the results of those calculations. The report may be included in the Energy Efficiency Action Plans referred to in Article 14(2) of Directive 2006/32/EC. (Article 5.2, etc.) (old Energy Efficiency Directive) Inspection of air-conditioning systems: Member States shall, as far as is economically and technically feasible, ensure that inspections are carried out in accordance with the inspection of heating systems and other technical systems referred to in Article 14 of this Directive and the inspection of leakages referred to in Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases (1). (Article 15)

ECOFYS
sustainable energy for everyone

Table 51 - Detailed policy instrument mapping: RoHS Directive 2011/65/EU Directive

		RoHS Directive 2011/65/EU
Summary		
Objective		This Directive lays down rules on the restriction of the use of hazardous substances in electrical and electronic equipment (EEE) with a view to contributing to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste EEE (Article 1).
Product Scope	Theoretical	This Directive shall apply to EEE falling within the categories set out in Annex I (Article 2).
	Practical / Implemented for the following products	Categories of EEE covered by this Directive 1. Large household appliances. 2. Small household appliances. 3. IT and telecommunications equipment. 4. Consumer equipment. 5. Lighting equipment. 6. Electrical and electronic tools. 7. Toys, leisure and sports equipment. 8. Medical devices. 9. Monitoring and control instruments including industrial monitoring and control instruments. 10. Automatic dispensers. 11. Other EEE not covered by any of the categories above (ANNEX I).
	Scope exemptions	This Directive does not apply to: (a) equipment which is necessary for the protection of the essential interests of the security of Member States, including arms, munitions and war material intended for specifically military purposes; (b) equipment designed to be sent into space; (c) equipment which is specifically designed, and is to be installed, as part of another type of equipment that is excluded or does not fall within the scope of this Directive, which can fulfil its function only if it is part of that equipment, and which can be replaced only by the same specifically designed equipment; (d) large-scale stationary industrial tools; (e) large-scale fixed installations; (f) means of transport for persons or goods, excluding electric two-wheel vehicles which are not type-approved; (g) non-road mobile machinery made available exclusively for professional use; (h) active implantable medical devices; (i) photovoltaic panels intended to be used in a system that is designed, assembled and installed by professionals for permanent use at a defined location to produce energy from solar light for public, commercial, industrial and residential applications; (j) equipment specifically designed solely for the purposes of research and development only made available on a business-to-business basis. (Article 2.4).
	Other requirements	
Aspects considered	Environmental aspects	Prevention: not containing the substances listed in Annex II (Article 4). Restricted substances referred to in Article 4(1) and maximum concentration values tolerated by weight in homogeneous materials - Lead (0,1 %) - Mercury (0,1 %) - Cadmium (0,01 %) - Hexavalent chromium (0,1 %) - Polybrominated biphenyls (PBB) (0,1 %) - Polybrominated diphenyl ethers (PBDE) (0,1 %) (ANNEX II).
	Life cycle phases	Whole life cycle
	Other aspects	Only refers to homogeneous materials
Product-related policy mechanisms	Information / Labelling	
	Minimum standards / requirements	Product-related requirements (maximum concentrations of restricted substances)

		RoHS Directive 2011/65/EU
	Mandatory / voluntary	Mandatory
	Public Procurement	
	Others	
Procedures	Additional legal acts in order to implement legislation	1. For the purposes of adapting Annexes III and IV to scientific and technical progress, (...) the Commission shall adopt by means of individual delegated acts in accordance with Article 20 and subject to the conditions laid down in Articles 21 and 22, the following measures: (a) inclusion of materials and components of EEE for specific applications in the lists in Annexes III and IV (...) .(Article 5) (b) deletion of materials and components of EEE from the lists in Annexes III and IV where the conditions set out in point (a) are no longer fulfilled.
	Decision making process	Delegated acts: Committee procedure. The Commission shall be assisted by the committee set up pursuant to Article 39 of Directive 2008/98/EC. That committee shall be a committee within the meaning of Regulation (EU) No 182/2011.(Article 19)
	Actors and responsibilities	Obligated parties: manufacturers, importers, and distributors (Art. 7,9,10) Manufacturers must declare compliance by using the CE marking. Can be exempt from liability if they show due diligence by ensuring compliance vis-a-vis suppliers, in one of the following ways: Obtain declarations of compliance for materials, components and other parts from suppliers, or selected analysis. Are required to keep technical files (no third party testing) Market surveillance and controls of EEE entering the Union market: Member States shall carry out market surveillance in accordance with Articles 15 to 29 of Regulation (EC) No 765/2008 (Article 18). Penalties: MS (Art. 23) Delegated acts: according to committee procedure.
	Update	No later than 22 July 2014 the Commission shall examine the need to amend the scope of this Directive in respect of the EEE referred to in Article 2, and shall present a report thereon to the European Parliament and the Council accompanied by a legislative proposal, if appropriate, with respect to any additional exclusions related to that EEE. 2. No later than 22 July 2021 the Commission shall carry out a general review of this Directive, and shall present a report to the European Parliament and the Council accompanied, if appropriate, by a legislative proposal (Article 24). Adaptation of the Annexes to scientific and technical progress 1. For the purposes of adapting Annexes III and IV to scientific and technical progress, and in order to achieve the objectives set out in Article 1, the Commission shall adopt by means of individual delegated acts in accordance with Article 20 and subject to the conditions laid down in Articles 21 and 22, the following measures: (a) inclusion of materials and components of EEE for specific applications in the lists in Annexes III and IV (...) .(Article 5) Review and amendment of list of restricted substances in Annex II: a review, based on a thorough assessment, and amendment of the list of restricted substances in Annex II shall be considered by the Commission before 22 July 2014, and periodically thereafter on its own initiative or following the submission of a proposal by a Member State containing the information referred to in paragraph 2. (Art. 6)
References to other legislation		(Directive 2002/95/EC=> amendment) Scope: This Directive shall apply without prejudice to the requirements of Union legislation on safety and health, and on chemicals, in particular Regulation (EC) No 1907/2006 (REACH), as well as the requirements of specific Union waste management legislation (Article 2). Art. 5a: (a) inclusion of materials and components of EEE for specific applications in the lists in

		RoHS Directive 2011/65/EU
		Annexes III and IV, provided that such inclusion does not weaken the environmental and health protection afforded by Regulation (EC) No 1907/2006 (REACH) and where any of the following conditions is fulfilled...(Article 5) Art. 6: The review and amendment of the list of restricted substances in Annex II shall be coherent with other legislation related to chemicals, in particular Regulation (EC) No 1907/2006 (REACH), and shall take into account, inter alia, Annexes XIV and XVII to that Regulation

Table 52 - Detailed policy instrument mapping: WEEE Directive 2012/19/EU

		WEEE Directive 2012/19/EU
Summary		- Product design (Article 4) - Separate collection (Article 5) - Disposal and transport of collected WEEE (Aricle 6) - Collection rate => minimum collection rates (Article 7) - Proper treatment (Article 8) - Recovery targets (Article 8) => producers meet the minimum targets set out in Annex V - Financing in respect of WEEE from private households (Aricle 12) - Financing in respect of WEEE from users other than private households (Aricle 13) - Information for users (Article 14)
Objective		The purpose of this Directive is to contribute to sustainable production and consumption by, as a first priority, the prevention of WEEE and, in addition, by the re-use, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste and to contribute to the efficient use of resources and the retrieval of valuable secondary raw materials. It also seeks to improve the environmental performance of all operators involved in the life cycle of EEE, e.g. producers, distributors and consumers and, in particular, those operators directly involved in the collection and treatment of WEEE (6). Measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste from electrical and electronic equipment (WEEE) and by reducing overall impacts of resource use and improving the efficiency of such use in accordance with Articles 1 and 4 of Directive 2008/98/EC, thereby contributing to sustainable development (Article 1).
Product Scope	Theoretical	This Directive shall apply to electrical and electronic equipment (EEE) as follows: (a) from 13 August 2012 to 14 August 2018 (transitional period), subject to paragraph 3, to EEE falling within the categories set out in Annex I. Annex II contains an indicative list of EEE which falls within the categories set out in Annex I; (b) from 15 August 2018, subject to paragraphs 3 and 4, to all EEE. All EEE shall be classified within the categories set out in Annex III. Annex IV contains a non-exhaustive list of EEE which falls within the categories set out in Annex III (open scope) (Article 2.1). 2. This Directive shall apply without prejudice to the requirements of Union legislation on safety and health, on chemicals, in particular Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency (3), as well as of specific Union waste management or product design legislation (Article 2.2). (..)
	Practical / Implemented for the following products	
	Scope exemptions	This Directive shall not apply to any of the following EEE: (a) equipment which is necessary for the protection of the essential interests of the security of Member States, including arms, munitions and war material intended for specifically military purposes; (b) equipment which is specifically designed and installed as part of another type of equipment that is excluded from or does not fall within the scope of this Directive, which can fulfil its function only if it is part of that equipment; (c) filament bulbs (Article 2.3). In addition to the equipment specified in paragraph 3, from 15 August 2018, this Directive shall not apply to the following EEE: (a) equipment designed to be sent into space; (b) large-scale stationary industrial tools; (c) large-scale fixed installations, except any equipment which is not specifically designed and installed as part of those installations; (d) means of transport for persons or goods, excluding electric two-wheel vehicles which are not type-approved; (e) non-road mobile machinery made available exclusively for professional use; (f) equipment specifically designed solely for the purposes of research and development that

		WEEE Directive 2012/19/EU
		is only made available on a business-to-business basis; (g) medical devices and in vitro diagnostic medical devices, where such devices are expected to be infective prior to end of life, and active implantable medical devices (Article 2.4).
	Other requirements	
Aspects considered	Environmental aspects	Disposal of waste; efficient use of resources; reducing the adverse impacts of the generation and management of waste on human health and the environment
	Life cycle phases	Production and end-of-life
	Other aspects	
Product-related policy mechanisms	Information / Labelling	
	Minimum standards / requirements	Procedural requirements: Separate collection (Article 5): - Member States shall adopt appropriate measures to minimise the disposal of WEEE in the form of unsorted municipal waste, to ensure the correct treatment of all collected WEEE and to achieve a high level of separate collection of WEEE, - systems allowing final holders and distributors to return such waste at least free of charge - when supplying a new product, distributors are responsible for ensuring that such waste can be returned to the distributor Collection rate (Article 7) Proper treatment (Aricle 8)
	Mandatory / voluntary	Mandatory recycling requirements Voluntary: MS shall encourage recycling-friendly design (in line with Ecodesign Directive)
	Public Procurement	
	Others	
Procedures	Additional legal acts in order to implement legislation	Delegated acts (Article 20)
	Decision making process	Before the Annexes are amended, the Commission shall, inter alia, consult producers of EEE, recyclers, treatment operators and environmental organisations and employees' and consumer associations (Article 19). Committee procedure: The Commission shall be assisted by the Committee established by Article 39 of Directive 2008/98/EC. That committee shall be a committee within the meaning of Regulation (EU) No 182/2011 (Article 21).
	Actors and responsibilities	Member States and Commission Member States shall encourage cooperation between producers and recyclers and measures to promote the design and production of EEE, notably in view of facilitating re-use, dismantling and recovery of WEEE, its components and materials (Article 4). Penalties: MS (Art. 22)
	Update	No later than 14 August 2015, the Commission shall review the scope of this Directive set out in point (b) of paragraph 1, including the parameters to distinguish between large and small equipment in Annex III, and shall present a report thereon to the European Parliament and to the Council. The report shall be accompanied by a legislative proposal, if appropriate (Article 2.5).
References to other legislation		Product design: Member States shall, without prejudice to the requirements of Union legislation on the proper functioning of the internal market and on product design, including Directive 2009/125/EC (ECODESIGN), encourage cooperation between producers and recyclers and measures to promote the design and production of EEE, notably in view of facilitating re-use, dismantling and recovery of WEEE, its components and materials (Article 4).

Table 53 - Detailed policy instrument mapping: REACH Directive 1999/45/EC old; repealed by 1272/2008 and 1907/2006

		REACH Directive 1999/45/EC old; repealed by 1272/2008 and 1907/2006
Summary		
Objective		Concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations (Subheading).
Product Scope	Theoretical	Classification, packaging and labelling of dangerous preparations (Article 1.1).
	Practical / Implemented for the following products	This Directive shall apply to preparations which: contain at least one dangerous substance within the meaning of Article 2, and are considered dangerous within the meaning of Article 5, 6 or 7 (Article 1.2). Without prejudice to Directive 91/414/EEC, the articles on classification, packaging, labelling and safety data sheets of this Directive shall apply to plant protection products (Aricle 1.4).
	Scope exemptions	This Directive shall not apply to the following preparations in the finished state, intended for the final user: (a) medicinal products for human or veterinary use, as defined in Directive 65/65/EEC (1); (b) cosmetic products as defined in Directive 76/768/EEC (2); (c) mixtures of substances which, in the form of waste, are covered by Directives 75/442/EEC (3) and 78/319/EEC (4); (d) foodstuffs; (e) animal feedingstuffs; (f) preparations containing radioactive substances as defined by Directive 80/836/Euratom (5); (g) medical devices which are invasive or used in direct physical contact with the human body in so far as Community measures lay down provisions for the classification and labelling of dangerous substances and preparations which ensure the same level of information provision and protection as this Directive. 6. This Directive shall not apply to: — the carriage of dangerous preparations by rail, road, inland waterway, sea or air, — preparations in transit which are under customs supervision, provided they do not undergo any treatment or processing (Article 1.5).
	Other requirements	
Aspects considered	Environmental aspects	The evaluation of the hazards of a preparation shall be based on the determination of: — - physico-chemical properties, — - properties affecting health, — - environmental properties. These different properties shall be determined in accordance with the provisions laid down in Articles 5, 6 and 7 (Article 3).
	Life cycle phases	Production
	Other aspects	
Product-related policy mechanisms	Information / Labelling	Labelling (Article 10, 11); registration. All manufacurers and importers have to register chemicals (1) exceeding a certain tonnage, with a staged approach, and (2) of special concern. Substances of very high concern need to be notified to ECHA and may be subject to authorization. Also, there are upstream and downstream information and communication requirements.
	Minimum standards /	

		REACH Directive 1999/45/EC old; repealed by 1272/2008 and 1907/2006
	requirements	
	Mandatory / voluntary	Mandatory
	Public Procurement	
	Others	
Procedures	Additional legal acts in order to implement legislation	Member States shall apply the laws, regulations and administrative provisions referred to in paragraph 1: (a) to preparations not within the scope of Directive 91/414/ EEC or Directive 98/8/EC as from 30 July 2002; and (b) to preparations within the scope of Directive 91/414/EEC or Directive 98/8/EC as from 30 July 2004 (Article 22).
	Decision making process	The Commission shall be assisted by a committee composed of the representatives of the Member States and chaired by the representative of the Commission. The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 205(2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The chairman shall not vote. The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the committee (Article 20). ECHA is keeping and amending a list of substances of very high concern
	Actors and responsibilities	Member States shall appoint the body or bodies responsible for receiving information, including chemical composition, relating to preparations placed on the market and considered dangerous on the basis of their health effects or on the basis of their physico-chemical effects (Article 17). ECHA Member States (Article 8) Penalties: MS (Art. 19)
	Update	Amendments required to adapt the Annexes to this Directive to technical progress shall be adopted in accordance with the procedure laid down in Article 29(4)(a) of Directive 67/548/ EEC (Article 20).
References to other legislation		Objectives and scope: (...)Without prejudice to Directive 91/414/EEC, the articles on classification, packaging, labelling and safety data sheets of this Directive shall apply to plant protection products(..)(Article 1.4). Determination of dangerous properties of preparations: Where the determination of dangerous properties is carried out in accordance with Articles 5, 6 and 7, all dangerous substances within the meaning of Article 2 and in particular those which: — - are listed in Annex I to Directive 67/548/EEC, etc. (and further references to 67/548...Classification, packaging, and labelling of dangerous substances) (Article 3) — Evaluation of the hazards deriving from physico-chemical properties: (...) 1. The hazards of a preparation deriving from its physicochemical properties shall be assessed by determining, by means of the methods specified in Part A of Annex V to Directive 67/ 548/EEC, the physico-chemical properties of the preparation necessary for appropriate classification and labelling in accordance with the criteria laid down in Annex VI to that

		REACH Directive 1999/45/EC old; repealed by 1272/2008 and 1907/2006
		Directive. 5. The hazards deriving from the physico-chemical properties of a preparation covered by Directive 91/414/EEC (plant protection products) shall be assessed by determining the physico-chemical properties of the properties of the preparation necessary for appropriate classification in accordance with the criteria set out in Annex VI to Directive 67/548/EEC (...) - — preparations placed on the market in the form of aerosols satisfy the provisions of Article 9a of Directive 75/324/ EEC (1) (Article 5) Evaluation of health hazards: 1. The health hazards of a preparation shall be assessed by one or more of the following procedures: (..) by determining the toxicological properties of the preparation necessary for appropriate classification in accordance with the criteria in Annex VI to Directive 67/ 548/EEC. These properties shall be determined by means of the methods laid down in Part B of Annex V to Directive 67/548/EEC, unless, in the case of plant protection products, other internationally recognised methods are acceptable in accordance with the provisions of Annexes II and III to Directive 91/414/EEC. (..) 2. Without prejudice to the requirements of Directive 91/ 414/EEC, only where it can be scientifically demonstrated by the person responsible for placing the preparation on the market that the toxicological properties of the preparation cannot correctly be determined by the method outlined in paragraph 1(a), or on the basis of existing test results on animals, the methods outlined in paragraph 1(b) may be used, provided they are justified or specifically authorised under Article 12 of Directive 86/609/EEC. When a toxicological property is established by the methods outlined in paragraph 1(b) to obtain new data, the test shall be conducted in compliance with the principles of good laboratory practice provided for in Council Directive 87/18/ EEC of 18 December 1986 on the harmonisation of laws, regulations and administrative provisions relating to the application of the principles of good laboratory practice and the verification of their applications for tests on chemical substances (1) and the provisions of Directive 86/609/EEC, in particular Articles 7 and 12 thereof (Article 6)

Table 54 - Detailed policy instrument mapping: REACH REGULATION (EC) No 1907/2006; establishing ECHA and amending 1999/45

		REACH REGULATION (EC) No 1907/2006; establishing ECHA and amending 1999/45
Summary		
Objective		Concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (Subheading). The purpose of this Regulation is to ensure a high level of protection of human health and the environment, including the promotion of alternative methods for assessment of hazards of substances, as well as the free circulation of substances on the internal market while enhancing competitiveness and innovation (Aricle 1.1).
Product Scope	Theoretical	These provisions shall apply to the manufacture, placing on the market or use of such substances on their own, in preparations or in articles and to the placing on the market of preparations. (Article 1.2).
	Practical / Implemented for the following products	
	Scope exemptions	This Regulation shall not apply to: (a) radioactive substances within the scope of Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation1; (b) substances, on their own, in a preparation or in an article, which are subject to customs supervision, provided that they do not undergo any treatment or processing, and which are in temporary storage, or in a free zone or free warehouse with a view to re-exportation, or in transit; (c) non-isolated intermediates; (d) the carriage of dangerous substances and dangerous substances in dangerous preparations by rail, road, inland waterway, sea or air (Article 2.1) Waste as defined in Directive 2006/12/EC (Article 2.2)
	Other requirements	
Aspects considered	Environmental aspects	
	Life cycle phases	Production
	Other aspects	
Product-related policy mechanisms	Information / Labelling	
	Minimum standards / requirements	
	Mandatory / voluntary	Mandatory
	Public Procurement	
	Others	Registration
Procedures	Additional legal acts in order to implement legislation	This Regulation shall apply without prejudice to: (a) Community workplace and environmental legislation, including Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work1, Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control2; Directive 98/24/EC, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy3 and Directive 2004/37/EC;

		REACH REGULATION (EC) No 1907/2006; establishing ECHA and amending 1999/45
		(b) Directive 76/768/EEC as regards testing involving vertebrate animals within the scope of that Directive (Article 2.4)
	Decision making process	
	Actors and responsibilities	The Commission, the relevant Community body, manufacturer
	Update	
References to other legislation		

Table 55 - Detailed policy instrument mapping: Energy Star: REGULATION (EC) No 106/2008

		Energy Star: REGULATION (EC) No 106/2008
Summary		Conclusion of the Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programmes for office equipment.
Objective		This Regulation establishes the rules for the Community energy-efficiency labelling programme for office equipment (hereinafter referred to as the Energy Star programme) as defined in the Agreement (Aricle 1).
Product Scope	Theoretical	Office equipment product groups defined in Annex C to the Agreement (Article 2).
	Practical / Implemented for the following products	see Annex C of the Agreement
	Scope exemptions	
	Other requirements	
Aspects considered	Environmental aspects	Energy consumption / energy efficiency
	Life cycle phases	Use phase
	Other aspects	
Product-related policy mechanisms	Information / Labelling	Labelling / Logo
	Minimum standards / requirements	No
	Mandatory / voluntary	Participation in the Energy Star programme shall be on a voluntary basis (Article 4.3).
	Public Procurement	For the duration of the Agreement, the Commission and the other Community institutions, as well as central government authorities within the meaning of Directive 2004/18/EC (Procurement) (...) shall, without prejudice to Community and national law and economic criteria, specify energy-efficiency requirements not less demanding than the Common Specifications (...) (Article 6).
	Others	Registration
Procedures	Additional legal acts in order to implement legislation	No
	Decision making process	Award of the logo: Producers apply to the COM to become part of the Programme. COM authorizes participation (Art. 5). Afterwards, producers can apply the logo Development of criteria: Criteria are decided by agreement with the USA via Council Decision. Commission consults with ECESB in order to propose a revision to USEPA or react to a revision proposed by USEPA. "With a view to preparing for the revision of the Common Specifications and of the office equipment product groups covered by Annex C to the Agreement, and before submitting a draft proposal or replying to USEPA in accordance with the procedures laid down in the Agreement and in Council Decision 2006/1005/EC (Energy Star Decision) (...) the steps set out in paragraphs 2 to 5 shall be taken (Article 11). Work plan: In accordance with the objective set out in Article 1, the Commission shall establish a work plan (Article 10). Subject matter: adaption of objectives, proposal of new product groups, promotional activities coordination with other policies
	Actors and responsibilities	Commission to award logo, to establsh work plan, to negotiate with USEPA The Commission shall establish a European Community Energy Star Board (ECESB) consisting of national representatives as referred to in Article 9 and representatives of interested parties. The ECESB shall review the implementation of the Energy Star programme within the Community and shall provide the Commission with advice and assistance, as appropriate, to enable it to carry out its role as Management Entity, as referred to in Article IV of the Agreement (Article 8).

		Energy Star: REGULATION (EC) No 106/2008
		Each Member State shall designate, as appropriate, national energy policy experts, authorities or persons (hereinafter referred to as national representatives) responsible for carrying out the tasks provided for in this Regulation (Article 9). Market surveillance and control of use of logo: MS and COM (Art.12)
	Update	The Commission may request the ECESB to make a proposal for the revision of the Agreement or of the Common Specifications for a product (Aricle 11.2). One year before the expiry of the Agreement, the Commission shall produce and submit to the European Parliament and the Council a report monitoring the energy efficiency of the office equipment market in the Community and evaluating the effectiveness of the Energy Star programme (Article 13). Before the Parties to the Agreement discuss its renewal in accordance with Article XIV, paragraph 2 thereof, the Commission shall assess the Energy Star programme in the light of the experience gained during its operation (Article 14).
References to other legislation		General principles: The Energy Star programme shall be coordinated, as appropriate, with other Community labelling or quality certification arrangements as well as with schemes such as, in particular, the Community eco-label award scheme, established by Regulation (EEC) No 880/92 (ECOLABEL OLD), the indication by labelling and standard product information of the consumption of energy and other resources by household appliances, established by Directive 92/75/EEC (Energy label old) and measures implementing Directive 2005/32/EC (Article 4) (Ecodesign old)

Table 56 - Detailed policy instrument mapping: Ecolabel REGULATION (EC) No 66/2010

		Ecolabel REGULATION (EC) No 66/2010
Summary		
Objective		This Regulation lays down rules for the establishment and application of the voluntary EU Ecolabel scheme (Article 1).
Product Scope	Theoretical	Any goods or services which are supplied for distribution, consumption or use on the Community market whether in return for payment or free of charge (Article 2.1).
	Practical / Implemented for the following products	see http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html
	Scope exemptions	Medicinal products for human use (defined in Directive 2001/83/EC or for veterinary use (defined in Directive 2001/82/EC) and any type of medical device (Article 2).
	Other requirements	
Aspects considered	Environmental aspects	The most significant environmental impacts, in particular the impact on climate change, the impact on nature and biodiversity, energy and resource consumption, generation of waste, emissions to all environmental media, pollution through physical effects and use and release of hazardous substances (Article 6.3a).
	Life cycle phases	Considering the whole life cycle of products (Article 6.3).
	Other aspects	Where appropriate, social and ethical aspects, e.g. by making reference to related international conventions and agreements such as relevant ILO standards and codes of conduct (Article 6.3e). As far as possible the principle of reducing animal testing (Article 6.3g).
Product-related policy mechanisms	Information / Labelling	Labelling
	Minimum standards / requirements	No
	Mandatory / voluntary	Voluntary
	Public Procurement	Promotion of the EU Ecolabel: awareness-raising actions and information and public education campaigns for consumers, producers, manufacturers, wholesalers, service providers, public purchasers, traders, retailers and the general public. Member States shall encourage the use of the "Manual for authorities awarding public contracts", as specified in Annex I, Part A, point 5. For this purpose, Member States shall consider, for example, the setting of targets for the purchasing of products meeting the criteria specified in that Manual (Article 12).
	Others	
Procedures	Additional legal acts in order to implement legislation	Ecolabel criteria developed in accordance with the procedure described in column R will be in the legal form of implementing measures, "in accordance with the regulatory procedure with scrutiny referred to in Article 16(2). (comitology procedure)
	Decision making process	Award of the label: to be decided by the competent bodies of the member states (Art. 9) Development and revision of EU Ecolabel criteria: Following consultation of the EUEB, the Commission, Member States, competent bodies and other stakeholders may initiate and lead the development or revision of EU Ecolabel criteria (Article 7). By 19 February 2011, the EUEB and the Commission shall agree on a working plan including a strategy and a non-exhaustive list of product groups. This plan will consider other Community action (e.g. in the field of green public procurement) and may be updated according to the latest strategic objectives of the Community in the field of the environment. This plan shall be regularly updated (Article 7.4). Where criteria have already been developed under another ecolabel scheme complying with the requirements of EN ISO 14024 type I environmental labels for a product group for which no EU Ecolabel criteria have been established, any Member State in which the other ecolabel scheme is recognised may, after consulting the Commission and the EUEB, propose those criteria for development under the EU Ecolabel scheme (Article 7.2).

		Ecolabel REGULATION (EC) No 66/2010
		Detailed description of the procedure in ANNEX 1; final criteria will have the form of implementing measures
	Actors and responsibilities	Member States, The Commission, the competent bodies, the EUEB Ecolabelling Board: The Commission shall establish a European Union Ecolabelling Board (EUEB) consisting of the representatives of the competent bodies of all the Member States, as referred to in Article 4, and of other interested parties. (...) It shall (...) provide the Commission with advice and assistance in these areas and, in particular, issue recommendations on minimum environmental performance requirements. The Commission shall ensure that, in the conduct of its activities, the EUEB observes a balanced participation of all relevant interested parties in respect of each product group, such as competent bodies, producers, manufacturers, importers, service providers, wholesalers, retailers, notably SMEs, and environmental protection groups and consumer organisations. (Article 5). Competent bodies: Each Member State shall designate the body or bodies, within government ministries or outside, responsible for carrying out the tasks provided for in this Regulation (...) and ensure that they are operational. (Article 4). - e.g. award of the label (Art.9); market surveillance (Art. 10)
	Update	Report: By 19 February 2015, the Commission shall submit to the European Parliament and the Council a report on the implementation of the EU Ecolabel scheme. The report shall also identify elements for a possible review of the scheme (Article 14).
References to other legislation		General requirements for EU Ecolabel criteria: (…) Before developing EU Ecolabel criteria for food and feed products, as defined in Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law (...) (Article 6.5) The EU Ecolabel may not be awarded to goods containing substances or preparations/mixtures meeting the criteria for classification as toxic, hazardous to the environment, carcinogenic, mutagenic or toxic for reproduction (CMR), in accordance with Regulation (EC) No 1272/2008 (REACH) of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (2 (REACH)), nor to goods containing substances referred to in Article 57 of Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency (1). (Article 6.6)

Table 57 - Detailed policy instrument mapping: General Product Safety Directive: 2001/96

		General Product Safety Directive: 2001/96
Summary		
Objective		
Product Scope	Theoretical	Any consumer product (Art. 1,2)
	Practical / Implemented for the following products	
	Scope exemptions	Products for which other, more specific legislation applies, certain categories of second hand products (Art.1, 2)
	Other requirements	
Aspects considered	Environmental aspects	None
	Life cycle phases	Production, use phase
	Other aspects	
Product-related policy mechanisms	Information / Labelling	Information requirements of producers towards consumers
	Minimum standards / requirements	Product-related requirements: manufacturers and importers are requiered to put only safe products on the market. This is determined by national law, national voluntary standards, or requirements set up by the commission Procedural requirements: testing, keeping register of complaints
	Mandatory / voluntary	Mandatory
	Public Procurement	
	Others	
Procedures	Additional legal acts in order to implement legislation	Commission sets up specific product-related and information requirements by way of comitology procedure. On the basis of these requirements, it issues a mandate for standardisation bodies to develop standards. Commission reports every three years to Parliament and Council.
	Decision making process	Development and revision of EU Ecolabel criteria: Following consultation of the EUEB, the Commission, Member States, competent bodies and other stakeholders may initiate and lead the development or revision of EU Ecolabel criteria (Article 7).
	Actors and responsibilities	COM; regulatory committee; market surveillance: MS. Establishment of a product safety network, coordinating with RAPEC
	Update	Report: By 19 February 2015, the Commission shall submit to the European Parliament and the Council a report on the implementation of the EU Ecolabel scheme. The report shall also identify elements for a possible review of the scheme (Article 14).
References to other legislation		This Directive shall be without prejudice to the application of Directive 85/374/EEC.

Table 58 - Detailed policy instrument mapping: GPP: Directive 2004/18/EC on procurement

		GPP: Directive 2004/18/EC on procurement
Summary		
Objective		Coordination of procedures for the award of public works contracts, public supply contracts, and public service contracts (subtitle)
Product Scope	Theoretical	All products, services and works that can be the object of public procurement
	Practical / Implemented for the following products	
	Scope exemptions	
	Other requirements	
Aspects considered	Environmental	No specification
	Life cycle phases	No specification
	Other aspects	
Product-related policy mechanisms	Information / Labelling	
	Minimum standards / requirements	
	Mandatory / voluntary	
	Public Procurement	Allows public purchasers to include environmental criteria (product-related or management-related) into procurement procedures and tender specification; lays down rules for doing so (Erwägungsgründe 5, 29, 33, 44 46. Art. 23 3b: "the technical specifications shall be formulated (...) in terms of performance or functional requirements; the latter may include environmental characteristics. Art. 25: "Contracting authorities may lay down special onditions relating to the performance of a contract, provided that these are compatible with Community law and are indicated in the contract notice or in the specifications. The conditions governing the performance of a contract may, in particular, concern social and environmental considerations." Art. 53: "1. Without prejudice to national laws (...) the criteria on which the contracting authorities shall base the award of public contracts shall be either: (a) (...) various criteria (...) for example, quality, price, technical merit, aesthetic and functional characteristics, environmental characteristics, (...) or (b) the lowest price only.
	Others	
Procedures	Additional legal acts in order to implement legislation	None
	Decision making process	
	Actors and responsibilities	
	Update	
References to other legislation		Art. 23 (6): Where contracting authorities lay down environmental characteristics in terms of performance or functional requirements as referred to in paragraph 3(b) they may use the detailed specifications, or, if necessary, parts thereof, as defined by European or (multi-) national eco-labels, or by and any other eco-label, provided that: — those specifications are appropriate to define the characteristics of the supplies or services that are the object of the contract, — the requirements for the label are drawn up on the basis of scientific information, — the eco-labels are adopted using a procedure in which all stakeholders, such as government bodies, consumers, manufacturers, distributors and environmental organisations can participate, and — they are accessible to all interested parties. Contracting authorities may indicate that the products and services bearing the eco-label are presumed to comply with the technical specifications laid down in the contract documents; they must accept any other appropriate means of proof, such as a technical dossier of the manufacturer or a test report from a recognised body.

Table 59 - Detailed policy instrument mapping: F-Gas-regulation No 842/2006

		F-Gas-regulation No 842/2006
Summary		This Regulation addresses the containment, use, recovery and destruction of the fluorinated greenhouse gases listed in Annex I; the labelling and disposal of products and equipment containing those gases; the reporting of information on those gases; the control of uses referred to in Article 8 and the placing on the market prohibitions of the products and equipment referred to in Article 9 and Annex II; and the training and certification of personnel and companies involved in activities provided for by this Regulation.
Objective		The objective of this Regulation is to contain, prevent and thereby reduce emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol. (Art.1)
Product Scope	Theoretical	Annex I to this Regulation contains a list of the fluorinated greenhouse gases currently covered by this Regulation. (Art.1) => all products that contain these gases Special provisions for: refrigeration, air conditioning and heat pump equipment, including their circuits, as well as fire protection systems, which ontain fluorinated greenhouse gases listed in Annex I (Art. 3); (a) the cooling circuits of refrigeration, air-conditioning and heat pump equipment; (b) equipment containing fluorinated greenhouse gas-based solvents; (c) fire protection systems and fire extinguishers; and (d) high-voltage switchgear. (...) other products and equipment, including mobile equipment unless it is serving military operations (..) to the extent that it is technically feasible and does not entail disproportionate cost(Art. 4) certain types of (a) refrigeration products and equipment (b) refrigeration and air conditioning products and equipment (other than those contained in motor vehicles), heat pumps, fire protection systems and fire extinguishers (...) (c) switchgear (..) (d) all fluorinated greenhouse gas containers. (Art. 7)
	Practical / Implemented for the following products	
	Scope exemptions	
	Other requirements	
Aspects considered	Environmental aspects	F-gas content
	Life cycle phases	Production, use phase, disposal
	Other aspects	
Product-related policy mechanisms	Information / Labelling	Reporting requirements for producers, importers and exporters of F-gases (Art. 6). Without prejudice to the provisions of Directive 67/548/EEC (1) and of Directive 1999/45/EC (2) in respect of the labelling of dangerous substances and preparations, the products and equipment (...) shall not be placed on the market unless the chemical names of the fluorinated greenhouse gases are identified by way of a label using the accepted industry nomenclature. (Art. 7(1))
	Minimum standards / requirements	Product-related requirements: prevent leakage, repair leaks, install leakage detection systems (Art.3). Prohibition of certain substances (Art. 8, 9) process-related requirements: check for leakages at defined intervals, keep track of gases used (Artz. 3), requirements for recovery (Art. 4)
	Mandatory / voluntary	
	Public Procurement	
	Others	Training and certification: Commission shall develop minimum standards for personell dealing with F-gases, and MS shall adapt their training programmes (Art. 5)
Procedures	Additional legal acts in order to implement legislation	Various Commission regulations, p.ex. on leakage detection requirements (Commission Regulation (EC) No 1516/2007), training, certification etc. determination of labelling format (Commission Regulation (EC) No 1494/2007)
	Decision making process	Comitology for defining leakage detection requirements and form of the label

		F-Gas-regulation No 842/2006
	Actors and responsibilities	
	Update	In the light of revisions provided for by Article 5(3) of the Kyoto Protocol and accepted by the Community and its Member StatesAnnex I may be reviewed and if appropriate may then be updated (Art. 1) Review envisaged for 2007 and 2010 (Art. 10). Commission Report available from 2011
References to other legislation		

Table 60 - Detailed policy instrument mapping: Regulation 1222/2009 Tyre labelling

		Regulation 1222/2009 Tyre labelling
Summary		
Objective		1. The aim of this Regulation is to increase the safety, and the economic and environmental efficiency of road transport by promoting fuel-efficient and safe tyres with low noise levels. (Art. 1.1)
Product Scope	Theoretical	This Regulation shall apply to C1, C2 and C3 tyres. (Art. 2.1) 'C1, C2 and C3 tyres' means the tyre classes defined in Article 8 of Regulation (EC) No 661/2009 (Art. 3.1)
	Practical / Implemented for the following products	
	Scope exemptions	This Regulation shall not apply to: (a) re-treaded tyres; (b) off-road professional tyres; (c) tyres designed to be fitted only to vehicles registered for the first time before 1 October 1990; (d) T-type temporary-use spare tyres; (e) tyres whose speed rating is less than 80 km/h; (f) tyres whose nominal rim diameter does not exceed 254 mm or is 635 mm or more; (g) tyres fitted with additional devices to improve traction properties, such as studded tyres; (h) tyres designed only to be fitted on vehicles intended exclusively for racing. (Art. 2.2)
	Other requirements	
Aspects considered	Environmental aspects	Fuel efficiency, noise
	Life cycle phases	Production, use phase
	Other aspects	Wet grip
Product-related policy mechanisms	Information / Labelling	This Regulation establishes a framework for the provision of harmonised information on tyre parameters through labelling, allowing end-users to make an informed choice when purchasing tyres. (Art. 1.2)
	Minimum standards / requirements	None
	Mandatory / voluntary	Mandatory
	Public Procurement	Incentives Member States shall not provide incentives with regard to tyres below class C with respect to either fuel efficiency or wet grip within the meaning of Annex I, Parts A and B respectively. Taxation and fiscal measures do not constitute incentives for the purpose of this Regulation. (Art. 10)
	Others	
Procedures	Additional legal acts in order to implement legislation	The following updates shall be made via comitology procedure: (a) introduction of information requirements with respect to wet grip grading of C2 and C3 tyres, (...) (b) adaptation (...) of grip grading to the technical specificities of tyres primarily designed to perform better in ice and/or snow conditions than a normal tyre (...) (c) adaptation of Annexes I to IV to technical progress. (Art. 11, 13) Review by COM 1. March 2016 (Art. 14)
	Decision making process	Comitology
	Actors and responsibilities	Suppliers, distributors, vehicle suppliers and distributors, MS suppliers must provide a sticker for C1 and C2 type tyres, and state the fuel efficiency class, the external rolling noise class and measured value and, where applicable, the wet grip class, of C1, C2 and C3 tyres in technical promotional material (Art.4) Distributors must attach the label in a visible way, or: "Where tyres offered for sale are not visible to the end-user, distributors shall provide end-users with information on the fuel efficiency class, wet grip class and external rolling noise

		Regulation 1222/2009 Tyre labelling
		class and measured value of those tyres. 3. For C1, C2 and C3 tyres, distributors shall state the fuel efficiency class, the external rolling noise measured value and, where applicable, the wet grip class, as set out in Annex I, on or with the bills delivered to end-users when they purchase tyres." (Art. 5) (Where there is a choice of) different tyres to be fitted on a new vehicle (...), vehicle suppliers and distributors shall, before the sale, provide (customers) with information (...) on the fuel efficiency class, the external rolling noise class and measured value, and, where applicable, the wet grip class of C1, C2 and C3 tyres (...)That information shall be included at least in the technical promotional material. (Art. 6) Market surveillance: MS
	Update	
References to other legislation		

Annex B Detailed product lists per legislation

Ecodesign	Label	Ecolabel	Energy Star	RoHS	WEEE	REACH	Energy Efficiency Directive	EPBD	GPSD	F-Gas
energy-related products except means of transport	**energy-related products except means of transport**	**any goods or services**	**Office equipment (potentially other energy-using equipment)**	**electrical and electronic equipment, except for PV, means of transport, some industrial, military and space applications; products for research and development; medical implants**	**Until 2018: electrical and electronic equipment in line with RoHs, but PV included and filament bulbs, military equipment, parts excluded. From 2018: all EEE; exemptions in line with RoHS, plus: medical equipment that could be infective excluded;**	**In principle all products which contain chemicals or preparations**	**Buildings; products that can be the object of public procurement; heating and cooling equipment; energy transformation, transmission and distribution**	**Buildings within the Union (Article 1.1); building units; building elements; technical building systems;**	**all consumer products, excluding certain second hand products**	**all equipment containing defined F-gases**
Simple Set-Top Boxes				IT and telecommunications equipment.	IT and telecommunications equipment.				Audio, video and similar electronic apparatus (2012/29/EU)	
Boilers and combiboilers,	Boilers and combiboilers,	Heat pumps		Monitoring and control instruments	Monitoring and control instruments		heating and cooling equipment;	technical building systems; heating and air-conditioning systems in buildings;		heat pumps
Water heaters,	Water heaters,			Monitoring and control instruments	Monitoring and control instruments		heating and cooling equipment;	technical building systems; heating and air-conditioning systems in buildings;		
PCs (Desktops and Laptops) and monitors,		PCs, Portable computers	Desktop computers, Notebook computers, Integrated desktop computers, Thin	IT and telecommunications equipment.	IT and telecommunications equipment.				Information technology equipment (2012/29/EU)	

Ecodesign	Label	Ecolabel	Energy Star	RoHS	WEEE	REACH	Energy Efficiency Directive	EPBD	GPSD	F-Gas
			clients, Small-scale servers, Workstations, Game consoles							
Imaging Equipment			Printers, Digital duplicators, Copiers, Scanners, Multi-functional devices (MFD), Fax machines, Mailing machines	IT and telecommunications equipment; Consumer equipment.	IT and telecommunications equipment; Consumer equipment.					
TV	TV	TV	Displays	Consumer equipment.	Consumer equipment.				Audio, video and similar electronic apparatus (2012/29/EU)	
Standby and off-mode losses,				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Battery chargers and external power supplies,				Consumer equipment.	Consumer equipment.					
Office lighting,	Office lighting,			Lighting equipment.	Lighting equipment.					
Street lighting	Street lighting			Lighting equipment.	Lighting equipment.					
Room air conditioning,	Room air conditioning,			Large household appliances.	Large household appliances.		heating and cooling equipment;			air conditioning
Comfort Fans,	Comfort Fans,			Large household appliances.	Large household appliances.		heating and cooling equipment;			
Residential Ventilation,	Residential Ventilation,			Large household appliances.	Large household appliances.		heating and cooling equipment;			
Electric motors,				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					

Ecodesign	Label	Ecolabel	Energy Star	RoHS	WEEE	REACH	Energy Efficiency Directive	EPBD	GPSD	F-Gas
Circulators,				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).			technical building systems; heating and air-conditioning systems in buildings;		
Fans				Large household appliances.	Large household appliances.		heating and cooling equipment;			
Water pumps				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Commercial refrigerators and freezers,	Commercial refrigerators and freezers,			Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					refrigeration equipment
Domestic refrigerators and freezers,	Domestic refrigerators and freezers,			Large household appliances.	Large household appliances.					refrigeration equipment
Domestic dishwashers,	Domestic dishwashers,			Large household appliances.	Large household appliances.					
Domestic washing machines,	Domestic washing machines,			Large household appliances.	Large household appliances.					
Solid fuel small combustion installations,	Solid fuel small combustion installations,									
Household tumble driers,	Household tumble driers,			Large household appliances.	Large household appliances.					
Vacuum cleaners	Vacuum cleaners			Small household appliances.	Small household appliances.					
Complex set-top boxes,				IT and telecommunications equipment.	IT and telecommunications equipment.					
Domestic lighting part I “non-directional lamps“,	Domestic lighting part I “non-directional lamps“,	Light bulbs		Lighting equipment.	Lighting equipment.					
Domestic lighting part II “directional	Domestic lighting part II “directional			Lighting equipment.	Lighting equipment.					

Ecodesign	Label	Ecolabel	Energy Star	RoHS	WEEE	REACH	Energy Efficiency Directive	EPBD	GPSD	F-Gas
lamps",	lamps",									
Local room heating products,	Local room heating products,			Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).		heating and cooling equipment;			
Central heating products using hot air to distribute heat,	Central heating products using hot air to distribute heat,			Monitoring and control instruments	Monitoring and control instruments		heating and cooling equipment;	technical building systems; heating and air-conditioning systems in buildings;		heat pumps
Domestic and commercial ovens,	Domestic and commercial ovens,			Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Domestic and commercial hobs and grills,	Domestic and commercial hobs and grills,			Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Professional washing machines, dryers and dishwasher,	Professional washing machines, dryers and dishwasher,			Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Non-tertiary coffee machines,	Non-tertiary coffee machines,			Small household appliances	Small household appliances					
Networked standby losses of energy using products,				IT	IT					
Uninterruptible power supplies (UPS),				IT	IT					
Wastewater pumps,				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Clean water pumps (larger than those under 11),				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					

Ecodesign	Label	Ecolabel	Energy Star	RoHS	WEEE	REACH	Energy Efficiency Directive	EPBD	GPSD	F-Gas
Motors and drives (outside scope of Regulation 640/2009)				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Compressors				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Medical imaging equipment,				Medical devices; but: active implantable medical devices exempted	Medical devices					
Refrigerating and freezing equipment,				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					refrigeration equipment
Transformers,				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).		energy transformation, transmission and distribution			high-voltage switchgear
Sound and imaging equipment,				Consumer equipment	Consumer equipment				Audio, video and similar electronic apparatus (2012/29/EU); personal music players	
Industrial and laboratory furnaces and ovens,				Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).					
Machine tools,				Electrical and electronic tools: but: large-scale stationary industrial tools and mobile machinery for professional use exempted	Electrical and electronic tools.					

Ecodesign	Label	Ecolabel	Energy Star	RoHS	WEEE	REACH	Energy Efficiency Directive	EPBD	GPSD	F-Gas
Air-conditioning and ventilation systems	Air-conditioning and ventilation systems			Monitoring and control instruments	Monitoring and control instruments		heating and cooling equipment;	technical building systems;heating and air-conditioning systems in buildings;		
parts of technical building systems (heating, cooling) already;M possibly in the future: building elements with an influence on energy performance	parts of technical building systems			Other EEE not covered by any of the categories above (ANNEX I).	Other EEE not covered by any of the categories above (ANNEX I).		Buildings; building units, building elements that form part of the building envelope and that have a significant impact on the energy performance of the building envelope; technical building systems	existing buildings,		
distribution (power cables); possibly: power generation				exempted: PV	PV NOT Exempted		energy transformation, transmission and distribution			high-voltage switchgear
Toys, leisure and sports equipment might be included in the future				Toys, leisure and sports equipment	Toys, leisure and sports equipment..					
Automatic dispensers might be included in the future.				Automatic dispensers.	Automatic dispensers.					
Means of transport exempted, but might be included in the future	Means of transport exempted			Means of transport exempted					bicycles and luggage carriers	

Annex C Supporting evidence concerning the appropriateness of labels

C.1 Extracts from the 2008 ELD Impact Assessment

The impact assessment undertaken before the Directive recast in 2010 also presents numbers regarding the cost of the Directive and its implementation, according to different proposed policy options for the recast (EC staff Working Document, Impact Assessment, 2008, chapter 5.5 and Annex 12). It looked at different types of costs, for different types of stakeholders, however, it underlines that figures are indicative. Because of the variety of policy options and the non-reliability of the figures, costs are difficult to interpret and compare to the chosen form of the recast Directive and new label format.

From section 5:
"The main activities causing the administrative costs for Member States and the Commission are:
- Definition of ELD implementing Directives/measures; Ecodesign preparatory studies and product specific impact assessments.
- The extension of the product scope of the ELD would broaden the choice of product groups for which implementing Directives/measures could be adopted. If this would happen, the administrative expenditure would be covered by the usual annual budgetary allocation.
- Costs for the Comitology procedure.

[For manufacturers and retailers]
"The administrative burden due to a possible extension of the scope of the ELD, and subsequent increased number of implementing measures, is composed of actions as follows:
- Printing labels and including them in product packaging (paid by manufacturers);
- Putting labels on products displayed in shops (paid by retailers);
- Testing products (paid by manufacturers but usually already part of the cost for assessing compliance with other legislation like the Ecodesign Directive);
- Industry 'self-policing' of voluntary agreements, 'challenges' etc. (paid by manufacturers). "

From Annex 12 - administrative and transposition cost:
This annex addresses administrative costs as discussed in Chapter 5.5 and based on the background study. The figures it presents are indicative.

"Main administrative costs for Members States and the Commission:
Amendment of the Framework Directive: €5 million in total (€1 million for administrative work on the amendment and €4 million for transposition by Member States).

Transposition cost for the 27 Member States from amended Framework Directive or amended or new implementing Directives of €4 million[42]. Amend an existing implementing Directive or develop a new implementing Directive under the existing ELD: €4.7 million (720.000 million for administrative work on the amendment/development of the new Directive and €4 million for transposition by Member States[43]).

It is to be noted that if the amendment to the Framework ELD would lead to implementation of the ELD with implementing Regulation or Decisions instead of Directives, the one-off €5 million revision cost would lead to savings of €40 million in transposition costs alone for the ten first upgraded or newly developed implementing measure adopted under the new framework.

Administrative cost for manufacturers and retailers

Changes in administrative cost to manufacturers and retailers will occur only if the scope is extended and/or implementing measures are set on new products. These costs will be assessed in product specific impact assessments. The background study shows that the costs are likely to vary considerably depending on the product involved, the number of models subject to testing and the degree of testing already carried out for other purposes, such as under the Ecodesign Directive. One of such shared costs is the testing for conformity assessment, which is estimated to €1000-3000 per product type. Another cost for manufacturers is to provide the background label for retailers on products that are displayed in shops and the black-and-white strip for every product shipped (see Annex 4).

The information required for the label and information fiche is derived from measurements manufacturers already carry out in the course of product development and quality control. Most manufacturers already publish the basic information in their brochure or technical literature but not in easily accessible form for consumers[44]. Thus the matter seems to be more about the accessibility and easiness to understand the information rather than the additional cost of providing it.

The cost for retailers is limited to the display of the right label on the product associated with the strip provided in the product packaging. Accordingly, given that only simple information requirements are set on manufacturers and retailers there is no risk that these actors would not be able to meet the set criteria, unlike in some cases when setting minimum requirements.

In summary, the background study shows that most of the energy efficiency measures are cost-effective, including energy labelling. In many cases there is some increase in operating cost to manufacturers and retailers due to energy labelling requirements. However, these costs can be passed on the consumer.

[42] Precisely €4.050.000 (27 MS x 150 000€)
[43] The background study estimated that the revision of an existing implementing Directive would cost less (€360.000) than the development of a new one. However, there is no such difference in cost given that new technical studies are needed due to market and technical development, including product development, and the same administrative/legal procedure will be used for both. This does not include any add on for overhead costs.
[44] Compliance cost assessment, The energy labelling (refrigerators and freezers) regulations 1994, Department of the Environment.

The background study shows that energy labelling leads to net money savings for the use, as electricity cost over the life time of the appliance will be bigger than any additional purchasing cost for the more efficient model. For example, in the case of EU white goods manufacturers, their operation has become more profitable, appliances cost less and the efficiency has improved with help of technological development and guidance towards more efficient and profitable appliances by the energy label – despite fears by manufacturers when the policy action was initially introduced in the 90ies".

The costs effectiveness of the label seems to be agreed upon. EC staff Working Document, Impact Assessment, 2008, states that "… most of the energy efficiency measures are cost-effective, including energy labelling. In many cases there is some increase in operating cost to manufacturers and retailers due to energy labelling requirements. However, these costs can be passed on the consumer. The background study shows that energy labelling leads to net money savings for the use, as electricity cost over the life time of the appliance will be bigger than any additional purchasing cost for the more efficient model. For example, in the case of EU white goods manufacturers, their operation has become more profitable, appliances cost less and the efficiency has improved with help of technological development and guidance towards more efficient and profitable appliances by the energy label – despite fears by manufacturers when the policy action was initially introduced in the 90ies."

C.2 Extracts from the CSES Cost effectiveness analysis of the Ecodesign Directive

The CSES 92012) study made the following costs estimates for the Ecodesign Directive many of which will incorporate or overlap with costs incurred for the energy labelling Directive.

- "Rough estimates have been made of the costs to the Commission and the Member States of their contributions to Ecodesign developments – they amounted to €18-25 million per year and, a total of €320-450 million in 2005 values for the whole period 2005 - 2020.
- It was not possible to make any definite estimates of costs to industry or of the costs to the consumer for the changing of appliances.
- According to a study quoted, if all products in the transitional period and the first Working Plan are covered, the benefits in the form of energy savings from the Directive would reach a total of €127 billion in 2020 or €90 billion if energy prices remained at 2005 levels.
- Overall, the estimated costs are a small fraction of the expected savings from the measures adopted. Consequently, the evaluation team considers, it is undisputable that the Ecodesign policy would be highly cost-effective, if the resources were available to carry through the current programme to completion in a reasonable time frame. "

From CSES, 2012:

"**3.4.6 Assessment of cost-effectiveness of the Ecodesign Directive**

In this section we bring together the information available on the costs but also compare them with the expected benefits from the implementation of the Ecodesign Directive in order to assess the cost-effectiveness of the Directive. We should note though that it has not been the objective of the evaluation to provide a detailed cost-benefit analysis of the Directive.

There has already been reference to the costs incurred by stakeholders at several points in the preceding sections. It has not been a primary objective of the evaluation to undertake a systematic analysis of the respective costs and benefits associated with the Directive. Nonetheless, as part of commenting on the efficiency with which the Directive is operating we present here estimates of the costs of implementation.

The costs elements identified are as follows:

- Developing the Ecodesign Framework:
  - The initial administrative costs of adopting the Directive
  - The process leading to the Working Plan
  - Monitoring & evaluation
  - Review and revision
- Development and revision of the Implementing Measures
  - Preparatory studies
  - Consultation & decision-making
  - Preparations of standards
  - Other supporting studies and technical analysis
- Implementation & Enforcement of the Regulations
  - Adaption by enterprises of products and production processes
  - On-going compliance costs
  - Market surveillance & enforcement

Different stakeholders incur these costs at different points:

- The Commission: contributions in all three areas listed above and including inputs from the JRC and other bodies close to the Commission;
- The Member States : contribute to the development of the Directive and the IMs and have prime responsibility for surveillance and enforcement;
- Enterprises : adaptation of products and processes, but also compliance costs and inputs into consultation processes;
- Business Associations : inputs particularly into the second area, but also into consultation and lobbying on the legislative framework and monitoring of implementation;
- NGOs : Inputs particularly into the second area, but also into consultation and lobbying on the legislative framework and monitoring of implementation;

- A systematic analysis of enterprise costs has been beyond the scope of the current study. Estimates of the costs to business associations and NGOs are also relatively sketchy. Broad assumptions will have to be made about the cost of these inputs.

Costs to the Commission and Member States

The analysis of the costs to the Commission and the Member States has been based on the following assumptions:

- The estimates distinguish between costs incurred during the 6 year period up to now (2005 – 11) and the costs for a period of similar duration (2012 - 2017). The cut-off point is possibly arbitrary but the periods allow for distinctions between what has already been incurred and what is projected for a reasonable time into the future, while recognising that there is increased uncertainty as we move beyond a certain period.
- An initial assumption of 10 new products resulting from the second working plan has been made. This is based on discussions with the Commission. The conclusion of the second working plan will provide a better base for estimating this number.
- A fix number of Commission staff for each period has been used for the initial calculation of the staff costs incurred. A total of 10 for the period 2006 - 2011 and 14 for the period 2012 - 2017. This is irrespective of the number of products examined and includes work on individual measures but also horizontal activities. The assumption of a fixed number of staff is important and it is conceivable that by 2016 more staff will be involved in the process. We therefore did some further analysis on the basis of a more flexible response.
- We have used an average of 4 years for the whole procedure from the time a preparatory study starts until the entry of an Implementing Measure into force. This represents the experience so far.
- Voluntary agreements have not been considered. Still, as suggested by the Commission, the amount of work involved during the development of a Voluntary Agreement is not always very different from that for an Implementing Measure.
- In the case of Member States, the estimates made were based on information provided by CLASP that indicates a total of around 80 FTE working on Ecodesign and Energy labelling compliance administration in the 30 EEA countries. These are not dissimilar to the estimates provided in section 3.4.3 on the basis of an average number of 2-3 FTE per country. For the period 2012-2017 we assumed an increase to a total of 110 FTE (1 more FTE per country) to reflect the increasing number of products covered and the needs for more extensive market surveillance activities. Furthermore, according to CLASP, expenditure on equipment energy performance regulatory compliance is in the order of €7 million annually.
- A total of 12 reviews of the existing Implementing Measures for the period 2012 - 2016 have been assumed referring to the Implementing Measures already in force when the analysis was conducted.
- In the case of activities (e.g. JRC studies) that took place during the period 2006 - 2011 that it would be reasonable to expect will be repeated in the coming period and for which no data were available we assumed a similar budget.

- Where data on the Ecodesign Directive were not available, consistency with estimates in parallel areas have been maintained. For instance, the initial costs of adopting the revised Directive are estimated at the same level as was given in the Impact Assessment for the Energy Labelling Directive.
- All costs are considered incurred at the time of the initial commitment.
  Bearing these assumptions in mind the main costs estimates are summarised in the Table below. A more detailed analysis is provided in Annex E.

Table D.1 Commission & EEA Member State costs: period 2006 - 2011 and 2012 - 2017 (numbers in €s)

	2006 – 2011	2012 - 2017
Commission		
Initial adoption	1,000,000	-
Staff	8,250,000	11,130,000
Preparatory studies	12,600,000	3,000,000
Work plans	300,000	-
IM reviews		2,400,000
MEEuP and update	375,000	-
Other studies / evaluation	1,060,000	760,000
Standards	n.d.	n.d.
NGOs / SME support	1,000,000	1,000,000
Total	**24,585,000**	**18,290,000**
Cost/year	**4,100,000**	**3,050,000**
EEA States (30)		
Initial adoption	4,000,000	-
Staff	38,400,000	52,800,000
Tests & studies	42,000,000	42,000,000
Total	84,400,000	94,800,000
Costs / year	14,066,000	15,000,000
Total costs	**108,985,000**	**112,330,000**
Total costs/year	**18,164,000**	**18,721,667**

The estimate of the cost to the Commission over the period up to the current year (6 year period of 2006 - 2011) is around € 25 million, including costs involved in the adoption of the current Directive. Over the coming six year period the overall costs to the Commission are estimated to fall to €18.3 million but this number assumes a much small number of new preparatory studies.

The costs to the 30 States of the EEA for the initial period are estimated to be around € 84 million (average of €2.8 million/MS), although, as expected, the cost for each Member State will vary greatly. With the addition of more FTE per State it is expected to increase to around €95 over the next 6 years. On the basis of the assumptions made for the future workload the total cost per year to both Commission and Member States is estimated to be around €18.5million.

One of the key assumptions made in this analysis is that the number of Commission staff will remain the same over the coming period. As already discussed, there have been calls for additional staff from a number of stakeholders in order to speed up the process and to be able to respond to an increasing number of on-going studies. So far, 12 IMs have been completed in the first 6 years (a rate of 2/year). We have assumed that an increase in FTE will lead to a proportional increase in the number of studies completed.

At this point, the Commission operates with around 0.4 FTE for every product covered. If this principle is to be followed and a total of 10 studies are initiated in the coming 6 years, the Commission costs for the coming period will increase only slightly leading to a total of around 24 Implementing Measures in place by 2017. If a higher number of studies are initiated or there are more FTE required per study the costs increase - in the range of €3-€6 million with a total 3-10 additional FTE. Only in the case that the number of new products covered is reduced to 5 will there be a reduction in the total budget and the FTE for the period 2012 - 2017.

For the Member States, an increase in resources to strengthen market surveillance may lead to additional costs of €24-26 million.

Table D.2 - Alternative scenario for the evolution of the Commission and MS budget (period 2012-2017)

	Scenario 1 Same resources 10 new ErPs	Scenario 2 More resources 10 new ErPs	Scenario 3 Same resources 20 new ErPs	Scenario 4 Same resources 5 new ErPs	Scenario 5 High Resources 10 new ErPs
Commission					
FTE / IM in progress	0.4	0.5	0.4	0.4	0.7
FTE / IM in force	0.1	0.2	0.1	0.1	0.2
New ErPs	10	10	20	5	10
Average FTE	15	19	16.5	13.5	23
ErPs / year	2	3	2	2	4
EuPs / ErPs covered by 2017	24	30	24	24	36
Staff costs	**10,740,000**	**13,428,000**	**11,880,000**	**9,720,000**	**16,776,000**
Studies' costs	**3,000,000**	**7,500,000**	**6,000,000**	**1,5000,000**	**3,000,000**
Commission costs	**18,190,000**	**19,828,000**	**21,280,000**	**14,620,000**	**23,176,000**
Additional budget	**660,000**	**2,298,000**	**3,750,000**	**-2,910,000**	**5,646,000**
Member States	**Same resources**	**More resources**		**High resources**	
Total FTE	**110**	**140**		**170**	
Total staff costs	**52,8000**	**67,200,000**		**81,600,000**	
Extra budget	**-**	**24,000,000**		**48,000,000**	

On the basis of these estimates of costs there are questions about the sustainability of the Ecodesign implementation process, even as far as the coverage of additional energy using and energy related products are concerned. These questions would become even more urgent if the Directive were to be extended to cover non-energy related products.

Costs to industry and stakeholders

As indicated in Section 3.3 the data available relating to the costs for industry are still limited and do not allow for a proper assessment of the total administrative costs. Furthermore, in many cases all or parts of the costs are expected to be passed down to consumers through (mainly short term) price increases. Administrative costs can also be significant for firms with multiple products and in relative terms are higher for smaller firms, although again the limited evidence provided suggested a rather mixed picture. Beyond these costs for firms, there are the costs of participating in the processes leading up to a decision on the nature and scope of the Implementing Measures. For many firms, this will be through their industry association, for which they usually pay a subscription fee. For some firms, however, especially the larger ones, there will be direct involvement. The costs involved in this process are not negligible, especially if the process is protracted. One representative organisation in a middle-size Member State reported that 4 full time staff is employed just in monitoring the Ecodesign process. In addition to industry and Member State input into the development of Implementing Measures, there is, of course, an input from various consumer and environmental organisations, a number of which have staff working on Implementing Measures. Estimates of time input ranged from 0.5 of a FTE to 3 full time staff, though a more typical number is 1 – 2 FTEs, only part of it covered by the €1 million grant provided by the Commission. Furthermore, some industry associations and enterprises have raised the issue of costs arising from their experience in some Member States of officials using their own national interpretations of requirements and of practices that are not derived from the Directive (often relating to former national procedures). This is an infringement of Internal Market rules, but in practice imposes additional administrative costs on firms trading in different Member States.

Cost-effectiveness of the Directive

The estimated costs to the Commission and the Member States for the implementation of the Directive are €18-25 million per year, giving a total of €320-450 million (2005 values) for the whole period 2005 - 2020[197] assumed annual increase of costs by 2% and a discount rate of 3.5%.)
- In comparison, according to a 2010 study by Ökopol[198] the energy savings from the Directive for a list of 40 products already regulated or in various stages in the process are expected to reach a total of €127 billion in 2020 or €90 billion if energy prices remain at 2005 levels. For the products already covered by the end of 2010 the annual energy savings were expected to be €19-20billion/year. Thus the costs of implementation for the Commission and Member States are a very small fraction of the value of the expected energy savings. Furthermore, the measures are expected to bring total energy savings in 2020 in the range of 900- 1200 TWh, of which 376TWh should come from the 12 products already covered by Implementing Measures. In terms of GHG emissions a total of 210-265 Mt CO_2 is estimated for the total number of products. To the extent that they are comparable, data from the US suggest a similarly large benefit to cost ratio from the introduction of energy efficiency standards.

Up to 2005, the standards had produced consumer savings of around $64 billion (€49 billion) in comparison to a total of $200-250million (€152-190 million) used by the Department of Energy to support the appliance standards programme, a ratio of around 250:1[199]. The cost figures stated, it should be recalled, do not include the costs to industry and the costs to consumers arising from changing appliances. The necessary figures are not available. Some evidence comes from the impact assessments of the individual Implementing Measures for the UK economy that was conducted for the UK government. The costs considered for a period up to 2020 included compliance costs to manufacturers and the costs from the possible increase in the prices of appliances to consumers. In many cases, costs to manufacturers were considered to be negligible assuming that these would be passed on through, mainly short term, price increases to consumers. The benefits considered included savings in electricity consumption but also CO_2 and other air emissions abatement costs. The benefit-cost ratio is in most cases greater than 4, with only the case of circulators and power supply units having a less favourable ratio."

C.3 External Factors influencing a label's appropriateness from Mills and Schleich (2010)

Mills and Schleich (2010) make the following observations about the external factors that influence the EU energy label's appropriateness.

"According to the European Commission, the energy labelling scheme for household appliances could account for about 35 TWh of final energy savings per year in 2010. In general though, there has been little quantitative evaluation of the impact of energy efficiency labelling schemes. Evaluation studies based on aggregate observed data for the EU, the US, and Australia have found a positive correlation between the uptake of energy efficient appliances and the implementation of energy labelling programs for household appliances (e.g. Sanchez et al., 2008; Lane et al., 2007; Banerjee and Solomon, 2003; Schiellerup, 2002; Bertoldi, 1999). Using the observed increase in the market share of energy-efficient appliances as an indicator, EU-wide early evaluations on the effectiveness of the labelling scheme for refrigerators and freezers (Waide, 1998) and also for washing machines and wash-driers (Waide, 2001) concur that the scheme was successful. According to CECED (2006), the average efficiency of newly purchased appliances between 1996 and 2004 improved by 30 percent for cold appliances, by 35 percent for dishwashers, and by 23 percent for washing machines. However, correlation does not imply causality and it is empirically challenging to separate the impact of the labelling scheme on the generation and diffusion of more energy-efficient appliances from other factors such as electricity prices, minimum efficiency standards or "business as usual" technical development.

Likewise, these factors may interact with the labelling scheme. For example, as pointed out by Newell et al. (1999) in the case of water heaters and air conditioners in the US, labelling schemes may reinforce price-induced technological innovation. Reiss and White (2008) observe that consumers respond to both energy prices and information campaigns to reduce energy consumption.

Recent studies based on experimental data are able to directly address the effects of labelling on consumers' choices. Using survey-based conjoint analyses, the findings by Sammer and Wüstenhagen (2006) for washing machines in Switzerland and by Heinzle and Wüstenhagen (2009) for televisions in Germany suggest that labelling increases consumers' (stated) willingness to pay for more eco-efficient products. However, few studies have explored the socio-economic or technology-related factors underlying consumers' choices of energy efficient appliances when ex- posed to label scheme"

C.4 Summary of the process which led to the adoption of the A+, A++and A+++ classes on the new label

Heinzle and Wüstenhagen (2010) provide the following summary on the process which led to the adoption of new A+ to A+++ classes in the new energy label.

"In Spring 2009, the Commission - with the support of industry - proposed instead the introduction of new "A" classes such as A-20%, A-40% and A-60% on top of class A. The rationale behind this label was that no reclassification of products would be needed and that this system could easily be harmonised throughout all EU countries. However, in May 2009 the Parliament rejected the proposal to introduce these additional classes. This decision was also supported by an independent research study by Heinzle and Wüstenhagen (2009), which showed that a well-known A-G scheme has a greater impact on consumer decisions than an open-end scale with additional classes. Since the decision in May 2009, negotiations have continued and the European Parliament called on the Commission to withdraw the draft directive and to submit a new proposal to the committee by the end of September 2009. The Parliament fought to retain the closed "A to G" scale, provided that a dynamic system would be implemented to review the thresholds of the various classes every couple of years and a validity period would be introduced on the label. Although the well-known closed A-G scale has become familiar to most European consumers and is regarded by most consumer and environmental organizations as being clear, comprehensive, comparable and easy to understand (ANEC, 2008; Topten, 2009), industry and some member states insisted that their efficiency ratings should not be downgraded. The system proposed by the European Parliament would have resulted in a complex re-labelling requirement for manufacturers and retailers and a transition period where old "A-G" labels would coexist with new, revised "A-G" labels. Industry mainly feared confusion in the market and claimed that these labels could no longer provide a clear ranking system that could communicate the improvements of an appliance (CECED, 2009). Industry has insisted on a label that goes "beyond A", allowing A rated appliances to remain A rated as newer, more efficient models enter the market and trigger the addition of new classes on top of the highest efficiency class. This industry position was also backed by a survey by the European Commission on graphic layouts for the Community Energy Label. The study showed difficulties during the transitional rescaling period during which old "A-G" labels would coexist with new "A-G" labels, showing that the validity period in form of annual figures initially could confuse consumers. The study found out that the closed A-G scale with rescaling was difficult for people to comprehend and concluded that an enlargement of the scale would actually be well understood by consumers (European Commission, 2009).

After months of negotiations, a compromise proposal from the Swedish Presidency of the Council finally came up. Members of the European Parliament and representatives from the European Commission and the EU Swedish Presidency finally reached an agreement that was also supported by manufacturers: the system would continue using letters A to G for classifications, but would expand the A categories into a maximum of three tiers (A+, A++ and A+++). Compared to the proposal of May 2009 which had additional classes A-20% etc., the new proposal limited the total number of classes to seven, unless more classes were still populated. Only the colour code of the highest class should al- ways be dark green and only the red colour could be duplicated if there are more than seven classes. Another important pillar of this new proposal is that a review of the classification will take place when a significant proportion of products achieve the two highest energy efficiency classes. Such a review, which would also include the possibility of rescaling, should be carried out when there is a potential for additional significant energy savings. No later than 31 December 2014, the Commission shall review the effectiveness of this Directive and of its implementing measures and submit a report to the European Parliament and the Council (COD 2008/0222, 2009).

However, environmental and consumer groups criticise a "beyond A" scale and support the retention of a simple, closed A-G Energy Label, provided that a dynamic system would be implemented to review the thresholds of the various classes every couple of years (ANEC, 2008). They argue that the message "buy A" would keep the label simple and clear and would help consumers to buy more efficient household appliances. By introducing additional classes they fear that consumers would perceive the differences between the different A classes as minimal. They also point out that as a result of introducing the additional classes, an "A" class product would no longer necessarily be the best in class but might be even the worst.

The two environmental organisations, BUND1 and DUH2, support the concerns of consumer groups regarding the proposed introduction of the additional classes. These two organisations claim that consumers need to be assured that an A labelled device is actually the most efficient product on the market, and they believe that there is no alternative to a continuation of the established scale "A to G", provided that there is a dynamic system of reclassification in place. They demand that only a predefined percentage of about 20% of the available products on the market would be allowed to be labelled with an A class, and that all letters of the scale should be occupied (Bund/DUH, 2009). Regarding industry and Commission critiques of the co-existence of two different label versions, BUND and DUH recommend that the information regarding the timeframe of validity must be more comprehensive and clearly printed on the label. They mention that periods of validity have been established in other areas too, e.g. TUV labelling for consumers. They do not see the introduction of such validity periods as a barrier for the European Energy Label, provided that there is thorough communication of the system (BUND/DUH, 2009).

In addition, some member states, including the UK, have called for a simple rescaling of the A-G label. Research conducted by Ipsos MORI showed that the closed A-G label was understood and recognised throughout Europe (MORI 2008a, MORI 2008b)."

C.5 Relation between ED and ELD

CSES (2012) make the following observations on the relationship between the Energy labelling and Ecodesign Directives.

"Among the different measures, the interaction with the Energy Labelling Directive is clearly central, as far as the energy efficiency aspects are concerned. Almost all stakeholders recognise the strong potential complementarities of the two pieces of legislation operating as push and pull mechanisms in the market. In practice, for most products these complementarities seem to work effectively since the requirements of the Implementing Measures are harmonised with the energy label levels. In general, the same official is responsible for drafting both the Ecodesign and Energy Labelling requirements. However, in the case of TV sets, some of the lower energy classes were empty, since they were below the minimum requirements. Only TVs labelled with 'A' class or better will therefore remain on the market.

The adoption of the Lisbon Treaty also poses challenges for the coordination and synchronisation of the Ecodesign and Energy Labelling Directives. In the recently revised ELD that followed the adoption of the Lisbon Treaty the regulatory committee stage has been removed, in contrast to the Ecodesign Directive that still operates under the Nice Treaty framework. This led to the adoption of Delegated Acts for certain products (fridges, TVs, etc.) before the adoption of the corresponding Ecodesign requirements.

In view of these practical problems, improved coordination between the two instruments should be pursued, if possible as part of a single process. The objective should be that Ecodesign requirements and energy labelling classes are reviewed simultaneously to ensure consistency, avoid cases of empty classes and ensure that labels reflect changes in the market and thus allow real differentiation with respect to the most efficient products. It should be noted here that the recast Energy Labelling Directive of 2010 includes a review clause that refers to assessing the need for amending current provisions on the design and content of the label, including the issue of 're-scaling'. Moreover, according to the SCP/SIP Action Plan, labelling categories are expected to be set as an outcome of procedures in the Ecodesign Directive. Article 10 (3) (a) of the ELD says that the Commission shall consider environmental parameters set out in Annex I, Part 1, of the Ecodesign Directive, which go beyond energy efficiency and integrate all environmental aspects over the product life cycle. Thus, the general legal and policy framework encourages co-ordination between both Directives."

C.6 Quotes from Joyce (2010) on a variety of initiatives relying on the use of ICT

- "EcoSearch: provide product efficiency information online. Online search is a primary source of product information for consumers. 98% of consumer electronics and appliances are researched even if the products are bought in a retail outlet. Many products have efficiency information labels but such information is rarely visible when using online search. This way, online information resources (search engines, comparison sites, brand sites etc.) disadvantage efficient products and the market. This initiative provides a simple mechanism to solve this emerging distortion."
- "Retail capture of product level carbon footprint data: Billions of individual products are bought by consumers in retail shops each year. Each product has a barcode to capture the price and other product data necessary for stock control and business management purposes. Information on the carbon footprint of a product can be added to the data captured from barcodes and RFIDs[45]."
- "Consumer meter readings using mobile phone: Electricity, gas and water are metered and then billed to consumers. It is generally billed as a fixed monthly charge during a year, with an adjustment at the end. This prevents consumers from immediately seeing or benefiting from reductions in their consumption of power and water. Now, however, consumers can provide their meter data to the utilities over the Internet or by mobile phone to have accurate monthly bills and immediate rewards for efficiency gains. An example s from British Gas recorded a 12% efficiency gain on introduction of a scheme such as just described. The savings seems to result from direct involvement of the consumer, immediate visibility on consumption trends and immediate rewards (lower monthly bill)."
- "Find local disposal facilities online: Consumers recycle less of their appliances, products and packaging than desired. Making it easy to find recycling services in one's neighbourhood can improve this. Equally, clear geo-location information can help identify needs and opportunities for providing such services where they are not yet available. Urban administrations and recycling service suppliers can provide consumers with easy to use, informative, online and wireless services to locate facilities, show their opening hours, see the materials that are accepted and get directions on how to get to the facilities."
- "App-gradable" product design: Today upgrading a product with a new functionality or to a new efficiency level typically requires its physical replacement. What is needed is a change of product design, so that products can be upgraded online using software applications (or "apps", hence the term "app-grade"). Instead of being designed for seasonal use and disposal, products need to be valuable to customers for their durability and openness to any number of functional upgrades at the user's fancy. This would allow multiple and frequent upgrades using existing ICT technologies without the need to replace the physical product."

[45] Radio-frequency identification (RFID) is a wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects.

- "Putting all initiatives together: personal carbon accounting: Personal carbon accounting is necessary to allow consumers to manage and reduce their carbon footprint. Carbon footprint has the same basic characteristics monetary price. Existing accounting applications and governance regimes can therefore provide carbon accounting capabilities. Sufficient carbon footprint data is available for carbon accounting to be immediately meaningful to consumers."

The next figure shows the advantages of RFIDs over printed labels that cannot be updated once printed.

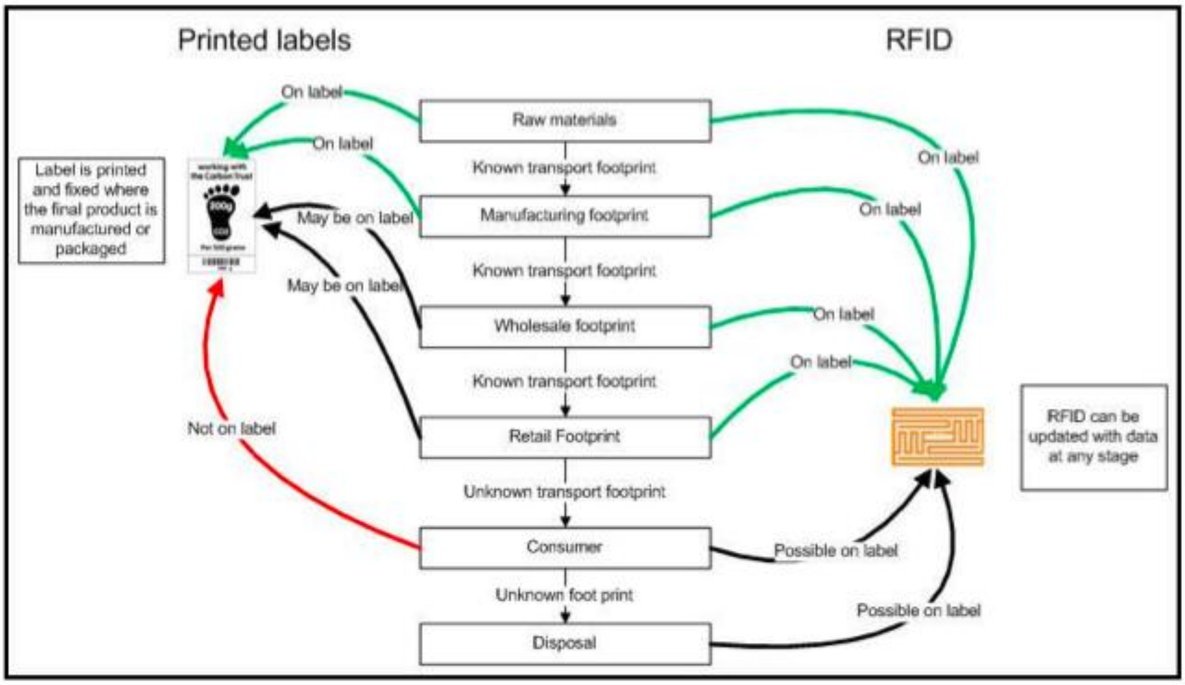


Figure D1 **Data availability and flexibility on labels V RFID (Joyce 2010)**

C.7 Summary of the French environmental labelling experiment (from (Centre d'Analyse Stratégique, 2013)

The French government has undertaken an ambitious environmental labelling trial involving the voluntary participation of 168 enterprises that displayed an environmental label on products for sale in their shops and/or for sale on-line. Most participating companies were retailers rather than manufacturers. Three of these enterprises are appliance manufacturers. The following figures give examples of the labels displayed.

Figure D2 Example of label on the Internet and in shops for appliances implemented by Discounteo (Centre d'Analyse Stratégique, 2013)

Figure D3 Example of label for paint and glue implemented by Leroy-Merlin (Centre d'Analyse Stratégique, 2013)

The ambition, regarding the content, was to supply full life cycle information using a multi-criteria approach covering several environmental impacts. The experiment was undertaken within the context of a legal framework which plans for the mandatory introduction of an environmental label in the near future. Participants were free to choose the products, methodology and shape of their label, etc. but in the future the intention is for the adoption of a single unified approach to inform consumers.

A platform coordinated by the French Agency for the Environment and Energy Management (ADEME) and the French standardisation association (AFNOR) elaborated good practice specifications to evaluate and present data on environmental impacts.

The experiment lasted from July 2011 to November 2012. Its evaluation (Ernst & Young, 2013) - on all product categories, including food, cosmetics, hotels, etc. - shows that:

- Participants are enthusiastic but reported methodological difficulties and implementation costs;

- Many specifics were tested in terms of content (name for indicators, explanatory text), formats (absolute values, scales, indexes) and support (on packaging, in shops, on-line);
- 90% of the companies continued until the implementation phase, operations went as planned for 74% and 60% declared they were satisfied with their participation;
- Several indicators, such as the water consumption, the water eco-toxicity or impact on biodiversity do not yet have a methodological framework;
- The absence of publically available databases was a considerable difficulty, especially regarding the raw material traceability and transportation. Without methodological frameworks, data provided by suppliers could vary a lot and hamper product differentiation;
- A majority of participants evaluated the design of the label to be complex and costly, though also expressed themselves to be open to new collaborations. These associated marketing costs should decrease when formats and support structures become fixed;
- At the general level, consumers have expressed an expectation to be able to understand the environmental impacts of products. This consumer trend now seems to be recognised and anticipated by manufacturers and retailers although it is not yet satisfied;
- However, most participating companies have evaluated that their own customers did not really pay attention to the labels or take the time to look for further information (on the Internet or on Smartphone applications). This was actually anticipated from the start: the limited scale of the experiment could not lead to changes in purchasing habits and measurable impacts on sales.

Most participants are in favour of the introduction of environmental labelling over the more or less long term. They also identified a number of pre-conditions to facilitate this:

- A harmonised methodological framework and technical background information, adapted to the specific conditions of SMEs;
- Harmonised specifications per sector;
- Complete and updatable databases;
- Automated impact calculation tools to avoid start-up costs for enterprises;
- The definition of homogeneous formats to insure consumer understanding and information comparability;
- A system compatible with a (wished for) European or even globally harmonised scheme to optimise French technical investments;
- A standardisation framework to secure long term visibility and investments that will need to be made;
- Verification procedures to build trust in the system and insure quality information to consumers (noting that the costs of these procedures should not constitute an economic obstacle to companies);
- Reasonable implementation timeframe, acknowledging the need of preparation and adaptation time (small enterprises do not have enough internal resources and large enterprises have large amounts of data to manage);
- Accompanying measures from public authorities such as information and communication campaigns.

C.8 Boardman et al. (2007): Executive summary

"It was agreed that the aim of any carbon labelling strategy developed would be to reduce greenhouse gas (GHG) emissions across the whole chain, through informing and influencing producers, retailers and users (consumers, government, caterers). The need for a coherent vision and broad set of mechanisms to drive down carbon emissions was recognised, with the expectation that significant savings are possible.

There are two separate components to this carbon labelling strategy: the detailed, precise collation of data on the carbon embodied in the product (called carbon analysis) and, separately, the way this information is conveyed to users (carbon display). There may or may not be a 'label'.
The carbon analysis would be based on Life Cycle Assessment. It was agreed that data be collected for all stages of a product's life-cycle, but that the carbon display would not necessarily reflect all of these (e.g. perhaps omitting food's home cooking phase).

The aim is to reflect the total carbon impact, in terms of all greenhouse gases. It may be necessary to start with just carbon dioxide, in the interests of speed. This will be clarified by research into the breadth and depth of data available, whether they are representative and stakeholder agreement on the process and values. Some numbers are highly contentious (mainly pre-farm gate).

It was agreed that a multi-stakeholder expert working party is needed to order to examine existing institutional models and facilitate the creation of appropriate, permanent bodies.

There was strong support for only one standardised UK scheme (both for carbon analysis and carbon display) underpinned by robust independent institutions.

Separate Institutions are needed to manage the whole carbon labelling process and to support aspects of the carbon analysis (eg establishing a reference data set, the methodology for using it and accreditation procedures), as well as to organise research (for instance into consumer preferences for the carbon display). The reference data set would contain general carbon figures for processes and inputs. These could be used for initial product carbon profiles, but data would progressively be replaced with primary data. The quality of data within the reference set would improve over time as the pool of embodied carbon data grows, and did not need to be perfect from the beginning.

The expertise of workshop participants centred on food, though carbon labelling could cover all products. With respect to which products were profiled first, a number of options were put forward. The most popular were: components of a standard shopping basket; products where data are available; where there is the biggest potential for carbon savings; and where there is supply chain interest and enthusiasm.

If the carbon display is a label, the brand owner is likely to put it on the product. The type of label might evolve, as the carbon analysis becomes more precise. Initially, it will be voluntary, but the aim would be to use UK experience to inform either EU or international approaches.

There are both synergies and conflicts between carbon labelling and consumer issues (e.g. organic, fair-trade) and producer policies (e.g. carbon trading, corporate social responsibility and farm-based renewable generation). "

sustainable energy for everyone

ECOFYS Netherlands B.V. | Kanaalweg 15G | NL-3526 KL Utrecht| T +31 (0)30 662 33 00 | F +31 (0)30 662 33 01 | E info@ecofys.nl | I www.ecofys.com
Chamber of Commerce 30161191