Preparatory Study to establish the Ecodesign Working Plan 2015-2017 implementing Directive 2009/125/EC

Task 4 Draft Report

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Contents

Foreword

BIO by Deloitte is pleased to submit this first draft of the Task 4 report for the project "Preparatory study to establish the Ecodesign Working Plan 2015-2017 implementing Directive 2009/125/EC", on behalf of the project team composed of Oeko-Institut, BIO by Deloitte, and ERA Technology.

1.Introduction

1.1 Purpose of Task 4

The purpose of Task 4 is to elaborate further aspects of selected product groups. The product groups have been selected at the end of Task 3 because they look interesting from an energy and/or resource savings perspective. In Task 4, the following additional aspects will be investigated:

- **Main other environmental impacts**. From the following list of potential environmental impacts or aspects, the analysis will cover those that are relevant for the respective product group:
  - Water consumption in use phase;
  - Consumables (e.g. detergents);
  - Presence of critical raw materials (according to EU list[1]);
  - Presence of flame retardants (halogenated, etc.);
  - Presence of plasticizers (phthalates);
  - Presence of other toxic substances;
  - Presence of F-gases;
  - Radiation;
  - Safety (fuel leakage, vibrations, etc.);
  - Health (hygiene, noise levels, etc.);
  - Direct emissions to air;
  - Direct emissions to water;
  - Direct emissions to soil; and
  - Other environmental issues.
- The following aspects have, in part, already been investigated in Task 3. Therefore they will only be added if there are still gaps in the Task 3 analysis:
  - Waste generation;
  - Durability (reusability, upgradability, reparability, etc.); and
  - End-of-life (recyclability, recycled content).
- **Policy coverage**. This includes, if applicable
  - EU policies;
  - Selected Member State policies;

[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the review of the list of critical raw materials for the EU and the implementation of the Raw Materials Initiative, Draft, http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/crm-communication_en.pdf.

  - Industry self-regulatory initiatives;
  - Selected third country policies; and
  - Test standards.

- **Appropriateness of Ecodesign or Energy Labelling**. This section deals with the question whether Ecodesign, and maybe Energy Labelling, is an appropriate instrument to deal with the issues identified. It may include considerations such as: existence of BAT (Best Available Technologies), variability of the product, speed of technological progress, market surveillance issues, etc.
- **Cost calculation**. This has partly already been done in Task 3 and will only be refined here, where necessary or where new data is available. The idea is to make a rough estimate of potential savings in energy cost, and relate them to possible increases of the product price.
- **Industrial competitiveness**. The following aspects will be explored, if relevant:
  - Market structure (and possible impact of Ecodesign regulations on it);
  - Innovation;
  - Macroeconomic effects; and
  - International competition.

The overarching goal is to identify further arguments that might speak in favour of or against Ecodesign and Energy Labelling Regulations. The result will be a refined product matrix that sums up, for each product group, the data gathered in Task 3 (sales and stock, energy and other resource consumption, improvement potential) as well as the results of the additional analysis done in Task 4.

1.2 Product groups covered

16 product groups have been identified at the end of Task 3 for further study, and will be covered in Task 4. They are presented below in alphabetical order. The names of some product groups have changed slightly: For greenhouses, the scope has been refined; the analysis will focus on greenhouse cover materials as the greenhouses themselves are rather custom made and rarely put onto the market as a complete unit. Reefers have been renamed as “refrigerated containers” because the term “reefer” is not widely known and may produce misunderstandings. The group of water, steam, and sand cleaning appliances was reduced to high pressure cleaners because the other subgroups belonging to this product group proved to be niche markets. The following list of product groups results:

- Base stations;
- Building automation control systems in non-residential buildings (the focus would be on the role of Ecodesign in the interplay with other Directives such as EPBD and EED);
- Gateways;
- Greenhouse covers (the focus would be on the role for Ecodesign and Energy labelling in providing information on the different energy performance of cover materials; and the interplay with EPBD and CPR);
- Hair dryers;
- Hand dryers;
- High pressure cleaners;

- (Free-standing) Hot vending machines;
- Kettles;
- Lifts (the focus would be on the interplay with other regulation);
- Mobile phones (the focus would be on resource use; issues to be explored in Task 4 include business models that currently prohibit longer lifetimes, as well as applicability of other legislation with respect to end-of-life treatment);
- PV inverters;
- Refrigerated containers (the focus would be on relation to transport-related regulation);
- Signage displays (currently discussed in the framework of the review of Reg. 642/2009; but might be excluded because they form a distinct subgroup with a different technology for commercial purposes only);
- Toasters; and
- Wireless chargers for consumer electronics.

1.3 Approach

The subtopics listed in chapter 1.1 have been taken as a checklist in order to have a comparable analysis framework for each product group, and to make sure that no relevant aspect is overlooked. However, only the aspects that have proven relevant for each specific product group have been pursued further.

For data collection purposes, questionnaires have been sent out to relevant stakeholders who have actively participated in the study so far and are knowledgeable for specific product groups. Care has been taken to contact relevant industries as well as environmental and consumer NGOs.

Information received from stakeholders has been completed by information from other sources, such as published LCAs, PCF (Product Carbon Footprint) studies, and other documents.

For **other environmental impacts,** each potential impact has been ranked, based on the information received from stakeholders and other sources, on a scale from 0 (not applicable) to +++ (very relevant). This step serves as a preparation for the further analysis where it will be investigated whether such impacts can be successfully addressed with Ecodesign or Energy Labelling policies. Note that the policy coverage of the relevant environmental impacts is not considered at this stage.

For **policy coverage**, the aspects presented in chapter 1.1 are qualitatively discussed. It is considered that there can be a case for Ecodesign (and/or Energy Labelling) Regulation mainly if other existing policies are insufficient to generate the envisaged environmental benefits for the product group. Another additional argument could be the presence of standards, labels or third country legislation that could serve as a model and facilitate the development of Ecodesign Implementing Measures. From this qualitative discussion, a score was developed from + to +++ (the more plus signs, the stronger the case for Ecodesign Regulation).

For **appropriateness of Ecodesign or Energy Labelling Regulation,** again the aspects presented in chapter 1.1 are qualitatively discussed. It is considered that there is a case for such regulation if BAT exists, if there is sufficient product diversity in the market, and if technological development is slow enough that it can be estimated over various years and tiers designed accordingly. On the other hand, aspects that speak rather against Ecodesign Regulation are market surveillance problems, the fact that BAT is proprietary technology, or a high variability across MS in infrastructural and climatic conditions related to the product group rather speak against this instrument. Also, the assessment of

excessive cost was included into this step. For cost calculation, projected energy savings across the product life cycle have been converted into cost savings using EU average energy prices as provided by Eurostat for EU-27 2013.

Table 1: EU-27 average energy prices, 2013. Source: Eurostat

	Unit	Domestic customers, incl. VAT	Non-domestic customers, excl. VAT
Electricity	€/kWh	0.20	0.12
Natural Gas	€/GJ	19.67	11.11

As escalation rates and discount rates are similar (4% by default according to the European Commission), energy costs are, in a simplified way computed as: *lifetime x energy tariff x annual energy consumption.* Cost savings thanks to improvement options are calculate as: *energy costs x improvement potential (%).* These cost savings are then related to the average product price. Stakeholders have been asked whether they think the potential increase in average product price is likely to outweigh the calculated energy savings. Their answer is presented, where available.

Again, a score from + to +++ is applied to express the overall assessment of the appropriateness of Ecodesign or Energy Labelling.

For **industrial competitiveness,** also the aspects mentioned in chapter 1.1 have been discussed. Positive impacts on innovation, on macroeconomic aspects such as purchasing power, employment or balance of trade, on the market structure (maintenance or increase of the diversity of firms) and international competitiveness have been regarded as favourable for Ecodesign Regulation, negative effects as unfavourable. Again a scoring of + to +++ has been employed.

The scores for all subsections are presented in a summary table. Finally, these scores are summarized together with the Task 3 results on energy and resource consumption and improvement potential. No overall score is created for each product group, as the various aspects are qualitatively different and a separate presentation allows for the setting of different political priorities.

1.4 Structure of the report

In the following chapters 2 and 3, general overviews of cross-cutting topics are given. Chapter 2 deals with the policy coverage. Overviews are given of policies that are relevant for many product groups, and of the system of market surveillance. In chapter 3, our understanding of industrial competitiveness is developed.

Chapter 4 provides an introduction to the analysis of the individual product groups. Chapters 5 to 19 are dedicated to this analysis according to the methodology described above. The product groups are presented in alphabetical order. Chapter 20 presents our conclusions.

2.Overview of policy coverage

2.1 Introduction

The goal of Ecodesign or Energy Labelling Regulations is to generate energy and resource savings and improve the environmental performance of products. In order to assess whether, in a specific case, they are the appropriate instruments to achieve this, the broader policy environment has to be taken into account. Aspects to investigate are: Are the relevant environmental aspects already covered by other Community or Member State policies? Is there a risk of double regulation, or in contrast, a potential for Ecodesign or Energy Labelling to produce synergies with such policies? Do third country policies exist that have, in some way, an impact on the respective product groups and environmental aspects (for example, by regulating products that are imported into the EU, or by serving as an example for possible EU policies). Do appropriate test standards, or even substantial standards regulating the performance of the product group exist? Is effective market surveillance possible?

These questions will be investigated in detail in the individual product group chapters (chapter 5 ff). The purpose of the present chapter is an introduction to some cross-cutting Community policies that affect many product groups and may interact with Ecodesign or Energy Labelling, as well as the system of market surveillance.

2.2 Introduction to Community legislation

Products are subject to many different policies in the EU. Figure 1 and Table 2 give an overview of relevant policies and their scope (in terms of product groups covered). The footnotes in the figure relate to the numbers in the table. It becomes clear that the product scope of Ecodesign (and Energy Labelling) (dark orange circle) overlaps with the product scope of many other policies. It is however important to note that the figure shows the theoretical, not the actual overlap because several of these policies are framework policies that have to be implemented for actual product groups by other legal acts (e.g. delegated acts).

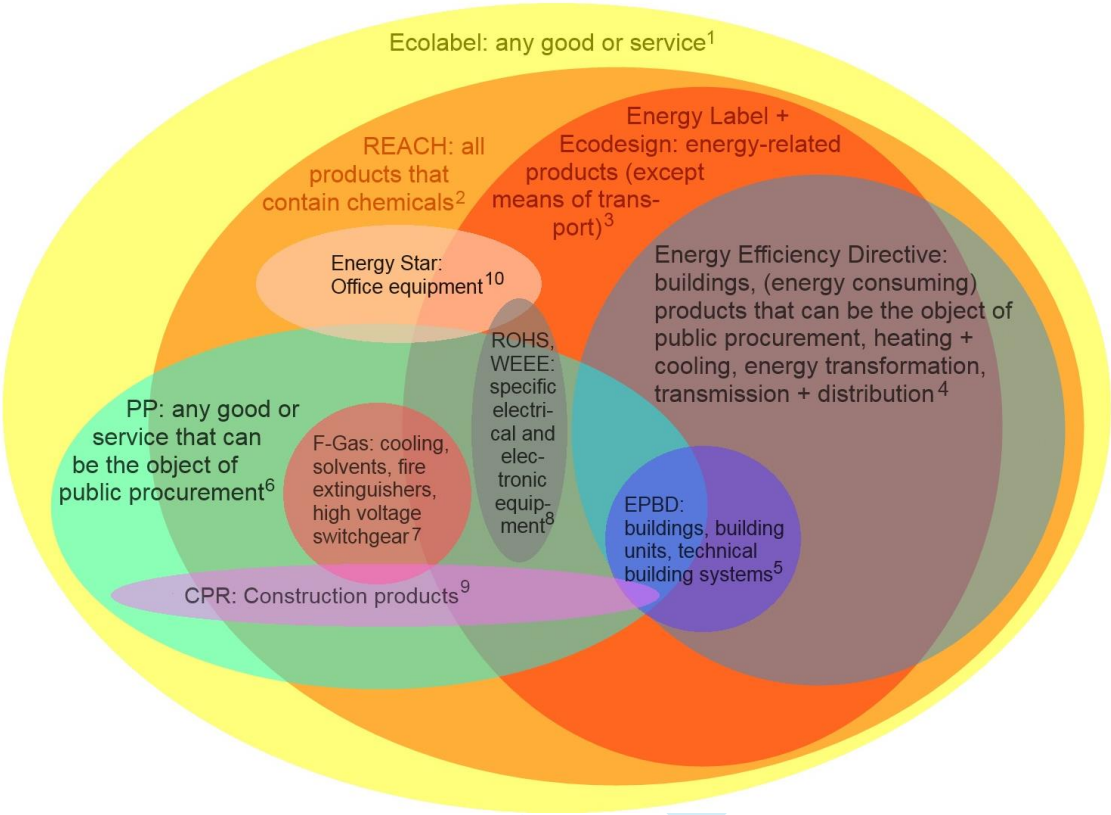

Figure 1: Product scope of selected EU policies[2]

Table 2: Product scope of selected EU policies[3]

No.	Short name	Product scope
1	**Ecolabel Regulation (66/20120)**	"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	**REACH Regulation (1907/2006 and 1272/2008)**	Although this is substance-related legislation, it also has obligations on substances in articles. 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.
3	**Energy Label and Ecodesign Directives (2010/30/EU and**	*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)

[2] Source: Author's own, first published in: Molenbroek et al. (2014), Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive. Final technical report; modified for the current report.

[3] Source: Author's own, first published in: Molenbroek et al. (2013), Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive, Background report I: Literature review, modified for the current report.

No.	Short name	Product scope
	2009/125/EC)	*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).
4	**Energy Efficiency Directive (2012/27/EC)**	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).
5	**Energy Performance of Buildings Directive (2010/31/EC)**	"(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).
6	**Public Procurement: Procurement Directive (2004/18/EC)**	No explicit product scope mentioned. From the context, it is clear that it affects all products and services that can be the object of public procurement. Green Public Procurement rules are also laid down in the Energy Efficiency Directive.
7	**F-Gas Regulation (842/2006)**	"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).
8	**RoHS (2011/65/EU)**	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).
8	**WEEE (2012/19/EC)**	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).

No.	Short name	Product scope
		Later to be extended to all EEE, with certain exemptions.
9	**Construction Products Regulation (305/2011)**	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).
10	**European Energy Star (Regulation No. 106/2008; Decision 2006/1005)**	Office equipment.

In order to understand the interaction of those policies with Ecodesign or the Energy Label, it is important to know which aspects and life cycle phases of a product the policies cover (thematic scope), which mechanisms are used and on which regulatory level (EU or Member States) they operate. For example, there can be synergies between policies:

- If they cover different aspects of a product (e.g. one policy covering energy efficiency and another one hazardous substances);
- If they use complementary and mutually enforcing mechanisms (e.g. Ecodesign banning the least efficient products, Energy Labelling providing incentives for buying the most efficient products, and Green Public Procurement using the Energy Label information for the same purpose). Generally, minimum standards provide good synergies with information and procurement ("push and pull" mechanisms); and / or
- If they reflect an appropriate task sharing between different political levels (e.g. Ecodesign setting community-wide minimum standards for components of (new) heating systems while EPBD allows for measures for integrating these systems in the optimally into the whole building in a way that is adapted to local climatic and infrastructural conditions).

On the other hand, double regulation would occur if different policies regulated the same aspect on the same level using the same mechanism (e.g. if bans on hazardous substances were introduced under Ecodesign, there would be an overlap with RoHS).

To facilitate the analysis in the individual product chapters, Table 3 provides an overview of the thematic scope, mechanisms and regulatory level of the policies mentioned above.

Table 3: Thematic scope, policy mechanisms and regulatory level of selected Community policies

	Thematic scope			Policy mechanisms				Regulatory level
	Environmental aspects	**Life cycle phases**	**Other aspects**	**Information / Labelling**	**Minimum requirements**	**Public Procurement**	**Others**	
Ecolabel Regulation (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).	Whole life cycle (Article 6.3).	- Social and ethical aspects, (Article 6.3e). - Reducing animal testing (Article 6.3g).	Voluntary labelling	No	Member States shall consider the setting of targets for the purchasing of products meeting the criteria specified in that Manual (Article 12).		- Labelling criteria to be suggested by Ecolabelling board, established by Commission and including representatives of MS (Article 5). - MS to designate bodies for carrying out tasks such as award of the label or market surveillance (Art. 4,9,10)
REACH Regulation (1907/2006)	Health and environmental effects of substances	Production, placing on the market		Information requirements along the value chain; data provision requirements depending on the substance; data must be made publicly available	Possible to restrict the use of certain substances or make its use in the EU dependent on prior authorization	No	Registration of all chemicals that are placed in the market	EU level (with support from MS bodies)
Ecodesign Directive (2009/125/EC)	"Significant environmental aspects"; including: (a) weight and volume of the product; (b) recycled content (c) consumption of energy, water and other resources (d) use of hazardous substances (e) quantity and nature of	(a) raw material selection and use; (b) manufacturing; (c) packaging, transport, and distribution; (d) installation and maintenance; (e) use; and (f) end-of-life		Mandatory consumer information requirements possible	Mandatory minimum standards	No		EU level: Implementing Measures MS: implementation, market surveillance

	Thematic scope			Policy mechanisms				Regulatory level
	Environmental aspects	**Life cycle phases**	**Other aspects**	**Information / Labelling**	**Minimum requirements**	**Public Procurement**	**Others**	
	consumables (f) ease for reuse and recycling (g) incorporation of used components; (h) avoidance of technical solutions detrimental to reuse and recycling (i) extension of lifetime (j) amounts of waste and hazardous waste generated; (k) emissions to air (l) emissions to water and (m) emissions to soil (Annex I)	(ANNEX I)						
Energy Labelling Directive (2010/30/EU)	Consumption of energy and where relevant other essential resources (Article 4)	Only use phase (Article 4)		Mandatory labelling (Article 10)	No	EU and MS authorities encouraged to procure only products of the highest class(es) (Art. 9).		EU level: Delegated acts, public procurement MS: implementation, market surveillance, public procurement

	Thematic scope			Policy mechanisms				Regulatory level
	Environmental aspects	**Life cycle phases**	**Other aspects**	**Information / Labelling**	**Minimum requirements**	**Public Procurement**	**Others**	
Energy Efficiency Directive (2012/27/EU)	Energy efficiency	Use phase, transformation, transmission		- MS shall implement consumer information programmes (Art.12) - Accurate metering (Art. 9) - Billing information (Art. 10)	No	MS to ensure that central governments purchase only products, services and buildings with high energy-efficiency performance (...) (Art. 6.1) and encourage public bodies at regional and local levels to do the same (Art. 6.3)	Various (national energy efficiency targets, long-term strategies, financial incentives, exemplary role of public authorities, energy efficiency obligation schemes, energy audits and energy management systems	Mainly MS
Energy performance of buildings Directive (2010/31/EU)	Energy consumption / energy efficiency	Use phase		Energy certification of buildings or building units (Art. 11-13)	- Minimum requirements for existing buildings or major renovations, building units, building elements and technical building systems (Article 1.2b and c, 4,6,7,8,9) - Minimum requirements for inspection and control (Art. 1.2 f and g, 14,15,16)	Possible	- MS 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) - MS must guarantee regular inspection of heating and air-conditioning systems in buildings	Mainly MS. They set and enforce minimum standards and are required to set up various policy measures EU level: sets certain minimum requirements, e.g. dates when all new buildings have to be zero-energy Delegated acts: power transferred to COM for a period of 5 years

	Thematic scope			Policy mechanisms				Regulatory level
	Environmental aspects	**Life cycle phases**	**Other aspects**	**Information / Labelling**	**Minimum requirements**	**Public Procurement**	**Others**	
Green Public Procurement: Procurement Directive (2004/18/EC)	No specification	No specification		No	No	Allows public purchasers to include environmental criteria into procurement procedures and tender specification; lays down rules for doing so.		EU and MS level
F-Gas-Regulation (842/2006)	F-gas content	Production, use phase, disposal		- Reporting requirements for producers, importers and exporters of F-gases (Art. 6). - Chemical names of the F-gases must be identified by way of a label using the accepted industry nomenclature (Art. 7(1))	- 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, keep track of gases used (Art. 3), requirements for recovery (Art. 4)	No	Training and certification: Commission shall develop minimum standards for personnel dealing with F-gases, and MS shall adapt their training programmes (Art. 5)	Mainly EU level, MS to adapt training programmes

	Thematic scope			Policy mechanisms				Regulatory level
	Environmental aspects	**Life cycle phases**	**Other aspects**	**Information / Labelling**	**Minimum requirements**	**Public Procurement**	**Others**	
RoHS Directive (2011/65/EU)	Restriction of hazardous substances listed in Annex II (Article 4): - Lead - Mercury - Cadmium - Hexavalent chromium - Polybrominated biphenyls (PBB) - Polybrominated diphenyl ethers (PBDE)	Production		CE mark directive	Mandatory maximum concentrations of restricted substances	No		EU level: Regulation; MS: Market surveillance
WEEE Directive (2012/19/EU)	Waste reduction; efficient use of resources; reducing adverse impacts of waste on human health and the environment	Production and end-of-life		User information: crossed rubbish bin symbol	Procedural requirements: - MS must ensure separate collection (Art. 5) - distributors responsible for ensuring that waste can be returned to the distributor - requirements with respect to collection rate (Art. 7) and proper treatment, including minimum recovery targets (Art. 8)	No	Voluntary: MS shall encourage recycling-friendly design (in line with Ecodesign Directive)	To be implemented mostly by MS while EU level sets framework

	Thematic scope			Policy mechanisms				Regulatory level
	Environmental aspects	**Life cycle phases**	**Other aspects**	**Information / Labelling**	**Minimum requirements**	**Public Procurement**	**Others**	
Construction Products Regulation (305/2011)	Giving off of toxic gas; emissions of dangerous substances, greenhouse gases particles; radiation; release of dangerous substances into water; faulty discharge of waste water, emission of flue gases or faulty disposal of solid or liquid waste; dampness in parts of the construction works; noise protection; energy performance; durability; recyclability; environmentally compatible materials (Annex I)	Whole life cycle	Stability of the construction, fire safety, safety and accessibility in use	A system and format is laid down for the declaration of the performance of construction products with respect to certain characteristics (directed at professional users). Performance must be disclosed for at least one characteristic	The Commission may, by delegated acts, determine threshold levels for product performance with regard to certain characteristics (Art. 3(3))	No		EU
EU Energy Star (106/2008; Council Decision 2006/1005/EC of 18 December 2006)	Energy consumption / energy efficiency	Use phase		Voluntary labelling	No	For the duration of the Agreement, the Commission and the other Community institutions, as well as central government authorities (...) shall (...) specify energy-efficiency requirements not less demanding than the Common Specifications (...) (Art. 6).		Commission to award logo, to establish work plan, to negotiate with USEPA MS to designate 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)

2.3 Introduction to market surveillance

The Ecodesign Directive is a New Approach Directive. This means that the manufacturer or importer is responsible for verifying that a product being placed on the market complies with the minimum requirements. This is done by following a conformity assessment procedure specified in the individual Implementing Measures. The manufacturer confirms compliance by affixing the CE mark to the product and issuing a declaration of conformity.

The role of market surveillance is to detect and punish possible violations. To this effect, information must be acquired from manufacturers or importers, and selected products must be tested for compliance. According to Art.3 of the Ecodesign Directive, market surveillance is the responsibility of the Member State authorities. It has to be performed in accordance with Regulation No. 765/2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products. It foresees, among other things, that Member States assign appropriate powers and resources to their Market Surveillance Authorities, that they develop and update market surveillance programs, and that they cooperate with each other and with the Commission. The forum for cooperation is the so-called Administrative Co-operation Working Group (ADCO).

In practice, various problems have emerged with respect to market surveillance.[4] Resources assigned to Market Surveillance Authorities by Member States are often insufficient. A lack of funds and skilled personnel prohibits the carrying out of market surveillance activities at an appropriate scale. Exchange between national authorities is hampered, for example, by differing model names that prohibit the identification of products that have been found noncompliant in one Member State in other markets. EU-funded projects such as ATLETE have shown that a substantial number of tested products are noncompliant.[5]

While such problems can in principle be overcome, certain requirements are more demanding to verify than others, because they may require more complex tests or the purchasing of expensive products. Also, there are more categorical limits to market surveillance. Compliance with certain types of (possible) requirements cannot, by means of inspection or testing, be verified on the product itself. This is for example true for criteria such as recycled content or origin of materials. In order to verify compliance with such criteria, reliable certification systems need to be in place.

Therefore, when discussing whether Ecodesign requirements are appropriate for a product group, one must also take into account whether possible requirements can actually be verified by Market Surveillance Authorities, whether additional systems need to be put in place to allow for such verification, and how costly or demanding it would be.

[4] See for details for example Molenbroek et al. 2014, Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive. Final technical report, June 2014.

[5] For example, Atlete II performed tests of 51 washing machines. Of those, 7 were noncompliant with specific Ecodesign requirements and 34 were noncompliant with generic requirements. After remedy action had been taken, 6 machines were still non-compliant. http://www.atlete.eu/2/doc/ATLETE%20II_Test_Results_PRINT_OUTS_25_06_2014

3. Overview of industrial competitiveness

This section aims at describing the various effects that Ecodesign requirements may have on industrial competitiveness. "Industrial competitiveness" refers to the economic performance and balance of European companies, both on the internal market and abroad.

This section is mostly based on evidence gathered following Ecodesign Regulations already adopted. It is split into four sub-sections:

- Market structure;
- Innovation;
- Macroeconomic benefits; and
- International competition.

3.1 Market structure

The overall objective of the European Commission is to ensure efficient markets and fair competition, so that consumers finally benefit from low prices and reliable and performing products. Even if imperfect itself, the framework of "perfect competition" remains useful to assess the level of competition. It may still be regarded as a model that European markets should come closer to.

To this extent, it is interesting to note that Ecodesign requirements strengthen at least two major conditions of perfect competition:

- **Perfect information**. Ecodesign information requirements, as their name indicates, do make information better – but even such Ecodesign specific requirements like plastic marking would contribute to it; and
- **Homogenous products**. As minimum performance standards are set through Ecodesign Regulation, products get closer to one another: the range of available products is reduced as a share of less efficient products is cut.

Finally, we may say that Ecodesign Regulation sets out favourable conditions for a more competitive market. The framework of perfect competition, however, includes other conditions regarding market structure. The two most prominent of them are the number of buyers and sellers (on the one hand) and the barriers to entry and exit of the market (on the other hand). It remains to be seen which effects do have Ecodesign requirements on those features.

Before dealing with it, a specific sub-section will observe the generic effects of Ecodesign requirements on products' purchase prices.

3.1.1 Purchase prices of products

An increase in purchase price may be expected following Ecodesign requirements. This price effect would be mainly due to the following two mechanisms:

- First of all, firms can be expected to pass at least a part of their incurred R&D costs on to consumers; and
- This might also be directly related to additional costs arising from the replacement of existing components or materials with more environmental-friendly ones, which thus gets reflected in a higher purchase price.

A DEFRA study[6] which undertook a review of 18 product groups, covering a wide range of products in both the domestic and industrial sectors, revealed a clear and consistent picture regarding the price effect. Relying on both theoretical and empirical analysis (with UK market data), the authors found a positive correlation between environmental improvement and price in 15 out of the 18 product groups; even if it was only incremental in some of the cases. Nonetheless, the price effect of new, more environmental-friendly technologies seems to diminish over time due to the learning effect before price stabilisation occurs once the transition in the economy is completed[6, 7.]

However, it should be clear that any increase in purchase price will be balanced, on the consumer's side, with a lower cost in use phase (reduction of energy bill).

3.1.2 Number of buyers and sellers

Obviously, the implementation of an Ecodesign Regulation will have different effects, depending on the number of companies on the market. Possible market structures of interest include monopoly, oligopoly or "perfect competition". One encounters a few large producers in an oligopoly, whereas competitive markets are characterized by a substantial share of Small and Medium-sized Enterprises (SMEs).

Experience shows that since the introduction of the Ecodesign Directive different market structures were encountered depending on the product group. Examples are the market for white goods, especially for cooling appliances, which has a large number of producers, whereas for lighting until recently only three firms could be identified making it effectively an oligopoly, namely Philips, Osram and General Electric.[8]

In theory, the more producers there are on the market, the more perfect the competition is – and the lower the prices (for consumers) and profits (for manufacturers), since manufacturers margins are limited by the presence of competitors. How would this be linked to Ecodesign Regulation? Table 4 below provides a basic theoretical assessment of Ecodesign effects, depending on the number of sellers on the market.

Table 4: Effects of Ecodesign requirements depending on the number of manufacturers on the market

Effects	Large number of small manufacturers	Small number of large manufacturers
…on profit and prices	If Ecodesign requirements generate an increase in	If Ecodesign requirements generate an increase in

[6] Policy Studies Institute and BIO Intelligence Service (2012), Final Report – Benefits of EuP-related Directives to the UK Green Economy (SPMT11_002). Prepared for the Department of Environment, Food and Rural Affairs.

[7] Policy Studies Institute and BIO Intelligence Service (2010), Final Summary Report - Impacts of Innovation on the Regulatory Costs of Energy-using Product Policy (SPMT09_045). Study prepared for Defra.

[8] Ecofys (2014), Impact of Ecodesign and Energy/Tyre Labelling on R&D and Technological Innovation. Study prepared for the European Commission, DG ENER.

Effects	Large number of small manufacturers	Small number of large manufacturers
	production cost, it might not be passed on sale prices. In this case, the sellers' profits would be reduced (this will depend on the size of the prices increase If large, manufacturers will have to pass this on).	production cost, it might be passed on sale prices. In this case, the sellers' profits would stay the same.
…on innovation activity	A smaller scale of production allows only for limited experience gains. In this case, companies might find it difficult to comply with the Ecodesign requirements.	A larger production allows to profit from increased learning, facilitating the environmental improvement of the product.
…on implementation costs		
• **For companies to comply to Ecodesign / Energy labelling**	Higher costs, as smaller companies may not have dedicated staff to take care of legal / technical compliance.[9]	Lower costs, as bigger companies do already have dedicated staff for compliance issues / purposes.
• **For public authorities to check up compliance**	Higher costs, as many companies have to implement Ecodesign requirements.	Lower costs, as only a few companies have to implement Ecodesign requirements.

In regard to the number of buyers, one can note that they are simply price-takers if the number is large enough. In this case, it is relatively easy for firms to put an additional mark-up, increasing the price of the product.

In the hypothetical case, in which there are only a few buyers, they possess a certain degree of market power, which makes it more difficult for companies to increase prices. However, this case is not of a great relevance given the fact that for a product to be considered for regulation under the Ecodesign Directive a significant number of sales (indicative mark of 200,000 units per year) has to take place. In reality, it is unlikely that only a few buyers will purchase such an important number of such a good.

3.1.3 Entry and exit barriers

Ecodesign may exert another important impact on the market structure in that it may create barriers to entry for new firms and induce the market exit of established companies. This section is of course linked to the above, as effects on entry or exit would affect the number of companies.

Barriers to entry

Market entry may be deterred following the entry into force of an Ecodesign Regulation as prior knowledge is often needed to manufacture more environmentally performing products: Research and Development (R&D) may be an objective brake to market entrance. Thus, an early paper by Mueller

[9] One aim of the European Commission is to come up with "less regulatory burden for small businesses". See: http://ec.europa.eu/enterprise/policies/sme/small-business-act/index_en.htm

and Tilton[10] showed that the learning curve from which established companies profit creates barriers to entry and protection from competitors given the falling average cost curves. Intuitively, it seems that the highest learning rates in an industry should result in the least number of market entries. However, Mueller and Tilton found in their study that barriers to entry would be actually highest for intermediate learning rates[11].

Furthermore, learning effects contribute to a reduction in the incremental costs of new technologies and product upgrades over time. The positive correlation between cumulative production and average unit costs is described by the learning rate and, with UK market data, it was found to be averaging around 18% for a wide range of energy-using products.[7] While there is some variation in the learning rates between different technologies, these differences were not found to be statistically significant for most of the products analysed. Other evidence suggested even higher learning rates related to product energy efficiency in the range of 13 to 35% in the Netherlands over the past forty years, averaging around 20%.[7]

All in all, Ecodesign requirements call for more technical expertise, which is only acquired thanks to R&D efforts and learning effects. R&D efforts tend to increase costs, while learning effects tend to reduce them. Then we can assert that the prevention of market entry exerts a negative impact on competition, and might possibly damage the European consumers if R&D efforts are not compensated through learning effects.

Barriers to exit

Ecodesign may not only have an impact on market entry, but also on market exit. As a matter of fact, companies that produce energy-efficient products at a competitive cost will adapt better to Ecodesign Regulation than those which manufacture less efficient products. The level of environmental performance that companies already achieve may be linked to their size, but not necessarily.

However, it seems that the risk consists especially in the exclusion of smaller companies given the following two reasons:

- First of all, it is unlikely that they are able to profit to the same extent as their larger competitors from learning effects given the smaller scale of their productions; and
- Furthermore, smaller companies might also face difficulties in obtaining the necessary investments for R&D in order to render their products more energy efficient and to comply with the requirements set out by the Ecodesign Regulation.

In both cases, this would result in the firm exiting the market. Once again, the occurrence of market exit will also depend on the size of the company. There might be, for instance, smaller companies engaged only in the production of a limited number of different product groups. In this case, the introduction of Ecodesign requirements for one of the product groups and the related capital investments required might lead to the sale of the entire business if the share of the product group to be regulated is important enough.

One also has to keep in mind that it is unlikely that the adoption of an Ecodesign Regulation is the sole factor driving a firm to exit the market. It is more likely to exert an additional (marginal) impact on a firm's considering the exit and its influence will also be highly dependent on the product group.

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[10] Mueller, D.C. and Tilton, J.E. (1969), Research and Development Costs as Barrier to Entry. The Canadian Journal of Economics, Vol. 2, No. 4, pp. 570-579.

[11] This could be further explained by the effect that new, innovative companies may enter the market in a period where framework conditions change and rapid learning is required, while incumbents are too slow to react in order to established procedures.

3.1.4 Upstream firms

Not only will the firms producing the final product be impacted by an Ecodesign Regulation, but also supplier industries. This could be the case for instance if parts of the product have to be replaced by new components and materials, forcing suppliers to adopt new technologies in order to comply with the requirements. Another potential impact is if a manufacturer in the EU exits the market and its competitors are all located in other geographic regions (e.g. Asia): in this case, this manufacturer's suppliers will be adversely affected as a result.

All effects of Ecodesign on prices, profits or innovation activity are then likely to be shared between the main company and its suppliers, depending on the market power owned by each party.

3.2 Innovation

Innovation plays an important role for companies' successes. In the context of product and process innovations, an evolution with eco-innovations contributing to a sustainable development increasingly gained importance over the recent years[12].

3.2.1 Innovation drivers

Innovation Impact of Ecodesign

The innovation impact from Ecodesign Regulations has been investigated rather extensively in a study conducted by Fraunhofer ISI, Ecofys, Triple E Consulting, Sea Green Tree and SoWatt, based on number of funding demands and patents as well as company case studies. While the number of funding demands somewhat correlates with the introduction of Ecodesign Regulations, the findings for number of patents are inconclusive. The authors state for the company case studies:

"The case study results show that the innovation impact differs for the various sectors. In sectors where the Ecodesign requirements and Labelling class levels were set in a rather ambitious way, the companies conducted a significant restructuring of production processes and product lines. The directives have supported market transformation towards more efficient technologies, mainly by facilitating the wider market introduction of existing high-efficiency technologies. Both for Ecodesign and Energy Labelling, most of the companies interviewed stated that the legislations have an influence on their innovation behaviour. The innovation impact is stronger in the deployment, commercialisation and diffusion of innovative energy efficiency technologies and is rather limited in the earlier R&D stages. For both Ecodesign and Labelling, a rather direct relationship between the ambition of the requirements and the innovation impact was observed."[13]

However, even though regulation may serve as one driver for innovation, it is not the only one, and certainly not the most prominent one. Other possible drivers of innovation include demand- and supply-side, as well as third party drivers, all of which will be elaborated on here below.

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[12] DG ENER finances the Eco-Innovation Observatory (EIO) aiming to provide integrated information on eco-innovation for companies and policy-makers. From 2010 to 2013, the EOI published eco-innovation scoreboard rankings and country briefs for the 28 Member States of the European Union. The ranking is based on 16 indicators which are aggregated into the following five components: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, environmental and socio-economic outcomes [Eco-Innovation Observatory (2013), Country Profile 2013: Sweden].

[13] Braungardt, S.; Molenbroek, E.; Smith, M.; Williams, R.; Attali, S.; McAlister, C, 2014.: Impact of Ecodesign and Energy/Tyre Labelling on R&D and Technological Innovation. http://ec.europa.eu/energy/efficiency/studies/doc/201405_ieel_product_innovation.pdf , Executive Summary

Demand-side

Demand, or consumers, can be divided into three groups, namely households (business-to-consumer activities), other businesses (business-to-business activities), and public procurement. For all groups, lifetime and the energy-use of the product during the use phase may be among the top criteria at the time of purchase. Nonetheless, businesses can be expected to be more careful with regard to energy-use as compared to households. This is due to the fact that the energy-use in households is more evenly distributed between larger numbers of products, whereas businesses might have a few appliances with highly significant energy-use. Thus, the energy consumption often represents a large share of operational expenses for some products, such as base stations, where it accounts for 15% of the operating costs[14]. An exception here is where products are sold business-to-business and then leased or loaned to consumers. This approach may be used for complex set top boxes and home network equipment that is supplied free of charge by service providers to their customers; however, it is their customers who pay energy bills.

That households might be a driver of innovation is also suggested by the fact that 95% of the respondents to a recent Eurobarometer[15] indicated that buying environmentally-friendly products would be "the right thing to do". However, only 54% of consumers said to buy the environmentally-friendly products occasionally and 26% buy them often. Another study conducted by a team of researchers at the Centre for Energy Policy and Economics (CEPE) of the Swiss Federal Institute of Technology showed that consumers are willing to pay more for a more energy-efficient product. Thus, they found, among others, that individual's willingness to pay for new windows as compared to medium old ones was of 13% of the rental price of a flat or the purchase price of a single family house, while the willingness to pay for an enhanced facade isolation was still of 3%[16].

Environmental-friendly products may be used a means of product differentiation by the companies as response to consumers who are increasingly aware of climate change. As a result, companies try to stand out against their competitors by differentiating their products. To this extent, Energy labelling requirements would be more appealing to consumers than Ecodesign requirements, since labels directly convey this information at the time of purchase. While Ecodesign requirements are hardly visible to consumers, this is not the case for Energy labelling, where the consumer is, among others, given information on appliance's details, energy class, consumption clearly on the label.

Newell and Siikamaeki[17] showed that consumer's decisions are easier guided through "simple" signals like energy labelling, as compared to more complex information (on CO_2 emissions for instance). Studies of the EU Energy Label show with a high level of reliability that up to 80 and 95% of European consumers recognize the Energy Label, and a large majority use it in their purchasing decisions[18].

Furthermore, public procurement may also have a significant impact on manufacturers if a large share of their product is bought by public authorities. This factor explains, for example, the success of

[14] Nokia Solutions and Networks (2014), Energy Efficiency: Green Telecom. Flattening total energy while catering to 1000x more data, Indo-European dialogue on ICT standards and emerging technologies, 13-14 March 2014

[15] TNS Political & Social (2013), Flash Eurobarometer 367 – Attitudes of Europeans towards building the single markets for green products. Prepared for: European Commission DG COMM.

[16] Banfi, S., Farsi, M., Filippini, M. and Jakob, M. (2005), Willingness to Pay for Energy-Saving Measures in Residential Buidlings. CEPE Working Paper No. 41

[17] Newell, R. G. and Siikamaeki, J. (2013), Nudging Energy Efficiency Behavior: The Role of Information Labels. Resources for the Future Discussion Paper 13-17.

[18] Molenbroek, E. et al. 2014: Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive. Final technical report

Energy Star-labelled office appliances. The Fraunhofer et al. study found public procurement to be an important driver for innovation[19].

Supply-side

The Ecodesign Directive gives firms the opportunity to sustain their businesses in the long-run. If products (or processes) consist in substantial innovations, this will help companies, not only to secure their competitiveness, but it can result in a first-mover advantage allowing them to obtain a significant share of the market. Energy efficiency or durability of products, for example, help to promote the reputation of companies and strengthen a brand. If identified as maker of efficient and reliable products, a company will be able to take a competitive advantage over its competitors.

Third parties

Innovation towards more energy-efficient products may be driven either by demand and supply, or by "third-party drivers". The latter category includes all private initiatives that are beyond companies' individual strategies, but below legislation.

Indeed, Industry Self-Regulatory Initiatives (SRI) are one (third) way to achieve savings in energy consumption. One example for this is the VDI 4707 standard, an energy efficiency classification guideline for elevators, which was established by the Association of German Engineers. This standard is thus already widely applied in Europe and is "gaining popularity in other parts of the world"[20]. The development of a voluntary initiative to measure and order energy consumption may well result in a market push, inciting others to stick to the standard as well.

In this case, one may think that there is no need for additional Ecodesign requirements. On the other hand, if there are only standards in place, one cannot be sure about the penetration rate and no central monitoring and verification system exists. Anyway, the question whether energy consumption would also be cut in the absence of regulation is a legitimate one.

3.2.2 Innovation barriers

While the Ecodesign Directive may, in general, seem favourable to innovation, there might be some cases in which it might be a hindrance to it. For instance, private companies might focus more on the reduction of energy and resources consumption and consequently lose sight of opportunities for more business-oriented innovations (not related to any environmental performance). To this extent, the Ecodesign Directive might be perceived as a "blinker" by companies and could result in a misallocation of time and money by the companies. Design, for instance, would be energy-focused rather than or on top of being appealing to customers – when energy consumption measurement standards are used as the basis for energy labelling, manufacturers design appliances in such a way that they can achieve the best possible energy rating.

This relates to the (fundamental) point that the Ecodesign Directive only aims at removing the least-efficient products from the market. Therefore, it sets minimal requirements, which can thus hardly serve as incentive for firms to come up with breakthrough innovations. However energy labelling can encourage the development of more energy efficient designs.

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[19] Braungardt, S.; Molenbroek, E.; Smith, M.; Williams, R.; Attali, S.; McAlister, C, 2014.: Impact of Ecodesign and Energy/Tyre Labelling on R&D and Technological Innovation. http://ec.europa.eu/energy/efficiency/studies/doc/201405_ieel_product_innovation.pdf, Executive Summary.

[20] Schindler, VDI 4707: Energy Efficiency Label for Elevators.

3.2.3 Innovation rhythms

One has to see the Ecodesign Directive also in the light of innovation pace in order to be able to fully analyse its impacts on the various industries. Here the fact that innovation speed differs between sectors has to be taken into consideration during the analysis.

Taking first the case, in which product development cycles are short, such as in the ICT sector, this makes it much harder for regulatory processes to keep pace with industries' developments. It takes several years for the specific Ecodesign Directive to enter into force, starting from the preparatory study to its adoption; a time during which substantial technological advances can independently be achieved by the companies. Energy savings estimates at a longer term are tricky to do for fast evolving products. Consequently, companies' own fast-paced Ecodesign innovations risk rendering the Ecodesign Directive of limited usefulness at its time of adoption.

As for the second case, in which innovation only happens steadily, the Ecodesign Directive can be a driver for innovation and achieve its foreseen effect. Nonetheless, an Ecofys study[21] dealing with the economic benefits of the Ecodesign Directive highlights that it would be important to set future efficiency targets ahead of time so as to allow the companies to prepare for the entry into force of the Regulation. This lead time would then tend to minimize cost implications from regulations aiming at increasing the environmental performance of the products. However, in the context of the Ecodesign Directive this lead time does not seem to present a major difficulty given that the requirements are often applicable in two or more tiers. Moreover, firms have the possibility to get involved as early as during the preparatory study, which is thus several years in advance before the adoption and entry into force. Past experience also showed that firms seize this opportunity to get involved in the process, as far as consumer products are concerned[22]. Thus, in this case, the Ecodesign Directive can, on one hand, exert a positive effect on companies' competitiveness, while, on the other hand, guaranteeing the environmental improvements of the products.

3.3 Macroeconomic benefits

The implementation of the Ecodesign Directive will not only have direct microeconomic effect (on companies), but also indirect macroeconomic effects (on European economy and beyond).

3.3.1 Direct income effect – Consumers' purchasing power

In a first step, households' disposable income may decline in the short-term, given the higher purchase price of the "greener" product. In the long-run, however, households will be able to profit from the energy savings (assuming that Ecodesign requirements will, amongst others, address energy consumption) of the environmentally-improved products leading to the reduction in households' energy bills. This, in turn, will exert a positive impact on households' incomes if the monetary savings from reduced energy use outweigh the additional costs at the time of purchase. The same holds eventually true for businesses in that the additional capital expenditure for a more energy-efficient good may be compensated for by reduced operating expenditures over the lifetime. Furthermore, in the medium to long term, reduced energy costs can reduce production costs and so make EU industry more competitive. Even if these savings will probably be limited by the increase in energy prices, the Ecodesign Directive will at least serve to mitigate the effects of such price rises.. However, one also

[21] Ecofys (2012), Economic benefits of the EU Ecodesign Directive – Improving European economies. Prepared for Natuur en Milieu.

[22] Commercial and industrial manufacturers tend to be much less supportive of prep studies – in the team's experience.

has to deduct from these positive impacts the costs related to the design, implementation and enforcement of the Ecodesign Regulation.

3.3.2 Indirect income effect – Employment and households consumption

The change of income brought about by the Ecodesign Regulation will also induce second round effects, in the case in which households decide to spend the savings from reduced energy consumption on other goods of the economy. This increase in the demand of other goods will, in turn, induce a change in the production plans of the affected companies to satisfy consumers' demands in order to reap the additional profits. This production increase, thus, requires additional workers resulting in the creation of new jobs in other sectors of the economy. And jobs could also be created through the reinvestments of companies.

On the negative side however, the savings could be spent on additional electrical equipment, causing an increase in electricity consumption in the EU, or more expenditure on leisure and vacations so increased GHG emissions from flights, etc. To this extent, the decisive point is the shape of households' consumption structure in Europe.

3.3.3 Efficiency effect – Balance of trade

The most significant efficiency impact, following the entry into force of any Ecodesign Regulation, is likely to be for the energy used by the product, reflecting its improvement in energy efficiency. This diminished energy consumption may then reduce the dependency on energy imports, such as natural gas or coal imports. Furthermore, this reduction in energy consumption will directly influence the companies operating in the European energy sector, since they will sell less. However, it is by no means certain that (employment and) profit among energy companies will decline, given the expected rise of energy prices in the future years and decades.

3.4 International competition

3.4.1 At companies' level

A distinction between European exporters and importers is made.

Starting with the companies exporting their goods from the EU, it has to be noted that these exporters will probably be reluctant to differentiate their products according to different markets, e.g. producing one more expensive but environmental-friendly good for their domestic market, and a second, cheaper, non-compliant one for export outside of the EU (although this will occur in some sectors, e.g. industrial furnaces). Therefore, domestic EU companies will face the decision whether to produce for the domestic or the foreign market, which will directly influence their competitiveness at international level.

- In the first case, in which the European manufacturer decides to serve its domestic market and to produce a product complying with the Ecodesign requirements, this implies a higher price in the initial phase following the product introduction, as was already elaborated on earlier. Consequently, this product might not be competitive on the international market given the higher price associated with it as compared to the extra-EU produced products. This does not necessarily have to be the case, since there may be third country requirements (which would echo EU Ecodesign requirements worldwide);
- In the second case, which does not seem very realistic, the firm decides to compete solely on the international market outside of the EU. This could be for various reasons, such as market size, if the firm realizes a major share of turnover abroad, or others. Here, the firm cannot be

expected to lose any of its competitiveness with regard to its international competitors. However, its products would be banned from the EU market (in case of Ecodesign Regulations) or experience a loss of sales (in case of Energy Labelling, if the firm's products are rated a "G" or "F" and there are many "A" rated products on the market).

The implementation of the Ecodesign Directive does not only affect European exporters, but also importers. Thus, importers might face difficulties when the third countries' requirements are less strict. As a consequence, this will result in importers' inability to introduce the product to the European market given its non-compliance, thereby reducing the quantity available in the EU market. If these imports constitute a significant share of the market this will result in increased costs to consumers given the higher purchase prices of the available goods. There may also be a reduced choice of products available, although this is likely only to be temporary as manufacturers design more products to replace those lost from the market

3.4.2 At EU level

The Ecodesign Directive might serve as an example to third countries outside of the EU. Given the increased number of energy policies worldwide, the EU may become a front runner and prominent driving force. As a matter of fact, it is quite common for many third countries to adopt either voluntary or mandatory Ecodesign standards for electrical appliances that match EU standards This, in turn, would result in the competitive advantage of EU exporters since they would be able to deliver their compliant and cost-effective products also to third countries.

Moreover, if energy production capacities are stagnating, it is highly probable that the share of fossil fuels in the European energy mix will diminish as a consequence of the implementation of the Ecodesign Directive. First of all, the development of new fossil fuel sites will be rendered less urgent given the reduction in energy consumption and secondly, old sites are mainly replaced by renewable energies. Thus, the Ecodesign Directive might results in a virtuous circle: on one hand, the Directive is directly driving energy efficiency and, on the other hand, it is indirectly promoting the use of renewable energies.

4.Introduction to the product groups

The following chapters contain analyses of selected aspects for 15 product groups. They are not complete assessments of the respective groups. Rather, they contain additional information to the Task 3 report which deals with market data, energy and resource consumption and improvement potential. For a more complete overview of the product groups, please consult the latter.

The fifteen product groups have been chosen from a set of 27 that have been investigated in Task 3 of this study. The process of choice is described in further detail in chapter 31 of the Task 3 report and is summarized here:

A "product matrix" was created that allowed for comparing various criteria. The core criteria were:

- Improvement potential with respect to aggregate EU-27 energy savings in 2020 and / or 2030;
- Improvement potential with respect to other resources; and
- Possibility that the energy and / or resource savings could be reaped by using the instruments of Ecodesign or Energy Labelling[23].

The following criteria were used as additional (supporting) criteria:

- Sales and anticipated market development;
- Need for in-depth study of the policy environment;
- Confidence in the savings estimates; and
- Any other specific considerations where applicable.

The criteria were applied in the following way:

The first and second step of the analysis led to the establishment of a preliminary list of product groups that presented either energy savings above a threshold of 7 PJ (first step) or quantitatively demonstrable relevant resource savings (second step). In a third step, some groups were excluded from this preliminary list, based on supplementary criteria: difficulty to reap the potential savings by design-related measures; potential to cover the product groups in reviews of existing legislations or self-regulation initiatives; low sales (partly in combination with a low reliability of the energy saving estimates); high uncertainty with respect to data and future technological developments. On the other hand, two product groups were added due to specific considerations.[24]

Each product group is, in the following, analysed according to the following aspects:

- Main other environmental impacts;
- Policy coverage;

[23] A detailed analysis of the regulatory coverage is the object of Task 4. However, it often emerged already in the course of Task 3 whether Ecodesign or Energy Labelling could at all be relevant.

[24] Free-standing hot vending machines were added because an Ecodesign Regulation might be adopted soon for cold free-standing vending machines and manufacturers usually produce both cold and hot appliances. Signage displays were added late in the process (they had not previously been assessed in Task 3) because the study team had been alerted to them in the context of the ongoing revision of Regulation 642/2009 which was about to exclude them.

- Appropriateness of Ecodesign or Energy Labelling; and
- Industrial competitiveness.

Details of these aspects are explained in chapter 1.1.

5.Base stations

5.1 Main other environmental issues

Table 5 below provides an overview of the relevant environmental aspects of the "base stations" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 5: Overview of relevant direct environmental issues and potential for improvement – Base stations

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Presence of critical raw materials (see the EU list[25])	+	Presence of critical raw materials at low concentration levels.	
Presence of flame retardants (halogenated, etc.)	+	Low levels of halogenated and non-halogenated flame retardants can be present in cables, Printed Circuit Board (PCB) and other electronic components. Flame retardants are used for technical and safety reasons.	
Presence of plasticisers (phthalates)	+	Phase-out is ongoing but phthalates are still used in cables.	A shift is ongoing and the less toxic, high-molecular-weight phthalates are becoming more common.
Presence of other toxic substances	+	Very low presence of other toxic substances. Minimum quantities for dedicated applications (e.g. beryllium as a component to spring material) could occur, depending to technical requirements.	
Presence of F-gases	0		
Radiation levels	+++	Base stations generate	EU Directives already cover

[25] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
		electromagnetic fields	EMF (Electro Magnetic Field) and EMC (Electro Magnetic Compatibility)
Safety (fuel leakage, vibrations, etc.)	0		
Health (hygiene, noise level, etc.)	0		
Durability (reusability, upgradability, reparability, etc.)	0	Longer lifetime (up to 20 years): base stations are generally very durable, and upgrading of capacity is common.	
End-of-life (recyclability, recycled content)	++	Materials used for base stations are mainly recyclable, but not always recycled.	
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

5.1.1 Presence of critical raw materials

As any ICT equipment, base stations include some critical raw materials. However, only low concentrations of critical raw materials are incorporated into some electronic components. Below figures are approximate figures of critical raw material content in a 100 kg outdoor base station[26]:

- Sum of Other Critical Metals, such as Ta, Sb, Co, Ga, In, W: <1 g;
- Sum of Platinum Group Metals: <0.0005 g; and
- Sum of Rare Earth Elements: <0.0001g.

Also as mentioned in Table 5 above, beryllium could also be present in smaller quantities. It is one of the critical raw materials mentioned in the EU list.

5.1.2 Radiation levels

The generation of electromagnetic fields by antennas is the intended use. It can be noted that the intensity of the radio waves is drastically reduced as the distance increases from the base station

[26] Digital Europe, stakeholder's input to Task 4.

antenna. On the ground, in houses, and other places where people reside, the exposure levels from radio base stations are normally below 1 percent of the limits[27].

5.1.3 End-of-life

With the change to the next technology (e.g. LTE), the existing equipment has to be replaced or completed by equipment with new frequency spectrum and technology. As replaced equipment cannot be used anymore, this raises the question of end-of-life practices.

However, according to stakeholders, base stations mainly contain metals and the recyclability at end-of-life treatment is high (>95%). Major telecommunication companies often report recycling targets in their yearly sustainability reports[26].

5.1.4 Conclusion for Ecodesign

The bigger environmental impact of base stations much probably remains energy consumption. However, more information would be needed on radiation levels and any health impairment that could occur.

5.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

5.2.1 Overview of EU policies

Currently, base stations are regulated under the EU WEEE and RoHS Directives and REACH Regulation.

Table 6: Main EU legislation applicable to the "base stations" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Base station	X	X	X	-	-	-

EMF (Electro Magnetic Field) and EMC (Electro Magnetic Compatibility) are fully covered by existing legislation. For EMF, safety and health requirements of Directive 1999/5 on the Radio and Telecommunications Terminal Equipment (RTTE) apply to base stations. In order to show compliance, there is a Harmonised Standard EN 50401 (from CENELEC)[26].

EMC is covered by the same legal framework (RTTE Directive). The objective is that non-intentionally emitted signals (i.e. not the intended signal from a radio transmitter) should be reduced to a level that they do not interfere with the receiving function of a radio device thus degrading the communication. The main Harmonised Standards for the type of base stations relevant for this study are in the EN

[27] http://www.ericsson.com/thecompany/sustainability-corporateresponsibility/conducting-business-responsibly/radiowaves-health/basestations-networks.

301489 series (from ETSI). Directive 1999/5 will be repealed in June 2016 and replaced by Directive 2014/53/EU (on health and safety) and Directive 2014/30/EU (on Electro Magnetic Compatibility).

Also the EU Energy Efficiency Directive (EED) may be taken into account. As it will make it mandatory for large companies to carry out "energy audits" every four years (with a first deadline falling in December 2015), it may turn out to be a significant driver for operators and suppliers to keep on improving energy performance. According to one stakeholder, "these audits will have to be done on network level, which we believe is a more accurate and relevant level"[28].

This echoes a recent study by Oeko-Institut for the European Commission, which explored the option of increased energy and GHG reporting from ICT organisations[29]. The scenario named Telecommunication Networks – 2 is a "comprehensive scenario with mandatory monitoring and reporting with a larger number of elements"; it includes such elements as the number of base stations (per technology).

5.2.2 Selected Member States policies

Not any Member State policy could be identified regarding base stations.

5.2.3 Industry Self-Regulatory Initiative

The European Code of Conduct on Energy Consumption of Broadband Equipment[30] has been already mentioned and described in Task 3. Furthermore, its target values have been taken as a basis for assuming energy consumption from 2020 onwards.

The Code of Conduct (CoC) gathered the commitment from 19 service providers and manufacturers across the EU-27. However, their global market share within the European market remains unknown[31]. It would be a helpful figure though to assess the relevance of Ecodesign requirements: obviously, the higher the market share, the less Ecodesign is needed (assuming the CoC sets out ambitious enough targets, what is generally considered to be the case by stakeholders). With a figure of typically 90% or above, this CoC could be considered as a kind of voluntary agreement.

5.2.4 Existing third country legislation and labels

No third country legislation or labels could be identified.

5.2.5 Test standards

A relevant test standard to measure energy consumption of base stations has been developed by the European Telecommunications Standards Institute (ETSI). Technical Specifications (TS) 102 706 were last updated in July 2013, with the release of version 1.3.1. The document defines a method to

[28] Ericsson, stakeholder's input to Task 4.

[29] European Commission (2014), Study on the practical application of the new framework methodology for measuring the environmental impact of ICT – cost/benefit analysis, Final report by Oeko-Institut and TU Berlin.

[30] JRC (2013), Code of Conduct on Energy Consumption of Broadband Equipment – Version 5.0. Available at: http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/files/documents/ICT_CoC/cocv5-broadband_final.pdf.

[31] The list of participants to the CoC shows a fair amount of big players: http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/energy-consumption-broadband-communication-equipment

analyse the energy efficiency of wireless access network equipment; it covers the following radio access technologies[32]:

- GSM [2G];
- WCDMA [3G];
- WiMAX [4G]; and
- LTE [4G].

The ETSI standard is currently used to assess and compare the efficiency of mobile radio network equipment from different vendors: it provides energy-efficiency values which are delivered to the customers. It is not intended to provide target values for the energy efficiency of equipment or networks.

The ETSI standard defines reference equipment configurations for Radio Base Stations (RBS) and reference load levels to be used when measuring RBS power consumption. Then basically, the standard provides two different levels to assess energy efficiency of RBS:

Static measurement encompasses "RBS under static load and without radio network features activated". This is equivalent to power consumption at site level. The following parameters must be listed and reported:

- Reference configurations (Number of sectors and carriers, Power input, Radio Frequency output power level, etc.);
- Frequency bands; and
- Load levels.

Dynamic measurement encompasses "RBS with dynamic load and with radio network features activated, i.e. including the functionalities located in the radio network controller". This is equivalent to power consumption at network level. The following parameters must be listed and reported:

- Reference configuration;
- Frequency bands;
- Traffic load levels; and
- Traffic case.

All parameters are further defined in the annexes of the standard, with specific sections for each technology in scope.

Last but not least, ETSI (together with ITU-T) is currently developing a test standard to measure efficiency of networks in operation. The standard (ES 203 228) is hopefully finalized during the next meeting in December 2014. That standard shall help operators to analyse their networks[33].

5.2.6 Conclusion for Ecodesign

The current policy coverage of base stations in Europe is low. However, the Code of Conduct developed for European broadband equipment (on the one hand) and the ETSI test standard (on the

[32] ETSI TS 102 706 v. 1.3.1 (2013), Environmental Engineering (EE) – Measurement method for energy efficiency of wireless access network equipment.

[33] Nokia Solution Networks, stakeholder's input to Task 4.

other hand) are significant initiatives to tackle the issue of energy consumption. Ecodesign requirements would go one step forward in the same direction.

5.3 Appropriateness of Ecodesign or Energy labelling

5.3.1 Excessive cost

Relevant information is related both to purchase price (CAPEX) and the cost in use phase (OPEX), including energy and other maintenance costs.

According to one stakeholder, CAPEX calculation is based on:

- Number of subscribers;
- Amount of served data broadband capacity;
- Number of handled frequencies; and
- Feature based fees, like: carrier aggregation, load balancing, optimisation and surveillance features, etc. There are up to several hundreds of parameters / technologies.

An average calculation of the purchase price is often very difficult. This depends mainly on the matureness of the mobile network. Hardware prices are often less than the additional software packages. Hardware without mast, steel, feeder cables often are around 5,000 – 15,000 Euro per sector and frequency band.

OPEX calculation would be based on:

- Licenses for use of base station;
- Operation and maintenance;
- Repair service on site;
- Backhaul and transport leasing;
- Real estate rental fee; and
- Energy costs.

As mentioned in Task 3, energy costs are said to account for 15% of operational expenses (OPEX) among mobile operator networks in developed countries[34].

5.3.2 Suitability of Ecodesign measures or Energy labelling

Energy costs for the operation of base stations are significant, in relative as well as in absolute values. This is a first point that would mitigate the need of Ecodesign measures, as there is already a strong economic incentive to reduce base stations' energy consumption.

Beyond this, at least three points need to be addressed to assess the suitability of Ecodesign requirements for base stations:

- Quick technological change;
- Integration of base stations into cellular networks; and
- Tailor-made products.

[34] Nokia Solutions and Networks (2014), Energy Efficiency: Green Telecom. Flattening total energy while catering to 1000x more data, Indo-European dialogue on ICT standards and emerging technologies, 13-14 March 2014.

As for energy labelling, it does not seem relevant for base stations, as the market is a pure business-to-business one and models are not standardised.

Quick technological change

One issue, which is common among ICT products, is the quick technological change. For every new generation of mobile communication, a new product is developed and used (e.g. change of frequencies, higher data rate, other signal-to-noise ratio). To this extent, any legal framework should either be focussed on the latest available technology, or encompass all technologies implemented so far.

Integration of base stations into cellular networks

As already highlighted in Task 3, energy consumption of a (mobile) telecommunication network is not easy to handle, as many parameters do account for it. However, if energy consumption of a whole network is difficult to monitor, this is not truly the case of individual equipment. The study by Oeko-Institut identified several points that make it difficult to take policy action cutting energy consumption in the telecommunication networks sector; yet a focus on base stations, at individual product level, removes much of the difficulty.

Obviously, hardware is but a piece of the puzzle, but "the RBS [Radio Base Station] power consumption is the dominant part of total power consumption of wireless access network"[32]. It may be a good start, and could pave the way towards lower energy consumption at the broader network level. Anyway, there is no reason why improvement in base stations' energy consumption would prevent or even brake any general improvement at network level.

Tailor-made products

Another point may be brought forward to play down the relevance of Ecodesign or Energy labelling measures. As a matter of fact, base stations are mainly "tailor-made" products which are adjusted to the architecture of each cellular network. Base stations are less standardised than mass-market, consumer products such as televisions, domestic kitchen appliances, etc. All stakeholders claim that customers need site- or network-specific solutions. Put in a different way, "network design and proper combination of different locations and different base stations open room for improved network efficiency"[33]. However, Ecodesign Regulation may be appropriate even for tailor-made products.

5.3.3 Conclusion for Ecodesign

Base stations are encompassed in cellular networks, so that it may be difficult to isolate them from all the other components of the networks. All in all, given the specificities of base stations, an in-depth preparatory study would be needed to ensure adequate requirements.

5.4 Industrial competitiveness

5.4.1 Market structure

The market is pure business-to-business (B2B) and dominated by a few large companies, that sell base stations worldwide: there is nearly no vendor dedicated for the European or any national market.

As reminded by a manufacturer[35], "the main task of a base station is to distribute the cellular signals over radio frequencies to a dedicated coverage are. A base station is a complex system of several

[35] Kathrein AG, stakeholder's input to Task 4.

product groups, manufactured by different producers". To this extent, the implementation of any Implementing Measures would require a strong collaboration between the installer and all the component suppliers.

5.4.2 Innovation and employment

If current generation technologies are taken as a basis for requirements on energy consumption, this may hinder innovation towards next generation. This is also why the indicators which are picked up to measure energy consumption have to be chosen carefully.

No information could be gathered on the number of jobs in Europe related to the production and sales of base stations.

5.4.3 International competition

European companies are at the forefront and the products are often exported.

One can note, however, that the European CoC includes international participants like Cisco, Huawei, Alcatel-Lucent, etc.[31]

5.4.4 Conclusion for Ecodesign

Ecodesign requirements would probably not have a significant impact on the industrial competitiveness of a few global providers of networks for mobile communication.

5.5 Product group summary and recommendations

Table 7 below presents a simplified scoring of the four main sections above, for the product group "base stations".

Table 7: Overall scoring of the "base stations" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Base stations	++	+++	+	+++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for base stations:

- Minimum requirements on energy efficiency; and
- Information requirements on radiation levels.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of base stations. Should the product group of base stations be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

6.Building automation control systems in non-residential building

6.1 Main other environmental issues

Table 8 below provides an overview of the relevant environmental benefits and environmental issues of the "Building automation control systems" (BACS) product group, and possible improvement options linked to them, based on information provided by stakeholders and gathered in the literature.

BACS functions as a control loop that consists of a sensor, an actor (valves or actuators) and a controller that executes the logics. Therefore, in Table 5, information on "Environmental issues linked to BACS" comes from expert guess and data extracted from 3 Environmental Product Declarations (EPD) provided by the industry. The following components are considered:

- Duct temperature sensors passive / Immersion temperature sensors passive;
- Automation stations / Controllers; and
- Valves and actuators.

Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 8: Overview of relevant direct environmental issues and potential for improvement – BACS

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Benefits due to the use of BACS			
Water consumption in use phase	+++		Using BACS helps to control and reduce water consumption.
Health (hygiene, noise levels, etc.)	+++		Using BACS helps to increase the quality of internal air and the comfort of users by having an adequate humidity and temperature when it is needed.
Environmental issues linked to BACS			
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Presence of critical	++	Printed Circuit Board (PCB) use gallium which is difficult	Separation methods for the recovery of metals from

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
raw materials (see the EU list[36])		to collect and recycle.	PCBs are available; however, many elements contained in the PCBs, including gallium, are disposed of as slag.[37]
Presence of flame retardants (halogenated, etc.)	++	Automation stations/ controllers contain halogens in plastic parts and in TBBA[38] used as flame retardants in PCB. Valves and actuators also contain halogens in cables, insulation tubing and PCBA (Printed Circuit Board assembled).	Replace halogenated flame retardants by non-halogenated flame retardants.
Presence of plasticisers (phthalates)	+	Possible presence of phthalates in PVC parts.	Switch to phthalates-free plastics.
Presence of other toxic substances	+	Some products may contain other hazardous substances in small quantities.	
Presence of F-gases	0		
Radiation levels	+	Remote control and other wireless distant control systems send low radiation levels.	Replace wireless distant control systems by manual or wire connected control systems.
Safety (fuel leakage, vibrations, etc.)	0		
Health (hygiene, noise level, etc.)	0		
Durability (reusability, upgradability, reparability, etc.)	++	Processors must be updated from time to time. Considering that some products are connected with several others, compatibility and upgradability issues may appear.	
End-of-life (recyclability, recycled content)	++	Recyclability of PCBs is difficult. Some products (e.g. Automation stations / controllers) are using Li-based batteries which need to be properly treated at their end-of-life.	Ease access to PCBs to facilitate the extraction and recycling. Appropriate separation collection of batteries.

[36] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

[37] DG ENTR (2014), Report on critical raw materials for the EU critical raw materials profiles.

[38] Tetrabromobisphenol A.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

As described in Table 5, BACS provides other environmental benefits mainly due to water savings and air quality and comfort. On the other hand, BACS also presents the following environmental issues.

6.1.1 Presence of flame retardants

Flame-retardant substances are used in wire and cable coatings and other electric and electronic components (Printed Circuit Board-PCB) to slow the spread of an accidental fire and reduce the amount of heat and smoke released. There are three classes of flame-retardants which are halogenated compounds, inorganic compounds (including antimony) and phosphorous compounds.

Flame-retardants and their converted forms and decomposition products can be released into the environment during manufacturing, incorporation into polymers, and during the entire life cycle of flame-retarded products causing toxicological and eco-toxicological issues.

Non-halogenated flame retardants are becoming increasingly popular to replace tetrabromobisphenol A (TBBA) notably in PCBs due to environmental pressures in the marketplace. While the PCB industry recognises that one-to-one replacement of TBBA is unlikely, there is growing recognition that mixtures based on non-halogenated alternatives can perform synergistically to provide[39].

6.1.2 Presence of critical raw materials (Gallium)

Gallium arsenide (GaAs) is a compound of gallium and arsenic used as a fundamental compound semiconductor material and forms the core substrate for semiconductor technology. It is largely used in consumer communication products such as digital mobile phones, personal communication systems, GPS navigation, satellite and fibre optic communications and wireless networks. Semiconductor technology devices based on GaAs circuitry are a key element of many wireless and Wifi consumer electronic products[40]. Due to its unique properties, GaAs in integrated circuit boards is hardly substitutable.

6.1.3 Conclusion for Ecodesign

Besides the energy consumption issue (detailed in Task 3), the use of BACS can be beneficial to reduce water consumption and improve indoor air quality. Direct environmental issues related to

[39] Kaprinidis N., Fuchs S. (2008), Halogen-free flame retardant systems for PCBs, OnBoard Technology.

[40] Source: European Semiconductor Industry Association.

BACS are quite common to electronic products, i.e. presence of some hazardous substances and critical raw materials in PCBs and other components.

6.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

6.2.1 Overview of EU policies

Currently, BACS are regulated under the WEEE and RoHS Directives EPBD.

Table 9: Main EU legislation applicable to the "BACS" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
BACS	X	X	X	X	-	-

The EPBD aims at maximising the benefits of using BACS, whereas WEEE and RoHS aim at reducing the environmental impacts of BACS.

Energy Performance of Buildings Directive (Directive 2010/31/EU)

On 19 May 2010, a recast of the Energy Performance of Buildings Directive was adopted by the European Parliament and the Council of the European Union in order to strengthen the energy performance requirements and to clarify and streamline some of the provisions from the 2002 Directive it replaces. As of 31 December 2020, new buildings in the EU will have to consume "nearly zero" energy and the energy will be "to a very large extent" from renewable sources. However, there is no specific target set for the renovation of existing building.

The EPBD includes specifications that should stimulate increased demand for BACS. Article 8 mentions that systems requirements to be specified in building codes that address control systems installed in existing buildings and mandates the adoption of intelligent energy metering systems.

Energy Efficiency Directive (Directive 2012/27/EU)

The EED imposes an obligation on central government buildings to go through deep renovations. However, Member States can take alternative cost-efficient measures to achieve an equivalent improvement regarding the energy performance of the buildings. This can be seen as an incentive opportunity to promote BACS within central government buildings and pioneer improvement within the sector[41].

6.2.2 Selected Member States policies

Main policies at Member State levels are the decrees transposing the EPBD, such as the *Réglementation Thermique 2012* in France, the *Energieeinsparverordnung* (EnEV) in Germany, or the

[41] Waide Strategic Efficiency for European Copper Institute (2013), The scope for energy and CO_2 savings in the EU through the use of building automation technology.

Part L of Building Regulations in UK, defining national targets and actions to reduce the energy consumption of existing and new buildings.

6.2.3 Industry Self-Regulatory Initiative

The European Building Automation Controls Association (eu.bac) has built a product certification scheme for the rated performance of building controls equipment tested under EN 15500/ISO 16484-3[42]. The scheme has been complemented with a voluntary product energy labelling system.

Certification of BAC systems and components is based on their potential capability to reduce energy consumption. The Certification is performed in accordance with the rules of the eu.bac mark scheme for products and systems for home and building automation, that includes the conformity testing of the products, checking of the manufacturer's relevant production line quality management system, inspection of the production location, and market surveillance. The certification procedure requires periodic tests of the products and systems and inspection by third parties.

The eu.bac labelling scheme is based on a scoring system and includes 6 classes from AA to E. eu.bac includes on a dedicated website a list of certified products with their energy class (www.eubaccert.eu). An example of product factsheet is displayed in Figure 2.

Energy Efficiency Label IZC

Product Information	
Licence Number:	213344
Licensee:	ATERNO
Product Identification	Optimal Eco-Logic
Test Specifications	
Tested Application: Electric Convectors (Ca Value = 0.3)	
Energy Efficiency Functions	**Present**
Integrated time switch program or ability to use an external scheduler	Yes
Communication	Yes
Open window detection function	Yes
Presence detection	Yes
Energy Efficiency Label According to eu.bac Labelling Rule 2-1 IZC	AA

Figure 2: Example of fiche for a certified product according to eu.bac scheme[43]

6.2.4 Existing third country legislation and labels

The Leadership in Energy Efficiency and Design (LEED) certification is a US consensus-based, voluntary certification program created to establish "green building" benchmarks and measure the environmental performance during the life cycle of a building. Many of the points needed to obtain

[42] See http://system.eubac.org/.

[43] IZC stands for Individual Zone Control.

LEED certification can be acquired through LEED credits that require or suggest the implementation of control systems for lighting, HVAC, and/or the entire building.

6.2.5 Test standards

EN 15232 standard

The European standard EN 15232: "Energy performance of buildings - Impact of Building Automation, Control and Building Management" aims at supporting the EPBD.

The standard specifies methods to assess the impact of Building Automation and Control System (BACS) and Technical Building Management (TBM) functions on the energy performance of buildings, and a method to define minimum requirements of these functions to be implemented in buildings of different complexities.

This standard specifies:

- A structured list of control, building automation and technical building management functions which have an impact on the energy performance of buildings;
- A method to define minimum requirements regarding the control, building automation and technical building management functions to be implemented in buildings of different complexities;
- Detailed methods to assess the impact of these functions on the energy performance of a given building. These methods enable to introduce the impact of these functions in the calculations of energy performance ratings and indicators calculated by the relevant standards; and
- A simplified method to get a first estimation of the impact of these functions on the energy performance of typical buildings.

Other European and international standards

Other relevant European and international standards for building automation, controls and building management, have been developed and are listed below:

- Product standards for electronic control equipment in the field of HVAC applications (e.g. EN 15500);
- EN ISO 16484-3 "*Standardisation of BACS functions*", used to assess the impact of BACS on energy efficiency;
- Open data communication protocols for BACS (EN ISO 16484-5), which is necessary for integrated functions with BACS impact on energy efficiency; and
- Specification requirements for integrated systems (EN ISO 16484-7).

Note also that the Commission issued in December 2010 a standardisation mandate to CENELEC (M/480)[44] for the "the elaboration and adoption of standards for a methodology calculating the integrated energy performance of buildings and promoting the energy efficiency of buildings, in accordance with the terms set in the recast of the Directive on the energy performance of buildings (2010/31/EU)".

[44] ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/M_480.pdf .

6.2.6 Conclusion for Ecodesign

BACS are regulated under the WEEE and RoHS Directives and the EPBD. WEEE and RoHS and current European standards seem adequate to deal with the main environmental impact related to the use of BACS. Therefore, the added value of Ecodesign and Energy Labelling Directives should focus on how it can help maximising the environmental benefits from BACS in addition to reducing the environmental impact of BACS.

6.3 Appropriateness of Ecodesign or Energy labelling

6.3.1 Excessive cost

According to the literature review conducted in the European Copper Institute study, the average cost to procure, install and commission BACS, is 28.7 €/m² for non-residential buildings. Cumulative total additional investments from 2013 to 2035 are estimated to be 44.0 billion € under the Optimal Scenario, and 40.8 billion € under the Recommended Action Scenario. However, maximum annual additional investments for the Optimal and Recommended scenarios are respect. 4.5 billion €, and up to 2.5 billion €.

Also, the cumulative economic savings on energy bills have been estimated to be between 15 and 18 times higher than the cumulative additional costs. Using these figures, the average payback period of using BACS were estimated to be less than two years.

Discussions with the authors of the European Copper Institute study will take place to gather further information of the methodology used to calculate the costs.

6.3.2 Suitability of Ecodesign measures or Energy labelling

Ecodesign or Energy Labelling Regulations could be implemented to increase the efficiency of BACS and reduce further the environmental impacts of non-residential buildings. The product certification and labelling scheme developed by eu.bac aim to assure the user a high level of performance of the products and systems, and could be used and made compulsory using Energy Labelling to increase its efficiency.

In addition, Ecodesign requirements could help to reduce environmental impacts by:

- Ensuring that sensors are accurate: according to eu.bac, the accuracy of sensors can be quite different from a product to another, with a direct consequence on the efficiency of the control system;
- Increasing the user friendliness and thus helping BACS to be better installed and operated: for instance working on the display, or using alerts related check lists for the installation;
- Increasing the re-commissioning of the system: for instance an alarm could alert the user periodically as a reminder that the efficiency of the system should be reassessed; and
- Strengthening the interoperability: communication protocols can be different from one system to another which affects the capability of all systems to work together. The use of open protocols could mitigate this problem.

Such requirements through an Ecodesign Regulation would be complementary with other directives such as EPBD and EED. These two Directives aim at increasing the energy performance and energy efficiency which can be achieved using BACS. These Directives can increase the penetration of BACS which would consequently increase the energy savings related to Ecodesign measures and Energy labelling.

6.3.3 Conclusion for Ecodesign

Ecodesign measures seem to be an adequate and cost-effective tool to reduce environmental impacts related to the use of BACS.

6.4 Industrial competitiveness

6.4.1 Market structure

eu.bac is the "European Building Automation and Controls Association" and represents the European manufacturers for Home and Building Automation and Energy Service Companies. eu.bac represents 85% of the European manufacturers of products for home and building automation. This represents an annual market of approximately 4.4 billion euros[45]. Eu.bac includes 27 members[46] of which Danfoss, Honeywell, Johnson Controls, Schneider Electric, Siemens, etc.

6.4.2 Innovation and employment

Waiting for additional stakeholders input

6.4.3 International competition

BACS systems are, like buildings themselves, set up locally. Products might be imported into the EU but the configuration and especially installation is done in the markets where the buildings are located. Therefore, foreign trade is not an important issue for BACS related services.

The share of BACS products sold within EU and coming from abroad is unknown.

6.4.4 Conclusion for Ecodesign

Considering that eu.bac represents 85% of European manufacturers and that eu.bac has already set a certification and energy labelling scheme, one could consider that any Ecodesign or Energy Labelling requirements would not adversely affect European manufacturers who are already engaged in a path to develop accurate and effective products. Without any information on the share of non-EU manufacturers, potential impact of Ecodesign or Energy Labelling Regulations on them is hardly assessable.

6.5 Product group summary and recommendations

Table 10 below presents a simplified scoring of the four main sections above, for the product group "BACS".

Table 10: Overall scoring of the "BACS" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
BACS	+++	++	++	+++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

[45] Source : http://www.eubac.org/index.php?id=89.

[46] See complete list here: http://www.eubac.org/index.php?id=90.

7.Gateways

7.1 Main other environmental issues

Table 11 below provides an overview of the relevant environmental aspects of the "gateways" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 11: Overview of relevant direct environmental issues and potential for improvement – Gateways

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Presence of critical raw materials (see the EU list[47])	+	Presence of critical raw materials at low concentration levels.	
Presence of flame retardants (halogenated, etc.)	++	Halogenated flame retardants are used mainly in cables, PCBs and connectors.	
Presence of plasticisers (phthalates)	+	The various cables of in home networking equipment (AC/DC power, phone line, Ethernet external jacketing, etc.) are using PVC with phthalates as plasticiser[48].	Alternative solutions are available on the market, with comparable performance. As the phthalate issue is generic for all electric and electronic products, it could rather be solved by a ROHS revision(s) taking in account the context of use of the final product.
Presence of other toxic substances	0		
Presence of F-gases	0		
Radiation levels	+	Electromagnetic radiation is	

[47] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

[48] Digital Europe, stakeholder's input to Task 4.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
		regulated in the EMC Directive[49]. Conformity is already demonstrated by the CE marking.	
Safety (fuel leakage, vibrations, etc.)	0		
Health (hygiene, noise level, etc.)	0		
Durability (reusability, upgradability, reparability, etc.)	++	Even if they have an incentive to manufacture durable products, manufacturers of gateways also commit to a constant evolution of their products.	
End-of-life (recyclability, recycled content)	+++	Recyclability is an issue and could much probably be improved.	
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

7.1.1 Material efficiency

Material efficiency was partly covered in Task 3 – yet additional information, under the form of a case study, was deemed to be useful. Actually, very few Internet service providers do have information on environmental topics available on their website. One interesting case study to elaborate on, however, is the French "Neufbox Evolution" by SFR.

This specific home gateway was ecodesigned (following a life cycle analysis), and released in autumn 2010. Compared to the previous version, pretty much progress could be achieved, including:

- Cut in energy consumption (by 30% in use phase and 40% in idle mode). Moreover, the new gateway features three buttons to 1°) turn on the gateway into "eco-mode"; 2°) shut down the Wi-Fi functionality; and 3°) shut down the Neufbox (i.e. on/off button at the back of the device); and
- Cut in material use. The product's size and weight have been reduced, as well as the number of components included in it (there were twice as many components in the previous version). The

[49] Directive 1999/5 on the Radio and Telecommunications Terminal Equipment (RTTE), to be replaced in 2016 by Directive 2014/30/EU.

case itself is now made up of 261 grams of plastic instead of 448 (-42%). A similar ratio could be found for Fritz!Box 7270 manufactured by AVM and marketed by Telecom Italia: "the weight of the plastic material used for the case has been reduced of 52% in comparison to a Telecom Italia product having similar functionalities"[50].

Additional environmental-friendly features were included in the gateway – they are showcased in section 7.1.5. All in all, the carbon footprint of the Neufbox Evolution decreased from 55 kilograms of CO_2-equivalent to 36 kilograms (-35%). Energy consumption in use phase still accounts for most of the impact, i.e. 73%[51].

This example is believed to depict a general trend of the evolution of gateways, to deliver boxes as compact as possible. As a matter of fact, with each generation of gateway providing the same functionalities (or more), the environmental impact is reduced due to the products being more compact, using less resources and less energy[48].

- The size of the case is minimized. This means a reduction of plastic material used for casing (and a lower product weight during transportation);
- The number and size of electronic cards are reduced. Indeed, the integration of components is improved constantly: the latest generation of Systems on Chip is embedding always more functionalities than the previous generation. This means a reduction of resource use among components;
- The size and thickness of the PCB are optimized, as the number of layers is increased; and
- Packaging material is reduced.

7.1.2 Presence of critical raw materials

Although in low concentration, critical raw materials are present in gateways as in much ICT equipment. The most common materials to be found in assembled printed circuit boards include: Beryllium (Be), Gallium (Ga), Ruthenium (Ru), etc.[52]

7.1.3 Presence of flame retardants

Halogenated flame retardants are used mainly in cables, PCBs and connectors[48]. Halogenated flame retardant is a generic issue for all electric and electronic products, and therefore could be treated through a horizontal policy.

If alternative solutions to halogenated flame retardant exist, these alternatives are not technically equivalent (e.g. not the same flame retardant performance, reduction of material strength, UV colour resistance) which may impact product design, used plastic material and cost. All these various issues may be a barrier to their adoption.

7.1.4 Durability

Attending that gateways are mainly leased to the customer, it is the interest of Internet service providers to enhance the durability of the devices[53]. Based on after sales information, average lifetime

[50] Telecom Italia (2013), Information to customer for Fritz!Box 7270 manufactured by AVM. Environmental Declaration – Support documentation.

[51] E. Delsol (2011), L'Usine Nouvelle n° 3252.

[52] CRM_InnoNet (2014), Internal report summarising the results of ICT and electronics sector analysis: http://cdn.awsripple.com/www.criticalrawmaterials.eu/uploads/D4-1-ICTsector-report-final.pdf.

of gateways is typically 4 years[48]. However, as gateways are constantly evolving, it pushes end-users to renew their equipment.

7.1.5 End-of-life

Gateways' main components are electronic cards, plastic casing and various type of cables such as AC/DC power, Ethernet, phone line, etc. Depending on the complexity of the device, the weight ratio between the recyclable and non-recyclable material calculated by LCA tools is between 40% and 50%[48]. However, as gateways are getting increasingly compact, the amount of plastics is constantly reduced and – as plastics is easier to recycle than electronics, the ratio of recyclability is decreasing over the years.

Building on the "Neufbox Evolution" case study, we can highlight the need for recyclability of the "gateways" product group. As a matter of fact, all components of this specific device have been made separable by SFR, so that they can be more easily recycled. This is one axis of ecodesign-thinking to think forward about the product's end-of-life as soon as the conception phase. However, even this new "Neufbox" is not fully recyclable, but only 69% of it[54]. To this extent, it is most likely that some room for improvement is left for gateways' end-of-life.

This is further confirmed by the environmental declaration from Telecom Italia, for Fritz!Box 7270: "the product's case is composed by 3 components and all connections between parts are implemented without screws and with adoption of snap fits, so that disassembling time has been reduced of 72,5% in comparison to a Telecom Italia product having similar functionalities". Table 12 displays a detailed report of the performance test which has been carried out.

Table 12: Performance test report for two gateways offering similar functionalities[55]

Product	Case weight (g)	Number of screws	Disassembling time (s)
Alice Gate VoIP Plus 2 Wi-Fi	463	7	200
Fritz!Box 7270	224	0	55
Reduction percentage	*51.6%*	*100%*	*72.5%*

7.1.6 Conclusion for Ecodesign

Recyclability could be an issue further regulated under Ecodesign, beyond energy consumption. End-of-life is much probably the most prominent environmental concern among the "gateways" product group, after energy consumption. Requirements could be defined to ease the dismantling of gateways and extraction of key components with high residual value and/or significant environmental impacts if not properly treated.

[53] Interestingly, what is rather detrimental to energy efficiency (known as "split incentive" and described in section 7.3.1) is rather beneficial to durability.

[54] http://groupe.sfr.fr/engagements/environnement/consommer-autrement/eco-conception/03182011-1408-leco-conception

[55] Telecom Italia (2013), Information to customer for Fritz!Box 7270 manufactured by AVM. Environmental Declaration – Support documentation.

7.2 Policy coverage

7.2.1 Overview of EU policies

Currently, gateways are regulated under the WEEE and RoHS Directives and REACH Regulation. There is not any GPP or EU Ecolabel criteria available for this product group.

Table 13: Main EU legislation applicable to the "gateways" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	EU Ecolabel
Gateway	X	X	X	-	-	-

As was mentioned in Task 3, gateways are already subject to the Ecodesign Regulation 801/2013 on networked standby. As of 1st January 2017, their power consumption shall not exceed 8 Watts.

There does not seem to be any other major environmental legislation applying to gateways in Europe.

7.2.2 Selected Member States policies

Not any specific policy covering gateways could be identified in European Member States.

7.2.3 Industry Self-Regulatory Initiative

The European Code of Conduct on Energy Consumption of Broadband Equipment[56] has been already mentioned and described in Task 3. Furthermore, its target values have been taken as a basis for assuming energy consumption from 2020 onwards.

The Code of Conduct (CoC) gathered the commitment from 19 service providers and manufacturers across the EU-27. However, their global market share within the European market remains unknown[57]. It would be a helpful figure though to assess the relevance of Ecodesign requirements: obviously, the higher the market share, the less Ecodesign is needed (assuming the CoC sets out ambitious enough targets, what is generally considered to be the case by stakeholders). With a figure of typically 90% or above, this CoC could be considered as a kind of voluntary agreement.

7.2.4 Existing third country legislation and labels

Quite a few third country regulatory initiatives have been taken in third countries. However, all labels displayed below are to be opted in on a voluntary basis.

First of all, the Energy Star label for Small Network Equipment[58] has been mentioned in Task 3. It is worth describing it further here, as it results from a two-step approach:

- A "Base Power Allowance" has been set for each product type, including gateways or Integrated Access Devices (IAD). The respective values can be found in Table 14; and

[56] JRC (2013), Code of Conduct on Energy Consumption of Broadband Equipment – Version 5.0. Available at: http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/files/documents/ICT_CoC/cocv5-broadband_final.pdf.

[57] The list of participants to the CoC shows a fair amount of big players: http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/energy-consumption-broadband-communication-equipment.

[58] Energy Star (2013), Product Specification for Small Network Equipment – Eligibility Criteria, Version 1.0.

- "Additional Power Allowance" values have been set for selected additional functional adders (also in Table 14).

The sum of one base power allowance and one or more additional power allowance(s) give a final result for each product – and measured products that are below this result are awarded the Energy Star label. The test standard used is further described in section 7.2.5.

Table 14: Power allowances in Energy Star label for small network equipment (version 1.0)[59]

Product type	Power values (W)
Base power allowances	
IAD – Cable	6.1
IAD – ADSL	5.5
IAD – VDSL	7.1
Optical Network Termination Device (ONT)	4.4
Additional power allowances	
Fast Ethernet	0.1
Gigabit Ethernet	0.3
Wi-Fi (802.11)	0.7
802.11n per Receive Spatial Stream	0.2
802.11ac per Receive Spatial Stream	1.3
Plain old telephone service	0.5

Other labels are present in Asia, namely:

- Energy Conservation Certification Rules for Broadband Customer Premises Equipment have been issued by the China Quality Certification Centre. They apply to broadband customer premises equipment, including home gateways. The label Endorsement is voluntary[60];
- The Korea Energy Management Corporation (KEMCO) includes home gateways in its e-Standby Program. They are defined as: "Electronic products, with nameplate output power of power supply less than equal to 150W at LAN port when the maximum network traffic occur, that enable receiving external access networks, connecting home network equipment based on wire/wireless networks, converting protocols, controlling, monitoring, managing and providing other home network related services"[61]. Precise requirements are not known, but since standby is already tackled in Europe through Regulation 801/2013, they may not have to be developed here. Interesting in this Korean example is the introduction of some "warning" label: compliant gateways are entitled to the regular energy-efficiency label, whereas non-compliant products should bear a "Standby Power Warning Label" (see Figure 3). The KEMCO claims that "Korea is the first country to introduce such mandatory label in the world"; and

[59] Power values for modems, routers, switches and access points are not displayed. Source: http://www.energystar.gov/sites/default/files/specs//SmallNetworkEquipment_V1_ENERGYSTAR_ProgramRequirements_Nov2013_0.pdf .

[60] CLASP: http://www.clasponline.org/en/Tools/Tools/SL_Search/SL_SearchResults/SL%20Detail%20Page.aspx?m=2227dc52-8f9a-49dd-9c9b-f0793a077595. Related documentation is in Chinese.

[61] http://www.kemco.or.kr/new_eng/pg02/pg02100300_2.asp

- Finally, Japan once set up requirements for routers and switches, which can be included in gateways. However, this specific label looks quite outdated, since the specifications make reference to shipment volume of year 2006[62].

Figure 3: Korean standby warning label (left side) and energy saving label (right side)

7.2.5 Test standards

Energy Star developed a specific test method to test energy consumption of small network equipment, namely the "ENERGY STAR Test Method for Small Network Equipment", revised in November 2013. Unfortunately, the test method is not publicly available[63].

7.2.6 Conclusion for Ecodesign

Regulation 801/2013 on standby is certainly a first step to cap energy consumption of gateways. As we said in Task 3, "one key element to keep in mind is that the targets are not cumulative: hence gateways, which include at least modem and router functions, are subject to the same 8 W and 12 W thresholds than standalone devices. As there is a trend to integrate more and more functionalities into a single gateway beyond modem and router (like Ethernet switch, WiFi 802.11xx access point, VoIP, etc.), Regulation 801/2013 may finally give a real cap to energy consumption of in-house networking equipment."

Moreover, the Code of Conduct is another means to limit energy consumption in use phase. However, the market share of participants remains unknown and may call for (mandatory) Ecodesign requirements. The US Energy Star for small network equipment could serve as one example to help setting such requirements.

7.3 Appropriateness of Ecodesign or Energy labelling

7.3.1 Excessive cost

Gateways are specific in the sense that they are often leased to the customer by the Internet service provider, instead of bought. The Internet service provider remains the owner of the gateway, while the customer pays the electricity bill. This is a case of "split incentive", which may result in a low consideration for energy consumption from manufacturers and/or service providers. A similar concern occurred for Complex Set Top Boxes (CSTB) and was highlighted by ENER Lot 18 Preparatory Study:

"The decision to buy a particular STB model is currently made by the service providers who purchase complex STB from appliance manufacturers. […] Purchasers of complex STB mainly focus on proposed functionalities and on the product price rather than on environmental characteristics (e.g.

[62] http://www.eccj.or.jp/top_runner/pdf/tr_small_routers-apr_2008.pdf

[63] A one-page note of clarifications on this test method has been made public, but this does not bring much light to the method itself. See: http://www.energystar.gov/sites/default/files/specs//SNE%20Test%20Method%20Clarification%20Memo.pdf.

energy consumption, use of recycled materials, hazardous substances). It is a tricky situation for subscribers who can hardly take into consideration environmental aspects in their buying decision as the choice is very limited or null."[64]

However, if we consider that the purchase price may be approached by the sum of monthly payments in leasing, an average price of 100 € might be assumed[65]. Table 15 below provides further information on the relation between economic savings as compared to purchase price.

Table 15: Detailed cost calculation for the "gateways" product group

	(Home) gateway
Average purchase / leasing price	100 €
Energy consumption / year (classic / fibre)	53 / 77 kWh
Lifetime	4 years
Average EU electricity price (domestic)	0.2 € / kWh
Energy costs over lifetime	42.4 / 61.6 €
Energy savings potential in use phase (2020)	10%
Economic savings potential	4.2 / 6.2 €
Relation (economic savings / purchase price)	4 / 6%

As long the average sales price does not increase more than 4-6%, the average product life cycle is likely to remain cost-neutral. However, it is complicated to follow the same reasoning for the "gateways" product group as for the others, because gateways are subject to quick technological change anyway: Internet service providers offer frequent updates which do not result into higher prices.

7.3.2 Suitability of Ecodesign measures or Energy labelling

Home gateways have high sales in Europe today, and the stock of EU-27 is promised to increase (see Task 3). Action to cap energy consumption has been already taken: by the European Commission on the one hand (Regulation 801/2013 on standby mode) and by the industry on the other hand (Code of Conduct on Energy Consumption of Broadband Equipment). In this context, would Ecodesign or Energy labelling requirements be suitable for gateways?

Final customers, i.e. users of gateways, have a very limited choice of products – typically two or three per Internet service provider, with a relatively low number of Internet service providers in a single country. This situation may feed the following conclusions:

[64] BIO Intelligence Service (2008), ENER Lot 18 Preparatory Study – Complex Set Top Boxes (CSTB).

[65] On the French market, the Orange Livebox is rented for 3 € per month (what makes 144 € if used four years; however the Livebox is occasionally available for sale at the prce of 79 € (http://boutique.orange.fr/doc/contrat3179.pdf). An average price of 100 € looks reasonable and was not challenged by stakeholders.

- Energy labelling is not appropriate for home gateways, as the range of products available is narrow. This is further supported by the fact that power consumption, and even more so, non-energy related aspects are not perceived as a significant argument by the end user to create a differentiation between in home networking products[48]; and
- Ecodesign looks definitely appropriate (in case the CoC is not signed by the majority of manufacturers and/or does not set ambitious targets in terms of energy efficiency), since the "natural" market pressure for energy-efficient products is almost inexistent (energy savings for gateways, as well as other environmental improvements, will not stem form consumers' demand). So one prominent rationale behind Ecodesign Regulation stems for the very business model of Internet service providers: since most of them lease their gateways to their customers, they do not have much incentive to make them more energy-efficient.

Additional requirements on recyclability may also be set. As explained in section 7.1.5., this would help to make the end-of-life of gateways better.

7.3.3 Conclusion for Ecodesign

At first sight, it seems that extended Ecodesign requirements (including recyclability) would make sense. However, the only certitude so far is that Ecodesign specific requirements would make more sense than Energy labelling.

7.4 Industrial competitiveness

7.4.1 Market structure

A major feature of the gateway market is that all devices are manufactured outside Europe, in Asian countries with low cost manpower[48]. This does not speak for or against Ecodesign requirements, but it should be noted that the implementation of any Implementing Measures would require a strong collaboration between manufacturers and Internet service providers.

7.4.2 Innovation and employment

Regarding the product design and development, there are several models[48]:

- Low end Home GateWays (HGW) are designed and developed in East Asia (e.g. Taiwan, India, China) based on specifications coming from European manufacturers;
- Middle range and high end HGW are designed and developed in East Asia (e.g. Taiwan, India, China), but the software development is made in Europe and in Asia, based on specifications coming from European manufacturers; and
- For innovative or/and complex products such as Media GW, the product design and product development are usually made in European manufacturer labs, knowing that EU manufacturer R&D labs in Asia may be also involved in the product development.

7.4.3 International competition

European companies are trying to keep all development tasks with a significant added value and know-how compared to the Asian competition. Development activities are kept in Europe as long as they are innovative and as long as their cost is not significantly higher than in Asia. This explains why some European companies have some of their labs in Asia. It is a way to keep existing know how without significant extra cost compared to Asian competition.

The other activities linked to business, such as marketing, sourcing, sale, distribution, after sale, are mainly located in Europe.

7.4.4 Conclusion for Ecodesign

The value chain of gateways is clearly split between a manufacturing Asia and a R&D Europe. Regulation of gateways under Ecodesign would "simply" mean that specifications handed over by European companies to their Asian counterparts would integrate Ecodesign requirements, i.e. manufacture gateways of lower energy consumption / better recyclability / etc.

7.5 Product group summary and recommendations

Table 16 below presents a simplified scoring of the four main sections above, for the product group "gateways".

Table 16: Overall scoring of the "gateways" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Gateways	++	++	++	+++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for gateways:

- Minimum requirements on energy efficiency. A mandatory compliance with the CoC for Broadband Equipment would be an option[66]; and
- Minimum requirements on recyclability.

Energy labelling is not a relevant option.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of gateways. Should the product group of gateways be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

[66] European Commission (2014), Study on the practical application of the new framework methodology for measuring the environmental impact of ICT – cost/benefit analysis, Final report by Oeko-Institut and TU Berlin.

8.Greenhouse covers

8.1 Main other environmental issues

Table 17 below provides an overview of relevant further environmental aspects of the "greenhouse covers" product group, and possible improvement options linked to them. Energy consumption has been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 17: Overview of relevant direct environmental issues and potential for improvement – Greenhouse covers

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Use of critical raw materials (see the EU list[67])	0	Certain types of glass make use of critical raw material. Unlikely for this purpose.	
Presence of flame retardants (halogenated, etc.)	?	Perhaps used in plastic covers	
Presence of plasticisers (phthalates)	?		
Presence of other toxic substances	?	Certain additives are used to improve performance of cover material. Unclear what these are and if toxic substances are used.	
Use of F-gases	0		
Radiation levels	0		
Safety (fuel leakage, vibrations, etc.)	?		
Health (hygiene, noise level, etc.)	?		
Durability (reusability, upgradability, reparability, etc.)	+++	Large differences in expected lifetime of different cover materials.	Improvement option lies in selecting the appropriate cover for the purpose.
End-of-life (recyclability, recycled	++	Depending on cover material, different homogenous materials need to be disposed	Selecting appropriate cover material and treatment

[67] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
content)		of or used for other purposes: glass, acrylic, polycarbonate or polyethylene.	option.
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issues	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from 1 (low) to 3 (high). "?" if not known.

Analysis of main environmental issues to be completed.

8.1.1 Conclusion for Ecodesign

For greenhouse cover materials their basic performance characteristics are of interest, e.g. insulation, light transmission, light diffusion, condensation, durability. As specific uses and climatic conditions may require particular materials, Ecodesign should not impose specific absolute requirements but rather facilitate decision making by users of such cover products.

8.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

8.2.1 Overview of EU policies

Few "classic" Ecodesign related EU policies apply to greenhouse covers.

Table 18: Main EU legislation applicable to the "greenhouse covers" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Greenhouse covers	-	-	(X)	X	-	-

As greenhouse cover materials generally constitute basic materials, **REACH Regulation** is obviously not of direct relevance. It may be relevant with regard to certain substances used for surface coatings. However, this has not been assessed as no evidence in that regard was available.

The **EPBD Directive** applies to all buildings, where a "building means a roofed construction having walls, for which energy is used to condition the indoor climate". This definition would apply to greenhouses. However, Member States implementing the Directive "may decide not to set or apply the requirements referred to … non-residential agricultural buildings with low energy demand and non-

residential agricultural buildings which are in use by a sector covered by a national sectoral agreement on energy performance". Hence, specific requirements may be in place in different Member States.

Further, "Member States shall take the necessary measures to ensure that minimum energy performance requirements are set for 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 replaced or retrofitted, with a view to achieving cost-optimal levels."

Therefore, the EPBD Directive provides a framework for setting minimum energy performance requirements for greenhouse building elements. Focus is, however, the reference building in which a building element is used and not the characteristics of the material itself.

Also, implementation in Member States may vary.

Construction Products Regulation (305/2011) has not been assessed yet and will be included at a later stage.

8.2.2 Selected Member States policies

Given the provisions in the EPBD, Member States policies may be established with regard to greenhouses and their "building elements". These have not yet been assessed here. A quick check of the German implementation reveals that greenhouses (and hence related building elements) have obviously been excluded from energy performance requirements.

8.2.3 Industry Self-Regulatory Initiative

No relevant SRIs have been identified.

8.2.4 Existing third country legislation and labels

None identified so far.

8.2.5 Test standards

To be identified.

8.2.6 Conclusion for Ecodesign

Depending on the specific implementation of the EPBD in each Member State, there is currently no coherent demand on energy performance and other related requirements for greenhouse cover materials. Hence, Ecodesign/Energy labelling could fill this gap.

8.3 Appropriateness of Ecodesign or Energy labelling

Whereas the "regulatory coverage" section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on "Appropriateness of Ecodesign requirements" addresses the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

8.3.1 Excessive cost

Specific costs are not assessed as no specific technological improvements are suggested. Information requirements likely impose only minimal additional costs to manufacturers as these would relate to

basic parameters that are anyway often communicated and similar across manufacturers, just often not according to the same standards.

Such information may help users of greenhouse cover materials to make the best choice for their purpose and also more easily consider total lifetime costs of each cover material considered.

8.3.2 Suitability of Ecodesign measures or Energy labelling

Setting minimum performance requirements for greenhouse covers does not make sense as demand for certain growing conditions or adaptations to local climatic condition may favour certain type of cover materials. However, basic information requirements on energy performance related parameters of different cover materials could help consumer make informed choices. For greenhouse cover materials Energy labelling, together with specific information requirements may be the most appropriate approach. The Construction Products Regulation (305/2011) may also be an appropriate framework for addressing these information requirements. This will be checked.

8.3.3 Conclusion for Ecodesign

Energy labelling is the more suitable approach.

8.4 Industrial competitiveness

8.4.1 Market structure

Greenhouse cover materials are sold by manufacturers of greenhouses. Hence, they may not only be available on the market individually but purchased together with the greenhouse structure.

8.4.2 Innovation and employment

Energy labelling would likely not lead to significant technological innovations and implications for jobs but rather raise awareness for energy use of greenhouses and related relevant characteristics.

8.4.3 International competition

No effect on international competition expected.

8.4.4 Conclusion for Ecodesign

Energy labelling could reduce information asymmetries in the market and provide a level playing field for the just comparison of different greenhouse cover materials.

8.5 Product group summary and recommendations

Table 19 presents a simplified scoring of the three main sections above, for the product group “Greenhouse covers”.

Table 19: Overall scoring of the "Greenhouse covers" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Greenhouse covers	+	+++	+++	++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

Should EPBD not generally be applied to greenhouse building elements in individual Member States, there is a case for introducing basic information requirements as part of Energy labelling on the following characteristics:

- U-values;
- Light transmission;
- Light diffusion;
- Durability; and
- Life cycle costs.

This is not yet a recommendation for specific Energy Labelling measures, but serves to illustrate the basic feasibility and suitability of the Energy Labelling Directive to contribute to the improvement of the environmental performance of greenhouse covers. Should the product group be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulatory process.

9.Hair dryers

9.1 Main other environmental issues

Table 20 below provides an overview of the relevant environmental aspects of the "hair dryers" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 20: Overview of relevant direct environmental issues and potential for improvement – Hair dryers

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Presence of critical raw materials (see the EU list[68])	+	Antimony, beryllium, might be used in small quantities in electronic components. Cobalt and chromium are present in metal alloys of the product parts. Overall quantities are small[69].	For the heating element, Titanium Beta Alloy and Nickel- Molybdenum Alloy are available as alternative materials that do not include critical raw materials. However, Titanium Beta Alloy is very costly and Nickel Molybdenum Alloy does not withstand temperature as well[70].
Presence of flame retardants (halogenated, etc.)	+	Flame retardants are present for safety reasons; the exact nature of these is not known.	Possible to exclude halogenated flame retardants and use alternatives. Some hair dryers comply with Blue Angel requirements.
Presence of plasticisers (phthalates)	+	Plasticizers are present in cabling (e.g. power cords)	
Presence of other toxic substances	0		
Presence of F-gases	0		

[68] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

[69] CECED, stakeholder's input to Task 4.

[70] Ercişli, H. (2011): Material Selection Process for Hair Dryer Components. http://web1.boun.edu.tr/ercanbalikci/sample%20ME411%20termproject%20report.pdf.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Radiation levels	0		
Safety (fuel leakage, vibrations, etc.)	0		
Health (hygiene, noise level, etc.)	+++	High noise level could be a drawback or even an issue as the hair dryer is used close to ears.	Some hair dryers on the market already achieve better noise performance.
Durability (reusability, upgradability, reparability, etc.)	+++	Considering the low price of usual hair dryers, when broken down customers may prefer to buy a new model rather than repairing it.	
End-of-life (recyclability, recycled content)	?		
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

9.1.1 Noise

A particular health impact which could occur during the use phase of the hair dryer is noise.

The noise volume of a hair dryer can negatively impact the health of the user, since it used quite close to the ear. Some hair dryers can have a noise level of above 85 or 90 decibels, which classify them in the "very loud" noise category (according to the American Speech-Language-Hearing Association)[71].

These results are in line with a recent Oeko-Institut study[72], which found that noise emissions of hair dryers can be well above 85 decibel (dB). Thus, around 50-60% of the products emit less than 85 dB, while 25-35% are below 75 dB[72]. Noise is a criteria taken into account in the awarding of the German Blue Angel label: the maximum noise emission for a product to be awarded the Blue Angel label is 80 dB, a value below which 35-50% of products fall.

9.1.2 Durability

Waiting for stakeholder input

[71] http://www.asha.org/public/hearing/noise/

[72] Oeko-Institut (2012). PROSA Haarpflegegeräte – Entwicklung der Vergabekriterien für ein klimaschutzbezogenes Umweltzeichen.

Considering the low price of usual hair dryers, when broken down customers might prefer to buy a new model rather than repairing it.

Within the German Blue Angel for hair dryers (see section 9.2.2), one of the requirements is that the manufacturer offers a warranty of at least two years. Also the endurance test of the same labelling scheme is an interesting item to consider.

9.1.3 Conclusion for Ecodesign

Improvement potential is present for noise, use of flame retardants, and maybe durability. Ecodesign requirements for noise are rather straightforward to implement. With respect to the other issues, it remains to be decided whether a substitution is feasible or can be reasonably expected from manufacturers, and whether Ecodesign or RoHS / REACH would be the appropriate instrument.

9.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

9.2.1 Overview of EU policies

Currently, hair dryers are regulated under the EU WEEE, RoHS and REACH.

Table 21: Main EU legislation applicable to the "hair dryers" product group

Product group	WEEE	RoHS	REACH	EPBD	Green Public Procurement GPP	EU Ecolabel www.ecolabel.eu
Hair dryers	X	X	X	-	-	-

9.2.2 Selected Member States policies

The following section is dedicated to Member States policies which are in place inside the EU and of which the following table gives an overview.

Table 22: Environmental labels at Member States level

Product group	DER BLAUE ENGEL JURY UMWELTZEICHEN	NF ENVIRONNEMENT	NORDIC ECOLABEL
Hair dryer	RAL-UZ 175	-	-

The only label which could be identified to certify hair dryers" is the German Blue Angel label. The criteria for the award of the Blue Angel label for hair dryers date from August 2012[73].

[73] Blue Angel (2012), Vergabegrundlage für Umweltzeichen, Haartrockner RAL-UZ 175.

Table 23 shows an extract of the requirements hair dryers have to comply with in order to obtain the Blue Angel label. However, the requirements listed here below are not exhaustive and there exist still various other demands.

Table 23: Requirements of Blue Angel label with respect to hair dryers[164]

Requirement	Hair dyer
Energy consumption	5.2 Wh/(g/min)
Noise emissions (max. dB)	80
Material of touchable surfaces	Compliance with REACH and other regulations. Ban of halogenated polymers and halogenated flame retardants; ban of flame retardants that are classified with the Risk Statement R50/53 or Hazard Statement H410 according to Annex VI, Part 3 of the RoHS Directive.
Safety	Compliance with requirements for GS[74]
Endurance test (hours of operation)	200
Warranty (min. in years)	2

So far, three hair dryers were awarded the Blue Angel label, namely the Silvercrest Haartrockner SHTR 2200 A1 by Lidl, the Relax comfort and Relax comfort Touch hair dryers by Savoir Vivre International[75].

9.2.3 Industry Self-Regulatory Initiative

No relevant SRI could be identified.

9.2.4 Existing third country legislation and labels

"Hand-held hair dryers" are one of the product groups for which criteria have been developed by the Environmental Protection Administration of Taiwan. The current version, revised in January 2013, sets out requirements on:

- Energy efficiency;
- Maximum content of some hazardous substances for plastic components over 25g: cadmium, lead, chromium, mercury, PBB, PBDE, i.e. the six substances of the RoHS Directive, with chloroparaffins in addition;
- Disassemblability;
- Noise emissions; and
- Electromagnetic interference[76].

The implementation of environmental criteria for hand-held hair dryers took place in 2001 and the latest version of the requirements was defined in January 2013.

[74] GS (Geprüfte Sicherheit, "Tested Safety") is a voluntary German certification mark for technical equipment.

[75] http://www.blauer-engel.de/produktwelt/haushalt-wohnen/haartrockner

[76] http://greenliving.epa.gov.tw/GreenLife/uploadfiles/Criteria/69/087ec305-7bdc-468f-9751-576fe608fc30.pdf

9.2.5 Test standards

What should be measured in order to assess energy efficiency is the drying rate per minute. In standard IEC 61855:2003, "Household electrical hair care appliances", the drying rate is defined thanks to the formula DR = M1 – M2, where M1 is the amount of water before drying and M2 the amount of water after one minute of drying and five seconds of waiting[77]. The Blue Angel also names the DIN EN 61855 norm to assess electricity consumption and drying rate.

Standards for noise also exist, namely the EN 60704 standard for "Household and similar electrical appliances – Test code for the determination of airborne acoustical noise". Even if the standard is not publicly available, the Blue Angel states that the three first parts must be used to assess noise, and namely:

- EN 60704 – 1: General requirements;
- EN 60704 – 2-9: Specific requirements for hair dryers; and
- EN 60704 – 3: Control and verification method of obtained values.

9.2.6 Conclusion for Ecodesign

Energy efficiency is not regulated so far, to the exception of the Blue Angel voluntary label. Besides, there may be room to regulate noise levels. For both topics (energy efficiency and noise), test standards are available. And finally, there might be some room for improvement beyond RoHS and REACH with respect to halogenated flame retardants (also as they are a criterion in the Blue Angel).

9.3 Appropriateness of Ecodesign or Energy labelling

9.3.1 Excessive cost

The discussion about "excessive cost" shall follow a simplified Life-Cycle Cost analysis (LCC), to make sure that savings stemming from lower energy consumption exceed any increase in purchase price. In the case of hair dryers, Table 24 below sums up the LCC performed.

Table 24 : Detailed cost calculation for the "hair dryer" product group

	Hair dryer
Average purchase price	41 €
Energy consumption / year	70 kWh
Lifetime	4 years
Average EU electricity price (domestic)	0.2 € / kWh
Energy costs over lifetime	56 €
Energy savings potential in use phase	30 %
Economic savings potential	16.8 €
Relation (economic savings / purchase price)	41 %

[77] CENELEC (2003). Household electrical hair care appliances – Methods of measuring the performance (IEC 61855:2003).

The relation between economic savings and purchase price is rather "comfortable". As long the average sales price does not increase more than 41%, the average product life cycle is likely to remain cost-neutral.

9.3.2 Suitability of Ecodesign measures or Energy labelling

There seems to be no major hindrance to the implementation of Ecodesign requirements to the "hair dryers" product group. Indeed, the following characteristics of the product group make it pretty suitable for Regulation:

- Mass market products;
- Slow technical evolution;
- There is room for improvement potential regarding both energy and noise efficiency;
- No excessive cost would occur;
- Standards and labelling criteria have been developed; and
- Products are homogenous, also between EU Member States.

The question whether Ecodesign would be better than Energy labelling, or the opposite, or complementary may be discussed here. Both options look possible at first sight. Energy labelling is feasible since we face a business-to-consumer configuration, with probably a sufficient differentiation in energy efficiency across the whole product group[78].

It would remain to be seen if Energy labelling would be enough to drive the market of hair dryers towards a significantly enhanced energy performance. And finally, it is up to the Commission to decide whether minimal requirements should apply to all products or if manufacturers should be able to decide between a A to G scale of energy classes.

9.3.3 Conclusion for Ecodesign

Both Ecodesign and Energy labelling would be appropriate for hair dryers. A preparatory study would / should help to decide which kind of Regulation would be more effective and make an accurate estimate of environmental benefits.

9.4 Industrial competitiveness

9.4.1 Market structure

The market for hair dryers is highly competitive, since there are many manufacturers and the differentiability of products is limited, what makes them rather homogenous. In that sense, competition in this product category is fierce and regulation under the Ecodesign Directive may not result in a big increase in prices.

9.4.2 Innovation and employment

Dealing with innovation, it should be noted that product differentiation already exists on the hair dryers market, what would mean that diverse "fields" are available for innovation (high versus low power, design versus basic, high end versus low end, ionic and ceramic dryers).

[78] According to the Blue Angel, labelled hair are already 30% more efficient than market average.

As manufacturing takes place mostly outside the EU, no major employment effects are expected[69].

9.4.3 International competition

Eight times more hair dryers got imported than exported by the EU-27 in 2012, while also the amount of exports was negligible. However, at least in the early stages, following the adoption of Implementing Measures, European producers might have a considerable advantage if they are better prepared for product and process innovations than their international competition. If this is the case, they will replace a large share of imports with their own Ecodesign-compliant products, resulting in a reinforced market position.

9.4.4 Conclusion for Ecodesign

At first sight, industrial competitiveness of European manufacturers of hair dryers would not be damaged by the implementation of Ecodesign or Energy labelling measures.

9.5 Product group summary and recommendations

Table 25 below presents a simplified scoring of the three main sections above, for the product group "hair dryers".

Table 25: Overall scoring of the "hair dryers" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Hair dryers	++	+++	+++	+++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for hair dryers:

- Minimum requirements on energy efficiency; and
- Minimum requirements on noise levels.

In addition, Energy Labelling may be an interesting option to explore for this product group.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of hair dryers. Should the product group of hair dryers be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

10.Hand dryers

10.1 Main other environmental issues

Table 26 below provides an overview of the relevant environmental aspects of the "hand dryers" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 26: Overview of relevant direct environmental issues and potential for improvement – Hand dryers

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Presence of critical raw materials (see the EU list[79])	?		
Presence of flame retardants (halogenated, etc.)	?		
Presence of plasticisers (phthalates)	?		
Presence of other toxic substances	?		
Presence of F-gases	0		
Radiation levels	0		
Safety (fuel leakage, vibrations, etc.)	0		
Health (hygiene, noise level, etc.)	+++	Noise and hygiene may be an issue.	Some hand dryers on the market already achieve better noise performance.
Durability (reusability, upgradability, reparability, etc.)	++	Durability may be an issue.	

[79] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
End-of-life (recyclability, recycled content)	+	Hand dryers are mainly made of aluminium, steel and/or plastics (see Task 3), i.e. materials that can be recycled.	Design for recyclability would ease a proper treatment at the end-of-life.
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

Generally speaking, the main reference studies for hand dryers were the two following life cycle assessments (LCAs): the Quantis study from 2009[80] which was commissioned by Excel Dryer, and the MIT assessment commissioned by Dyson and dating from 2011[81].

The main differences in assumptions in the hand dryer studies are summarized in the following table.

Table 27: Major assumptions used in the two LCAs of hand driers[80, 81]

Assumption	Quantis study	MIT study
Hand dryer system(s) analysed	Dyson - Airblade, aluminium Dyson - Airblade, plastic Standard warm air dryer	Excel Dryer – XLERATOR Standard warm air dryer
Functional unit (in number of pairs of hands)	1	260,000
Number of pairs of hands dried over life cycle	350,000	260,000
Lifetime (in years)	5	10

Results of both LCAs to be presented.

10.1.1 Noise

Even if used for a short time, hand dryers can have a high noise volume. NSF Protocol P335 for Hygienic Commercial Hand Dryers includes requirements related to noise levels: "Any continuous noise, measured at a distance of one meter directly in front of the system, shall not exceed 90 dBA. Any periodic noise associated with unit operations shall not exceed 100 dBA."[82] Even if the Dyson

[80] Quantis (2009). Comparative Environmental Life Cycle Assessment of Hand Drying Systems: The XLERATOR Hand Dryer, Conventional Hand Dryers and Paper Towel Systems. Commissioned by Excel Dryer, Inc.

[81] MIT (2011). Life Cycle Assessment of Hand Drying Systems, Commissioned by Dyson.

[82] NSF International (2007), NSF Protocol P335 for Hygienic Commercial Hand Dryers.

Airblade was the first to receive NSF Certification to P335, numerous people have noted that new hand dryers are significantly louder than the older, less energy efficient models[83].

This was confirmed by another study entitled "Noise from Energy Efficient Hand Dryers: Is this Progress?"[84], which was focussing solely on the noise levels of hand dryers and which was contradicting manufacturers' statements. Manufacturers stated noise levels of 73-75 dB for warm air hand dryers, while Excel Dryer indicated 78-80 dB for its jet air Xlerator and Dyson published 84 dB for its Airblade. The values the authors of the study found during their own investigations were of 82 dB for conventional warm air dryers, both with and without hands introduced. As for the Xlerator, noise emissions measured reached 83-103 dB (the lower level representing the case without hands, while the higher level accounts for the case with hands). As for the Dyson Airblade their value obtained is with 87-90 dB, also slightly higher than indicated by the manufacturer. Yet, lower sound levels are available, even in new models including: the Clean Dry by Toto (58-62 dBA), Jet Towel by Mitsubishi (65 dBA), Airforce and AirMax by World Dryer (83 dBA), and SpeedFlow by Saniflow[85].

In a study prepared for the European Tissue Symposium[86], the noise level of a jet air hand dryer was measured for different distances first in a laboratory experiment and then in a public washroom. It shall be noted that within a 2-meter distance, any noise level is higher than 80 dB. Table 28 below summarizes the results of the study.

Table 28: Noise levels of jet air hand dryers in laboratory experiment and public washroom

Distance to hand dryer (in m)	Noise level (in dB) – Laboratory experiment	Noise level (in dB) – Public washroom
0.5	94.1	-
1.0	87.4	-
2.0	86.3	83.6 for one hand dryer 92.0 for two hand dryers
10.0	-	77.9

There are technical improvement options with respect to the noise level of hand dryers, as Dyson showed with its Dyson Airblade dB hand dryer, which is, according to the manufacturer, 50% quieter than the original Dyson Airblade[87]. In order to achieve this improvement, the sound from two key sources was reduced, namely air rush noise and motor noise. The first kind of noise was reduced through a redesign of the shape of the apertures through which the air is forced, while the second kind of noise was diminished by improvements directly at the motor.

[83] NSF International (2007), Questions & Answers about the new NSF Protocol P335: Hygienic Commercial Hand Dryers.

[84] Fullerton, J. L. and Unger, G. (2010). Acoustics of energy efficient hand dryers: Is this progress? Journal of the Acoustical Society of America. 127, 1833, http://dx.doi.org/10.1121/1.3384273

[85] J. Fullerton (2010), Noise from Energy Efficient Hand Dryers: Is This Progress? Acoustical Society of America 159th Meeting Lay Language Papers.

[86] University of Westminster (2008), A comparative study of three different hand drying methods: paper towel, warm air dryer, jet air dryer. European Tissue Symposium (ETS).

[87] Dyson Airblade Brochure: http://www.dysonairblade.co.uk/medialibrary/Files/Brochures/Airblade_Brochure_GB.pdf.

10.1.2 Hygiene

Also the hygiene of hand driers has been challenged, since they blow hot air with bacteria onto the hand and the face[88]. According to the study from the University of Westminster, "the performance of both the warm air dryer and the jet air dryer was inferior to paper towels in all respects (drying efficiency, bacterial numbers on the hands, bacterial contamination of the air flow and surfaces of the devices, and transmission of bacteria in the washroom) with the one exception that the jet air dryer is equal in drying efficiency. The jet air dryer was shown to be superior to the warm air dryer in all respects except for similar bacterial contamination and greater transmission potential"[89].

10.1.3 Durability

Waiting for stakeholder input.

Within the German Blue Angel for hand dryers (see section 10.2.2), one of the requirements is that the manufacturer offers a warranty of five years over the whole device as an option.

10.1.4 Conclusion for Ecodesign

Beyond energy consumption, noise could be fairly straightforward to regulate under Ecodesign. Additional information on durability (as well as plasticisers, toxic substances, etc.) would be needed in order to complement the overview of hand dryers' main environmental issues.

10.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards.

10.2.1 Overview of EU policies

Currently, hand dryers are regulated under the WEEE and RoHS Directives and REACH Regulation.

Table 29: Main EU legislation applicable to the "hand dryers" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Hand dryers	X	X	X	-	-	-

Criteria for Green Public Procurement (GPP) of hand dryers have not been developed so far. As hand dryers are commonly installed in public bathroom and almost all buildings occupied by public authorities, it would definitely make sense to develop some. GPP criteria already exist for the following product groups, which are part of the same "environment":

- Flushing toilets and urinals (published in 2013)[90]; and

[88] See for instance: http://www.dailymail.co.uk/health/article-2335811/Ditch-hand-dryer-Paper-towels-MORE-hygienic-remove-germs.html.

[89] University of Westminster (2008), A comparative study of three different hand drying methods: paper towel, warm air dryer, jet air dryer. European Tissue Symposium (ETS).

[90] http://ec.europa.eu/environment/gpp/pdf/criteria/toilets/criteria_Toilets_en.pdf

- Tissue paper, including paper towels (draft)[91].

10.2.2 Selected Member States policies

The following section is dedicated to Member States policies which are in place inside the EU and of which the following table gives an overview.

Table 30: Environmental labels at Member States level

Product group			
Hand dryers	RAL-UZ 8	-	-

Thus, the only label which could be identified to certify hand dryers is the German Blue Angel label. The criteria for the award of the Blue Angel label for hand dryers from April 2010[92] were recently updated in May 2014[93].

Table 31 shows an extract of the requirements hand dryers have to comply with in order to obtain the Blue Angel label. For hand dryers, both award criteria from 2010 and 2014 are presented below, so as to show the evolution. For instance, in the 2014 award criteria, a requirement on the design for recyclability was added. However, the requirements listed here below are not exhaustive.

Table 31: Requirements of Blue Angel label with respect to hand dryers[92, 93]

Requirement	Jet air hand dryer		Warm air hand dryer	
Date of release	April 2010	May 2014	April 2010	May 2014
Energy consumption	7 Wh	12 Wh	12 Wh	12 Wh
Noise emissions (max. dB)	-	85	-	85
Material of touchable surfaces	Compliance with REACH and other regulations			
Safety	Compliance with requirements for GS[94]			
Design for recyclability	-	The device must be easy to disassemble	-	The device must be easy to disassemble
Warranty (as an option, in years)	5			

[91] http://ec.europa.eu/environment/gpp/pdf/Tissue%20paper%20-%20EU%20GPP%20Criteria%20Final%20draft.pdf

[92] Blue Angel (2010), Vergabegrundlage für Umweltzeichen, Elektrische Händetrockner RAL-UZ 87.

[93] Blue Angel (2014), Vergabegrundlage für Umweltzeichen, Elektrische Händetrockner RAL-UZ 87.

[94] GS (Geprüfte Sicherheit, "Tested Safety") is a voluntary German certification mark for technical equipment.

Also one requirement of the label is that the hand dryer should have a kind of standby mode, i.e. a contactless on/off system (like a sensor), which has the device run only when a pair of hands is detected in a drying position. The power consumption in standby shall not exceed 0.5 W.

So far, ten hand dryers on the market have been awarded the label, five of which are manufactured by AIR-WOLF and the other five by ELECTROSTAR[95].

10.2.3 Industry Self-Regulatory Initiative

No relevant SRI could be identified.

10.2.4 Existing third country legislation

The Taiwanese Energy Conservation Labelling program sets the following requirements[96]: the measured Useful Energy Ratio for Energy Label qualified hand dryer products shall be no less than 90%. If the product is touch activated, each drying session shall be less than 40 seconds; if the product is motion activated, the power shall be cut-off within 2 seconds after the sensor sensed the absence of user, and each drying session shall be less than 1 minute.

Hand dryers are also part of the e-Standby Program from the Korea Energy Management Corporation (KEMCO). They are defined as "electrical equipment that utilize fan or electrical heat to dry hands with the nameplate consumption power of 3,000W or below"[97]. Additional information on this specific product group could not be obtained.

10.2.5 Test standards

The Blue Angel label for hand dryers is based on American test standard NSF Protocol P335, which indicates that certified products must dry the users' hands within 15 seconds. Studies have shown this is the typical amount of time a person will spend drying their hands[98].

Standards for noise also exist, namely the EN 60704 standard for "Household and similar electrical appliances – Test code for the determination of airborne acoustical noise".

10.2.6 Conclusion for Ecodesign

To the exception of the Blue Angel environmental label, policy coverage of the "hand dryers" product group appears to be quite limited in Europe (other labelling initiatives are present in Asia – Taiwan and Korea). Yet test standards are available both for noise and energy efficiency so that to this extent, Ecodesign requirements may look interesting.

10.3 Appropriateness of Ecodesign or Energy labelling

10.3.1 Excessive cost

The discussion about "excessive cost" shall follow a simplified Life-Cycle Cost analysis (LCC), to make sure that savings stemming from lower energy consumption exceed any increase in purchase

[95] http://www.blauer-engel.de/produktwelt/elektrogerate/energiesparende-h-ndetrockner-ausgabe-april-2010.

[96] http://www.clasponline.org/en/Tools/Tools/SL_Search/SL_SearchResults/SL%20Detail%20Page.aspx?m=ddd617f5-9666-415e-8e5c-ce52dded7775

[97] http://www.kemco.or.kr/new_eng/pg02/pg02100300_2.asp

[98] NSF (2013). Questions and Answers about the new NSF Protocol P335: Hygienic Commercial Hand Dryers.

price. The case of hand dryers is made complicated by the fact that two main technologies are available, with much difference in purchase price across them. As a matter of fact, a warm air hand dryer will be cheaper to buy but consume more energy in use time, whereas a jet air hand dryer will be more expensive to buy but consume less energy in use time.

Table 32 below sums up the LCC performed, including two different columns:

- Without technology switch. Energy savings for warm air hand dryers only were assumed to be 15% in Task 3 Report; and
- With technology switch. Energy savings when moving from warm air to jet air hand dryers were assumed to be 68% in Task 3 Report.

Table 32: Detailed cost calculation for the "hand dryers" product group

	Without technology switch	With technology switch
Average purchase price	300 €	300 €
Energy consumption / year	1,400 kWh	1,400 kWh
Lifetime	8 years	8 years
Average EU electricity price (non-domestic)	0.12 € / kWh	0.12 € / kWh
Energy costs over lifetime	1,344 €	1,344 €
Energy savings potential in use phase	15%	68%
Economic savings potential	201.6 €	913.9 €
Relation (economic savings / purchase price)	67%	304%

If specific Ecodesign requirements are set and achievable while keeping the warm air technology, the relation between economic savings and purchase price is the following: as long the average sales price does not increase more than 67%, the average product life cycle is likely to remain cost-neutral. If strong / ambitious requirements on energy consumption are set through Ecodesign, they may force manufacturers to switch from warm air to jet air technology. In this case, the relation between economic savings and purchase price is the following: as long the average sales price does not increase more than 304%, the average product life cycle is likely to remain cost-neutral.

10.3.2 Suitability of Ecodesign measures or Energy labelling

There seems to be no major hindrance to the implementation of Ecodesign requirements to the "hand dryers" product group. Indeed, the following characteristics of the product group make it pretty suitable for Regulation:

- Mass market products (even if business-to-business);
- No excessive cost would occur (even if a change in technology may be necessary); and
- Standards and labelling criteria have been developed.

Energy labelling does not sound like a promising option, since the market is business-to-business.

10.3.3 Conclusion for Ecodesign

Ecodesign requirements look reasonable for “hand dryers”. At least the general features of the product group do not present any major counter-argument to the implementation of Ecodesign Regulation.

10.4 Industrial competitiveness

10.4.1 Market structure

The market of hand dryers is rather a business-to-business one, as hand dryers are typically installed in restaurants, offices, etc. There are a few major players in the market of hand dryers, including Conair, Dyson, Excel Dryer, etc. Nonetheless, products are also sold by a big number of SMEs[99]. As for the possibility of new entrance, it may deteriorate, since some amount of experience is probably to manufacture most energy-efficient products.

10.4.2 Innovation and employment

Waiting for stakeholders input.

10.4.3 International competition

Waiting for stakeholders input.

According to Prodcom data, eight times more hand dryers got imported by EU-27 in 2012 as compared to exported.

10.4.4 Conclusion for Ecodesign

Waiting for stakeholders input.

10.5 Product group summary and recommendations

Table 33 below presents a simplified scoring of the four main sections above, for the product group “hand dryers”.

Table 33: Overall scoring of the "hand dryers" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Hand dryers	++	+++	+++	++

The more “+” there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for hand dryers:

- Minimum requirements on energy efficiency; and
- Minimum requirements on noise levels.

Energy labelling is not very appropriate, but GPP criteria could be an interesting policy instrument to explore (complementary to Ecodesign, if any).

[99] CECED, stakeholder’s input to Task 4.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of hand dryers. Should the product group of hand dryers be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

11.High pressure cleaners

11.1 Main other environmental issues

Table 34 below provides an overview of the relevant environmental aspects of the "high pressure cleaners" product group, and possible improvement options linked to them, based on information provided by stakeholders and gathered in the literature. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 34: Overview of relevant direct environmental issues and potential for improvement – High pressure cleaners

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	+++	Water consumption is inherent to the cleaning process.	Water consumption can be reduced by a better cleaning efficiency and product improvement[100] (narrowing the diameter of the nozzle).
Consumables (detergents, etc.)	+	Usually no consumables required for high pressure cleaning. Detergents are sometime used to remove special kind of dirt, e.g. grease or oil.	The consumption of detergents can be reduced by a better cleaning efficiency (of the detergents and the HPC), and a precise dosage system. Environmental impacts can be reduced by using more environmentally friendly detergents.
Presence of critical raw materials (see the EU list[101])	+	Some critical raw materials may be parts of semi-manufactured materials, subsystems or components of a high pressure cleaner.	
Presence of flame retardants (halogenated, etc.)	+	Brominated and chlorinated flame retardants are present in some HPC, especially in CWC and HWC.	
Presence of plasticisers (phthalates)	+	Phthalates can be found in some HPC, especially in PVC-cables and PVC-hoses.	
Presence of other toxic	+	Toxic substances such as heavy metals are present in	

[100] Source: European Cleaning Journal, *High pressure cleaners – can they be sustainable?*, November, 28th, 2011 (http://www.europeancleaningjournal.com/magazine/articles/special-features/high-pressure-cleaners-can-they-be-sustainable)

101 See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
substances		some HPC especially in PVC-cables and PVC-hoses.	
Presence of F-gases	0		
Radiation levels	0		
Safety (fuel leakage, vibrations, etc.)	++	High pressure cleaning operation generates vibrations which can cause Hand Arm Vibration Syndrome (HAVS).	Vibrations can be reduced by product improvement (design of the handle of the spray lance).
Health (hygiene, noise level, etc.)	++	Noise emission from the high pressure cleaning unit (engine and pump) and from the water jet during cleaning operations. Some domestic appliances can emit noise up to 95 dB.	Reduction of noise and power to an optimum level, development of innovative nozzle technologies, implementation of appropriate cleaning practices.
Durability (reusability, upgradability, reparability, etc.)	++	Short durability is a problem of poor quality products. Those products have a shorter life span, are not sufficiently repairable, spare parts are not available, no upgrade possible.	Products can be designed to ease the access to key components facilitate the repair and reuse.
End-of-life (recyclability, recycled content)	++	HPC are usually made of aluminium and plastics.	Some products on the market are recyclable up to 90% with appropriate design.
Direct emissions to air	+++	Direct emissions, CO, CO_2 and particulate matter (for hot water commercial products) from the consumption of heating oil.	Emissions and particulate matter can be reduced by improvement of cleaning efficiency for all HPC and usage of low emissions burner for hot water HPC.
Direct emissions to water	+	Emissions to water are caused by cleaning of objects or surfaces polluted with oil, grease, etc., or by using detergents.	Emissions and pollution with oil, etc., cannot be reduced by modification of the HPC. Some professional HPC are equipped with a sucking system that collects, recycles and allow reusing up to 95% of the direct water consumption of the HPC. Emissions to water of detergents can be reduced by a precise dosing system.
Direct emissions to soil	+	Emissions to soil can possibly occur if the cleaning process is done on unpaved ground.	Emissions to soil cannot be reduced by modification of the HPC.
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

11.1.1 Water consumption

High pressure cleaning operations inevitably generates significant water consumption hence water consumption is a major environmental issue for HPC. Water consumption of HPC is estimated at 350 L/hr, 650 L/hr and 700 L/hr respectively for Cold Water Domestic, Cold Water Commercial and Hot Water Commercial HPC, according to the industry[102]..

According to the industry, significant improvements of water consumption can be achieved by improving the cleaning efficiency of HPC. For example, the reduction of the time required to operate a cleaning task is an important parameter of the water consumption efficiency of HPC: a manufacturer carried out some tests on two 160 bar models that showed that using for an identical cleaning task a 700 L/hr machine required 1 hour 12 minutes to clean compared with only 26 minutes for a 1,200 L/hr machine, generating more than 500 L of water savings while saving energy and labour costs103.

The design of HPC nozzle can also lead to significant water savings: a manufacturer developed a new nozzle technology for domestic HPC that reduces cleaning operations time up to 50 % and claims that this new technology generates energy and water savings of up to 50 %[103].

Finally, some professional HPC are equipped with a sucking system that collects used water which can be recycled by the cleaning unit. A manufacturer claims that up to 95% of the water consumed can be recycled and reused with such a system[104].

11.1.2 Durability

Durability of high pressure cleaners is closely linked to the quality of the products. Product's lifespan improvement can be achieved by increasing:

- The reparability of the products, to be considered at the design phase, can be improved by using a limited number of components and assemblies, as many standard parts as possible and by ensuring a good accessibility to the components to be replaced;
- The availability of spare parts until the end of the projected service life of the products: some manufacturers guarantee a spare parts supply for up to 10 years after a model goes out of production[105]; and
- The resistance of key elements of the products such as the hose, some engine parts (pumps).

11.1.3 Safety

High pressure cleaners can be subject to inadvertent movement, with the potential to cause harm to workers or people standing close to the cleaning operations. The following safety issues regarding high pressure cleaners can be stated:

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[102] However, manufacturers argue that using a domestic HPC to wash a car consumes between 6 and 10 times less water than the use of a simple hose pipe at low pressure. The additional pressure and water flow provides a level of cleaning performance that cuts cleaning time. Source: European Cleaning Journal, *High pressure cleaners – can they be sustainable?*, November, 28th, 2011 (http://www.europeancleaningjournal.com/magazine/articles/special-features/high-pressure-cleaners-can-they-be-sustainable)

[103] Source: Kärcher, http://www.karcher.com/int/Products/Home__Garden/Pressure_washers/50_percent_faster.htm

[104] Source: Aquila Triventek, http://www.aquila-triventek.com/en/

[105] Source: Kärcher, http://www.karcher.com/versions/int/assets/ecoefficiency_GB_0911.pdf

- The powerful spray from a high pressure cleaner can travel at speeds exceeding 3,300 kilometres per hour[106] and can cause serious damages to the human body;
- Debris propelled by water jets can injure eyes, skin, and body parts upon impact;
- Electric shock can occur if the pressure washer is not used properly;
- For fuel-powered hot water pressure cleaners, engines can cause carbon monoxide poisoning if the product is used in confined spaces or partially enclosed spaces;
- High pressure cleaning is physically demanding work; workers are often required to work in awkward positions or in confined spaces, to lift heavy tools or materials, and to work with high push/pull (reaction) force. Those working conditions can cause musculoskeletal injuries; and
- The very purpose of the activity is to clean or remove chemical substances; hence contact with hazardous chemical substances is a real risk in the high pressure cleaning process.

Some of those safety risks can be addressed by equipping the products with special features such as dead man's trigger, unloaders and thermal relief valves, adjustable nozzle to change the spray pattern from narrow (higher pressure) to wide (lower pressure), but most of those issues depends directly on the user's practices and can be addressed with safe practices implementation and appropriate legislation and standards (see section 11.2).

11.1.4 Noise

Noise is emitted from the high pressure cleaning unit due to the mechanical operation of the engine and the pump, and from the water jet during cleaning operations. In addition of being a nuisance for the environment, noise is also damaging for the human health, especially for worker frequently exposed to noise emissions from HPC. According to manufacturers' technical data, cold water domestic HPC can make a noise up to 95dB.

Some manufacturers try to tackle the noise emission issue e.g. by reducing noise and power to an optimum level, or by developing new nozzle technologies. According to the motor used, the noise made by HPCs can be reduced. As an example, Kärcher reduced by 10 dB the noise of some of its cold water domestic HPC models compared to average similar appliances, by using water-cooled motor instead of using external air-cooled motor, reaching a maximum noise level of 76 dB.

11.1.5 End-of-life

Waiting for stakeholders input.

11.1.6 Conclusion for Ecodesign

Besides the energy consumption issue, other environmental aspects are of importance regarding high pressure cleaners. Water consumption, durability, recyclability, noise and safety aspects could be improved thanks to a proper design, and some manufacturers are communicating on models allowing such environmental benefits.

[106] Source: WorkSafeBC (2008), High pressure washing – Safe Work Practices.

http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/bk123.pdf

11.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

11.2.1 Overview of EU policies

Currently, high pressure cleaners are regulated under the EU WEEE and RoHS Directives, and REACH Regulation.

Table 35: Main EU legislation applicable to the "High Pressure Cleaners" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
High pressure cleaners	X	X	X	-	-	-

Outdoor Noise Directive (2000/14/EC)

The Noise Emission in the Environment by Equipment for Use Outdoors Directive, or Outdoor Noise Directive, aims at controlling and monitoring noise of equipment for use outdoors so as to reduce noise nuisance and to remove technical barriers to trade arising out of European Member States' different noise requirements. Manufacturers are required to measure, or have measured, the sound power level of the 57 categories of equipment listed in the Directive, 22 of which have to meet limits.

HPC fall under the Directive and are subject to noise marking only.

Other relevant Directives

- Battery Directive (2006/66/EC) on batteries and accumulators containing certain dangerous substances that regulates the manufacture and disposal of batteries. This Directive sets maximum quantities for certain chemicals and metals in certain batteries and requires proper waste management of these batteries;
- Noise Directive (2003/10/EC) on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise). The regulations introduced exposure limits in relation to noise in the workplace and defines the average level of noise that an employee could be exposed to during an average day or week;
- Physical Agents (Vibration) Directive (2002/44/EC) on minimum requirements for the health and safety of workers exposed to vibration. It introduces exposure action and limit values for both hand-arm vibration and whole-body vibration, setting minimum standards for the control of vibration risks;
- 97/68/EC Directive on emission of gaseous and particulate pollutants from internal combustion engines. The Directive stipulates the maximum permitted exhaust emissions as a function of the power of the relevant engine. Moreover the Directive includes a series of emission limit stages of increasing stringency with corresponding compliance dates. Manufacturers must ensure that new engines comply with these limits in order that they can be placed on the market.

- PED (Pressure equipment Directive - 97/23/EC) sets out the standards for the design and fabrication of pressure equipment and also sets the administrative procedures requirements for the "conformity assessment" of pressure equipment;
- ATEX Directive (equipment and protective systems intended for use in potentially explosive atmospheres - 94/9/EC) that provides harmonised requirements for non-electrical equipment, equipment intended for use in environments which are potentially explosive due to dust hazards and protective systems; and
- 90/396/EEC Directive on appliances burning gaseous fuels contains essential requirements that an appliance must meet when it is placed on the European market. The Directive does not indicate how these requirements must be met, thus leaving flexibility to manufacturers as regards technical solutions to be adopted.

11.2.2 Selected Member States policies

No Member State policy applying to domestic and commercial HPC has been identified.

11.2.3 Industry Self-Regulatory Initiative

EUnited Cleaning[107] produces Technical Recommendations (TR), i.e. “semi-standards” for issues that the cleaning machines industry considers as not adequately covered by European or international standards. Thus, the industry defines requirements and recommends measures in addition to the existing European and international standards.

Examples of specific TR are given below:

- TR 34001 “Electromagnetic compatibility (EMC)”: this document recommends those European standards for electromagnetic compatibility that must be taken into consideration to fulfil the essential requirements of European Directive 2004/108/EC on the electromagnetic compatibility of cleaning machines;
- TR 34002 “Machinery Directive Guideline”: this TR is a guideline for manufacturers applying the Machinery Directive, besides the specification of requirements within relevant safety standards; and
- TR 34003 “Wheel pressure in floor cleaning machines”: for the professional application of floor-cleaning machines in public and commercial buildings (e.g. hospitals, railway stations, airports, sports facilities and supermarkets), the input from manufacturers of machines shall be considered regarding the nature of floors and the stress involved. Building operators and engineers shall consider the main effects mentioned within the TR as well as the application instructions from the manufacturers relating to the machinery in question.

Moreover EUnited Cleaning set up the “EUnited Cleaning Burner Efficiency” labelling scheme that applies to burners of oil-heated stationary or quasi-stationary HPC, which have to meet requirements on thermal exhaust loss, CO emissions, and dust emissions. An example of such label is presented in Figure 4.

[107] The association of European cleaning machines manufacturers - EUnited Cleaning - represents the leading producers of floor cleaning machines and high pressure cleaners for commercial and industrial use.

Figure 4: Example of label according to the EUnited Cleaning scheme for oil-heated HPC

11.2.4 Existing third country legislation and labels

In the US, high pressure cleaners are targeted by the Clean Water Act (CWA) though this legislation refers to the user practices and not the design of the device. This Act is the principle law governing pollution control and water quality of the USA's waterways. The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the USA's waters. Section 301 of the CWA prohibits a point source discharge of pollutants into waters of the USA without a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permits require treatment of the pollutants to a degree that will comply with established water quality standards. Discharges from Power (Pressure) Washers that clean such things as equipment, a restaurant's solid waste storage areas, or a parking lot and discharges the process water into a storm drain are prohibited without an NPDES permit..

11.2.5 Test standards

No specific standard on energy (and water) consumption has been identified for HPC. Two European standards related to safety have been identified:

- EN 60335: Safety of household and similar electrical appliances standard; and
- EN 1829: High pressure water jet machines - Safety requirements standard.

EN 60335: Safety of household and similar electrical appliances

Standard EN 60335 deals with the safety of high pressure cleaners without traction drive, intended for household and commercial indoor or outdoor use with a rated pressure up to 2.5 MPa and not exceeding 35 MPa. It also applies to steam cleaners and those parts of hot water high pressure cleaners incorporating a steam stage which have a capacity not exceeding 100 L, a rated pressure not exceeding 2.5 MPa.

This standard does not apply to high pressure water jet machines which are covered by EN 1829.

EN 1829: High pressure water jet machines - Safety requirements standard

EN 1829 is divided in two parts: the first part describes the safety requirements for high pressure washers and high pressure water jet machines regardless the type of drive and takes into account the significant hazards related to their use. It concerns more specially the machines used in industrial applications such as cleaning, surface preparation, moving equipment, concrete adjustments and

cutting. The second part deals with the safety requirements, testing protocols and marking that apply to hoses connection and their security mechanisms. It takes into account significant hazards that may result from the assembly, operation and maintenance of hoses, hose lines intended for use with high pressure cleaners and high pressure water jet machines, covered by part 1.

11.2.6 Conclusion for Ecodesign

Policy coverage of the HPC product group mainly encompasses health and safety issues, as well as chemical and hazardous substances. No specific policy or initiative covering energy and water consumption were identified.

11.3 Appropriateness of Ecodesign or Energy labelling

Whereas the "regulatory coverage" section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on "Appropriateness of Ecodesign requirements" will address the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

11.3.1 Excessive cost

The discussion about "excessive cost" follows a simplified Life-Cycle Cost analysis (LCC), to make sure that savings stemming from lower energy consumption exceed any increase in purchase price. In the case of HPC, Table 36 below sums up the LCC performed.

Table 36: Detailed cost calculation for the "high pressure cleaners" product group

	Cold Wat HPC Dom	Cold Wat HPC Com	Hot Wat HPC Com
Average purchase price	200 €	500 €	4,500 €
Electricity consumption / year	19.2 kWh	400 kWh	750 kWh
Oil consumption / year	-	-	7,500 kWh
Lifetime	10 yrs	12 yrs	10 yrs
Average EU electricity price	0.2 €/kWh	0.12 €/kWh	0.12 €/kWh
Average EU oil price	-	-	0.153 €/L
Energy costs over lifetime	38 €	576 €	12,375 €
Energy savings potential in use phase	10%	10%	10%
Economic savings potential	3.84 €	57.60 €	1,237.50 €
Relation (economic savings / purchase price)	2%	12%	28%

The average Cold Water Domestic, Cold Water Commercial and Hot Water Commercial HPC life cycles are likely to remain cost-neutral as long the average sales price does not increase more than 2%, 12% and 28% respectively..

11.3.2 Suitability of Ecodesign measures or Energy labelling

Considering that the improvement potential is about 10%, this means that there is not enough difference between the “worst” and the “best” models, in terms on energy consumption, to set an energy label.

Applying Ecodesign to high pressure cleaners could be a good example to address various important issues with a single tool. Indeed, improvement potential exists on energy, water, noise, durability and recyclability aspects according to some manufacturers’ claims.

11.3.3 Conclusion for Ecodesign

Ecodesign could be a useful policy instrument to address issues not already covered, even if the compliance of requirements for Cold Water Domestic HPC at affordable cost for customers is questionable.

11.4 Industrial competitiveness

11.4.1 Market structure

EUnited Cleaning represents 16 European HPC manufacturers among which are the two market leaders, i.e. Karcher and Nilfisk Advance.

Waiting for stakeholders input

11.4.2 Innovation and employment

Waiting for stakeholders input

11.4.3 International competition

The cleaning machines sector is highly specialised and extremely export-oriented. State of the art technology, excellent processing and the development of new areas of application, secure the European manufacturers a good position within the scope of international competition.

11.4.4 Conclusion for Ecodesign

To be completed

11.5 Product group summary and recommendations

Table 37 below presents a simplified scoring of the four main sections above, for the product group “high pressure cleaners”.

Table 37: Overall scoring of the "high pressure cleaners" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Cold Wat HPC Dom	++	++	TBC	TBC
Cold Wat HPC Com	++	++	TBC	TBC
Hot Wat HPC Com	+++	++	TBC	TBC

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for HPC:

- Minimum requirements on energy efficiency;
- Minimum requirements on water efficiency in the use phase; and
- Minimum requirements on the operational motor life time and on the durability of specific parts (e.g. spray lance, pumps, burners)[108].

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of HPC. Should the product group of HPC be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

[108] Suggestion from a stakeholder taking Vacuum cleaners Ecodesign Regulation for example.

12.(Free-standing) Hot vending machines

12.1 Main other environmental issues

Table 38 below provides an overview of the relevant environmental aspects of the "Free-standing hot vending machines" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 38: Overview of relevant direct environmental issues and potential for improvement – Free-standing hot vending machines

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0	Water used to produce the beverage is considered not wasted.	
Consumables (detergents, etc.)	0	Cups, coffee or other ingredients required to produce and deliver the beverage are required to fulfil the function and do not impact the environmental performance of the product.	
Presence of critical raw materials (see the EU list[109])	+	Some CRM and precious metals contained in printed circuit boards and in screens (e.g. indium).	Extractability of PCBs and of screens would ease the recycling of CRM.
Presence of flame retardants (halogenated, etc.)	?		
Presence of plasticisers (phthalates)	?		
Presence of other toxic substances	?		
Presence of F-gases	0		
Radiation levels	0		
Safety (fuel leakage, vibrations, etc.)	0		
Health (hygiene, noise level, etc.)	++	Materials in contact with water must comply with EU Food	The industry strongly recommends hygiene quality

[109] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
		Contact Materials Regulation. Cleaning of machines is essential to comply with health requirement and ensure "right" taste.	training and controls for machine operators.
Durability (reusability, upgradability, reparability, etc.)	++	Vending machines might be replaced while still functioning and thus second hand-market may be important.	Manufacturing machines on a modular basis, so parts can be substituted and replaced easily by an operator.
End-of-life (recyclability, recycled content)	+	Besides some CRM that worth being recycled, vending machines are mainly made of steel, iron, copper, aluminium and plastics which are recyclable.	As vending machines are in the scope of WEEE, good design practices might already be applied.
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

12.1.1 Durability

To be completed.

12.1.2 Hygiene

The purpose of a hot vending machine is to prepare the desired hot beverage (coffee, tea, etc.) that will be drunk by the customer. Therefore, it is important that the beverage does not present any risk of contamination for him that could lead to complains, in the best case.

Manufacturers of vending machines dedicate particular attention to potential health to meet customers' expectations and to comply with existing legislation. Indeed, the European Vending Association (EVA) has developed a guide for vending "The Essentials of Hygiene", that describes the basic principles to which a route filler must abide when dealing with a machine (how to clean one's hands, how to handle the cups, etc.). EVA has also developed guidance on "Food Safety Management For Vending", to help operators establish a HACCP (Hazard Analysis Critical Control Point) plan.

Operators should follow such documents and be trained.

12.1.3 Conclusion for Ecodesign

Health and hygiene concerns are already addressed by the industry and we do not consider that ecodesign could handle such aspect. However, if Ecodesign requirements are defined for this product group, it will be important to ensure that they do not affect health requirements.

12.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

12.2.1 Overview of EU policies

Currently, free-standing hot vending machines are regulated under the EU WEEE (category 10), RoHS and REACH.

Table 39: Main EU legislation applicable to the "Free-standing hot vending machines" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Free-standing hot vending machines	X	X	X	-	-	-

Regarding health and hygiene issues, vending machines should comply with Regulation 852/2004 on the hygiene of foodstuffs, and with Regulation 1935/2004 on food contact materials.

12.2.2 Selected Member States policies

No policies at Member State level could be identified.

12.2.3 Industry Self-Regulatory Initiative

As indicated in Task 3, EVA has developed an Energy Measurement Protocol (EVA EMP), which describes a uniform method to measure the energy consumption of vending machines. The latest version of EVA EMP is 3.0B (see more detailed in section 12.2.5), targeted at hot and hot & cold drinks machines. The EVA EMP 3.0B calculation sheet provides an energy labelling scale for tertiary hot beverage vending equipment[110].

12.2.4 Existing third country legislation and labels

It is worth mentioning the Japanese Top Runner programme. This programme is intended to improve energy efficiency of end-use products and to develop "world's most energy-efficient products"[111], and on covered product group is vending machines, including those for canned/bottled beverages, those for beverage in paper containers, and those for beverage served in cups (however compact table-top models used on tables are excluded). The programme establishes a measurement method for energy consumption and a maximum energy consumption value (based on the hot water tank capacity).

[110] EVA indicated that the scale is just a visual facility for people filling in the test and that E VA has never pretended to use this scale as an energy label.

[111] http://www.eccj.or.jp/top_runner/

Last version of the specifications of the Top Runner Programme was published in June 2007.

12.2.5 Test standards

Within the EVA EMP standard, the energy consumption is measured in stand-by situation and vending situation. In details, there are seven test phases:

- Machine Heat Up phase;
- Machine Idle phase;
- Machine Vending phase;
- Energy Saving Mode phase;
- Heat Up phase from Energy Saving Mode to Idle;
- Machine Idle phase – Cold drinks only; and
- Machine Vending phase – Cold drinks only.

The EVA-EMP is a self-declaration standard. EVA asks his members that use the EVA EMP standard to send him the test report.

In addition, as also mentioned in Task 3, A DIN standard exists for measuring of the energy use of commercial coffee machines, which is identical to the EFCEM Energy Efficiency Standard for Commercial Coffee Makers. It was not specifically developed for vending machines, and actually it seems that is not currently used for such products. In addition, even if applied to a same product, results of measurements using both EVA EMP and DIN/EFCEM standard would not be comparable as the DIN/EFCEM standard is measuring energy losses, i.e. not considering energy required to produce the beverage.

12.2.6 Conclusion for Ecodesign

Regarding the energy consumption of free-standing hot beverage vending machines, no EU or Member State policy is tackling this issue.

The EU main industry association has already developed a measurement standard and an energy scale allowing benchmarking models. EVA considers that this voluntary initiative has been effective in driving the market into more energy efficient products.

12.3 Appropriateness of Ecodesign or Energy labelling

Whereas the “regulatory coverage” section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on “relevance of Ecodesign requirements” will address the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

12.3.1 Excessive cost

The discussion about “excessive cost” shall follow a simplified Life-Cycle Cost analysis (LCC), to make sure that savings stemming from lower energy consumption exceed any increase in purchase price. In the case of free-standing hot vending machines, Table 73 below sums up the LCC performed.

Table 40 : Detailed cost calculation for the "Free-standing hot vending machine" product group

	Free-standing vending machine
Average purchase price	4,500 €[112]
Energy consumption / year	2,350 kWh
Lifetime	7.25 years
Average EU electricity price (non-domestic)	0.12 €/kWh
Energy costs over lifetime	2,045 €
Energy savings potential in use phase	35%
Economic savings potential	715 €
Relation (economic savings / purchase price)	16%

As long the average sales price does not increase more than 16%, the average product life cycle is likely to remain cost-neutral. However, the assumed improvement potential of 35% is contested by EVA, which also considers that the more straightforward energy efficiency improvement options have been implemented in the machines already, and that future improvement options would likely push the purchase price higher.

12.3.2 Suitability of Ecodesign measures or Energy labelling

EVA indicates that amongst European manufacturers, the difference in terms of environmental performance of models is limited what would not favour an Energy label scheme (considering that most of sales come from EU manufacturers). The relevance of the EVA energy scale, even if not presented as an energy labelling scheme, is however questionable if only marginal variations between models exist.

Even if challenged by EVA, improvement options are available (as claimed by some manufacturers) and are not proprietary technologies. However, no information allows indicating that such options could be implemented at affordable cost. As mentioned in Task 3, the Working Document related to ENER Lot 12 on refrigerated commercial display cabinets, including cold vending machines, includes requirements related to durability and end-of-life aspects (e.g. PCBs larger than 10 cm², LCD screens larger than 100 cm² and gas discharged lamps shall be easily identified, easily accessed, and extracted for recycling using only standard tools). As about half of manufacturers produce both cold and hot vending machines, we could suppose that such types of requirements could alo be set for hot vending machines.

[112] Note that in Task 3 report an average purchase price of 6,000€ was indicated. However, EVA has provided a revised estimate of 4,500€.

12.3.3 Conclusion for Ecodesign

Energy labelling does not seem to be a suitable option. The example of cold vending machines would indicate that ecodesign requirements could be developed for hot vending machines, not only in terms of energy efficiency but also to ease the repair and recycling of the product.

12.4 Industrial competitiveness

12.4.1 Market structure

The European market is dominated by a lot of SMEs. EVA includes about 25 machine manufacturers and represents the majority of sales[113].

12.4.2 Innovation and employment

EVA indicates that between 3,000 and 5,000 people are employed for the production of hot vending machines in Europe.

12.4.3 International competition

According to EVA, almost 100% of hot vending machines sold in Europe are manufactured in Europe. In addition, EVA claims that European vending machines are much more energy efficient than foreign vending machines.

12.4.4 Conclusion for Ecodesign

Based on available information, any Ecodesign Regulation would mostly affect European manufacturers mainly made of SMEs.

12.5 Product group summary and recommendations

Table 7 below presents a simplified scoring of the four main sections above, for the product group "Free-standing hot vending machines".

Table 41: Overall scoring of the "Free-standing hot vending machine" product group

Product group	Other environmental impacts	Regulatory coverage	Relevance of Ecodesign or Energy labelling	Industrial competitiveness
Free-standing hot vending machines	+	++	+	++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for free-standing hot vending machines:

- Minimum requirements on energy efficiency; and
- Requirements to ease the access, extract for repair and recycling of key components such as PCBs and LCD screens.

[113] http://www.vending-europe.eu/en/members/companies.html

Energy labelling does not seem to be a relevant option.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of gateways. Should the product group of gateways be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

13.Kettles

13.1 Main other environmental issues

Table 42 below provides an overview of the relevant environmental aspects of the "kettles" product group, and possible improvement options linked to them. Task 4 considers domestic electric kettles for heating water for drinks and cooking only. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group,

Table 42: Overview of relevant direct environmental issues and potential for improvement – Kettles

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	++	Users have a tendency to heat more water than necessary.	The main benefit is from the energy saving but a small saving in water use would also be achieved.
Consumables (detergents, etc.)	0	Descaling chemicals may be used, but are not usually hazardous.	None.
Presence of critical raw materials (see the EU list[114])	+	Chromium is used in stainless steel and in nichrome heating elements. Antimony is used (as a flame retardant), cobalt and beryllium might be used in very small amounts in alloys.	Not an issue due to relatively small amount used.
Presence of flame retardants (halogenated, etc.)	+	Flame retardants are required by EU safety legislation.	These substances are not an issue as these do not pose a risk if kettles are recycled according to the requirements of EU waste legislation.
Presence of plasticisers (phthalates)	+	May be present in mains cable and a few other parts.	Hazardous phthalates are already being phased out due to REACH and four may be banned by RoHS.
Presence of other toxic substances	0	Kettles are in scope of RoHS and REACH which restricts the use of hazardous substances.	No unregulated hazardous substances are used that pose a risk.
Presence of F-gases	0		
Radiation levels	0		

[114] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Safety (fuel leakage, vibrations, etc.)	+	Fire would cause environmental & health damage but are prevented by safe designs and use of flame retardants.	None.
Health (hygiene, noise level, etc.)	+	Some designs are noisier than others but the level is annoying but not harmful. Materials in contact with water must comply with EU Food Contact Materials Regulation.	
Durability (reusability, upgradability, reparability, etc.)	++	Some evidence that durability is an issue. Kettles are usually impossible to repair.	Improved durability would reduce resource consumption.
End-of-life (recyclability, recycled content)	+	In scope of WEEE Directive so should be collected and recycled.	
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

13.1.1 Durability

This is extensively described in Task 3 with all available data. This is however not conclusive and further research will be needed to establish the true extent of this issue.

13.1.2 Noise

Although some users complain that some kettles are noisy, the noise level is not thought to cause harm. The result of unusually noisy kettles is that some users return them to suppliers or discard them prematurely.

13.1.3 End-of-life

Kettles are relatively simple products that are easily recyclable. In principal, the metals and plastics can be recovered for reuse. Kettles are in scope of the WEEE Directive.

13.1.4 Conclusion for Ecodesign

No significant issues have been identified apart from those described in task 3. Based on published data, there appears to be a significant potential energy saving. Manufacturers have claimed that electric kettles are already very energy efficient; this is correct, they are much better than heating

water on hobs, however, the aim of this assessment is to identify product groups where the potential energy saving is significant and this appears to be the case.

The issue of durability is less clear with contradictory evidence available. It is clear that early kettle failures occur but the percentage in years 1 and 2 may not always be a large percentage and data for subsequent years is not available apart from data from Which? that suggests that most kettles last 3 or less years whereas they can be designed to last for 7 without an excessive increase in production cost.

13.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

13.2.1 Overview of EU policies

Currently, kettles are regulated under the EU WEEE, RoHS and REACH.

Table 43: Main EU legislation applicable to the "kettles" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	EU Ecolabel
Kettles	X	X	X	-	-	-

There is an ecolabel for water heaters that are used for central heating systems, but kettles are not in scope and no ecolabel exists.

- **WEEE** – Kettles should be collected at end of life and treated and recycled according to the obligations of the WEEE Directive and EU waste legislation. Kettles consist mainly of plastics and metals; however, it is the metals content that has a sufficiently high value to encourage recycling. Ecodesign obligations are unlikely to benefit end of life except by improving durability so that fewer kettles reach end of life each year.
- **RoHS** – This Directive currently restricts the use of six substances in kettles and it is likely that more substances will be restricted in the future (e.g. phthalates). It is therefore not necessary for any future ecodesign legislation to consider hazardous substance restrictions.
- **REACH** – This legislation either discourages use of hazardous substances (by inclusion in the SVHC candidate list) or by imposing restrictions. This is effective legislation that should not be duplicated by ecodesign.
- **Ecodesign** – in scope of standby and off-mode Regulation which limits standby energy consumption to 0.5W. In practice, most kettles have 0W consumption when not used.
- **Food contact materials Regulation** – this is applicable for parts that are in contact with water that is consumed by the user.

13.2.2 Selected Member States policies

The following section is dedicated to Member States policies which are in place inside the EU and of which the following table gives an overview.

Table 44: Environmental labels at Member States level

Product group	DER BLAUE ENGEL JURY UMWELTZEICHEN	NF ENVIRONNEMENT	NORDIC ECOLABEL
Kettles	X	-	-

There is a Blue Angel Label for kettles.

Details to follow.

13.2.3 Industry Self-Regulatory Initiative

No relevant SRI could be identified.

13.2.4 Existing third country legislation and labels

None identified.

13.2.5 Test standards

The British Standards Institute published BSI BS 3999-1 “Methods of Measuring the Performance of Household Electrical Appliances Part 1: Electric Kettles and Jugs” in 1993.

There is no specific standard for measurement of energy consumption although kettle safety standards exist. Development of an energy consumption measurement method would be straightforward; it would need to measure energy from a predefined temperature (e.g. 10˚C) until the kettle automatically switches off. The standard would need to define the amount of water used and this may vary depending on the kettle’s capacity.

Standards for noise also exist, namely the EN 60704-3 standard for “Household and similar electrical appliances – Test code for the determination of airborne acoustical noise”. This gives a test method which is suitable for household appliances including kettles

13.2.6 Conclusion for Ecodesign

Kettles are already regulated by EU legislation such as RoHS, REACH, WEEE, food contact materials and standby and off-mode but energy consumption is not regulated in the EU or elsewhere.

13.3 Appropriateness of Ecodesign or Energy labelling

Task 3 showed that the potential energy saving in the use phase may be significant, based on the published data described in task 3. There is evidence that durability may be an issue with potential for improvement, but this is not conclusive as extensive independent data is not available. It is also unclear whether the savings in resource consumption would be sufficiently large to warrant regulation.

13.3.1 Excessive cost

This was discussed in task 3. Retail prices vary from €6 to €120 although production costs can be as little as €6.2, so a small increase in production costs would not significantly impact consumers, although may affect manufacturers of kettles that sell for the lowest prices. The Ecodesign issues discussed in Task 3 will mainly require R&D and design changes with minimal impact on production costs, apart from use of thick film elements which currently are more expensive than resistance coil heaters. Consumers would benefit from reduced energy consumption as the value of savings on electricity bills will be larger than any likely price increases, even if the Task 3 estimates are over-optimistic and are only half those predicted from published data.

In the case of kettles, Table 45 below sums up the LCC performed.

Table 45: Detailed cost calculation for the "kettles" product group

	Kettle
Average purchase price	€40
Energy consumption / year	167kWh
Lifetime	Up to 7 years
Average EU electricity price (domestic)	0.2 €/kWh
Energy costs over lifetime	233 €
Energy savings potential in use phase	Up to 24%
Economic savings potential	56 €
Relation (economic savings / purchase price)	140%

13.3.2 Suitability of Ecodesign measures or Energy labelling

There seems to be no major hindrance to the implementation of Ecodesign requirements to the "kettles" product group. Indeed, the following characteristics of the product group make it suitable for Regulation:

- Mass market products (60 million annual sales);
- Published data indicates a significant potential energy saving, although this is disputed by manufacturers;
- Best Available Technologies (BAT) exists as described in Task 3;
- No excessive cost would occur; and
- Products are homogenous, also between EU Member States with many manufacturers on this market.

Kettles are a consumer product so would benefit from an energy label if this can show a significant difference in energy consumption between products. If the size of the resource consumption saving

from improved durability is seen as being significant, then Ecodesign obligations would be required to achieve this.

13.3.3 Conclusion for Ecodesign

The impact of ecodesign requirements should not result in excessive costs to manufacturers or consumers. Most manufacturer costs will be for R&D and for testing and so will have a larger impact on SMEs than on large enterprises.

13.4 Industrial competitiveness

13.4.1 Market structure

The market for kettles is highly competitive with many manufacturers on the EU market. Differentiation of products is limited, which makes kettles a rather homogenous product group. Competition in this product category is fierce and regulation under the Ecodesign Directive may not result in a big increase in prices.

13.4.2 Innovation and employment

Kettles are relatively mature products and so Ecodesign requirements are unlikely to significantly affect innovation. Although kettles appear to be relatively simple designs, achieving good performance, low energy consumption and durability all require a high level of expertise and good production quality. Ecodesign requirements will encourage reputable EU brands of manufacturers to continue to invest in achieving good performance, low energy consumption and durability and would also encourage cheaper brands and retailer brands to ensure that they can also achieve good performance, low energy consumption and durability.

The majority of kettles sold in the EU are manufactured in factories in Asia although there are a few EU factories that make kettles. Ecodesign requirements could benefit EU employment if it encouraged more production in the EU as control of good design and product quality is easier if manufacturing is located in the EU.

13.4.3 International competition

Although most kettles sold in the EU are imported into the EU, these are mostly EU owned brands that are made by sub-contractors in Asia. One Chinese factory may for example make kettles for several EU brands. The more well established EU brands design their own products and ensure that the kettles produced meet their quality requirements whereas some smaller EU suppliers let the Asian manufacturer also design the product. It is possible that non-EU brands could take a larger proportion of the EU market as has occurred with other electrical products whereas Ecodesign requirements could assist established EU manufacturers.

13.4.4 Conclusion for Ecodesign

Ecodesign Regulation should not affect EU competitiveness and may assist with EU jobs. Most manufacturer costs will be for R&D and for testing and so will have a larger impact on SMEs than on large enterprises. Kettle manufacturers in the EU are mostly large companies, but there are a few SMEs.

13.5 Product group summary and recommendations

Table 46 below presents a simplified scoring of the three main sections above, for the product group "kettles".

Table 46: Overall scoring of the "kettles" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Kettles	+	++	+++	+++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

Overall, therefore:

- Only use phase energy consumption is significant as the size of resource consumption saving is uncertain and may not be significant;
- Kettles are regulated by RoHS, REACH, WEEE, Food contact materials legislation as well as standby and off-mode energy consumption;
- Energy labels would be the most applicable option; and
- Ecodesign Regulation would not have a negative impact on EU industrial competitiveness.

14.Lifts

14.1 Main other environmental issues

Table 47 below provides an overview of the relevant environmental aspects of the "lifts" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 47: Overview of relevant direct environmental issues and potential for improvement – Lifts

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0	For a representative installation (in Paris) ca. 0.2 litre of cleaning and degreasing agents are used for annual corrective & preventive maintenance[115]. This would be hardly linked to the design of the lift, and therefore cannot be blamed on the lift itself.	
Presence of critical raw materials (see the EU list[116])	+	Presence of critical raw materials at low concentration levels in the lift's electronic components.	
Presence of flame retardants (halogenated, etc.)	+		
Presence of plasticisers (phthalates)	+		
Presence of other toxic substances	?		
Presence of F-gases	+	Traces of F-gases can be used in some gas buffers. The use of F-gases is the regulated in the corresponding regulation EC 842/2006 on	The industry must be (and is) EC 842/2006 compliant. Therefore the improvement potential is very low.

[115] European Lift Association (ELA), stakeholder input to Task 4.

[116] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
		certain fluorinated greenhouse gases.	
Radiation levels	+	It is known that lift equipment is prone to cause electromagnetic emissions. The level of such emissions is regulated by specific standards which give presumption of conformity to the relevant EU Directives[117].	A continuous update of the legal requirements for electromagnetic emissions and of the relevant standards will help keeping the impact of such emissions under control, by adapting the requirements to the evolution of the lift products.
Safety (fuel leakage, vibrations, etc.)	++	Oil leakage in both hydraulic and (to a lesser extent) traction lifts may occur.	Improvement options do exist.
Health (hygiene, noise level, etc.)	++	Vibrations and noise are of concern.	
Durability (reusability, upgradability, reparability, etc.)	0	Durability is not a prevailing issue, since lifts have a long lifetime (typically 40 years). Moreover, all parts of a lift can be replaced, some of them within preventive maintenance. Some components of a lift might be reused, if still efficient (in rare occasions).	
End-of-life (recyclability, recycled content)	++	Materials used for lifts are mainly recyclable, but not always recycled.	Permanent magnets could be marked.
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

Lift manufacturers usually claim that the two major environmental impacts of lifts are: 1) material use in manufacturing phase and 2) energy consumption in use phase, which have been both studied in Task 3. All other contributors to environmental impacts over the whole life cycle, they say, account for less than 5% of the total[118].

[117] European Federation for Small and Medium-size Elevators Enterprises (EFESME), stakeholder input to Task 4.

[118] Feedback from various stakeholders (received per email).

14.1.1 Presence of critical raw materials

Some (critical) raw materials may be parts of semi-manufactured materials, subsystems or components of a lift. Indeed, as electronic components are estimated to be about 1.5% or 2% of a lift's total weight, there is a certain amount of critical raw materials present in such lift components.

From researches made in conjunction with the evaluation of the Carbon Footprint of a certain new lift products, it emerged that the amount of Neodimium was about 0.001% of the total weight of the concerned lift[117]. However, specific information from suppliers would be needed to identify precisely all critical raw materials used. Today, suppliers do not have any legal duty to provide such information.

More specifically, rare-earth materials are mainly concentrated in the permanent magnets used for traction motors in the most recent types of traction lifts. As mentioned in Task 3, permanent magnet motors are a means to improve energy efficiency of lifts. Mechanically, the impact of such rare earth materials is increasing as the market share of these new products is growing. The permanent magnet motors technology was first introduced a time when the concern about the negative impact of such materials was not a primary issue[117]. Nowadays, it is up to the manufacturers to develop new solutions which could minimize the use of rare earth materials in permanent motors.

14.1.2 Safety – Risk of oil leakage

Leakage of oil is an issue which slightly affects, more or less, most of the existing lifts. There are small leakages of lubricating oil and/or grease, normally present in most lifts fitted with slide guide shoes: this happens involuntarily due to the collection of the excess at the bottom of the guide rails in the pit. More recently, some containers have been fitted to collect such small quantity of lubricant, but it is still inevitable to seen large stains and oil on the pit floor[117].

When it comes to hydraulic lifts specifically, there might also be some leakage of oil, but the amount of leakage is extremely limited during the normal operation of the lift, due to the special provisions which shall be implemented to cope with the higher pressure involved. There is still some risk of accidental dispersion of fluid during the replacement of any exhausted lift. In any case, the damage caused by this type of fluid, especially by those being used in the most recent (hydraulic) units, is much lower than that caused by the lubricating oil.

Possible improvement options include:

- Reduction of the need for grease or oil lubrication of the guide rails;
- Changes in the design of the related equipment in hydraulic lifts, and development of appropriate means to cut the risk of accidentally spilling oil during replacement procedures; and
- Accurate selection of the type of oil in use. If possible, further research and development may be carried out to eliminate the oil's residual adverse impact to the environment.

14.1.3 Safety and health – Vibrations and noise

Vibrations and noise are not a negligible issue regarding the "performance quality level" of the lifts. Although there are not yet specific vibration level requirements in the lift standards, there are some legal requirements which limit the level of vibrations and noise in specific areas of some type of buildings. This is already a constraint which establishes a certain maximum level of vibrations and noise emitted by the lifts[117].

For example, lift vibrations get measured by KONE using a specific Protocol that get in ISO 18738[115]. And generally speaking, the natural improvement of the "quality of life" expectations would likely drive the market towards a continuous reduction of noise and vibrations (slowly but inexorably).

14.1.4 End-of-life

According to the Environmental Product Declaration published by KONE for its MonoSpace (mid-rise elevator solution), the metals represent about 97% of the elevator material weight and are recyclable[119]. It is not said, however, how much of this is actually recycled, since lifts are not owned by manufacturers and waste disposal is regulated differently in every Member State. To this extent, the amount of materials recycled cannot be fully controlled by the lifts manufacturer.

From the Carbon Footprint mentioned above, it turns out that the result of the recyclability (for a certain residential type of lift) was actually fairly good. In details, the impact of recyclability, considered in conjunction with the disposal of the equipment, was only 0.7 % of the total Carbon Footprint value[117].

Last but not least, as long as traction lifts with permanent magnet motors are concerned, the marking of permanent magnets could be introduced (as also suggested as a horizontal measure).

14.1.5 Conclusion for Ecodesign

Material efficiency may be introduced as a requirement, but energy consumption remains the major environmental impact of lifts. Requirements for safety and health, regarding oil leakage, vibrations and noise, fall within the scope of Ecodesign regulation but may be more adequately covered (a revision of) the Lifts Directive – see section 14.2.1.

14.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

14.2.1 Overview of EU policies

Currently, lifts are regulated under the REACH Regulation. Also the Lifts Directive and the Directive on the Energy Performance of Buildings (EPBD) are relevant to consider.

Table 48: Main EU legislation applicable to the "lifts" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Lifts	-	-	X	X	-	-

Lifts have to comply with REACH as toxic substances can be included in them in very low amounts[115]. Also halogenated substances and plasticizers are used in plastics (e.g. PVC), and the use of such substances is regulated by REACH.

It is interesting to note that lifts are not subject to the WEEE and RoHS Directives. The rationale behind it is that they are "large stationary installations", so they do not present much risk of "leakage"

[119] http://cdn.kone.com/www.kone.us/Images/kone-monospace-environmental-product-declaration.pdf?v=2

into the environment. The WEEE and RoHS Directives apply to products that can be moved and carried; they do not apply to fixed installations.

Lifts Directive (Directive 95/16/EC)

The so-called "Lifts Directive" was adopted in 1995[120]. Article 2 of the Directive sets out requirements regarding health and safety.

The Lifts Directive does not make any reference at all to energy consumption. Essential health and safety requirements mentioned in Annex I are rather general requirements and do not include anything on oil leakage, vibrations and noise (as addressed in section 14.1). To this extent, it may be an option to revise the Directive with new requirements on these three specific (negative) impacts on health and the environment.

Energy Performance of Buildings Directive (Directive 2010/31/EU)

On 19 May 2010, a recast of the Energy Performance of Buildings Directive was adopted by the European Parliament and the Council of the European Union in order to strengthen the energy performance requirements and to clarify and streamline some of the provisions from the 2002 Directive it replaces. As of 31 December 2020, new buildings in the EU will have to consume "nearly zero" energy and the energy will be "to a very large extent" from renewable sources. However, there is no specific target set for the renovation of existing building[121].

Lifts and escalators represent only between 3 % and 8 % of the energy consumption of buildings, whether main public buildings or residential dwellings[122]. However, lifts (and escalators) are neither explicitly mentioned nor explicitly covered by the Energy Performance of Buildings Directive: it is still unclear what a "building" really includes, and there is room left for Member States interpretation.

One option would be the inclusion of lifts into EPBD. This seems to be the favoured option of the E4 study coordinator (Professor Aníbal de Almeira)[123], who oriented the Portuguese transposition of EPBD in this direction (see next section). It is not certain, however, that specific requirements for lifts will ever be as precise within EPBD as they could be within Ecodesign Regulation.

14.2.2 Selected Member States policies

For the reason that lifts are a part of buildings, ELA recommends to define energy efficiency requirements, if needed, in the corresponding Directive for buildings (EPBD). The fact that Denmark (see regulation BR10) and Portugal (see Portaria n° 349-D/2013) included such requirements for lifts in their national transpositions supports ELA recommendation[124].

Indeed, the transposition of EPBD in Portugal is one example of Member State action to reduce energy consumption of lifts. "Taking advantage of the reputation of the team of Professor de Almeida (University of Coïmbra), the Portuguese authorities accepted to integrate lifts & escalators in the national law covering the energy performance of buildings and imposed some energy efficiency improvement to all public buildings lifts in Portugal. The German guideline VDI 4707 was used as a

[120] European Parliament and Council Directive 95/16/EC of 29 June 1995 on the approximation of the laws of the Member States relating to lifts.

[121] ECEEE, EPBD Recast (Directive 2010/31/EU): http://www.eceee.org/policy-areas/buildings/EPBD_Recast

[122] http://www.lift-report.de/index.php/news/417/355/ELA-2010-Seminar-in-Berlin

[123] http://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/e4_summary_slides_en.pdf

[124] ELA, stakeholder comment to Task 3 (received per email).

basis to measure energy consumption (see section below). The process is on track and it is expected that the Decree will be published during the first quarter of 2013"[125].

A similar transposition of EPBD took place in Denmark, i.e. the Building Regulation 2010 (BR 2010)[126]. It sets out information requirements, and namely: "The power consumption of lifts based on expected transport per day must be stated. Standby consumption must also be stated. Provision must be made for measuring consumption". The expected standby consumption and the energy consumption from operation of lifts will be included in the energy performance framework after 2015.

14.2.3 Industry Self-Regulatory Initiative

Beyond the German Guideline VDI 4707, which has been developed by the Association of German Engineers (*Verein Deutscher Ingenieure*) and which will be presented later on, the only industry initiative that could be identified is Product Category Rules (PCR) for lifts.

These specific PCR have been under development since May 2013, and final publication is expected to take place in June 2015[127]. A "draft PCR for second open consultation – Lifts (elevators)" was released and made public in May 2014. It provides draft Product Category Rules (PCR) for the assessment of the environmental performance of lifts, and the declaration of this performance by an Environmental Product Declaration (EPD).

The function of the lift can be defined as the vertical (or inclined) transportation of persons, freights or both. The functional unit which has been defined to carry out Life Cycle Analysis (LCA) is the transportation of 1 ton of load over a distance of 1 kilometre. The system boundaries covered by this PCR can be broken down to:

- Upstream module (cradle-to-gate), core module (gate-to-gate), and downstream module (gate-to-grave);
- Product stage, (building) construction process stage, use stage, and end-of-life stage according to EN 15804[128]; and
- "Cradle-to-Gate", "Cradle-to-Job", and "Cradle-to-Grave" according to typical clustering of life cycle stages in LCA studies.

As is also illustrated in figure below, the scope of Product Category Rules goes far beyond energy consumption (and energy efficiency). The letters in the figure are referring to the annexes (A to C) of the draft PCR.

[125] ELA (2013), Quarterly Information Newsletter – February 2013: http://www.ela-aisbl.eu/pdf/ELA%20NEWS/March%202013/ELA_News%2024%20-%20UK.pdf

[126] Available in English at: http://www.buildup.eu/sites/default/files/content/BR10_ENGLISH.pdf

[127] http://environdec.com/en/PCR/Detail/?Pcr=9211#.U_RxEsWSyCk

[128] EN 15804 (2012), Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products.

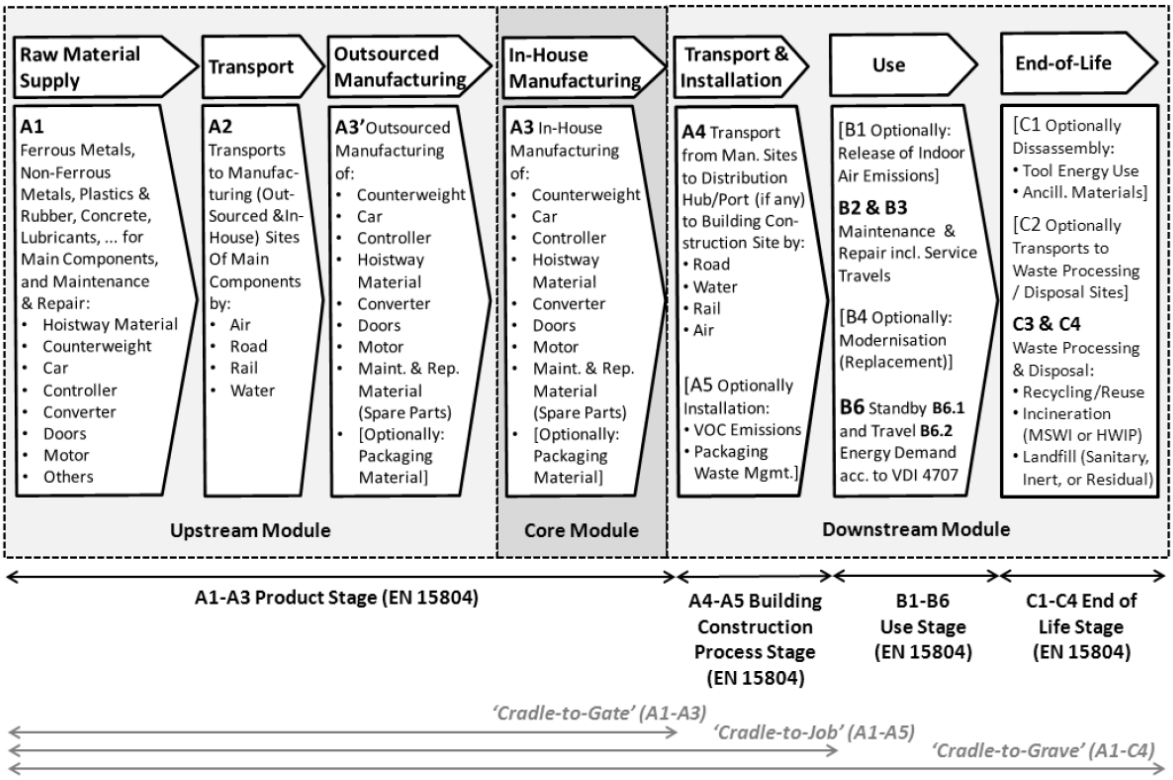

Figure 5: Presentation of core, upstream and downstream modules and their corresponding life cycle stage and information modules according to EN 15804

The European Federation for Small and Medium-size Elevators Enterprises (EFESME) considers that "a voluntary type of instrument such as PCR for Lifts, duly agreed upon by the higher possible representatives of the lift industry, might lead to the expected results while limiting the burden for all the companies involved"[117].

However, it should be noted that Product Category Rules are only a methodological convention, which defines how an LCA should be carried out. They do not include any requirements on the product itself.

14.2.4 Existing third country legislation and labels

One Mexican endorsement label (Sello FIDE No. 4165) establishes specifications for electric traction elevators for passenger transport and movement of objects with vertical guides, with or without machine room.

The 2011-revision of this Mexican label sets out requirements on[129]:

- Energy consumption in both standby and travel modes, based on VDI standard 4707; and
- Noise levels (60 dB inside the lift's cabin).

14.2.5 Test standards

Two test standards have to be mentioned:

- European standard EN 81-20/50; and
- VDI 4707 standard.

[129] http://www.fide.org.mx/images/stories/sellofide/esp4165_01.pdf

European standard EN 81-20/50

At European level, the main set of norms for the lift industry will become EN 81-20/50 (Examinations, calculations & tests of lift components). According to the European Lift Association (ELA), the ultimate goal is to migrate the European standard EN 81-20/50 to ISO and make it the global lift standard for the world (ISO Energy performance of lifts, escalators and moving walks – Part 1: Energy measurement and conformance)[125]. With ISO 25745-2, an international standard is available which provides some ways to evaluate the energy consumption of lifts during their use phase. At the moment, there are no standards giving specific indications for lifts concerning their ecological impact extended to the whole life cycle.

VDI 4707 standard

The VDI 4707 standard is a lift energy efficiency classification guideline which has been established by the Association of German Engineers (*Verein Deutscher Ingenieure*). VDI 4707 classifies lifts from A to G according to their energy performance, in a way that is much similar to Energy labelling.

The VDI 4707 guideline breaks down energy demand into two parts:

- Standby demand: "the standby demand is determined 5 minutes after the last trip has ended and includes all relevant components for readiness for operation and maintaining it in standby"[130]; and
- Travel demand: "travel demand is typically determined with a reference trip with an empty cabin and covers a complete trip cycle. The measurement starts at open door at first level. The lift doors close and the lift travels to the top level when the doors open and close once. The cabin travels down and the measurement cycle ends when the doors open"[130].

Elevators are assigned to different energy efficiency classes depending on their calculated standby and travel demand values, what is further illustrated by Figure 6. Specific demand classes for standby and travel modes are detailed in Table 49.

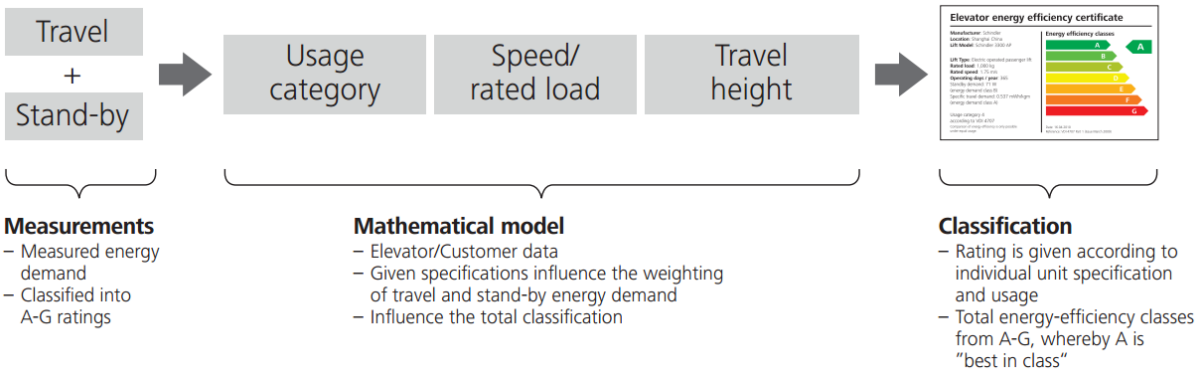

Figure 6: VDI 4707 elevator energy efficiency classification, established by the Association[131]

[130] Bucher Hydraulics (2010), VDI 4707 "Energy efficiency of lifts".

[131] Schindler, VDI 4707 – Energy Efficiency Label for Elevators.

Table 49: Energy demand classes for standby and travel modes[132]

Class	A	B	C	D	E	F	G
Standby (power in W)	≤ 50	≤ 100	≤ 200	≤ 400	≤ 800	≤ 1,600	> 1,600
Travel (energy consumption in mWh/(kgm)	≤ 0.56	≤ 0.84	≤ 1.26	≤ 1.89	≤ 2.80	≤ 4.20	> 4.20

Today, the "big four" manufacturers are using the VDI standard, and even if the precise figure is not known, the vast majority of new lifts fall into class A or class B. All KONE's latest products, for instance, are class A[133].

The VDI 4707 standard also serves as a basis for various purposes, including the transposition of EPBD in Danish and Portuguese law, or the voluntary label developed in Mexico.

14.2.6 Conclusion for Ecodesign

Policy coverage of the lifts product group is already pretty dense. Most notably, the Energy Performance of Buildings Directive (EPBD) forms an existing framework into which specific requirements on energy consumption could fit. Moreover, two promising European initiatives could be elaborated on: Product Category Rules (PCR) on the one hand, and the VDI 4707 test standard on the other hand – both of them being complementary to each other.

14.3 Appropriateness of Ecodesign or Energy labelling

14.3.1 Excessive cost

Relevant information is related both to purchase price (CAPEX) and the cost in use phase (OPEX), including energy and other maintenance costs.

Information is scarce and difficult to get, since prices and costs can vary very much across different lift configurations. As far as excessive cost is concerned, it can only be said that excessive cost could occur if the requirements set are too ambitious: for instance if target values are extremely tight and force manufacturers to switch to regenerative drive and/or permanent magnet motors even for mid-rise or small rise elevators.

Regarding maintenance costs, it is being said that they are not necessarily higher with a new range of technological options[133]. And as was already mentioned in Task 3, competition on purchase price is high, but all manufacturers are much interested in maintenance contracts (which bring cash flows on a more regular basis). One could conclude that this business-model is closed to a leasing business-model, but no manufacturer made the switch to a real service-oriented business-model so far (where the lift is only leased and remains the property of the manufacturer). This shift to "functional economy" has been thought about since the 1990s, but the extended lifetime of lifts make it difficult to implement. As a matter of fact, the building owners prefer to be proprietary of the lift (including all related software solutions), so that they can hedge the risk of a bankruptcy of the lift manufacturer.

[132] Toni Tukia (2014), Determining and modelling the energy consumption of elevators. Master thesis of Aalto University – School of Electrical Engineering.

[133] Phone interview with a representative from Schindler.

And finally, as far as energy and economic savings are concerned, it would be interesting to study the possibility of changing only the control system of lifts, i.e. without refurbishing the shaft, cabin and machinery. Theoretically, separate action on software should be cheaper to implement than any physical change, while causing (possible) significant energy savings. The feasibility of such Ecodesign / Energy labelling requirements would need to be further explored.

14.3.2 Suitability of Ecodesign measures or Energy labelling

Barriers to and strategies for promoting energy-efficient lift technologies have been already studied by E4, with no major hindrance noticed[134].

VDMA points out that "lifts can be designed very individually and customer-specific so that they are sometimes difficult to compare. Hence, these do not represent an easily comparable mass product and they are not suitable for a regulation under the Ecodesign Directive"[135]. Indeed, lifts are integrated into buildings, and this can affect their respective energy consumption. However, Ecodesign Regulation may be appropriate even for tailor-made products.

Some manufacturers claim that much progress has already been done[136]. This means that products placed on the market today are more energy-efficient than they used to be. However, existing installations probably show a higher improvement potential – but it is difficult to force the improvement of today's lifts through any Regulation.

Information requirements could be also envisaged, for instance: next to the lift calling button, there could be a mandatory sign indicating in which configuration / load the energy consumption is minimal. This way, people could decide to take the stairs if they are alone; or, if there are too many passengers and several adjacent elevators, they could split into two or three groups instead of cramming into a single one.

14.3.3 Conclusion for Ecodesign

When it comes to the suitability of Ecodesign measures or Energy labelling, the most serious concern is that they may be redundant with the Energy Performance of Buildings Directive (EPBD). An in-depth study, which could be either a preparatory study explicitly, or a general update of the E4 study with a clear focus on policy action, should clarify which of Ecodesign or EPBD Regulation is the most appropriate for lifts.

14.4 Industrial competitiveness

14.4.1 Market structure

There are big four lifts manufacturers in Europe (Schindler, KONE, ThyssenKrupp, Otis) and several hundreds of smaller players (present at national levels)[137]. In one single country like Germany, there are over 800 companies working in the lift industry (including component-makers). It is also being said that the number of manufacturers in Italy alone is higher than the overall number in the rest of

[134] http://www.e4project.eu/Documenti/WP5/E4-WP5%20-%20D5_1_Barriers%20Final%2020100225.pdf

[135] Comment sent out to the project team.

[136] According to Mitsubishi, 70% savings have been already achieved since the 1960s for elevators and 38% for escalators.

[137] Mitsubishi could be mentioned along with the big players, but its share on the European market is not as significant as it is on the American or Asian markets.

Europe[133]. There is a connection between the sales of new lifts and the after-sales service, which is the reason why there are so many thousands of SMEs operating in Europe.

14.4.2 Innovation and employment

In year 2008, it was estimated that some 150,000 workers were involved in the lift sector in the UK, 60% of them in the field of installation, renovation and maintenance[138]. Although the number of lifts in service in Europe has grown steadily, the number of employees has certainly not grown in parallel by a proportional amount. It has not been possible to get any figure at broader European level.

14.4.3 International competition

Obviously, any Regulation on the environmental performance of lifts should carefully consider the implications of products which are manufactured in countries outside Europe, where such rules and concerns about the environmental impact are almost completely ignored[117]. However, as Ecodesign requirements uniformly apply to all manufacturers regardless of where they are originally located, this concern is really relative.

14.4.4 Conclusion for Ecodesign

The split of the lift industry between a few big players and many smaller manufacturers probably means that Ecodesign requirements would not be equally received (and implemented) by all obligated parties.

14.5 Product group summary and recommendations

Table 50 below presents a simplified scoring of the four main sections above, for the product group "lifts".

Table 50: Overall scoring of the "lifts" product group

Product group	Other environmental impacts	Policy coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Lifts	++	+	++	++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for lifts:

- Minimum requirements on energy efficiency – check consistency with EPBD; and
- Update of Lifts Directive on health and safety.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of lifts. Should the product group of lifts be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

[138] ETUI (2010), A Trade Union look at the Lift Sector

15.Mobile phones

15.1 Main other environmental issues

Table 51 below provides an overview of relevant further environmental aspects of the "mobile phones, smartphones" product group, and possible improvement options linked to them. Energy and basic resource consumption have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 51: Overview of relevant direct environmental issues and potential for improvement – Wireless chargers for consumer electronics

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Use of critical raw materials (see the EU list[139])	++	A number of different critical raw materials is used in mobile phones.	For battery containing variants, easy retractability of battery at EoL can facilitate increase of **cobalt** recycling rates. Some manufactures attempt and achieve phase out of beryllium and to a limited extend antimony based on grounds of hazardousness.[140] According to stakeholder comment, limited substitution possible due to unique material properties. Recycling is presently happening through metallurgical processes. Industrial scale recycling and smelter technologies do not exist for some materials.
Presence of flame retardants (halogenated, etc.)	?	Possibly flame retardants in plastic and electronic components (Printed Circuit Boards, connectors)[141].	None identified.

[139] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

[140] http://blogs.sonymobile.com/about-us/sustainability/substance-control/substances-of-concern/.

[141] See http://flameretardants.americanchemistry.com/Electrical-Electronic-Equipment/EEE-Products-that-Use-Flame-Retardants.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
		Claims by stakeholders that no halogenated flame retardants present in mobile phones. Will be explored further based on stakeholder comments.	
Presence of plasticisers (phthalates)	+	Possibly in attached cables	Alternatives with less harmful phthalates or other substances possible. Some manufacturers achieve phthalate-free cables.[142]
Presence of other toxic substances	?	Possibly arsen in display glass	Some manufacturers achieve arsen-free glass.[142]
Use of F-gases	0		
Radiation levels	+	Electromagnetic radiation is technology immanent.	Technological options exist to limit electromagnetic exposure.
Safety (fuel leakage, vibrations, etc.)	0	According to stakeholder comment, phones do not leak fuel or battery material during use. Batteries are designed to be puncture proof and fail safe. Vibration levels of cell phones are well within safety limits.	
Health (hygiene, noise level, etc.)	0	According to stakeholder comment, no relevant related impacts. Phones are designed to operate in the safe auditory range and provide warnings to consumers when they attempt to override the volume control – governed under existing product safety legislation (2014/35).	
Durability (reusability, upgradability, reparability, etc.)	+++	Discussed in Task 3.	
End-of-life (recyclability, recycled content)	+++	Discussed in Task 3.	
Direct emissions to air	0		
Direct emissions to water	0		

[142] http://www.apple.com/chde/environment/.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Direct emissions to soil	0		
Other environmental issues	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

15.1.1 Consumables

Battery lifetime is limited and for optimal performance should be replaced after a certain number of charging cycles. Waste battery treatment is regulated.

15.1.2 Use of critical raw materials

The following critical raw materials may be used in mobile phones based on typical components, i.e. plastic casings, ICs, PCBs:[143]

- Possibly **antimony** in (plastic) flame retardants as substitute for banned flame retardants;
- **Beryllium** in electronic components;
- **Borates** commonly used in LCDs (and possibly in display glass?);
- **Cobalt** in rechargeable Li-Ion batteries (its major use);
- **Gallium** in Integrated Circuits (ICs) and in LEDs;
- **Germanium** used for high-brightness LEDs;
- **Indium** used i.a. in LCDs (strong growth expected), lead-free solders, batteries, LEDs;
- **Magnesium** alloys used in some mobile phones;
- **Natural graphite** in Li-Ion batteries;
- Small amounts of **niobium** used;
- **PGMs**: platinum and palladium in some printed circuit boards, iridium for manufacture of LEDs and used in OLEDs; in manufacture of LCDs; and
- Light Rare Earth Elements used in NiMH batteries.

It is not clear to what extent phone variants are on the market that do not make use of these. Some manufactures attempt and achieve phase out of beryllium and to a limited extend antimony based on grounds of hazardousness.[144]

Li-Ion batteries are the main use for cobalt, amounts used in mobile phones hence more significant than for other critical raw materials. Recycling of cobalt is possible if batteries are treated separately at end-of-life. Improvement potential hence lies in facilitating easy retrieval of battery (within seconds for economic operation).[145]

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[143] European Commission, Report on Critical Raw Materials for the EU: Critical Raw Material Profiles, http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/crm-critical-material-profiles_en.pdf.

[144] http://blogs.sonymobile.com/about-us/sustainability/substance-control/substances-of-concern/.

[145] See Task 2 supplementary report and Task 3 report on mobile phones.

Gallium use in ICs and LEDs presumably experiencing rapid growth.

No indication of feasible improvement options for the other critical raw materials beyond existing regulation.

15.1.3 Presence of flame retardants

Flame retardants are used to comply with fire safety requirements. Possibly flame retardants in plastic and electronic components (Printed Circuit Boards, connectors). Claims by stakeholders that no flame retardants present in mobile phones. Will be explored further based on stakeholder comments.

Use of flame retardants is informed by REACH Regulation (1907/2006) and restricted in RoHS. Less harmful substitutes are available, e.g. through use of antimony (see previous Section).

15.1.4 Presence of plasticisers

Mobile phones usually use cables for their own power supply. Cables often contain phthalates, which may have health impacts through air intake or contact with skin and especially mucous membranes. Phthalates exposure is bio-accumulative. Phthalates are also used in synthetic rubber and flexible PVC. If this applies to mobile phones on the market is not clear.

Four phthalates are banned for manufacture and use in the EU (REACH Annex XIV) but not banned in imported products (though reporting is required).

Improvement options are available, either the use of less harmful phthalates or other substances.

15.1.5 Presence of other toxic substances

Based on claim by at least one manufacturer about arsen-free displays[142], presence of arsen in displays may be an issue.

15.1.6 Radiation levels

Electromagnetic radiation (EMC, EMF) is technology immanent. There is, however, no indication that existing legal requirements cannot or are not met. Technological options exist to limit electromagnetic exposure.

15.1.7 Conclusion for Ecodesign

Durability (economic and technical lifetime) and end-of-life treatment/ treatability seem to be the major issued. These have been thoroughly discussed in Task 3.

15.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

15.2.1 Overview of EU policies

Currently, EU WEEE, RoHS and REACH are relevant for wireless chargers for consumer electronics. No applicable Ecolabel or GPP criteria were identified.

Table 52: Main EU legislation applicable to the "wireless chargers" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Mobile phones, smartphones	X	X	X	-	-	-

Mobile phones fall under scope of **WEEE Directive (2012/19/EU)** under category 3. IT and telecommunications equipment or category 4.

With regard to Annex III they would fall in the category 6. Small IT and telecommunication equipment (no external dimension more than 50 cm).

WEEE i.a. requires that the following be "removed" (i.e. to contain hazardous substances, mixtures and components for their monitored environmentally safe treatment):

- Batteries;
- Printed circuit boards if the surface of the printed circuit board is greater than 10 square centimetres;
- Plastic containing brominated flame retardants; and
- External electric cables.

The WEEE Directive has implications for the design of mobile phones as well as their end-of-life treatment.

Ecodesign could facilitate the prevalence of adequate design of products to allow for easy retractability of batteries for the recovery of contained cobalt and safer operations. Setting such Ecodesign requirements is an implicit suggestion in Article 4 of the WEEE Directive.

The **RoHS Directive (2011/65/EU)** similarly applies to mobile phones and falls in Category "IT and telecommunications equipment" in Annex 1. Hence, its provisions apply, i.a. Article 4 on Prevention, hence the restricted substances and the tolerated maximum concentrations apply as follows:

- Lead (0.1 %);
- Mercury (0.1 %);
- Cadmium (0.01 %);
- Hexavalent chromium (0.1 %);
- Polybrominated biphenyls (PBB) (0.1 %); and
- Polybrominated diphenyl ethers (PBDE) (0.1 %).

It is unclear if and how provisions under RoHS could be complemented by Ecodesign.

Provisions of **REACH Regulation (1907/2006)** apply with regard to use of substances in the product. No consideration of specific substances has been taken here. Should the product group contain substances that are subject to specific provisions in REACH, it is conceivable that Ecodesign establishes additional criteria to limit exposure to these substances in the final product. This would be in line with the consideration of the European Parliament and of the Council in establishing the REACH Regulation:

(14) This Regulation will generate information on substances and their uses. Available information, including that generated by this Regulation, should be used by the relevant actors in the application and implementation of appropriate Community legislation, for example that covering products, and Community voluntary instruments, such as the eco-labelling scheme. The Commission should consider in the review and development of relevant Community legislation and voluntary instruments how information generated by this Regulation should be used, and examine possibilities for establishing a European quality mark.

This would, however, require a general clarification of the interplay of the two regulations.

Further specific regulations that (potentially) relate to mobile phones and that have not yet been assessed further here include:

- Directive 2013/56/EU on batteries and accumulators and waste batteries and accumulators;
- Commission Regulation (EC) Standby and off mode (1275/2008);
- Directive 2004/108/EC on Electromagnetic Compatibility: and
- Regulations relating to safe levels and configurations of electromagnetic radiation.

Others to be identified.

15.2.2 Selected Member States policies

The following section is dedicated to Member States policies which are in place inside the EU and of which Table 53 gives an overview.

Table 53: Environmental labels at Member States level

Product group			
Mobile phones	RAL-UZ 106	-	-

Thus, the only label which could be identified to certify "mobile phones" is the German Blue Angel label. The criteria for the award of the Blue Angel label for mobile phones date from February 2013 and are valid until 2015[146].

Table 54 shows an extract of the requirements mobile phones have to comply with in order to obtain the Blue Angel label. However, the requirements listed here below are not exhaustive and there exist still various other demands.

Table 54: Requirements of Blue Angel label with respect to mobile phones

Requirement	Mobile phone
Charging bar and notification	Display recharging status and notify when phone should be disconnected from power source after charging is complete
External power supply	Standardised power supply according to EN 62684 - "Interoperability specifications of

[146] Blue Angel (2013), Vergabegrundlage für Umweltzeichen, Mobiltelefone RAL-UZ 106.

Requirement	Mobile phone
	common external power supply (EPS)" and respective USB interface
Warranty	Free-of-charge 2 year warranty except for battery
Software	Free-of-charge software updates to address especially security issues
Personal data	To facilitate re-use by other, personal data shall be erasable by user him-/herself and without additional cost
Batteries	Must be easily retrievable for recycling purposes, with standard tools and within 5 seconds, without punctuating battery. User must be able to replace battery without tools. Requirements for tested battery durability.
Hazardous substances	Restriction of certain hazardous substances in different components; to be added
SAR	< 0.6 Watt/ kg

Currently no phones are registered under the Blue Angel scheme.

15.2.3 Industry Self-Regulatory Initiative

No relevant SRIs have yet been identified.

Waiting for stakeholder input.

15.2.4 Existing third country legislation and labels

EPA Taiwan has a regulation/ label for mobile phones in place. Details will be added later.

15.2.5 Test standards

To be completed

15.2.6 Conclusion for Ecodesign

The most important issues with regard to environmental impacts of mobile phones, i.e. design for durability/longer technical and economic lifetimes as well as easy recoverability of resources at end-of-life are not yet adequately addressed or implemented in existing policies. Ecodesign could complement provisions in WEEE, e,g, imposing requirements on easy retrievability of cobalt (through fast retrievability of battery), easy replicability of battery, and measures to increase economic lifetime of mobile phone, e.g. with regard to data security and storage. Similar considerations have been made in the Task 3 report.

15.3 Appropriateness of Ecodesign or Energy labelling

Whereas the "regulatory coverage" section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on "Appropriateness of Ecodesign requirements" addresses the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

15.3.1 Excessive cost

As no energy efficiency requirements are suggested, additional costs imposed by technical improvements do not lower electricity bills of end-consumers. However, measures to increase technical and economic lifetime could reduce need for consumer for purchase of new phones, significantly lowering monetary expenses.

15.3.2 Suitability of Ecodesign measures or Energy labelling

Ecodesign seems suitable for regulation of mobile phones:

- Mass market product;
- Technical variants for easy retrievability of battery at end-of-life are on the market;
- Same for data-handling possibilities and software updates; and
- Open question is the availability of test standards, which will be explored further.

Generally, Ecodesign seems the more appropriate instrument as compared to energy labelling, as no performance continuum has been identified. A caveat is the fast innovation cycle of mobile phones, which may limit suitability of specific Ecodesign measures. Hence, generic and technology neutral requirements, should be favoured.

15.3.3 Conclusion for Ecodesign

To be completed.

15.4 Industrial competitiveness

15.4.1 Market structure

The market of mobile phones is highly competitive, with short innovation cycles. It is closely linked to other services (e.g. software eco-systems, apps, telecom providers, search, location based services, mobile payment, etc.) that influence market dynamics. Many manufacturers also sell other electronic devices, components or software. Many mobile phone variants exist on the market (estimate: several hundreds). However, few models make up major share of overall market. Roughly speaking, there are three market segments:

1. Simple mobile phones at lower end of price-spectrum;
2. Feature phones, employing additional features but also in heavy price competition; and
3. High-end phones that compete mostly over features, design and services and only partly on price.

15.4.2 Innovation and employment

Smartphones today could be considered icons of technological innovation. Hence, the industry is developing new smartphone features and related devices at a rapid rate and presumably acts as a catalyst for innovation in related sectors.

At the same time basic technologies are established and standardised.

Introducing Ecodesign requirements could boost further innovation (if implemented technology neutral) and strengthen those companies that already implement such requirements internally.

The mobile phone market is a global market with most devices manufactured and even designed outside Europe. Introducing requirements in Europe would likely stimulate a global uptake. Hence, no specific implications for employment in Europe are expected.

However, design and end-of-life requirements could strengthen the European recycling industry, leading to possible creation of additional jobs.

15.4.3 International competition

See Section before.

15.4.4 Conclusion for Ecodesign

Establishing Ecodesign requirements for mobile phones could stimulate innovation on resource efficiency, especially in related sectors, especially recycling infrastructures in Europe. No particular effect on competitiveness in the mobile phone industry is expected if implemented in a technology neutral fashion.

15.5 Product group summary and recommendations

Table 55 below presents a simplified scoring of the four main sections above, for the product group “mobile phones, smartphones”.

Table 55: Overall scoring of the "mobile phones, smartphones" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Mobile phones, smartphones	+++	++	+++	+++

The more “+” there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

In particular, the following Ecodesign measures should be considered: (see Task 3)

- Requirements for easy retractability of battery at end-of-life (possibly through a horizontal measure for consumer devices or similar);
- Requirements for easy retrieval and erasure of personal data;
- Requirements for easy reparability, especially replacability of battery by end-user without additional cost; and
- Possibly long-term support for security and performance relevant software updates or equivalent measures.

There does not seem to be a case for Efficiency labelling.

If REACH and RoHS are continually developed to take into account new evidence those regulations are the best place to deal with many of the substance related issues.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of mobile phones, smartphones. Should the product group be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulatory process.

16.PV inverters

16.1 Main other environmental issues

Table 56 below provides an overview of relevant further environmental aspects of the "mobile phones, smartphones" product group, and possible improvement options linked to them. Energy and basic resource consumption have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 56: Overview of relevant direct environmental issues and potential for improvement – PV inverters

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Use of critical raw materials (see the EU list[147])	?	Possibly (to be verified): Antimony in (plastic) flame retardants as substitute for banned flame retardants. Berylium in electronic components. Cobalt in rechargeable Li-Ion batteries. (its major use) Gallium in Integrated Circuits (ICs) and in LEDs. Indium used i.a. in LCDs (strong growth expected), lead-free solders, batteries, LEDs. Natural graphite in Li-Ion batteries. PGMs: platinum and palladium in some printed circuit boards, Light Rare Earth Elements used in NiMH batteries	None identified.
Presence of flame retardants	+++	Possibly flame retardants in plastic and electronic	None identified.

[147] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
(halogenated, etc.)		components (Printed Circuit Boards, connectors)[148]. PBB and PBDE have been identified in inverters.[149]	
Presence of plasticisers (phthalates)	+	Possibly in attached cables	Alternatives with less harmful phthalates or other substances possible.
Presence of other toxic substances	++	Lead and hexavalent chromium have also been identified.[150]	
Use of F-gases	0		
Radiation levels	+	Electromagnetic radiation may be an issue.	
Safety (fuel leakage, vibrations, etc.)	+	Electric safety.	
Health (hygiene, noise level, etc.)	+	Noise has been identified as an issue, especially in residential installations. With large differences between different inverters on the market. This typically relates to ventilation.	Inverters with lower noise emission levels are available on the market.
Durability (reusability, upgradability, reparability, etc.)	?	Achievable life-time yet unclear. 20 years envisioned.	Easy software updates.
End-of-life (recyclability, recycled content)	?	Not much experience gained. Some manufacturers presumably offer designs for easy recyclability and use recycled material. Take-back schemes offered by some manufacturers.	
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issues	0		

[148] See http://flameretardants.americanchemistry.com/Electrical-Electronic-Equipment/EEE-Products-that-Use-Flame-Retardants.

[149] Oeko (2012), PROSA Photovoltaik Wechselrichter: Entwicklung der Vergabekriterien für ein klimaschutzbezogenes Umweltzeichen. Studie im Rahmen des Projekts „Top 100 – Umweltzeichen für klimarelevante Produkte“, 2012.

[150] http://www.oeko.de/oekodoc/1457/2012-038-de.pdf.

Scoring: “0” if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). “?” if not known.

16.1.1 Use of critical raw materials

To be identified.

16.1.2 Presence of flame retardants

Use of flame retardants is addressed by REACH Regulation (1907/2006) and restricted in RoHS. As RoHS does not yet apply to PV inverters (see below), hazardous flame retardants may be present in PV inverters. In particular PBB and PBDE have been identified in inverters.[149]

Less harmful substitutes are available, e.g. through use of antimony (see previous Section).

16.1.3 Presence of plasticisers

PV inverters contain electric cables. Cables often contain phthalates, which may have health impacts through air intake or contact with skin and especially mucous membranes. Phthalates exposure is bio-accumulative.

Four phthalates are banned for manufacture and use in the EU (REACH Annex XIV) but not banned in imported products (though reporting is required).

Improvement options are available, either the use of less harmful phthalates or other substances.

16.1.4 Presence of other toxic substances

Lead and hexavalent chromium have been identified in PV inverters. [149]

16.1.5 Radiation levels

Electromagnetic radiation (EMC, EMF) is technology immanent. There is, however, no indication that existing legal requirements cannot or are not met. Technological options exist to limit electromagnetic exposure.

16.1.6 Noise

Has been identified as an issue with large differences in inverters available on the market. Hence technological options exist.

16.1.7 Durability

Not clear. 20 years envisioned. 5-year warranty times offered by some manufacturers.

16.1.8 End-of-life

Not much experience gained. Some manufacturers presumably offer designs for easy recyclability and use recycled material. Take-back schemes offered by some manufacturers.

16.1.9 Conclusion for Ecodesign

Conversion efficiency is major issue (as discussed in Task 3). Of additional interest are noise emissions and contained hazardous substances.

16.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

16.2.1 Overview of EU policies

Currently, WEEE Directive and REACH Regulation applies to PV inverters. PV inverters are currently exempted from RoHS. No applicable Ecolabel or GPP criteria were identified.

Table 57: Main EU legislation applicable to the "PV inverters" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
PV inverters	X	-	X	-	-	-

PV inverters fall under scope of **WEEE Directive (2012/19/EU)** under category 4. Consumer equipment and photovoltaic panels. With regard to Annex III they would fall in either category 4. Large equipment (any external dimension more than 50 cm) or 5. Small equipment (no external dimension more than 50 cm).

WEEE i.a. requires that the following be "removed" (i.e. to contain hazardous substances, mixtures and components for their monitored environmentally safe treatment):

- Batteries;
- Printed circuit boards if the surface of the printed circuit board is greater than 10 square centimetres;
- Plastic containing brominated flame retardants; and
- External electric cables.

The WEEE Directive has implications for the design of PV inverters as well as their end-of-life treatment.

It is unclear what role Ecodesign could play to complement the WEEE Directive.

The **RoHS Directive** does not currently apply to PV inverters as photovoltaic panels are excluded and PV inverters form an integral part of PV installations.

There may be room for Ecodesign to fill this gap. However, this should be based on a general consideration of the appropriateness of addressing gaps in existing substance regulation through Ecodesign. Given the long lifetime of inverters there may be a case of introducing Ecodesign requirements to manage end-of-life risks for inverters that still contain hazardous substances.

Provisions of **REACH Regulation (1907/2006)** apply with regard to use of substances in the product. No consideration of specific substances has been taken here.

Further specific regulations to be identified.

16.2.2 Selected Member States policies

The following section is dedicated to Member States policies which are in place inside the EU and of which the following table gives an overview.

Table 58: Environmental labels at Member States level

Product group			
PV inverters	RAL-UZ 163	-	-

Thus, the only label which could be identified to certify "PV inverters" is the German Blue Angel label. The criteria for the award of the Blue Angel label for PV inverters date from January 2012 and are valid until 2018[151].

Table 59 shows an extract of the requirements PV inverters have to comply with in order to obtain the Blue Angel label. However, the requirements listed here below are not exhaustive and there exist still various other demands.

Table 59: Requirements of Blue Angel label with respect to PV inverters

Requirement	PV inverter
Energy efficiency	Total conversion efficiency according to DIN 50530 of min 95 %
Standby Power consumption	< 0.5 W In case of integrated remote data interface: < 5 W
Provision of reactive power	PV inverter must provide reactive power for grid stability according to VDE-AR-N 4105
Warranty	Free-of-charge for min 5 years, extendable to 20 years
Hazardous substances	Various provisions, especially requiring application of RoHS provisions, which do not yet apply to PV inverters.
End-of-life	Requirements on easy and efficient dismantability
Noise	Devices must not exceed 55 dB(A)
SAR	< 0.6 Watt/ kg

Currently no PV inverters are registered under the Blue Angel scheme.

16.2.3 Industry Self-Regulatory Initiative

No relevant SRIs have yet been identified.

[151] Blue Angel (2012), Vergabegrundlage für Umweltzeichen, Photovoltaik Wechselrichter RAL-UZ 163.

16.2.4 Existing third country legislation and labels

None identified so far.

16.2.5 Test standards

To be completed.

Standards exist for measuring conversion efficiency, noise levels, safety, electromagnetic compatibility.

16.2.6 Conclusion for Ecodesign

The most important impact of PV inverters, conversion efficiency, is currently not addressed. Here, Ecodesign could appropriately address minimum conversion efficiencies.

Same seems reasonable for maximum noise levels.

RoHS Directive does not currently apply to PV inverters. It could be argued that Ecodesign could fill this gap, should PV inverters not be included in RoHS in the future.

Test standards are available.

16.3 Appropriateness of Ecodesign or Energy labelling

Whereas the "regulatory coverage" section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on "Appropriateness of Ecodesign requirements" addresses the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

16.3.1 Excessive cost

As PV inverters convert PV generated electricity, their conversion efficiencies directly impact revenue streams of consumers. Oeko-Institut has estimated yearly allocated installation costs of 300 Euro (at 1,500 Euro device costs, 5 year lifetime; taking longer lifetimes as basis, the amount would be reduced accordingly) and lost annual revenues (based on the German feed-in-tariffs!) of 8 to 28 Euro. Hence, around 5 % of purchase price could be lost due to low conversion efficiencies.

Stakeholder input is sought to clarify if a 5 % increase in purchase price could improve conversion efficiencies accordingly.

16.3.2 Suitability of Ecodesign measures or Energy labelling

Ecodesign seems suitable for regulation of PV inverters:

- Conversion efficiency most important environmental impact and not addresses by other regulations;
- Improved technology is available on the market; and
- Test standards available.

Instead of Ecodesign, Energy labelling may be an appropriate alternative with regard to conversion efficiencies as inverter efficiencies can be described on a "performance continuum" and users of such information will usually make detailed calculations on investments and expected revenues. This could thus be facilitated.

With regard to other environmental impacts, in particular noise and hazardous substances, Ecodesign criteria could be established. Measurement standards are available. However, with regard to hazardous substances, relation to other Directives, in particular RoHS, should be clarified.

16.3.3 Conclusion for Ecodesign

To be completed.

16.4 Industrial competitiveness

16.4.1 Market structure

Market is highly concentrated, with European manufacturers having a major share. Market is closely linked to PV market in general.

16.4.2 Innovation and employment

PV inverters are still undergoing major innovation, particularly to adapt to new demands for grid stability and management.

Establishing strong Ecodesign requirements could strengthen European manufacturers against cheaper Asian competitors, as European manufactures will likely more easily meet requirements. This could safeguard jobs in Europe. This would be less so with Energy labelling alone.

Also high conversion efficiencies for renewable energy may contribute to other policy objectives with regard to energy systems transformation.

16.4.3 International competition

Europe is still a technology leader, though there is strong and growing competition especially from Asian manufacturers. See previous Section.

16.4.4 Conclusion for Ecodesign

Establishing Ecodesign criteria could strengthen European manufacturers and competiveness.

16.5 Product group summary and recommendations

Table 60 below presents a simplified scoring of the four main sections above, for the product group "PV inverters".

Table 60: Overall scoring of the "PV inverters" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
PV inverters	++	+++	+++	+++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

In particular, the following Ecodesign measures should be considered: (see Task 3)

- Ecodesign requirements for or Energy labelling of conversion efficiencies;
- Limiting stand-by/night-time energy consumption;

- Limiting noise emission levels; and
- Possibly limiting the use of certain hazardous substances that are not addressed by other European Directives, in particular RoHS.

If REACH and RoHS are continually developed to take into account new evidence those regulations are the best place to deal with many of the substance related issues.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of PV inverters. Should the product group be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulatory process.

17.Refrigerated containers

17.1 Main other environmental issues

Table 61 below provides an overview of relevant further environmental aspects of the "refrigerated containers" product group, and possible improvement options linked to them. Energy consumption has been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 61: Overview of relevant direct environmental issues and potential for improvement – Refrigerated containers

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	?	Some refrigerated containers contain water-cooled condensers and need water supply from storage tank.	None identified.
Consumables (detergents, etc.)	0		
Use of critical raw materials (see the EU list[152])	?	Possibly related to electronic (monitoring and control) components.	
Presence of flame retardants (halogenated, etc.)	?	As flammability is an important issue, flame retardants likely used.	
Presence of plasticisers (phthalates)	+	Possibly in attached cables.	Alternatives with less harmful phthalates or other substances possible.
Presence of other toxic substances	?		
Use of F-gases	+++	Used as refrigerant (e.g. R134a). HCFC-141b is still used in insulation foams.	Use of cyclopentane (and perhaps other substances) for manufacture of polyurethane insulating foam can reduce GWP by supposedly more than 99%[153].
Radiation levels	?		
Safety (fuel leakage, vibrations, etc.)	?	There are reports of methyl chloride contamination of R134a refrigerant gas leading	

[152] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

[153] http://www.mcicontainers.com/products/reefercontainers/pages/supotec.aspx.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
		to explosions of refrigerated containers.[154]	
Health (hygiene, noise level, etc.)	?		
Durability (reusability, upgradability, reparability, etc.)	++	Durability of insulation seems to be an issue.	Regular maintenance.
End-of-life (recyclability, recycled content)	?		
Direct emissions to air	+++	Refrigerants; diesel exhaust in genset variants.	
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issues	?		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from 1 (low) to 3 (high). "?" if not known.

Analysis of main environmental issues to be completed.

17.1.1 Conclusion for Ecodesign

With regard to possible and applicable Ecodesign measures, focus should indicatively be on energy efficiency, including insulation properties. Refrigerants and blowing agents for insulation foams may also be of interest for Ecodesign consideration should they not be covered elsewhere.

17.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

17.2.1 Overview of EU policies

Few "classic" EU policies apply to refrigerated containers.

[154] http://www.containerownersassociation.org/container-projects/reefers/59-unep-conference-fake-refrigerants-should-we-worry.html.

Table 62: Main EU legislation applicable to the "refrigerated containers" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Refrigerated containers	-	-	X	-	-	-

Also the **F-gas regulation** presumably does not effectively regulate HFC emissions from refrigerated containers.[155] To be elaborated.

Regulation (EC) No 1005/2009 on substances that deplete the ozone layer bans the use of HCFCs for containers placed on the European market. However, the temporary admission of such containers cannot be prevented, in line with international Conventions.[156] For the future the Montreal Protocol is expected to effectively regulate use of HCFCs in refrigerated containers (from 2020 or in case of developing countries, from 2030).

Further specific regulations, e.g. relating to transport or food, may be of relevance for refrigerated containers. Conventions by the International Maritime Organization would likely be the best place for global regulation of refrigerated containers, which are then implemented by members.

The European ship recycling regulation and Marine Equipment Directive may have implications for containers.

No regulation could yet be identified that specifically applies to energy or environmental performance of refrigerated containers beyond Regulation (EC) No 1005/2009.

17.2.2 Selected Member States policies

No applicable Member States policies could be identified.

17.2.3 Industry Self-Regulatory Initiative

No relevant SRIs have been identified.

17.2.4 Existing third country legislation and labels

None identified so far.

17.2.5 Test standards

To be identified.

17.2.6 Conclusion for Ecodesign

At first sight, few regulations if any at all seem to address energy efficiency and other environmental impacts of refrigerated containers. There could hence by a case for introducing Ecodesign requirements if refrigerated containers fall under scope of Ecodesign. This is to be clarified.

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[155] Preparatory study for a review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases. Final Report, 2012 http://ec.europa.eu/clima/policies/f-gas/docs/2011_study_en.pdf.

[156] See an explanation by Ms. Hedegaard on behalf of the European Commission: http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2013-001622&language=DE.

A limiting factor is probably the small amount of refrigerated containers actually placed on the European market instead of being temporarily admitted. Ecodesign as well as other European regulation may not able to effectively regulate such temporarily admitted containers.

17.3 Appropriateness of Ecodesign or Energy labelling

Whereas the "regulatory coverage" section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on "Appropriateness of Ecodesign requirements" addresses the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

17.3.1 Excessive cost

To be completed.

17.3.2 Suitability of Ecodesign measures or Energy labelling

Refrigerated containers can be used on ships but also stationary in ports and are then connected to port electricity supply. It could be argued that they do not fall under the strict category of "means of transport" and hence are in the scope of Ecodesign.

Though sizes of containers are highly standardised, the specific equipment and materials used are not. Hence, refrigerated containers differ with regard to achieved cooling efficiencies and insulation parameters. Ecodesign could effectively address these through basic requirements. Alternatively also Energy labelling could be established for refrigerated container energy efficiency, provided that clear performance standards are available.

17.3.3 Conclusion for Ecodesign

To be completed.

17.4 Industrial competitiveness

17.4.1 Market structure

Refrigerated container demand and supply is largely determined by global container shipping companies and global trade volumes. Manufacturing takes place mostly outside of Europe.

17.4.2 Innovation and employment

Innovation in refrigerated container transport is mostly related to the direct customer demands for safe and cost-efficient transport of valuable goods. Sustainability is an issue which is recognised by some manufacturers and actively marketed. If effective Ecodesign requirements were established, these would likely spur further research and development as the market has so far been driven by other considerations. It is conceivable that this would also enhance demand for European expertise and hence job creation here. However, effects of Ecodesign or Energy labelling on jobs could not be well assessed.

17.4.3 International competition

Competition is taking place mostly among non-European manufacturers and traders. Ecodesign requirements could give those companies an advantage that are already actively developing and promoting more sustainable refrigerated containers.

17.4.4 Conclusion for Ecodesign

Indecisive.

17.5 Product group summary and recommendations

Table 63 presents a simplified scoring of the four main sections above, for the product group "refrigerated containers".

Table 63: Overall scoring of the "Refrigerated containers" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Refrigerated containers	++	++	+++	++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

If the general applicability of the Ecodesign Directive to refrigerated containers can be established and appropriate test standards identified/ developed, Ecodesign could establish:

- Minimum energy efficiency requirements for different cooling applications;
- Minimum requirements on insulation performance (heat transfer and durability); and
- Possibly minimum requirements on refrigerants used, though existing regulation may prevail.

Alternatively energy labelling requirements could be established that would inform users of refrigerated containers on achieved efficiency and thus stimulate market demand for more efficient containers.

Before coming to a first conclusion further background information is necessary.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of refrigerated containers. Should the product group be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulatory process.

18.Signage displays

18.1 Main other environmental issues

Table 64 below provides an overview of the relevant environmental aspects of the "signage displays" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group. It is to note that the issues are basically the same as they are for related products (namely consumer electronics and computers).

Table 64: Overview of relevant direct environmental issues and potential for improvement – Signage displays

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Presence of critical raw materials (see the EU list[157])	0		
Presence of flame retardants (halogenated, etc.)	+	Used in cabinet structure etc.	Alternatives to problematic flame retardants are available. The German Blue Angel for TVs requires to avoid halogenated flame retardants and flame retardants with the Risk Statement R 59/53 / Hazard Statement H410 according to REACH, and complying products are on the market.
Presence of plasticisers (phthalates)	+	Used in Cabinet structures and light processing films in displays	
Presence of other toxic substances	+	Mercury in CCFL backlights for older LCD signage display designs	Phased out by efficient LED backlight even for high brightness displays
Presence of F-gases	0		
Radiation levels	0		
Safety (fuel leakage,	0		

[157] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
vibrations, etc.)			
Health (hygiene, noise level, etc.)	0		
Durability (reusability, upgradability, reparability, etc.)	+	Waiting for stakeholder input	Waiting for stakeholder input
End-of-life (recyclability, recycled content)	+	Waiting for stakeholder input	Waiting for stakeholder input
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

18.1.1 Durability

Waiting for stakeholder input

18.1.2 End-of-life

Waiting for stakeholder input

18.1.3 Conclusion for Ecodesign

Other environmental issues relate to flame retardants, phthalates, mercury, and durability / end-of-life issues?. This strengthens the case for potential Ecodesign requirements with respect to LED backlighting, because they would tackle efficiency and mercury issues at the same time. With respect to hazardous substances, the relation of Ecodesign to other policies it will be discussed in chapter 18.2.1.

18.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

18.2.1 Overview of EU policies

Currently, signage displays are regulated under the EU WEEE, RoHS and REACH.

Table 65: Main EU legislation applicable to the "signage displays" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Signage display	X	X	X	-	-	-

For WEEE, to add, when stakeholder input on end-of-life has been received.

Not all hazardous substances that may be present in signage displays are fully regulated under REACH or RoHS so far. RoHS does not include phthalates, and not all halogenated flame retardants. However, there is currently a process in place where the extension of RoHS to one brominated flame retardant and several phthalates is under discussion..

In addition to the policies listed above, the Ecodesign Regulations for computers and TVs (the latter currently being under review) are also relevant. As the technological options for improving energy efficiency are basically identical, these regulations can be drawn on in order to formulate criteria adapted to signage displays. The same is true for the Ecolabel: While it has no specific criteria for signage displays, criteria for televisions and computers can be used as a basis.

18.2.2 Selected Member States policies

Signage displays can earn the TCO certified label[158]. Criteria are quite extensive, covering ergonomics, electric and magnetic fields, noise, electrical safety, energy consumption, hazardous substances, lifetime, recyclability, and packaging, along with Corporate Social Responsibility. Further detail to be added

Figure 7: TCO label

18.2.3 Industry Self-Regulatory Initiative

No relevant SRI could be identified.

18.2.4 Existing third country legislation and labels

Signage displays are regulated under the version 6.0 of the US Energy Star for displays. Version 7.0 is currently under development, the process having been launched on February 24, 2014.

Version 6.0 has a requirement on maximum on-mode power, depending on screen size and pixel density (see Table 66). Also, there are requirements on the External Power Supply, and a power management feature is required. Maximum sleep mode and off-mode power is 0.5 W, with certain allowances for network capabilities.

[158] TCO Certified Displays 6.0, 5 March 2012. http://tcodevelopment.com/tco-certified/tco-certified-product-categories/tco-certified-displays/

Table 66: Energy Star 6.0 On-mode power requirements for displays

Product Type and Diagonal Screen Size, *d* (in inches)	$P_{ON\ MAX}$ where $D_p \leq 20{,}000$ pixels/in^2 (in watts) *Where:* ▪ *r = Screen resolution in megapixels* ▪ *A = Viewable screen area in in^2* ▪ *The result shall be rounded to the nearest tenth of a watt*
$d < 12.0$	$(6.0 \times r) + (0.05 \times A) + 3.0$
$12.0 \leq d < 17.0$	$(6.0 \times r) + (0.01 \times A) + 5.5$
$17.0 \leq d < 23.0$	$(6.0 \times r) + (0.025 \times A) + 3.7$
$23.0 \leq d < 25.0$	$(6.0 \times r) + (0.06 \times A) - 4.0$
$25.0 \leq d \leq 61.0$	$(6.0 \times r) + (0.1 \times A) - 14.5$
$30.0 \leq d \leq 61.0$ *(for products meeting the definition of a Signage Display only)*	$(0.27 \times A) + 8.0$

By the way, criteria developed by Taiwanese Environmental Protection Administration for many product groups – see: http://greenliving.epa.gov.tw/GreenLife/eng/E_Criteria.aspx

18.2.5 Test standards

A test method for displays has been developed under the Energy Star programme. It is also being used by TCO certified. Furthermore, IEC 62087 Edition 3 on-mode testing methodology for TVs could be applied.

18.2.6 Conclusion for Ecodesign

Existing policies do not yet cover all relevant environmental aspects. Specifically, energy efficiency has not yet been regulated. RoHS and REACH do not yet cover fully all hazardous substances (especially phthalates and halogenated flame retardants) that can be present in signage displays. However, as a RoHS extension is currently under discussion, it is recommended to await the outcome of this process before further discussing the appropriateness of potential Ecodesign requirements.

Finally, existing labels such as TCO development and the US Energy Star with their test methods would provide good starting points for potential Ecodesign requirements.

18.3 Appropriateness of Ecodesign or Energy labelling

Whereas the "regulatory coverage" section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on "Appropriateness of Ecodesign requirements" will address the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

18.3.1 Excessive cost

Table 67 below sums up the LCC performed in Task 4 for different types of signage displays.

Table 67: Detailed cost calculation for the "signage display" product group

	Advertising pillar, 46"	Advertising pillar, 70"	LCD screen, 40"	Plasma screen, 50"	LCD screen, 82"
Average purchase price (EUR)	1.990	11,990	699	1,099	49,999
Energy consumption kWh / year	2890.8	8322	221.92	963.6	2686.4
Lifetime / years	7	7	7	7	7
Average EU electricity price (industrial) EUR / kWh	0.12	0.12	0.12	0.12	0.12
Energy costs over lifetime EUR	2,428	6,990	186	809	2,257
Energy savings potential in use phase (%)	26.67	26.67	26.67	20	20
Economic savings potential (EUR)	647.54	1864.13	49.71	161.88	451.32
Relation (economic savings / purchase price)	33%	16%	7%	15%	1%

Present the answer of stakeholders to the question: Considering an average product that currently costs X €, do you think that for reducing the average energy consumption by X %, the average sales price of the product would increase by more than X %?

18.3.2 Suitability of Ecodesign measures or Energy labelling

Various conditions are favourable to the implementation of Ecodesign requirements to the "signage displays" product group:

- Relevant and growing market;
- Best Available Technologies (BAT) exist; experience from the much bigger TV and computers markets can be used;
- The migration of experience from the TV market might also help to keep costs down; and
- Existing labels can be used as a basis for Ecodesign requirements.

Possible barriers could be the rapid technological evolution and the variability of products with different configurations. Experience from the computer regulation could be used to deal with this situation. Also

the fact that the product generally involves a specialized installer responsible for physical installation and network integration could complicate things. More to be added

Given the broad range in energy efficiency, also energy labelling or a similar mechanism suited to B2B products could be envisaged.

18.3.3 Conclusion for Ecodesign

In general, the product group provides considerable potential and is promising. Requirements seem to be feasible. However, the rapid technological development and strong systems integration need to be addressed.

18.4 Industrial competitiveness

More detail to be added

18.4.1 Conclusion for Ecodesign

Given that the display technologies involved are developed and marketed by major manufacturers whose main display R&D is based on the worldwide TV market wehich is already subject to energy labelling and ecodesign regulation, I would opine that further product specific regulation would have little impact on industrial competiveness.

18.5 Product group summary and recommendations

Table 68 below presents a simplified scoring of the four main sections above, for the product group "signage displays".

Table 68: Overall scoring of the "signage displays" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Signage displays	+	+++	++	+++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

To be completed.

19. Toasters

19.1 Main other environmental issues

Table 69 below provides an overview of the relevant environmental aspects of the "toasters" product group, and possible improvement options linked to them. Energy consumption and material efficiency have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 69: Overview of relevant direct environmental issues and potential for improvement – Toasters

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Presence of critical raw materials (see the EU list[159])	+	Antimony, beryllium, might be used in small quantities electronic components. Cobalt, chromium are present in metal alloys of the product parts[160].	
Presence of flame retardants (halogenated, etc.)	+	Flame retardants are used in cables.	
Presence of plasticisers (phthalates)	+	Plasticizers are present in cabling (e.g. power cords).	
Presence of other toxic substances	+	Products comply with RoHS and REACH restrictions on toxic substances.	
Presence of F-gases	0		
Radiation levels	0		
Safety (fuel leakage, vibrations, etc.)	0		
Health (hygiene, noise level, etc.)	+	Must comply with EU Food Contact Materials Regulation.	

[159] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

[160] CECED, stakeholder's input to Task 4.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Durability (reusability, upgradability, reparability, etc.)	+++	Considering the low price of usual toasters, when broken down customers might prefer to buy a new model rather than repairing it.	The Blue Angel label for toasters introduced a requirement for a warranty of at least two years.
End-of-life (recyclability, recycled content)	?		
Direct emissions to air	0		
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issue	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

19.1.1 Presence of flame retardants

Toasters are corded products that need to be safe for the end-user and hence have to comply with safety standards. Compliance with the safety standards likely requires the use of flame retardants.

If the use flame retardants are to be regulated, it should be done horizontally under the RoHS Directive (according to the industry).

19.1.2 Durability

The Joint Research Center (JRC) of the European Commission points out that the establishment of durability requirements could be highly suited when taking into account the consumer perspective (reduction of cost at purchasing) for domestic kitchen appliances. Considering the low price of usual toasters, when broken down customers might prefer to buy a new model rather than repairing it.

Within the German Blue Angel for toasters (see section 0), one of the requirements is that the manufacturer offers a warranty of at least two years.

Waiting for stakeholder input

19.1.3 Conclusion for Ecodesign

The main environmental concern regarding toasters is the energy consumed during the use phase. Durability aspects may be worth considered under the Ecodesign Directive (specifically for toasters or as a horizontal measure) even if at this stage, no specific information was shared by manufacturers regarding best practices.

19.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards.

19.2.1 Overview of EU policies

Currently, toasters are regulated under the WEEE and RoHS Directives and REACH Regulation

Table 70: Main EU legislation applicable to the "toasters" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Toasters	X	X	X	-	-	-

Furthermore, all electric domestic kitchen appliances have to fulfil specific requirements on materials and articles intended to come into contact with food (Regulations (EC) No 1935/2004 and (EU) No 10/2011). In addition to that, the EDQM Guide (European Directorate for Medicines & Healthcare) that deals with the migration of heavy metal and alloy into food, sets very specific substance restrictions for kitchen utensils.

Regulation (EC) No 1935/2004[161] on materials and articles intended to come into contact with food requires that "any material or article intended to come into contact directly or indirectly with food must be sufficiently inert to preclude substances from being transferred to food in quantities large enough to endanger human health or to bring about an unacceptable change in the composition of the food or a deterioration in its organoleptic properties". Regulation (EU) No 10/2011[162] on plastic materials and articles intended to come into contact with food is a specific measure within Regulation (EC) No 1935/2004 and thus sets detailed requirements in regard to the properties of materials used.

The EDQM Guide foresees specific tests for iron, chromium, zinc and other heavy metals as they are potential contaminants[163].

19.2.2 Selected Member States policies

The following section is dedicated to Member States policies which are in place inside the EU and of which the following table gives an overview.

Table 71: Environmental labels at Member States level

Product group	Der Blaue Engel	NF Environnement	Nordic Ecolabel
Toasters	RAL-UZ 167	-	-

[161] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:338:0004:0017:en:PDF

[162] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:012:0001:0089:EN:PDF

[163] European Directorate for Medicines & Healthcare (2003), Comments concerning sime revised/corrected texts published in supplement 4.5. PHARMEUROPA Vol. 15, No. 2.

Thus, only one label could be identified to certify products of the category "toasters", namely the German Blue Angel label. The criteria for the award of the Blue Angel label for toasters date from January 2012[164].

Table 72 shows an extract of the requirements toasters have to comply with in order to obtain the Blue Angel label. However, the requirements listed here below are not exhaustive (there exist various other demands).

Table 72: Requirements of Blue Angel label with respect to toasters[164]

Type of Requirement	Requirement
Energy consumption	0.125 kWh for 2 slice toasters 0.250 kWh for 4 slice toasters
Material of touchable surfaces	Compliance with REACH and other regulations
Safety	There exist requirements in regard to the temperature of the side surfaces, electrical safety and product design
Warranty (min. in years)	2

19.2.3 No information with respect to certified products could be found on the Blue Angel website. Following a written inquiry, the Blue Angel confirmed that up to date no product of the category toasters has been awarded the environmental label. Industry Self-Regulatory Initiative

No relevant SRI could be identified.

19.2.4 Existing third country legislation and labels

No existing third country legislation relating to toasters could be identified. There exists only one scoping report on toaster ovens by the ENERGY STAR programme dating from 2011[165].

19.2.5 Test standards

There are test standards available for toasters. The Blue Angel measurement of energy consumption is based on German norm DIN 60442 (*Elektrische Haushalt-Brotröster, Verfahren zur Messung der Gebrauchseigenschaften*), which is the equivalent of European norm EN 60442.

The American NSF Protocol P405 could also be identified, which is intended to measure energy consumption of "Toasters & Toaster Ovens for Home Use"[166]. It was not possible to get more details on this standard.

19.2.6 Conclusion for Ecodesign

To the exception of the Blue Angel environmental label, policy coverage of the "toasters" product group appears to be quite low in Europe and worldwide. Only safety requirements apply to this product group on a mandatory basis, and not any requirement related to energy efficiency.

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[164] Blue Angel (2012), Vergabegrundlage für Umweltzeichen, Toaster RAL-UZ 167.

[165] ENERGY STAR (2011). ENERGY STAR Market and Industry Scoping Report, Toaster Ovens.

[166] http://www.nsf.org/consumer-resources/health-and-safety-tips/home-product-appliance-tips/toasters-toaster-ovens/

19.3 Appropriateness of Ecodesign or Energy labelling

19.3.1 Excessive cost

The discussion about "excessive cost" shall follow a simplified Life-Cycle Cost analysis (LCC), to make sure that savings stemming from lower energy consumption exceed any increase in purchase price. In the case of toasters, Table 73 below sums up the LCC performed.

Table 73 : Detailed cost calculation for the "toasters" product group

	Toaster
Average purchase price	60 €
Energy consumption / year	40 kWh
Lifetime	6 years
Average EU electricity price (domestic)	0.2 € / kWh
Energy costs over lifetime	48 €
Energy savings potential in use phase	35 %
Economic savings potential	16.8 €
Relation (economic savings / purchase price)	28 %

It is difficult to assess in a very precise way the cost increase that would result from the implementation of technological options ensuring energy savings. The possible available options are described below[160]:

- Eco-slots. A 30-35% saving for the one eco-slot working on a two-slot toaster is possible, although there are many single-slot toasters on the market (where an eco-slot is not suitable);
- Covering slots. Adding automatic mechanisms to close/open the slots will lead to significant cost increases. Moreover, despite warnings on the product and in the product user manual, several incidents occurred related to these coverings resulting in e.g. melted/deformed components;
- Infrared technology. This technology leads to price increase that does not compensate for the potential energy saving. Furthermore, infrared lamps are made with a glass vessel which has a higher environmental footprint at the manufacturing site compared to technology commonly used nowadays for toasters.

Some options, like the NewGen selector control mentioned in Task 3 (which allows the user to heat either one or both slots), seem to be proprietary technologies. However, there are many different options available to enhance energy efficiency of toasters, so that proprietary technologies should not be a major hindrance. For instance, the manufacturer Strix has developed Faster Toaster technology, to create a higher power but more efficient toaster that both speeds up toasting and saves energy (about 30%)[167].

[167] Strix (2014), Strix Fast Toaster.

19.3.2 Suitability of Ecodesign measures or Energy labelling

The following characteristics of the "toasters" product group make it pretty suitable for Regulation:

- Mass market products;
- Only limited product variability and slow technical evolution;
- Best Available Technologies (BAT) exist; and
- Standards and labelling criteria have been developed.

Energy labelling could also be an option, since toasters are mass consumer-products. Furthermore, according to stakeholders, there is sufficient differentiation between products on the market[160]. Even if this would have to be confirmed by further study, there seems to be significant differences for energy consumption across various models on the market, what would contribute to make the case for Energy labelling.

Finally, requirements on durability may also be explored; but at the moment, there is a general lack of data on this issue.

19.3.3 Conclusion for Ecodesign

The question on excessive cost is not clear-cut and would need to be further studied by any preparatory study taking place. However, the general features of the "toasters" product group make it rather suitable for Ecodesign or Energy labelling Regulation.

19.4 Industrial competitiveness

19.4.1 Market structure

The major manufacturers of domestic kitchen appliances include Philips, SEB, Morphy Richards, Bosch und Siemens Hausgeräte GmbH (BSH), Electrolux, Whirlpool, Arçelik AS, Miele[168]. In the toaster market there are some dominant players in terms of energy and resources efficiency, such as the British manufacturer Dualit, which introduced a selector control in the NewGen ® model. But there are also other manufacturers engaging in this kind of improvement activities, like Morphy Richards or Russell Hobbs, which both offer toasters with a lid saving energy and time during the use phase.

19.4.2 Innovation and employment

Even though the European production is rather limited, there could be a substantial effect on the European job market deriving from these innovation processes. Indeed, if toasters become more energy-efficient and longer lasting this might result in the opportunity to relocate production to Europe instead of producing less performing products abroad.

In the case in which materials are affected and exchanged, this might influence suppliers' industries. Innovation in the toaster industry might also impact other sectors if toasters become more and more multi-functional[169].

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[168] Source: Euromonitor International.

[169] There are, for instance, toasters on the market, which in addition to their original use were extended to poach eggs at the same time.

19.4.3 International competition

Even if the number of imports into the European market is important (according to Prodcom data), there are major manufacturers such as SEB in France, BSH in Germany or Dualit and Morphy Richards in the UK. As for the comparative average quality of imported as opposed to European manufactured products no important differences could be identified. However, it was not possible to obtain an estimate of the market share of European manufacturers abroad.

On the other hand, the implementation of the Ecodesign Directive will have an important impact on third country manufacturers, given that it is companies from outside the EU which hold the largest market share. Their costs will go up as a consequence of the Regulation in order to guarantee compliance of their products. Some of them may even decide to stop supplying the EU, if it turns out that compliance is too difficult to reach for them.

If European producers managed to better prepare for the possible product and process innovations as compared to their international competitors, this would result in a considerable comparative advantage, at least in the early stages, following the adoption of Implementing Measures of the Directive. In this case, European manufacturers could replace a certain share of imports with their own Ecodesign-compliant products (if they are able to increase their production activities in time), resulting in their reinforced market position (and the creation of additional jobs).

19.4.4 Conclusion for Ecodesign

The (theoretical) impacts of Ecodesign on the European "toaster industry" look rather good, as it could foster innovation and employment. However, as limited information was gathered through manufacturers, such conclusion should not be considered as robust.

19.5 Product group summary and recommendations

Table 74 below presents a simplified scoring of the three main sections above, for the product group "toasters".

Table 74: Overall scoring of the "toasters" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Toasters	+	+++	+++	++

The more "+" there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

The following types of Ecodesign measures could in principle be envisaged for toasters:

- Minimum requirements on energy efficiency; and
- Minimum requirements on durability.

Energy labelling also seems to be a suitable option for this product group.

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of toasters. Should the product group of toasters be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulative process.

20. Wireless chargers for consumer electronics

20.1 Main other environmental issues

Table 75 below provides an overview of the relevant environmental aspects of the "wireless chargers for consumer electronics" product group, and possible improvement options linked to them. Energy and basic resource consumption have been discussed in Task 3. Hence the table and the paragraphs below focus on the main other environmental impacts of the product group.

Table 75: Overview of relevant direct environmental issues and potential for improvement – Wireless chargers for consumer electronics

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Water consumption in use phase	0		
Consumables (detergents, etc.)	0		
Use of critical raw materials (see the EU list[170])	+	Possibly **antimony** in (plastic) flame retardants as substitute for banned flame retardants. **Berylium** in electronic components. **Cobalt** in wireless charger variants that use rechargeable Li-Ion batteries. **Gallium** in Integrated Circuits (ICs) and in LEDs. **Indium** in lead-free solders. **Natural graphite** in Li-Ion battery containing variants. Possibly **PGMs** in printed circuit boards (PCBs).	For battery containing variants, easy retractability of battery at EoL can facilitate increase of cobalt recycling rates. No other identified.
Presence of flame retardants (halogenated, etc.)	+	Possibly flame retardants in plastic and electronic components. According to stakeholder comments only flame retardants used that are needed to comply with fire safety requirements of the products.	None identified.

[170] See http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
Presence of plasticisers (phthalates)	?	Possibly in attached cables and flexible PVC/ synthetic rubber components.	Alternatives with less harmful phthalates or other substances possible.
Presence of other toxic substances	?		
Use of F-gases	0		
Radiation levels	+	Electromagnetic radiation is technology immanent. It may be more prominent than in other electronic products given the power transfer between two separate devices in close proximity of consumers.	No indication that wireless chargers are not and could not be made to comply with existing legal standards.
Safety (fuel leakage, vibrations, etc.)	?		
Health (hygiene, noise level, etc.)	?		
Durability (reusability, upgradability, reparability, etc.)	+	Presumably more durable than conventional charger, due to less strain, less moving parts etc. through lack of connection to the phone. Hence, possibly longer lifetime than conventional charger. Some charger types may contain non-removable rechargeable batteries[171], which may limit lifetime. Some indication that some devices on the market are at risk of premature failure, perhaps more than conventional chargers and other device Short charging / discharging cycles could stress the batteries as could induced temperature stress.	In case of non-removable batteries, improvement may be reached by allowing for easy change of battery by end-user without tools. No other product group internal improvement potential identified. Possible improvement potential against other external power supply technologies, where these are particularly strained, e.g. certain phone power cords and could be substituted by wireless chargers. (However, these may be best addressed in the respective Ecodesign Regulation)
End-of-life (recyclability, recycled content)	+	Similar to other small electronic devices. Some charger types may contain non-removable rechargeable batteries[171].	In case of non-removable batteries, improvement may be reached by allowing for easy retractability of batteries in end-of-life treatment for

[171] e.g. http://download.support.nokia.com/ncss/PUBLIC/en_GB/webpdf/100000348836/Nokia_Portable_Wireless_Charging_Plate_DC-50_UG_en_GB.pdf.

Environmental issue categories	Scoring	Description of the environmental issue	Description of related improvement potential
		Copper as valuable material.	economic recoverability of contained cobalt.[172]
Direct emissions to air	0	No specific indication. Emissions from energy use, resource extraction, manufacturing, transport.	Increase of energy and resource efficiency. Use of renewable energy. No specific interventions identified.
Direct emissions to water	0		
Direct emissions to soil	0		
Other environmental issues	0		

Scoring: "0" if not an issue for the product group. If this is an issue, the indicative importance of the environmental issue is provided from + (low) to +++ (high). "?" if not known.

20.1.1 Use of critical raw materials

The following critical raw materials may be used in wireless chargers based on typical components, i.e. plastic casings, ICs, PCBs.[173] It is not clear if these apply to all wireless chargers on the market. Amounts have not been assessed and are likely small compared to other applications for these materials.

- Possibly **antimony** in (plastic) flame retardants as substitute for banned flame retardants;
- **Beryllium** in electronic components;
- **Gallium** in Integrated Circuits (ICs) and in LEDs;
- **Indium** in lead-free solders; and
- Possibly **Platinum Group Metals (PGMs)** in printed circuit boards (PCBs).
- Wireless charger variants that provide portable power "on-the-go" contain rechargeable batteries and hence normally the following critical raw materials:
- **Cobalt** in Li-Ion batteries; and
- **Natural graphite** in Li-Ion battery.

Li-Ion batteries are the most important application of cobalt worldwide. Recycling is possible if batteries are treated separately at end-of-life.

Improvement potential hence lies in facilitating easy retrieval of battery (within seconds for economic operation).[172]

[172] See also Task 2 Supplementary Report of this project: http://www.ecodesign-wp3.eu/sites/default/files/Ecodesign%20WP3_Task%202_Supplementary%20report%20on%20resources_17092014.pdf#overlay-context=documents.

[173] European Commission, Report on Critical Raw Materials for the EU: Critical Raw Material Profiles, http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/crm-critical-material-profiles_en.pdf.

No indication of feasible improvement options for the other critical raw materials beyond existing regulation.

20.1.2 Presence of flame retardants

Flame retardants are used to comply with fire safety requirements. With regard to wireless chargers common plastic casings and electronic components are likely subject to use of flame retardants.

Use of flame retardants is informed by REACH Regulation (1907/2006) and restricted in RoHS. Less harmful substitutes are available, e.g. through use of antimony (see previous Section).

20.1.3 Presence of plasticisers

Wireless chargers usually use cables for their own power supply. Cables often contain phthalates, which presumably have health impacts through air intake or contact with skin and especially mucous membranes. Phthalates exposure is presumably cumulative.

Phthalates are also used in synthetic rubber and flexible PVC. Some wireless charger variants use mats as transmitters, on which electronic devices are placed, which hence depending on the materials used may be prone to use of phthalates.

Four phthalates are banned for manufacture and use in the EU (REACH Anned XIV) but not banned in imported products (though reporting is required).

Improvement options are available, either the use of less harmful phthalates or other substances.

20.1.4 Radiation levels

Electromagnetic radiation (EMC, EMF) is technology immanent. It may hence be more prominent than in other electronic products given the power transfer between two separate devices in close proximity of consumers and other devices. There is, however, no indication that existing legal requirements cannot or are not met.

20.1.5 Durability

Wireless chargers are presumably more durable than conventional chargers, due to lack of connection to the phone and, hence, less strain, less moving parts, etc. Therefore, possibly longer lifetime than conventional charger.

Some charger types may contain non-removable rechargeable batteries, which may limit lifetime.

Some indication that some devices/receivers on the market are at risk of premature failure, perhaps more than conventional chargers.[174]

In case of non-removable batteries, improvement may be reached by allowing for easy change of battery by end-user without tools.

No other product group internal improvement potential identified.

[174] See e.g. https://de.ifixit.com/Answers/View/153119/nexus+5+wireless+charging+broken+after...

20.1.6 End-of-life

End-of-life issues are similar to other small electronic devices. Some charger types may contain non-removable rechargeable batteries. Of particular interest for end-of-life treatment are copper as valuable material in the coil and cobalt in possible rechargeable batteries.

In case of non-removable batteries, improvement may be reached by allowing for easy retractability of batteries (within seconds) in end-of-life treatment for economic recoverability of contained cobalt.

20.1.7 Conclusion for Ecodesign

Most issues relate to electronic components. More complex electrical and electronic components indicate higher resource consumption than conventional chargers.

With regard to Ecodesign and beyond energy consumption discussed in Task 3 a suitable Ecodesign measure is, for battery containing variants, the easy retractability of battery at end-of-life. This would facilitate increase of critical raw material cobalt recycling rates and also limit exposure of rest of the waste stream to batteries, altogether leading to safer and more effective treatment.

20.2 Policy coverage

This section is dedicated to the regulatory coverage of the product groups addressed, be it through legislation, within the EU or in third countries, through voluntary agreements and environmental labels or standards. The goal is to identify where Ecodesign or Energy Labelling regulations could have added value beyond the existing legislation, and, in the case of third country legislation, whether there is successful legislation that could serve as a model for Ecodesign or Energy Labelling legislation.

20.2.1 Overview of EU policies

Currently, EU WEEE, RoHS and REACH are relevant for wireless chargers for consumer electronics. No applicable Ecolabel or GPP criteria were identified.

Table 76: Main EU legislation applicable to the "wireless chargers" product group

Product group	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel
Wireless chargers for consumer electronics	X	X	X	-	-	-

Wireless chargers fall under scope of **WEEE Directive (2012/19/EU)** in Annex I under category 3. IT and telecommunications equipment or category 4. Consumer equipment and photovoltaic panels.

With regard to Annex III they would fall in the category 6. Small IT and telecommunication equipment (no external dimension more than 50 cm)

WEEE i.a. requires that the following be "removed" (i.e. to contain hazardous substances, mixtures and components for their monitored environmentally safe treatment):

- Batteries, if included;
- Printed circuit boards if the surface of the printed circuit board is greater than 10 square centimetres (unlikely in most wireless chargers);

- Plastic containing brominated flame retardants; and
- External electric cables.

The WEEE Directive has implications for the design of wireless chargers as well as their end-of-life treatment.

Ecodesign could facilitate the prevalence of adequate design of products to allow for easy retractability of batteries (in wireless charger variants containing rechargeable batteries) for the recovery of contained cobalt and safer operations. Setting such Ecodesign requirements is an implicit suggestion in Article 4 of the WEEE Directive.

The **RoHS Directive (2011/65/EU)** similarly applies to wireless chargers and falls in Category "IT and telecommunications equipment" in Annex 1. Hence, its provisions apply, i.a. Article 4 on Prevention with tolerated maximum concentrations:

- Lead (0.1 %);
- Mercury (0.1 %);
- Cadmium (0.01 %);
- Hexavalent chromium (0.1 %);
- Polybrominated biphenyls (PBB) (0.1 %); and
- Polybrominated diphenyl ethers (PBDE) (0.1 %)

It is unclear if and how provisions under RoHS could be complemented by Ecodesign.

Provisions of **REACH Regulation (1907/2006)** apply with regard to use of substances in the product. No consideration of specific substances has been taken here. Should the product group contain substances that are subject to specific provisions in REACH, it is conceivable that Ecodesign establishes additional criteria to limit exposure to these substances in the final product. This would be in line with the consideration of the European Parliament and of the Council in establishing the REACH Regulation under (14).

This would, however, require a general clarification of the interplay of the two regulations.

Further specific regulations that (potentially) relate to wireless chargers and that have not yet been assessed further here include:

- Directive 2013/56/EU on batteries and accumulators and waste batteries and accumulators;
- Commission Regulation (EC) Standby and off mode (1275/2008);
- Commission Regulation (EC) for External Power Supplies (No 278/2009). Relation has been briefly discussed in Task 3;
- Directive 2004/108/EC on Electromagnetic Compatibility; and
- Regulations relating to safe levels and configurations of electromagnetic radiation.

20.2.2 Selected Member States policies

No relevant Member States policies could be identified.

20.2.3 Industry Self-Regulatory Initiative

A Code of Conduct on Energy Efficiency of External Power Supplies exists.[175] Its scope could potentially cover wireless chargers, which are not explicitly excluded. Though signatories include companies using wireless charging for their products, it is unclear if the Code of Conduct would be applied.

20.2.4 Existing third country legislation and labels

No relevant third country legislation and labels could be identified.

20.2.5 Test standards

Test standards for measuring energy efficiency of external power supplies may be applicable to wireless chargers/ power supplies for consumer electronics, e.g.

EN 50563:2011: External a.c. - d.c. and a.c. - a.c. power supplies – Determination of no-load power and average efficiency of active modes

This needs to be verified.

Unknown if specific measurement standards for wireless power exist.

IEC (IEC61980) and SAE (J2954) will be checked, following an early stakeholder comment.

20.2.6 Conclusion for Ecodesign

Most important environmental impact of wireless charging is arguably from energy losses in power transmission. Energy efficiency could be addressed in Ecodesign or Energy labelling and is not currently addressed in other policies or voluntary instruments. Specific test standards are not yet available/ known. However, it should be assessed, if existing measurements standards for efficiency of external power supplies are applicable to wireless chargers. Also, standardization mandates could be issued.

With regard to other environmental issues Ecodesign could be utilised to ensure easy retrieval of battery (in battery containing variants, which will only be a small share of wireless chargers on the market) for recovery of contained cobalt and easy replacability of battery by end-user without tools for increased durability.

20.3 Appropriateness of Ecodesign or Energy labelling

Whereas the “regulatory coverage” section addressed the question of current mandatory and voluntary instruments (are they enough to cover this specific product group?), the section on “Appropriateness of Ecodesign requirements” addresses the question of future regulation (would Ecodesign or Energy labelling adequately cover this specific product group?).

20.3.1 Excessive cost

As no specific design-related improvement options for better energy efficiency could be identified, a cost calculation is based on approximate purchase price and efficiency improvement potential.

[175] http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/efficiency-external-power-supplies.

The discussion about "excessive cost" follows a simplified Life-Cycle Cost analysis (LCC), to compare savings stemming from lower energy consumption with possible increases in purchase price. For wireless chargers for consumer electronics, Table 77 below sums up the LCC performed.

Table 77 : Approximate cost calculation for the "wireless charger" product group

	Wireless charger for consumer electronics
Average purchase price	80 €
Energy losses/ year (70 % efficiency)	6.9 kWh
Lifetime	2.5 years
Average EU electricity price (domestic)	0.2 € / kWh
Energy costs over lifetime	3.45 €
Improved energy losses/ year (82 % efficiency)	4.14 kWh
Economic savings potential	1.38 €
Relation (economic savings / purchase price)	1.7 %

Stakeholder input sought on reasonability of these assumptions.

The induced additional costs due to efficiency improvements are dependent upon a number of factors, including general technological development. Also purchase price will likely change significantly with the broader introduction of the technology (e.g. being implemented by default in mobile phones). The higher efficiency is today more of a research and development and market dominance question with regard to prevailing technologies than simple costs for specific improvement options.

20.3.2 Suitability of Ecodesign measures or Energy labelling

Pro Ecodesign:

- Mass market product;
- Energy efficiency important and not regulated elsewhere;
- Basic technological variants; and
- Measurement standards obviously similar to that for external power supplies.

Obstacles for Ecodesign:

- Still rapid technological development;
- Best Available Technology not yet clear; and
- Still lacking universal standards for basic technologies.

Generally, Ecodesign seems the more appropriate instrument as compared to energy labelling, similar to regulation on external power supplies. However, given the rapid technological development and the needed flexibility for further innovation, energy labelling could be introduced as bridging regulation

before more stringent Ecodesign requirements are introduced, dependent upon universally applicable measurement standard(s).

20.3.3 Conclusion for Ecodesign

To be completed.

20.4 Industrial competitiveness

20.4.1 Market structure

Market for wireless charging/ power is still forming. Different alliances have formed encompassing a range of companies from various backgrounds, e.g. wireless technology developers, consumer electronics manufacturers, retailers, automotive, furniture, etc., indicating the cross-cutting potential of this product group.

Hence, a clear market structure is not yet established. At the moment established manufacturers (particularly mobile phone) introduce devices alongside smaller accessory providers.

Major developers and manufacturers of wireless charging technology include Powermat, Energizer, ConvenientPower, Witricity, Fulton.

20.4.2 Innovation and employment

Innovation is the crucial aspect with regard to possible Ecodesign measures. Wireless charger technologies still undergo rapid innovation, driven by various demands:

- Flexibility of charging circumstances;
- Low charging times;
- Technological flexibility/ compatibility; and
- Size.

Energy and resource efficiency does not seem to be a primary driver in innovation, though it could follow from e.g. the ambition to reduce charging times. Energy and resource efficiency could hence lag behind other innovation.

Introducing Ecodesign/ Energy labelling requirements could boost innovation if carefully considered, planned and announced ahead to allow for technological adjustment and requirements slowly increased in line with technological possibilities. This is especially applicable for already introduced innovations, e.g. placing mobile phones on charging mats for recharging. As product variants are similar around the world, related innovation could stimulate increased energy efficiency beyond Europe alone.

However, if Ecodesign requirements limit the scope of possible new technological options or true innovations than these may have an adverse effect.

Generally, increased efficiency is probably favourable for adaptability of wireless charging/ power to a range of different application, even beyond wireless charging for consumer electronics. Early competence in this aspect of wireless charging can secure long term market access.

Many wireless chargers on the market today are imported from outside Europe. Expertise in efficiency could help increase general technological expertise in Europe and hence stimulate job creation here. However, estimating effects on jobs must remain vague.

20.4.3 International competition

Distribution of European vs. other companies not yet assessed.

Seems to be a global market, closely related to manufacturing and development of electronic components, manufacturing hence likely often outside Europe.

Introducing Ecodesign requirements could stimulate local research and development, securing a better position in future competition. In a business as usual scenario, Europe does not seem to play a major role in technology development. This should be verified.

20.4.4 Conclusion for Ecodesign

A close monitoring of technological innovation and developments is advisable should Ecodesign requirements be introduced. Ecodesign requirements are most appropriate for those technological systems that are already introduced in various devises and already undergo innovation cycles. The following provides an indicative list of such technological systems:

- To be completed

Ecodesign requirements or in a bridging manner Energy labelling should be carefully considered, planned and announced ahead to allow for technological adjustment and requirements slowly increased in line with technological possibilities. In that manner such requirements could also inform further standardisation of wireless charging technologies, e.g. faster integration of different power supply components instead of multiple steps that each have conversion losses.

Standardisation of wireless charging technologies seems crucial for their future market penetration rates. Lack of standardisation may also lead to multiple parallel technologies on the market. Hence, standardisation could also reduce future resource use by reducing the need for multiple end-use devices.

20.5 Product group summary and recommendations

Table 78 below presents a simplified scoring of the four main sections above, for the product group “wireless chargers for consumer electronics”.

Table 78: Overall scoring of the "wireless chargers for consumer electronics" product group

Product group	Other environmental impacts	Regulatory coverage	Appropriateness of Ecodesign or Energy labelling	Industrial competitiveness
Wireless chargers for consumer electronics	++	+++	+++	++

The more “+” there are in the assessment, the more favourable it is for Ecodesign Regulation to be implemented.

Ecodesign could play an important role in ensuring minimum energy efficiency of wireless chargers for consumer devices and hence a range of possible future variants of power supply.

Ecodesign is an appropriate instrument for ensuring minimum energy efficiency if it is:

- Implemented in such a way that innovation in the market is not adversely effected or at best even stimulated; and

- Measurement standards for external power supplies can be adapted to wireless charging power conversion or alternative measurement standards can be developed.

More specifically:

- Minimum requirements on energy efficiency could be set and announced ahead of time to allow for innovation;
- Energy labelling could serve as a “bridging regulation” to stimulate energy efficiency without limiting innovation; and
- For battery containing variants, requirements for easy retractability of battery at end-of-life could be established (possibly through a horizontal measure for consumer devices or similar)

This is not yet a recommendation for specific Ecodesign measures, but serves to illustrate the basic feasibility and suitability of the Ecodesign Directive to contribute to the improvement of the environmental performance of wireless chargers for consumer devices. Should the product group be chosen for the Working Plan 2015-2017, detailed recommendations will have to be developed in the course of the preparatory study and the regulatory process.

21.Summary

The following summary tables sum up the results of the individual product groups that have been presented above in order to give a better overview. They do not yet imply a conclusion.

Table 79: Summary of other environmental impact

	Water con-sump-tion use phase	Con-suma-bles	Criti-cal raw mate-rials	Flame retar-dants	Plasti-cisers	Other toxic sub-stances	F-gases	Radia-tion	Safety	Health	Dura-bility	End-of-life	Direct emis-sions to air	Direct emis-sions to water	Direct emis-sions to soil	Other environ-mental issue
Base stations	0	0	+	+	+	+	0	+++	0	0	0	++	0	0	0	0
BACS	0	0	++	++	+	+	0	+	0	0	++	++	0	0	0	0
Gateways	0	0	+	++	+	0	0	+	0	0	++	+++	0	0	0	0
Green-house covers	0	0	0	?	?	?	0	0	?	?	+++	++	0	0	0	0
Hair dryers	0	0	+	+	+	0	0	0	0	+++	+++	?	0	0	0	0
Hand dryers	0	0	?	?	?	?	0	0	0	+++	++	+	0	0	0	0
High pressure cleaners	+++	+	+	+	+	+	0	0	++	++	++	++	+++	+	+	0
(Free-standing) Hot vending machines	0	0	+	?	?	?	0	0	0	++	++	+	0	0	0	0
Kettles	++	0	+	+	+	0	0	0	+	+	++	+	0	0	0	0
Lifts	0	0	++	+	+	?	+	+	++	++	0	+++	0	0	0	0
Mobile phones	0	0	++	?	+	?	0	+	0	0	+++	+++	0	0	0	0
PV inverters	0	0	?	+++	+	++	0	+	+	+	?	?	0	0	0	0
Refrige-rated containers	?	0	?	?	+	?	+++	?	?	?	++	?	+++	0	0	?

	Water con-sump-tion use phase	Con-suma-bles	Criti-cal raw mate-rials	Flame retar-dants	Plasti-cisers	Other toxic sub-stances	F-gases	Radia-tion	Safety	Health	Dura-bility	End-of-life	Direct emis-sions to air	Direct emis-sions to water	Direct emis-sions to soil	Other environ-mental issue
Signage displays	0	0	0	+	+	+	0	0	0	0	+	+	0	0	0	0
Toasters	0	0	+	+	+	+	0	0	0	+	+++	?	0	0	0	0
Wireless chargers	0	0	+	+	?	?	0	+	?	?	+	+	0	0	0	0

Table 80: Summary of regulatory coverage

	WEEE	RoHS	REACH	EPBD	GPP	Ecolabel	Others	Member States	Third Country	SRI	Standards
Base stations	+	+	+	-	-	-	EED; Directive 1999/5 on Radio and Telecommunications Terminal Equipment	-	-	+	+
Building Automated Control Systems	+	+	?	+	-	-	EED	EPBD implementation	LEED	+	+
Gateways	+	+	+	-	-	-	Reg. 801/2013 (Networked standby)	-	Energy Star, various Asian labels	+	+
Greenhouse covers	-	-	(+)	+	-	-	-	?	?	-	?
Hair dryers	+	+	+	-	-	-	-	Blue Angel	Taiwanese label	-	+
Hand dryers	+	+	+	-	-	-	-	Blue Angel	Taiwanese label, Korean standby programme	-	+
High pressure cleaners	+	+	+	-	-	-	Outdoor Noise Directive 2000/14/EC and various others	-	US Clean Water Act	+	+
(Free-standing) Hot vending machines	+	+	+	-	-	-	Food contact material Regulation 1935/2004 and Regulation 852/2004 on the hygiene of foodstuffs	-	Japan Top Runner Programme	+	+
Kettles	+	+	+	-	-	-	Food contact material Regulation 1935/2004 and 10/2011	Blue Angel	-	-	+
Lifts	-	-	+	+	-	-	Lifts Directive 95/16/EC	EPBD implementation	Mexican Label	+	+
Mobile phones	+	+	+	-	-	-	-	Blue Angel	Taiwanese label	-	?
PV inverters	+	-	+	-	-	-	-	Blue Angel	-	-	+
Refrigerated containers	-	-	+	-	-	-	Reg. 1005/2009 on ozone-depleting substances	-	-	-	?
Signage displays	+	+	+	-	-	-	-	TCO label	Energy Star	-	+
Toasters	+	+	+	-	-	-	Food contact material Regulation 1935/2004 and 10/2011	Blue Angel	-	-	+
Wireless chargers	+	+	+	-	-	-	-	-	-	?	+

Table 81: Summary of preliminary product group assessment

	Energy savings 2020 (Use phase, PJ)	Energy savings 2030 (Use phase, PJ)	Resourceefficiency improvement	Other environmental impact	Regulatory coverage	Appropriateness of Ecodesign or Energy Labelling	Industrial competitiveness
Base stations	3.4	12.2	+	++	+++	+	+++
Building Automated Control Systems	1,361*	3,611*	?	+++	++	++	+++
Gateways	7.3	35.3	+	++	++	++	+++
Greenhouse covers	15.2	51.1	?	+	+++	+++	++
Hair dryers	29.7	31.1	?	++	+++	+++	+++
Hand dryers	49.5	43.7	?	++	+++	+++	++
High pressure cleaners	9	10	+	++(+)	++	tbd	tbd
(Free-standing) Hot vending machines	6	6	+	+	++	+	++
Kettles	43.4-73.8	43.7-77.6	+	+	++	+++	+++
Lifts	12.0	28.7	+	++	+	++	++
Mobile phones	6.8	n.a.	++	+++	++	+++	+++
PV inverters	4.6	35	+	++	+++	+++	+++
Refrigerated containers	17.3	21.1	?	++	++	+++	++
Signage displays	20.1	n.a.	?	+	+++	++	+++
Toasters	23.1	23.9	+	+	+++	+++	++
Wireless chargers	16.3	32.5	?	++	+++	+++	++

*Savings potential of the application of BACS vs. no BACS. Savings potential of Ecodesign of BACS would have to be determined.