Addressing resource efficiency through the Ecodesign Directive

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A review of opportunities and barriers

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Foreword

This is the final report from the research project “Ecodesign and Future Product Policy,” commissioned and financed by the Sustainable Consumption and Production Working Group of the Nordic Council of Ministers.

The project is subdivided into three parts: (1) From energy efficiency during use to resource efficiency, (2) the role of the Ecodesign Directive within a broader policy package for improved resource efficiency, (3) resource efficiency in Eco-labels and an Implementing measure for one project group. In this report, the main focus is on part one and three, but do also relate to part two.

In another study, an analysis was made of the synergies and coherence between nine European and Nordic policy instruments in order to minimize the environmental impacts from all life cycle stages of washing machines and to drive innovation. This case study of household washing machines is published in: Product policies on the environmental performance of washing machines. TemaNord Report 2013:549.

In this report, a comprehensive summary of the existing investigations and case studies is made related to the Eco-design directive and the Integrated Product Policy of the European Union. Besides, the benefits and drawbacks of moving from energy efficiency to resource efficiency are discussed. The linkages between different policy instruments are analysed, especially if the use of resource criteria in different eco-labels can be used as platform for resource efficiency applied in the implementing measures of the Eco-design directive. Furthermore, the viewpoint of stakeholders from industry and different authorities are highlighted through interviews.

Researchers at Lund University and Aalborg University have written the report. Carl Dalhammar is the main author of the chapters 1–4, 6–7, 9 and 11. Erika Machacek is the main author of chapters 8 and 10. Anja Bundgaard, Kristina Overgaard Zacho and Arne Remmen are the main authors of chapter 5.

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Consumption and Production Working Group,
Ministry of the Environment, Reykjavik, Iceland

Abbreviations

B2B	Business to business
B2C	Business to consumer
BOM	Bill of materials
BREF	Best Available Techniques Reference Document
CBA	Cost-benefit analysis
CMS	Chemical management services
CO ₂	Carbon dioxide
COM	European Commission
CPD	Construction Products Directive (now repealed by CPR)
CPR	Construction Products Regulation [No. 305/2011]
CRM	Critical raw materials
DG	Directorate-General (within the COM)
ESCO	Energy service company
DEFRA	The Department for Environment, Food and Rural Affairs, UK
ECMA	Ecma International – European association for standardizing information and communication systems
Ecodesign Directive	Directive 2009/125/EC of the European Parliament and of Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products
EEB	European Environmental Bureau
EEE	Electrical and electronic equipment
EMAS	Eco-management and audit scheme [regulated in Regulation (EC) No 1221/2009]
EOL	End-of-life
EPBD	Energy Performance of Buildings Directive
EPD	Environmental Product Declaration
EPEAT	The Electronic Product Environmental Assessment Tool
EPR	Extended producer responsibility
ERP/ErP	Energy-related product
ESO	European Standardization Organization
EU	European Union
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GHG	Greenhouse gas emissions
GPP	Green public procurement
HVACR	Heating, Ventilation, Air-Conditioning & Refrigeration
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IM	Implementing measure (set under the Ecodesign Directive)
IP	Intellectual property
IPP	Integrated product policy
IPR	Individual producer responsibility
KEMI	The Swedish Chemicals Agency
LC	Life cycle
LCA	Life cycle assessment
LCC	Life cycle costing
LCD	Liquid crystal display
LED	Light-emitting diode
MEErP	Methodology for the Ecodesign of Energy-related Products

MEEuP	Methodology for the Ecodesign of Energy-using Products
NGO	Non-governmental organization
PC	Personal computer
PM	Permanent magnets
PPI	Public procurement for innovation
PPMs	Processing and production methods
PSS	Product service system
R&D	Research and development
REE	Rare earth element
RFID	Radio-frequency identification
REACH	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency
RoHS Directive	Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment [previously Directive 2002/95/EC]
SMEs	Small and medium sized enterprises
TBT	Technical barriers to trade
TCA	Total cost accounting
TCO	Swedish Confederation of Professional Employees [Tjänstemännens centralorganisation]
TFEU	Treaty of the Functioning of the European Union
VA	Voluntary agreement
WEEE Directive	Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) [it will be repealed by the new WEEE Directive in February 2015: Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)]
WFD	Waste Framework Directive
WTO	World Trade Organization

Executive summary

Introduction and background

Resource use considerations have come to the forefront of the sustainability agenda in the last couple of years. Both the European Union (EU) and various nations are currently developing strategies to promote resource efficiency and address resource security issues, in addition to existing strategies of importance such as waste and recycling policies.

An effective response to the resource related concerns would involve a number of strategies at the international, European and national levels. These can include an increased use of taxes and charges, more focus on “resource use” issues in eco-labeling (e.g. requirements related to recycled content), and international cooperation on the use and sharing of resources. Many of the proposed policies are however difficult to implement due to political and legal reasons, and the policy options are limited. Therefore, more application of resource related requirements set through the Ecodesign Directive is an interesting option. The Directive is already in place, and currently a lot of institutional learning is taking place on how to regulate the ecodesign characteristics of products. Most implementing measures set under the Ecodesign Directive so far regulate energy efficiency during the use phase. Several current trends however provide interesting arguments for addressing resource related issues in the future, including:

- as energy efficiency of products improves significantly, the environmental impacts associated with other environmental life cycle phases become relatively more important
- the life spans of many product groups – such as mobile phones, TV and laptops – are becoming shorter. Therefore, aspects related to materials and resources are becoming more important relative to energy during the use phase
- information about embedded energy in materials and components, and the potential energy savings of recycling practices, provides a case for setting resource requirements
- improvements in recycling technology, and increasing demand for rare earth elements and other key resources is expected to increase the economic feasibility of take-back systems and more recycling

- resource criteria are already applied in eco-labels and green public procurement, and this indicates that resource requirements can also be applied in the Eco-design Directive
- upcoming standards set in industry-driven standardization, related to monitoring and measurement of recycled content and other relevant parameters will assist the setting of resource related requirements.

Objective and methodology

Some studies propose that resource related ecodesign requirements can – according to ex ante estimates – make environmental and economic sense. A number of recent reports address relevant issues such as measurement methods and indicators that may be used when setting relevant implementing measures (IMs), and provide examples of how such IMs could look like.

In this report, a comprehensive summary of existing knowledge is provided and a new discussion is raised on issues related to the advantages and disadvantages of using the Ecodesign Directive to address resources, and how the Directive could – and should – interact with other policies. We also review the concerns related to how such requirements would influence trade and industry competitiveness, and innovation, including the link to functional aspects of eco-design and sustainable business models. The main objectives of this research are thus to:

- *outline the state of play*, i.e. past experiences with applying the Directive and the policy ideas provided for how to address resource efficiency in the future
- *analyze how the Directive can promote resource efficiency objectives* in various ways
- *assess the interactions between the Ecodesign Directive and other product policy instruments* and how this interaction can be improved.

The main methodologies included in the project are:

- a vast literature review covering several streams of literature
- a case study of permanent magnet motors that provides more contextual knowledge on the potential for resource efficiency requirements
- a comparative study on resource related requirements that have been applied in various product policy instruments
- semi-structured interviews with policymakers and industry representatives.

Potential legal requirements related to resource efficiency

Recent reports and case studies have outlined different types of legal obligations related to resource efficiency that may be set under the Ecodesign Directive in the future. These include durability requirements; removing certain substances to improve recycling; undertake cost efficient design measures to enable future recycling; provide information about certain critical materials and where they are placed in the product; longer guarantees provided to consumers; maximum disassembly times; requirements to provide evidence that ecodesign was considered during the design process; requirements on percentages of recycled content in the product.

Further, several studies indicate that new types of environmental requirements that relate to resources and toxic content seem to meet both economic and environmental objectives. These studies also propose potential requirements for a number of product groups. Some of these requirements can be measured with existing standards, tools and calculation methods, whereas some may require development of new calculation methods, standards and certification schemes. The compliance problems do not seem to be insurmountable since resource efficiency criteria can be found in eco-labels for many product groups. A weakness is however that no deeper analysis of the costs and benefits of proposed IMs are made in any of the studies, nor a more elaborated study of implications for competitiveness of EU industries, most notably SMEs.

Advantages and disadvantages with addressing resource issues through the Eco-design Directive

The main *benefits* with using the Directive to address resource issues are identified to be:

- the Directive offers a “difficult but feasible” way forward whereas many other policies – such as more use of taxes and charges – are less likely to be politically acceptable
- requirements set through the Ecodesign Directive will – unlike taxes and charges – not necessarily put EU manufacturers at competitive disadvantage because they apply equally to all products put on the EU market (also those produced outside the EU)

- many actors seem to view stringent energy efficiency requirements as a potential source of competitive advantage for EU industries, promoting resource savings and innovations
- several reports stress the need to push sustainability and resource efficiency within supply chains, but current policies have not been able to stimulate progressive supply chain efforts. There are some expectations among stakeholders that the Ecodesign Directive could be “the pioneer instrument” for driving supply chain measures, paving the way for other instruments. Requirements related to information, recycled content, materials declarations etc. could trigger supply chain initiatives
- a potential advantage with using legal requirements is the “extra-territorial effects” of EU product laws; other jurisdictions often implement similar policies.

Public interventions are needed to make progress on resource efficiency as we cannot rely on voluntary initiatives. Business organizations have also advocated stronger policy interventions to deal with climate change and resource use in the last couple of years. Further, promoting resource efficiency through the Ecodesign Directive can pave the way for other types of policies, as it promotes institutional learning regarding the effectiveness of different instruments. However, potential drawbacks can be associated with addressing resources through the Directive, such as:

- There are significant delays in the setting of ecodesign requirements for several product groups. More focus on resource requirements could stall the process even further. The counter-argument is that the inclusion of resource requirements could actually lead to improvements in the process, for instance as it holds the potential to improve coordination within the Commission, and improve the set-up and quality of preparatory studies.
- By setting requirements related to resources and materials, there is risk of putting restrictions on innovation and/or increase costs. This is an argument often used by industry, not least by the IT sector. The counter-arguments are that research indicates that product and service regulation are positively correlated with domestic industry competitiveness, and that barriers to innovation mainly occur if ecodesign requirements are poorly designed.
- A common critique is that certain rules may pose trade barriers, and impose EU rules on other jurisdictions. Such concerns have to be taken into account when setting rules.

- The potential clash between different environmental aspects is a concern. Some inherent conflicts are likely between different environmental objectives.
- Product requirements related to resource use may affect the competitive position of EU industries positively and/or negatively. While there are potential benefits, potential negative implications for EU industries include:
 - Industries may move outside EU to avoid certain rules and inspections.
 - SMEs may have a difficult time obtaining data, compared to larger firms.
 - Some types of requirements, such as declarations on recycled contents, will require supply chain issues and declarations from suppliers. Firms outside EU will however be difficult to inspect. This puts EU firms at a potential disadvantage.
- Unknown chemicals in products are seen as barriers to recycling requirements and requirements on recycled content.

Substantial introduction of resource related requirements in IMs has many potential benefits, but also disadvantages. Of special importance is the problem of further delaying the policy process, the potential risks to innovation processes, and the risks for competitive disadvantages to EU industries. It is however important to note that:

- similar concerns have been voiced when most comparable regulatory reforms were launched, including the REACH Regulation and the WEEE and RoHS Directives. The warnings – predicting large trade concerns, barriers to innovation etc. – were manifold, when these instruments were introduced. While the implementation of these policies has not always been smooth, and compliance is far from perfect, few actors now suggest we should scrap them, and the environmental benefits are obvious
- addressing resources is a “chicken-and-egg” situation; we can hardly expect perfect indicator systems and means of compliance until we have set requirements in the policy process. For instance, few companies will devote resources to set up supply chain initiatives, until there are clear rules in place.

A “system orientation”: which are the main concerns?

Currently, a relevant discussion is how to deal with products that are part of systems when setting requirements under the Ecodesign Directive. The MEErP report discusses the “extended product” approach and a wider “systems approach” in relation to some product groups such as pumps and circulators. With the future regulation of various components in buildings, there will be an even greater need to deal with such matters. Some of the main concerns are:

- How to define the regulated entity in terms of components, product, function and system? A system approach may be necessary since the performance of a given product depends on how it functions together with the system and that the proper product is chosen fitting to the task e.g. in the case of pumps. Besides, maintenance and user behavior may also influence the performance. But a system approach requires different scoping methods and methodologies, and may encounter barriers related to legal design.
- What to do when two different types of products affect each other’s performance (e.g. washing machines and detergents, or electric motors and their use in a wide variety of end use applications), but where policies are set at different forums without coordination? For some product groups the capacity to improve the technology is limited, unless changes take part in other product groups.
- The use of some products will mean that other products are required (gas ovens requiring more ventilation is an example), which lead to more environmental impacts. This should be considered when requirements are set, but besides user behavior and infrastructure will have an important impact on the outcome.
- Regarding appliances in buildings, then many different issues need to be dealt with, such as:
 - “Built-in” intelligence in appliances and how it functions with the building,
 - Appliances has to be designed to suit the needs of passive houses and other types of energy efficient buildings as well as to the smart grid,
 - Different directives use different metrics and measurement methods, which could be problematic e.g. when choosing the right appliance for the building.

System approaches may provide certain benefits to producers. Increasingly more interest is directed to the services related to products (maintenance, repair, new business models etc.), and manufacturing firms have increased the business offerings related to services in the last decades. A system approach can help promote new business models and revenue streams. However, it can also constitute a challenge both for lawmakers, that have to design the rules, and for industries that have to prove compliance.

A related discussion addresses multi-functional products. Multi-functional products pose challenges to product requirements set through eco-labeling and legislation, as the functional unit to apply is not evident. Research on Japanese practices has revealed that the issue of multi-functionality is addressed differently in different standard setting schemes. With the emergence of new types of products across the boundaries of previous product groups (e.g. computer TVs) and the planned regulation of building components, the issues above need to be dealt with in a coherent manner, and new types of methodologies should be developed.

What role for the Directive in a policy mix for resource efficiency?

In the report, some main ideas on how product policy instruments may interact at the conceptual level are proposed. They include:

- *Policy mixes to stimulate innovation among both leaders and laggards.* It appears as if both legal requirements set through the Ecodesign directive and criteria in labeling need to be strengthened in many cases to provide stronger incentives for more radical innovation. Faster updating of performance standards in both mandatory and voluntary instruments is necessary.
- Another way to look at the interaction is to look at *policies that are directed towards single product groups as a complement to horizontal rules that affects a larger body of products.* The Ecodesign Directive can set requirements as in the case of stand-by consumption that complement horizontal instruments like RoHS.
- *Some environmental and social aspects are difficult to address through legal requirements.* Then other instruments and standards (e.g. codes of conduct) and eco-labels may be a better way forward. For instance, GPP is often viewed as an instrument that may be used to address issues that

are difficult to address through mandatory requirements. The *preparatory studies could highlight best practices in industry and help provide benchmarks that can be applied in other instruments, e.g. GPP.*

- New business models tend to be hard to enforce through legal requirements, and procurement may be a better option to stimulate such models. But also here *the preparatory reports could help in identifying best practices and functional innovations.*

Regarding how the Ecodesign Directive currently interacts with other policies, we can note:

- *Energy labeling:* At the EU level, the Ecodesign Directive and the energy label is well coordinated, but for several product such as refrigerators, etc. the “worst” performing products allowed on the internal market comes with an A+ label from December 2013.
- *Eco-labeling:* The (lack of) coordination between the Ecodesign Directive and the eco-label is problematic and needs to be improved. There is an obvious need to update and thigten some eco-labeling criteria. In several cases, eco-label criteria already include resource efficiency and can in this way inspire to set up resource requirements in the eco-design directive.
- *Green public procurement and technology procurement:* GPP and subsidy schemes mainly take place at the national level. Coordination appears to be limited. Technology procurement have been used successfully in the past in countries like the US and Sweden. Such initiatives have received increasing interest lately due to the renewed interest in demand-driven innovation among OECD countries. Procurement can stimulate innovation and diffusion of technology whereas legal requirements are setting a minimum bar for the environmental performance of the product.
- *The WEEE Directive:* There are recent ideas on how the Ecodesign Directive can complement the horizontal rules in the WEEE Directive, through setting requirements related to maximum disassembly time, or rules that deal with toxic substances that can pose a barrier to cost-efficient recycling practices.
- *The RoHS Directive and the REACH Regulation:* The Ecodesign Directive could complement the REACH/RoHS rules through setting additional rules for chemicals for certain product groups, when this would be required to stimulate recycling and contribute to cleaner materials streams. If this were done in a more systematic way it will

require that methodologies are developed within the MEErP, or special provisions.

- *The Waste Framework Directive*: There are many potential synergies between the Ecodesign Directive and the WFD, and other waste related rules. Most notably, the standards for when waste is no longer considered to be waste may become increasingly important for rule development for the Ecodesign Directive.

Legal issues in relation to resource efficiency requirements

The main regulations of importance are the relevant WTO-administered agreements (most notably GATT and the TBT Agreement), and the text of the Ecodesign Directive itself. The most prominent issue concerns the potential to regulate processing and production methods (PPMs). Clearly, the wording of the Directive has been influenced by the GATT provisions and it is rather clear that only environmental aspects related to product design can be regulated through the Directive; upstream processes can sometimes be regulated indirectly, however, through product design provisions which may influence the production in some cases. In principle, it should not be possible to require PPM-related information from producers either, unless it is clearly related to product design. It should however be possible to require PPM related information in order to prove compliance with product design requirements. For instance, it is possible to mandate information to prove that a product contains a certain percentage of recycled content. The somewhat limited potential to regulate all types of PPMs also implies that there is a role for GPP and eco-labels to play in pushing PPM related criteria. PPMs are applied in eco-labels, and EU case law has established that many PPMs can in principle be addressed in public procurement.

The main concerns however relate to the text of the Ecodesign Directive itself. Especially Art. 15(2) and its criteria related to “*significant environmental impact within the Community*” and “*significant potential for improvement without entailing excessive costs*” are of interest. It is not clear how these wordings should be interpreted, especially in relation to resource use issues. In any case, some types of requirements that have a significant environmental potential would probably be allowed even if the legal text is interpreted in a “reductionist” way. Several potential requirements that would boost recycling could probably be warranted.

One genuine problem concerns rules set now that could boost recycling in the future.

Certain rare earth elements (REEs) and other materials can be cost-efficiently recycled in the future as there are ongoing pilot projects to elaborate and test new recycling methods for commercialization, and prices of some REEs are expected to rise. The costs of recycling practices however, will be influenced by the design applied now, when products are put on the market, even if the life time for some products are 15 years or more. However, *even if producers can make design alterations at low cost today to allow more cost-efficient recycling in the future, it is not clear if this is allowed under Art. 15.* If so, the potential for strategic, long-term ecodesign policies is clearly restricted.

The link to competitiveness

New types of requirements set through the Ecodesign Directive may have both a positive and a negative impact on the competitiveness of European enterprises. Potential links include:

- Policies can boost resource efficiency and related innovation, and open up new material supplies through improved recycling.
- There is potential for policies and rules to trigger new business models, not least if rules and standards have a functional and system orientation.
- Generally, product and service regulations and standards tend to be more positively correlated to improved competitiveness than process oriented legal requirements. Product-related requirements increase the costs for manufacturers in the short term, but induce investments that pay off in the longer term. Further, as the rest of the world tends to follow EU product rules, there is potential for first-mover advantages for EU firms.

Interviews with policymakers

A limited empirical study with ten policymakers was made as part of the project. Virtually all interviewees saw a potential to address resource efficiency through the Directive, but there were diverging views regarding how difficult this would be. Some actors saw a need to develop more indicators on resource use/efficiency before this would be possible,

whereas other considered it possible to set requirements in the near future. Clearly, addressing recyclability in various ways appeared to be the aspect with the highest acceptance. Some interesting views expressed by the interviewees were:

- The interpretation of the “significance” requirement in Art. 15 of the Ecodesign Directive may be crucial for the setting of some new types of IMs.
- We need to have a better idea on what type of resource issues are best addresses within the scope of the Ecodesign Directive, and which ones are to be addressed by other instruments.
- End-of-life aspects and certain resource use requirements may be a good starting point for regulations within the Directive.
- Long term target setting, preferably based on functional considerations, is important.
- The Directive contribution towards resource efficiency improvement is perceived to be dependent on available, accepted, and most important, measurable indicators, with the critical material indicator introduced in the MEErP representing a first step.
- Resource related aspects could be regulated in a horizontal way, spanning several products groups. One example would be e.g. a long term requirements that the level of recycled content must be 35% for a certain product groups.
- It may be effective to address resources as “embedded energy,” since energy and CO₂ reduction benefits are easier to communicate to some stakeholders.
- New approaches and LCC calculation methods, such as the “Top performer” approach proposed by Germany, could move things forward.

Interviews with industry

Nine people from corporations and industry associations were interviewed during the project. The interviews provided interesting insights and opinions, such as:

- The types of requirements that can/should be put on products vary a lot depending on product group, as characteristics such as technical solutions, user patterns, and type of business (e.g. B2B or C2C) are of importance.

- Among the potential requirements considered acceptable by several interviewees were: durability (if proven by technical documentation); removing certain substances (to improve recycling); undertake cost effective design measures to improve future recycling (this could include the banning of certain types of design – such as plastic coating – if other designs exist and do not impose high additional costs); provide information about certain critical materials (e.g. REEs) and where they are placed in the product.
- Requirements in REACH/RoHS/US laws on conflict minerals have meant that there are now information formats that provide the foundation for more BOM type of requirements. However, keeping track of recycled material, or providing information about material composition is often more complex than providing information about chemicals.
- Among requirements not considered highly feasible and/or desirable are: longer guarantees provided to consumers; maximum disassembly times; and requirements to provide evidence that ecodesign was considered during the design process (since it is hard to monitor and show compliance for such requirements).
- Recycled content: In many cases it may be difficult to have different systems for monitoring and handling virgin materials as compared to recycled materials, which have implications for the possibilities to prove that products are compliant.
- The Ecodesign Directive cannot be “the” main driver for resource efficiency and improved recycling, but it may help to push developments in some cases. Many interviewees point to the WEEE Directive, other waste regulations, and resource pricing, as the main tools to stimulate resource efficiency and better reuse and recycling.
- Article 15 of the Ecodesign Directive could provide a barrier towards certain requirements, but formal legal disputes over the legality of future requirements are not expected by the interviewees: stakeholders usually do not enter into such disputes.

Several interviewees were clearly in favor of promoting individual producer responsibility (IPR), stating that if the producer does not get any benefits from a better design, then the incentives for ecodesign are non-existent. This seems to reflect the renewed interest in IPR more generally, which in turn seems to have been (at least partly) triggered by higher resource prices.

A case study on the potential inclusion of permanent magnets in the electric motor product group

A case is presented on permanent magnet motors (lot 30). The case study was built on semi-structured interviews, and discussions with stakeholders. The study looked at the potential for setting resource related rules, with special focus on REEs. It is an interesting case because REE-permanent magnets allow motors to achieve the highest efficiency classes (including IE4) as compared to motors using conventional materials such as iron and copper. However, due to soaring prices of REEs the last couple of years some manufacturers have begun re-considering alternative materials for which price changes are easier to predict and which are easier to obtain. This move towards using alternative materials could however make the motors less energy efficient, unless it was accompanied by innovations that reduced overall material need and achieve high energy densities. Alternatively, a more efficient use of REE was considered in their application in the magnets with a view to facilitating recycling. Several pilot projects are currently being undertaken, which look at the potential for recycling REE; the technical implications and future cost/revenue projections are uncertain at the moment.

The interviews indicate that ecodesign requirements can indeed speed up innovation in the sector, though materials costs constitute an even more important driver for change. There was also input on what kind of legal requirements that are considered acceptable by industry, such as BOMs to promote recycling (when new technologies allow for profitable recycling if the motors are easy to disassemble), and requirements that prevent that some parts are covered by plastic to ease recycling practices. Some requirements cannot be set today but may be possible in the future when we know more about the technical and economic viability of recycling practices for REEs.

Recommendations

The overall conclusion is that there is reason to begin working more coherently with resource efficiency requirements under the Ecodesign Directive, but that it is wise to “advance slowly” to avoid setbacks. The report discusses short and long term recommendations, and complementary actions. Potential short-term actions include:

- *Consider new types of requirements:* According to the industry representatives, certain types of requirements are more acceptable than others. The preparatory studies could review the potential for such requirements. The consultants should be encouraged to propose new types of requirements even if not all of them can be applied in the final requirements. Benchmarks – e.g. a review of the best performers on the market – should be part of the studies, and more measures should be taken at the EU level to ensure that benchmarks are considered in the application of other instruments like GPP. There are reasons to look at e.g. durability requirements for product groups where the technological developments are slow. Regarding information, it may be relevant to examine:
 - if manufacturers should account for critical materials and components
 - if manufacturers should provide information about where these materials can be found in the product to enable future cost-efficient recycling
 - if certain design solutions (e.g. coatings and material mixes) should not be allowed as they may impede future recycling efforts.
- *Methodologies must be developed:* The MEERp methodology has begun to deal with some issues such as critical materials. There is a need for methodologies to deal with the problems associated with the “system orientation”, and for better policy coordination at the EU level.
- *Chemicals in components and materials:* Chemicals that is or can be a barrier to recycling should be identified and assessed in all consultancy studies.
- *Rules now to enable recycling later:* There could be reason to already set rules now that would allow for cheaper recycling in the future. Such rules may relate e.g. to material declarations, or banning plastic coatings, to better allow for cost-efficient future recycling.
- *No more “passing the buck”:* during the preparatory studies, consultants should not be allowed to state that WEEE/RoHS/REACH takes care of some issues, nor should they be allowed to simply refer to theoretical recycling scenarios etc. This does not mean that IMs must be set if other instruments do not function properly, in all cases, but at least proposed policies will be based on realistic assessments.
- *In connection to that last point, there should be more consideration of other policies, and what a good policy mix entails, when setting requirements under the Ecodesign Directive;* for instance, EoL legislation, waste treatment standards and recycling targets should be taken into account.

- *The EU must invest more in the preparatory studies:* The US invests more resources in their studies. It can pay off to do so in the EU as well, especially if EU wants to integrate resource efficiency aspects.

A main concern is that the political acceptability of some types of rules is low, and the concern that all industries may not be able to comply. These issues can be addressed through different strategies, such as:

- *Several tiers of requirements with checkpoints:* By setting long term targets through several tiers of requirements, industry has sufficient time to adopt practices and set up systems for information, finding suppliers of recycled material and so forth. Some industries and member states may be reluctant because of concerns that some industries cannot comply. The introduction of checkpoints, where requirements can be made more or less progressive due to market and technological developments, could partly solve this dilemma.
- *Benchmarks and the use of other instruments:* preparatory studies can provide benchmarks, for instance through identifying the best performers in terms of recycled content, material declarations etc. If there is resistance towards setting IMs in some cases, the benchmarks may be used in other instruments such as public procurement, to trigger diffusion and ultimately innovation.

Potential long term actions include:

- *Make use of new instruments to promote resource efficiency:* Some instruments are hardly discussed at the EU level. For instance, technology procurement has a good track record in the US and Sweden, and is an obvious complement to the Ecodesign Directive due to its proven ability to trigger the market introduction of more energy-efficient appliances.
- *The wording of the Ecodesign Directive:* It seems as if the wording of the Directive, most notably Art. 15, may impede the setting of some types of strategic requirements that may enable better recycling in the future. If so, a change in the wording should be considered. This is clearly a major issue, and it should therefore be dealt with in conjunction with other similar issues related to the application of the Ecodesign Directive in the future; such as the inclusion of an EU “Top runner” concept, and the interpretation of the “least life cycle cost” as a guide for legal standard setting.

- *Develop the WEEE Directive and other EPR directives to promote individual producer responsibility (IPR):* The Ecodesign Directive cannot make up for shortcomings in other directives. We urgently need to stimulate the economic case for Ecodesign. Promoting IPR¹ is one course of action. Green public procurement (e.g. award criteria for manufacturers providing better information on the materials) could be another option.

Among complementary actions we can identify:

- Establish pilot projects and research to examine the potential to cost-effectively recycle critical materials like REEs.
- Establish research in new materials and better design.
- Review the need for (European) standardization to contribute to new requirements through timely introduction of new standards (see below). This may entail new mandates to the European standardization bodies.

Need for further research

A number of issues need to be researched further. These include:

- We need to have a better idea on how the different instruments should interact to deliver resource efficiency, therefore we need to both elaborate on:
 - the role of different instruments and their interactions, and
 - which instruments should trigger more radical innovations.
- We need to examine the implications on industry competitiveness (short and long term) related to resource efficiency requirements, for manufacturers and other actors. This could entail both historical case studies and studies on single product groups.
- A better overview is needed of what kind of industry standards there are related to resources, in connection to design, measurement, and indicators. The need to develop new types of standards should be assessed and applied in EU standardization policy.

¹ There is much confusion on what individual producer responsibility is; it does not have to entail individual take back schemes. See more on this in Annex I.

1. Introduction: Addressing resource use issues through the Ecodesign Directive

1.1 The Ecodesign Directive: current state of play and research gaps

The Ecodesign Directive² was adopted in 2005. The legislative process was long and quite controversial.³ Its initial scope included “energy-using” products, but this scope was extended to include all “energy-related” products in 2009. The Directive is unique in several ways:

- *It builds on the concept of “life cycle thinking,”* inspired by the ideas expressed by the Commission on Integrated Product Policy (IPP).⁴ It aims to encourage ecodesign among industries, including the use of life cycle assessment (LCA) and ecodesign tools, which makes it quite unique.
- *It constitutes one of few successful policy instruments for improved energy efficiency and cuts in CO₂ emissions.*
- The issue of *resource/material scarcity* has come to the fore of the environmental agenda in later years, and *the Directive is considered one of the few feasible policy instruments to address these issues* in EU environmental policy.

A main reason for the enactment of the Directive was that various market drivers and support tools (e.g. energy labels, eco-labels and consumer information) were not enough to encourage cost-efficient design solutions among producers. This actually applied also for design improve-

² Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products.

³ See e.g. Misonne 2005; van Rossem and Dalhammar 2005; Dalhammar 2007a; Kautto 2008.

⁴ Most notably Commission of the European Communities 2001; 2003. See also Dalhammar 2007b; Kautto 2008.

ments that provide reduced energy usage with very low associated costs for manufacturers.⁵

EU has outlined the expected savings from the requirements for the first 12 regulations set under the Directive in Table 1. (11 product groups and one horizontal regulation for standby and off-mode losses).

Table 1. Expected savings under the first 12 implementing measures adopted under Directive 2005/32/EC. (European Commission 2012)

Adopted implementing measures	Estimated savings (yearly by 2020)
Standby and off mode losses of electrical and electronic equipment (household and office)	35 TWh
Simple set top boxes	9 TWh
Domestic lighting	39 TWh
Tertiary sector lighting (office and street)	38 TWh
External power supplies	9 TWh
Televisions	43 TWh
Electric motors	135 TWh
Circulators	23 TWh
Domestic refrigeration	8 TWh
Domestic dishwashers	2 TWh
Domestic washing machines	1.5 TWh
Fans	34 TWh
	= 376 TWh
	= 14% of the electricity consumption of the EU in 2009

The Directive could potentially be both the most effective, and not least the most cost-effective,⁶ EU policy instrument for inducing energy efficiency and reducing GHG emissions, but this has not been properly researched.⁷ Also in the US context the effectiveness of product regulation

⁵ See e.g. Boardman 2004.

⁶ In the recent evaluation, the cost-efficiency of the measures were considered very high, see CSES/Oxford Research 2012. Earlier studies also claim that promoting energy efficiency through products standards can be very cost-efficient, see e.g. Boardman 2004; Hinnells and McMahon 1997.

⁷ Regarding effectiveness: While CO₂ emission trading systems and CO₂ taxes have high potential for emission reductions they have not yet delivered to their potential, in the jurisdictions where they have been implemented, for several reasons. While several studies point to a price on carbon as the main “engine” for

to stimulate energy efficiency has been established, and in a recent study Sachs states that:

“Although information disclosure, financial incentives, and other softer alternatives to regulation play a vital role in reducing energy demand, these should be viewed as complements to efficiency regulation, rather than replacements.”⁸

We are now at a point where the Ecodesign Directive has been applied for a couple of years, and implementing measures (IMs) for a number of product groups have been set. The first substantial review of the Directive has been performed.⁹

There is much hope pinned on the Directive being a main tool for achieving several policy targets related to sustainability, but there is uncertainty as to whether the Directive can fulfil its promises. Some of the suggested areas where there is need for more research are:¹⁰

- *Energy efficiency and “energy sufficiency” of systems and appliances:*
 - How can the Directive set even more stringent energy efficiency requirements?¹¹
 - Can it be used to drive “sufficiency” type of requirements, where technological innovations are required if larger appliances are to be allowed on the market?¹²
 - Can the rules focus more on systems¹³ – as opposed to single products – and what is the environmental potential if such an approach is widely used? What are the barriers?

climate policy (see e.g. Söderlund 2012), a main problem concerns the legal and political obstacles to do so, both within nations and at the EU level.

⁸ Sachs 2012.

⁹ CSES/Oxford Research 2012. See also ECOFYS 2012.

¹⁰ Dalhammar 2012.

¹¹ The question as to whether standards are stringent enough is relevant both in the context of the Ecodesign Directive and the Japanese Top Runner scheme, see Siderius and Nakagami (forthcoming).

¹² Regarding “sufficiency” standards see the discussion in Calwell 2010.

¹³ E.g. a “pump system” instead of a single pump, or the “coordinated optimization of various products in a building” rather than addressing the product groups individually. For discussion and examples see Kemna *et al.* 2011.

- *Resources and material use:*
 - Can the Directive be an effective tool to trigger environmental improvements related to resource use and material choice, e.g. by setting rules for recycled content, design for dismantling and recycling, phasing out hazardous substances, and through material restrictions?¹⁴
 - Can the Directive aim in the pursuit of new business models and promote a “service orientation” with high potential for resource savings, based on selling functions instead of products?
 - What are the potential clashes with WTO law?¹⁵
- *Innovation and competitiveness:*
 - How can the rules set under the Directive and related standards be designed in order to boost the competitiveness of EU industries?
 - What are the most important policy issues to consider?
 - How should legal requirements interact with industry-driven standardization?
- *The policy mix and the potential for CO₂ reductions in relation to other instruments:*
 - How should the Directive interact with other relevant policy instruments, including green public procurement, technology procurement, eco-labels, and (mandatory and voluntary) energy labels, as well as EU Directives and regulations such as RoHS, WEEE and REACH?
 - How well does the Directive function as a tool for CO₂ reductions in comparison with the EU-ETS and carbon taxes when evaluated through criteria including environmental effectiveness, cost-efficiency, and political feasibility?

Five issues of high concern in the current EU environmental policy debate are:

- *Life cycle orientation:* The Directive has not fulfilled its potential to deliver on its initial promise to be a product life cycle oriented law that promotes ecodesign practices for all relevant environmental

¹⁴ E.g. View Sustainability Services *et al.* 2011; CSES/Oxford Research 2012; Aalborg University 2012; JRC 2012; Dalhammar *et al.* 2010.

¹⁵ This is discussed to some extent in View Sustainability Services *et al.* 2011; Dalhammar 2007; Dalhammar and van Rossem 2010.

aspects in industry.¹⁶ Almost all requirements are related to energy efficiency during the use phase though there is potential for setting also other types of requirements relating to different phases in the product life cycle.¹⁷ As many actors within the EU promote the Directive as an instrument for improved resource efficiency there is an evident need to investigate how this can be done.

- *Interactions with other policies:* The general idea on how the Directive should interact with other policies is rather given: the Directive should ensure that all products put on the market have a certain level of environmental performance, while eco-labels and other instruments provide incentives for eco-design among more progressive manufacturers. However, the coordination between the various instruments have shortcomings in practice¹⁸ and there is an evident need to find better ways to coordinate the various activities and the criteria setting of various instruments, e.g. legal rule-setting, eco-label criteria and procurement criteria, in order to provide incentives for change for all types of manufacturers. An improved coordination between standard-setting under different types of instruments – such as legal standards, eco-labelling and procurement criteria – would be beneficial to ensure a more optimal interaction of policies.¹⁹ There is also a need to review what kinds of outcomes the Directive can deliver, and whether some policy objectives are better served by other instruments.
- *Competitiveness:* While industry organisations have often resisted the use of legal rules, there are now signs that some actors believe that stringent energy efficiency requirements adopted under the Directive can actually have several benefits for the EU as a whole and boost the competitiveness of EU industries, e.g.:
 - A recent ECOFYS report stresses the benefits in terms of net savings, reduced dependence on imported energy, and potential job creation.²⁰
 - Germany has issued position papers that favour an approach lending elements of the Japanese Top Runner approach and

¹⁶ van Rossem, Dalhammar *et al.* 2010; Global View Sustainability Services *et al.* 2011; CSES/Oxford Research 2012; Aalborg University 2012.

¹⁷ Global View Sustainability Services *et al.* 2011.

¹⁸ Aalborg University 2012; CSES/Oxford Research 2012.

¹⁹ E.g. Jepsen *et al.* 2011.

²⁰ ECOFYS 2012.

- which would lead to more stringent requirements, and more frequent updates of rules.²¹
- Some industries favour more progressive requirements, if they are designed properly.²²

These views are in line with recent research showing that product and service regulations can improve domestic industry competitiveness;²³ the likely reason being that this kind of regulation directs R&D activities in a “productive” direction. Further, product-oriented regulations at the domestic and/or EU level tend to trigger similar regulations in other jurisdictions, for several reasons, to a higher degree than other types of regulations (e.g. green taxes or process-oriented regulations)²⁴ There is however a need to investigate further how ecodesign requirements and competitiveness relate to each other, not least in relation to non-energy related requirements and more specifically resource use, as previous reports have dealt only with energy efficiency and CO₂ reductions. Bleischwitz and Bringezu discuss how the resource efficiency of economies are positively correlated with their competitiveness,²⁵ and as we enter an era of potential resource constraints and higher material prices, this will likely be even more true in the future. They argue for the need to strengthen producer responsibility with material stewardship and that *“...resource productivity underlines a new category of innovation that can be characterized as “material flow innovation.”*”

The potential of resource savings through supply chains can be a vital source of competitive advantage in the future. According to Rennings and Rammer only 3% of German companies have reported significant undertakings to increase material efficiency (in the EU CIS survey), though sales per employee in those companies are approximately 15% higher than in average industries.²⁶ Of special interest is the issue of how the Ecodesign Directive can help trigger new functional business solutions,²⁷ which are considered essential for delivering future value to

²¹ See BMWi/BMU 2012.

²² See e.g. Jönbrink and Melin 2008; Coolproducts 2012. See also Grundfos 2008.

²³ E.g. Blind 2012; Böhringer *et al.* 2012.

²⁴ For an overview of these issues and related literature see Dalhammar 2007a; Dalhammar and Leire 2012. See also Onida 2005. See also the discussions in forthcoming chapters.

²⁵ Bleischwitz and Bringezu 2011.

²⁶ Rennings and Rammer 2009.

²⁷ For a discussion on the link between policy and new functional solutions see Mont and Lindhqvist 2003.

consumers while respecting the integrity of the planet,²⁸ and the relationship between legal requirements and business-driven standardisation. There is a need to get more input from industry on these matters:

- *Long process of setting IMs for product groups:* An issue is the long process of setting IMs for various product groups.²⁹ This delays the process and therefore also the date when CO2 savings can be realized, and has negative implications for the stringency of rules (see below). The process can be delayed in many ways due to the extensive stakeholder consultation, to poor preparatory studies and the long time between the start of the preparatory study and the coming into force of the first tier requirements. For the 12 implementing measures published so far the time span varies between 3.5 years and 6.7 years, with an average of almost 5 years. The time span from the start to the second tier varies between 5.25 years and 9.25 years with an average of almost 7 years.³⁰ The recent evaluation of the Directive³¹ stressed the need for more resources to be allocated for this purpose within the Commission. This is not only a matter of resources, but also how the resources can be applied more efficiently and effectively through various types of policy coordination and other improvements. Current ideas among stakeholders include:
 - Significant changes to the policy process and the related interactions between the actors involved.³²
 - Innovative policy changes to speed up the process, such as setting joint targets for resource use related requirements for a number of product groups with similar characteristics, rather than having to do it separately for all product groups.³³
- *The stringency of implementing measures:* The savings projected in the table above are substantial but still they constitute only the “low-hanging fruits” as obligations set for energy efficiency under the Directive are generally not very stringent – though there are variations between product groups – due to the lengthy procedures

²⁸ WBCSD 2011; for a recent review of examples see Danish Enterprise and Construction Authority *et al.* 2010.

²⁹ E.g. CSES/Oxford Research 2012; Siderius 2012.

³⁰ Siderius and Nakagami (forthcoming).

³¹ CSES/Oxford Research 2012.

³² Siderius 2012.

³³ EEB 2012.

and the problem of accounting for emerging technologies.³⁴ Further, in many cases the requirements are not stringent enough to act as drivers of innovation and eco-design among the most progressive firms; then other policy instruments should act as drivers of innovation. The current Directive is not explicitly intended to trigger eco-innovation,³⁵ but there is a growing recognition among stakeholders that it should do so. Thus, there is need for research on how the legislative process could speed up, how emerging technologies can be taken into account, and whether rules should be more progressive to stimulate eco-innovation. There is also a need to discuss what kind of environmental aspects are best regulated through minimum legal standards, and where other instruments are better suited to provide stimulus for change. Some actors stress the need to change the “least life cycle cost” methodology in order to allow the setting of stricter rules, and to allow for updating legal standards during the legislative process so they do not risk being obsolete once adopted.³⁶ A special consideration is whether the Directive could – as is done within some eco-labelling programs³⁷ – set “sufficiency” related requirements, i.e. an absolute cap on energy use from a product group; this would mean that larger appliances (many appliances constantly grow in size) are only allowed if they use no more energy and/or resources than existing ones, which in effect means that technological innovation is required in order for manufacturers to put larger. The main motivation for such a measure is that it will not be enough to promote eco-efficiency in a world with a growing human population with ever-increasing demands for consumption of goods and services, and where rebound effects offset efficiency gains; more stringent rules must be set which imply more absolute “caps” on resource use.³⁸ Basically, this means that in all areas of sustainability policy making we can foresee a move towards stricter rules and standards and probably more focus on regulating the impacts directly, as opposed to a mere focus on eco-efficiency.

³⁴ E.g. Jepsen *et al.* 2011; Aalborg University 2012; Siderius 2012; Siderius and Nakagami (forthcoming); CSES/Oxford Research 2012.

³⁵ Cf. CSES/Oxford research 2012.

³⁶ Jepsen *et al.* 2011. The case of obsolete rules has been very relevant in the case of TVs, as the emergence of the LED technology was not taken into account in the standard-setting process; see Dorotea Andersen and Remmen 2012.

³⁷ Calwell 2010.

³⁸ For a discussion on this issue see e.g. Alcott 2010.

- *Monitoring and enforcement:* As is the case with EU regulations – such as the RoHS Directive and REACH Regulation – the compliance with the IMs set under the Directive has shortcomings, and the market surveillance and enforcement practices in the EU are deficient, with much variation between EU member states.³⁹ This is problematic not only because it means that non-compliant products are available on the Internal Market, but also because a functioning system is crucial for the credibility of the Directive; progressive manufacturers must see that non-compliant competitors are forced out. Several actors have proposed changes to deal with the situation.⁴⁰

1.2 Resource use on the environmental policy agenda: recent policy developments and ongoing research

In the last couple of years resource use has received more and more attention due to a number of coinciding circumstances – including fears of resource scarcity and escalating prices.⁴¹ The current economic downturn was not triggered by a lack of resources, but the next one could very well be, as limits to resources may slow down future economic growth.⁴² Also in the past, there have been concerns about potential resource shortages, but innovation and price mechanisms have meant that the challenges have been overcome. But this time could be different, not least due to the expected number of new middle class consumers that take part in the global economy, with high consumption aspirations.⁴³ While relevant measures and policies are identified (see below), a key question is whether corporations and governments will enforce them quickly enough to avoid a period of very high resource prices, and irreversible environmental damage.^{44, 45}

³⁹ CSES/Oxford Research 2012.

⁴⁰ EEB 2012.

⁴¹ For an overview see e.g. Bleischwitz *et al.* 2011; European Commission 2011.

⁴² Krugman 2008.

⁴³ McKinsey Global institute 2011.

⁴⁴ *Ibid.*

⁴⁵ It should be noted that improved resource efficiency may increase demand and extraction due to rebound effects. We will however not discuss rebound effects in this study. This implies that more policies should probably be devoted to extraction practices themselves. This is however not an issue related to ecodesign and will not be discussed in this report.

Resource use entails the extraction and processing of both renewable and non-renewable resources. An increasing use of natural resources puts even more pressure on ecosystems, limiting their long-term resilience. Resource use is highly connected to a number of current ecological threats, most notably, climate change, deforestation and reduced biodiversity. It is also claimed that climate change and resource overexploitation are basically two sides of the same coin.⁴⁶ Further, sometimes a distinction is made between policies aimed at “sustainable management of natural resources” and policies aiming at “sustainable material use.”⁴⁷ The two concepts are however widely over-lapping.⁴⁸

Natural resources may be traded like other commodities, but some important “strategic” resources – such as rare earth elements used in many consumer appliances (such as electronics and wireless tools and appliances running on batteries), renewable (green) technologies, metallurgical processes and in several other industries including glass and ceramics – are unlike other commodities in the sense that they are produced in limited quantities, in few places, and therefore buyers often have limited options to change the supply base.

There is some agreement that we need to develop policies that can secure a stable, conflict-free access to resources, including rare earth elements, for all relevant actors.⁴⁹ Policies must also help in providing a fairer global distribution of resources between different regions and countries as developing countries use a small fraction of current resources.⁵⁰ Further, environmentally harmful extraction processes are often located in countries that do not have stringent rules to protect the environment and human health. Solving these issues require international cooperation, but there will still be a need for regional, national and local policies.

As many developing countries will need to increase their resource use in the short term, developed countries must urgently adopt progressive approaches to decrease resource use. The challenge is enormous, as the demand for raw materials is expected to double or even triple within

⁴⁶ Bleischwitz and Bringezu 2007.

⁴⁷ For a discussion on the concept resource efficiency, see e.g. EEA 2011.

⁴⁸ Sustainable materials management for a resource efficient Europe 2010.

⁴⁹ At least this is the agreement among most policymakers and researchers; some economists have larger faith that the price mechanisms will solve these issues, see e.g. Radetzki 2010.

⁵⁰ Moll *et al.* 2005.

the next 10–15 years.⁵¹ There is a need for progressive policies, both to limit material use and to close the loops, e.g. urban mining.

Resource security and resource efficiency are currently hot topics on the policy agenda both in the European Union (EU) and internationally. This has been reflected at several levels, e.g.:

- Corporations increasingly undertake resource security assessments, and evaluate the supplier base in order to have guaranteed supply of vital resources in the future. Domestic firms also increasingly call on national governments to evaluate future resource supply.⁵² The main issue for firms and governments is not necessarily “resource scarcity” as much as “resource security”; making sure resources are available for domestic industries in large enough quantities at reasonable prices. Therefore, governments are currently enacting macro level policies and R & D activities to deal with these issues.⁵³ Interviews with corporations reveal that resource efficiency is seen as the single most effective response to address resource scarcity (75%). Data provision or access to data, recycling technology, substitution technology and regulation are all considered as required elements of any response to the issue of minerals and metals scarcity.⁵⁴
- National governments are closely looking into the issue of resource security, including making assessments of vital strategic resources; and depicting policies for dealing with these issues.⁵⁵
- At the EU level, resource use has strongly influenced the environmental agenda, in several ways. Not least due to the dependence on imports. The Commission has stated:⁵⁶ *“Europe has the world’s highest net imports of resources per person, and its open economy relies heavily on imported raw materials and energy. Secure access to resources has become an increasingly strategic economic issue, while possible negative social and environmental impacts on third countries constitute an additional concern.”* The European Union has initiated several policy initiatives to deal with the issues. Important earlier initiatives included the Thematic Strategy on the Sustainable Use of Natural Resources, and the Thematic Strategy on Waste Prevention and Recycling. There are also a number of

⁵¹ Bleischwitz and Bringezu 2007.

⁵² To take but one example, the UK has issued a resource security action plan. See DEFRA 2012.

⁵³ See DEFRA 2012 and EEA 2011 for an overview of various government policies.

⁵⁴ PwC 2012.

⁵⁵ Ibid.

⁵⁶ COM(2011) 571 final. Roadmap to a Resource efficient Europe.

other strategies and policies that entail elements related to resource use, such as the Integrated Product Policy (IPP), and the Environmental Technologies Action Plan (ETAP).⁵⁷ The Raw Materials Initiative was launched in 2008.⁵⁸ It primarily proposes a more targeted use of existing policies and instruments. The Commission has recently launched a Roadmap for improved resource efficiency, which outlines some concrete measures to be taken at the EU and national levels.⁵⁹ Further, a Resource efficient Europe is one of the flagship initiatives under the 2020 strategy.⁶⁰ During the Belgian presidency 2010 there were renewed efforts into developing a strategy for sustainable materials management. In a policy paper from July 2010, a number of strategies were proposed.⁶¹

Also in the research field we see more and more publications related to resource use and resource security.⁶²

1.3 Using the Ecodesign Directive to address resource use: research gaps

Achieving the overall objectives for a more sustainable regime for natural resources will require a large number of measures at various levels (international, regional, national, and local). Among proposals for new policies we find international agreements on resource limits and trade, sustainability standards and certification schemes for product chains, mandated limits to resource extraction and consumption, and more focused policies to achieve individual producer responsibility (IPR).⁶³ An adequate pricing of resources and ecosystem services, where all external effects are taken into account, as well as improved recycling methods and techniques, are all crucial elements of an effective policy mix.

⁵⁷ Now replaced by the Eco-innovation Action Plan.

⁵⁸ Commission of the European Communities 2008.

⁵⁹ European Commission 2011b.

⁶⁰ European Commission 2011c.

⁶¹ Sustainable materials management for a resource efficient Europe 2010.

⁶² E.g. Bleischwitz *et al.* 2011; Allwood and Cullen 2012; Bartra 2007; Moll *et al.* 2005; Bleischwitz and Bringezu 2007; McKinsey Global institute 2011.

⁶³ See e.g. DEFRA 2012a; E.g. Bleischwitz *et al.* 2011; Allwood and Cullen 2012; Bartra 2007; Moll *et al.* 2005; Bleischwitz and Bringezu 2007; McKinsey Global institute 2011.

There are some potential problems with the proposed strategies. First of all, they are as yet quite vague, and in many cases they provide *few details* on the way forward. This implies that it will take some time before concrete measures are on the table, not to mention decided upon. There are also few suggestions on legally binding measures. Further, the track record regarding enforcement of current rules and strategies on waste collection and recycling are rather poor,⁶⁴ and little progress has been made in the area of resource efficiency generally.⁶⁵ We also know that various environmental policies, enacted with the best intentions, may have undesired effects on resource use, the most well-known example being the discussion on whether policies that promote bio fuels may cause deforestation and reinforce food shortages.

The most problematic issue concerns the *political feasibility* of proposed policies; few proposed policies seem feasible. The better pricing of resources (to internalize external effects) is difficult to achieve, and international coordination – which is in principle impossible to achieve – may be necessary in order to avoid unfair competition. Likewise, the chances of setting mandated limits of resource extraction and use through international law appear very slim, except in certain areas. *There is a general tendency to promote theoretically optimal but politically impossible policy instruments in the debate.*⁶⁶ This is evident in several fields of environmental policymaking.

Many actors propose that the Ecodesign Directive should be a key instrument in EU resource use policies. One reason for using the Directive in a progressive way to promote resource efficiency is that is feasible, while most other policies – e.g. taxes and charges – are more controversial and challenging to implement – especially on European scale. The Directive is already in place, and if the political will is in place it may be applied to promote resource efficiency. Further, as methodologies and indicators develop, more resource related requirements should be feasible to apply. Additional, the Directive is potentially very effective in cutting CO₂ emissions and has the potential to address additional life cycle environmental aspects. Ecodesign is also a key strategy for resource efficiency more generally,⁶⁷ and the Directive would therefore appear to be a key strategy in an EU policy mix for resource efficiency.

⁶⁴ See e.g. Commission of the European Communities 2009a; 2009b.

⁶⁵ European Commission 2010.

⁶⁶ For a discussion on this in the context of GPP see Dalhammar and Leire 2012.

⁶⁷ BIO Intelligence Services *et al.* 2012.

A study commissioned by DEFRA⁶⁸ has shown that it is possible to set resource related requirements, which make environmental and economic sense through the Directive, if various barriers can be overcome. Some of these barriers – such as indicators, measurements standards, and the general question of what kind of rules can be legally enforced – are dealt with in a JRC project, whose final reports were presented in 2012.⁶⁹

Some controversial issues that require special attention in the ongoing debate are:

- *The promise of addressing non-energy aspects through the Directive is not confined to the actual environmental benefits:* The Directive may also be a pioneering instrument that promotes institutional learning which can be applied in other policy settings for addressing resource use, on issues like:
 - Supply chain related requirements and verification systems
 - Indicators and standards for resource use, recyclability and durability, etc.
 - The interactions between different instruments.
- *National vs. EU-level policies:* Generally, EU policies promote resource efficiency to be tackled both at the EU and member state level. The Waste Framework Directive⁷⁰ – which encourages EU member states to provide incentives for EPR and ecodesign through domestic policies – is one example. Further, many of EU's product related policies have originated at the Member State level; the Commission has often proposed EU-wide rules to avoid distortions in the Internal Market from national policies.⁷¹ This points to the tension between product policies: there is a need for a certain degree of harmonization, while allowing member states some room for adopting new policies.⁷²
- *A wider policy mix:* A wider mix of policies than usually presented will be relevant if we are to induce more progressive ecodesign practices, or even stimulate functional innovations and new business models, among manufacturers. Also among industries, such innovations are considered necessary to solve the resource

⁶⁸ Global View Sustainability Services *et al.* 2011.

⁶⁹ The JRC reports are discussed in more detail in chapter 2.

⁷⁰ Directive 2008/98/EC on waste.

⁷¹ See Onida 2005; Dalhammar 2007a.

⁷² Dalhammar 2007a.

puzzle.⁷³ Technology procurement is an example of such policies; it offers the flexibility that law does not.⁷⁴

- *Need for more progressive innovation*: There is a need to proceed with care in order not to set poorly designed requirements. On the other hand, the research points to an evident need to start regulating resources more progressively.⁷⁵

1.4 Objective and methodology

We are now in the phase where we know more why non-energy aspects have seldom been dealt with under the Ecodesign Directive,⁷⁶ and that such requirements may – according to ex ante estimates – in some cases make environmental and economic sense.⁷⁷ With the recent reports from JRC⁷⁸ we also know more about measurement methods, standards, and indicators that may be used when setting relevant IMs, and have been presented with some examples of how such implementing measures could look like. There are also new reports that address crucial issues, such as knowledge gaps about chemicals in products, which affect the potential to recycle the materials.⁷⁹ In our view, the next logical steps are to summarize the knowledge – which is quite fragmented – and provide a more coherent policy analysis, and provide an initial discussion on issues that the research has not covered in detail, such as issues relating to trade law and competitiveness concerns. Further, with a look into the future, there are reasons to consider how the Directive can be a more prominent vehicle for stimulating innovation, including functional aspects of eco-design, and new business models.

The objectives of this report are to:

- Outline the state of play, i.e. past experiences with applying the Directive and the policy ideas provided for how to use it for addressing resource efficiency in the future. Further, we aim to

⁷³ WBCSD 2011;2012.

⁷⁴ Bauer *et al.* 2009; Dalhammar and Leire 2012.

⁷⁵ Moll *et al.* 2005.

⁷⁶ See the review in chapter 2.

⁷⁷ Global View Sustainability Services *et al.* 2011.

⁷⁸ Ardente *et al.* 2012; Ardente and Mathieux 2012a;2012b;2012c.

⁷⁹ See chapter 2.

analyze how the Ecodesign Directive can contribute to resource efficiency objectives in various ways.

- Assess the benefits and perceived drawbacks of addressing resource use issues through the Directive, and critically review the arguments: which ones are especially valid, which ones are less so? Are the issues fundamentally different from those associated with the introduction of the RoHS and WEEE Directives and the REACH Regulation?
- Analyze recent proposals on setting IMs related to resource use, e.g. the studies conducted by DEFRA and the JRC. Further, some relevant reports in related fields are also reviewed.
- Discuss how the Directive can interact with other policy instruments and laws in promoting resource efficiency, including dimensions like:
 - Environmental aspects
 - Life cycle phases
 - Promoting innovation.
- Outline the main challenges associated with setting resource related requirements through implementing measures (IMs) related to EU law, and the WTO-administered agreements.
- Outline the main issues in relation to competitiveness of EU industries: in what ways can various requirements strengthen or weaken competitiveness, and promote or hinder innovation?
- Provide an analysis of the link between IMs set through the Ecodesign Directive and eco-labeling criteria.
- Outline the potential ways forward.

The methodologies included in the project are:

- A vast literature review covering various reports and research on the Ecodesign Directive and related fields.
- A case study of the potential inclusion of permanent magnet motors in the regulated product group of electric motors – in order to obtain more contextual knowledge.
- Semi-structured interviews with a limited number of policymakers and industry representatives (more details are provided in the respective chapters).

1.5 Limitations

The project was carried out during a limited time period, within the constraints provided by the project budget. For these reasons, certain limitations apply, most notably:

- The links between legal ecodesign requirements and industry-driven standardization are discussed only briefly. No updated review of the various international standards that may be applied for assisting calculation and verification of legally mandated resource related requirements are performed.⁸⁰
- The discussion on legal implications of resource related requirements is only preliminary and generally performed at a general level.
- The discussion on the link between resource-related requirements and industry competitiveness is quite general in nature. It is likely that the outcomes are – to a smaller or larger extent – contextual, depending on the product group at hand.
- Only one case study was performed in order to study the potential for resource related legal standards (permanent magnet motors, in lot 30; a niche product). We believe that many of the findings could be relevant for other product groups, but the empirical base is limited.
- Only a limited number of interviews with government officials and industry representatives could be conducted during the study. The aim of the interviews has been to gain insights from experts and explore a number of topics in relation to ecodesign and resource efficiency.
- It should be noted that improved resource efficiency may increase demand and extraction due to rebound effects. We will however not discuss rebound effects in this study. Ecodesign will mainly relate to resource efficiency, and the potential for recycling, and less to sufficiency per se.
- It should be noted that ecodesign solutions are no panacea: ecodesign will not make EU self sufficient on resources, though it could form a vital part of a policy mix for such an objective. Further, no research, however detailed, can provide a definite answer to questions concerning that “optimal” policy mix.

⁸⁰ References to such standards can be found in the various preparatory studies and Ardente *et al.* 2012; Ardente and Mathieux 2012a; 2012b; 2012c; Global view sustainability services *et al.* 2011; van Rossem *et al.* 2010.

1.6 Structure of the report

The second chapter accounts for the findings in the most relevant studies related to the potential and suitability of addressing resource use issues through the Ecodesign Directive.

The third chapter looks at the potential benefits and drawbacks of using the Ecodesign Directive to address resource efficiency.

Chapter four discusses the role of the Ecodesign directive within a wider policy mix: various ways to approach the issue of instrument coordination, possible ways in which the Directive can interact with other policy instruments, how to deal with products that are part of “systems”, standards that support regulatory requirements, and interactions of national policies and EU laws.

Chapter five provides an analysis of to what extent resource efficiency already is included in other voluntary policy instruments such as eco-labeling that are targeting the front-runner enterprises. A lot of inspiration can be found here, also for developing additional requirements than the ones recently suggested by Joint Research Centre (JRC).

Chapter six makes a preliminary legal analysis of the potential for setting IMs related to resource use, including an analysis of the Directive, and relevant elements of the WTO agreements.

Chapter seven looks at the relation between resource-related standards and competitiveness, discussing issues like innovation, business models, and standardization.

In chapter eight, we account for the results of 10 interviews with eight respondents from national contact points for the Ecodesign Directive implementation in the EU member states, one NGO representative, and one representative from DG Environment. The interviews focus on the potential to embrace a full life cycle perspective, and set resource efficiency requirements, under the Ecodesign Directive.

In chapter nine, we account for the results of interviews with nine people in corporations and industry federations. The interviewees have provided their views on a number of topics discussed in the report including: the scope for different types of IMs related to resource efficiency; the link between product-related rules and competitiveness; the implications for SMEs, and; the systems perspective.

Chapter ten presents a case study that exemplifies the complexity of setting IMs related to resource use.

Chapter eleven presents the main conclusions, policy recommendations, and the need for further research.

Annex III outlines some thoughts on the relationship between the WEEE and Ecodesign Directives, in relation to the promotion of individual producer responsibility (IPR).

2. Existing studies: findings and policy proposals

This chapter summarizes the findings in the most relevant studies examining the potential and suitability of addressing resource use issues through the Ecodesign Directive. Apart from studies directly related to this topic, some studies related to “chemicals in products” are included, due to that chemicals in products are a key barrier for setting requirements for e.g. recyclability and recycled content. Further, findings from general studies on policies for ecodesign are also accounted for when the findings are considered to be of great interest in the context of this study. Only findings from recent studies – mainly from the last five years – are discussed.

The chapter ends with a discussion on the main learnings from the studies, and the policy implications.

2.1 DEFRA study – 2011

A study commissioned by DEFRA⁸¹ is very relevant for the purpose of this report. It had several objectives:

- Review the existing evidence base (ecodesign Preparatory Studies and wider sources) to determine energy related products with significant non energy in use impacts opportune for consideration.
- Determine whether the evidence in the Preparatory Studies is robust enough to inform Implementing Measures (IM).
- Provide clarity on the reasons that the IMs have not focused on non-energy in use impacts to date.
- Develop evidence based recommendations for incorporating non energy-in-use improvement targets in the IMs or other instruments going forward.

⁸¹ Global View Sustainability Services *et al.* (2011). Review of EuP preparatory study evidence: Does it support development of non energy related implementing measures? Report for DEFRA.

The methods employed were literature reviews, reviews of preparatory studies of several product groups, and interviews with different stakeholders.

Product groups with obvious non energy in use environmental improvement opportunities were identified to be: TVs, PCs, Imaging Equipment, Commercial Refrigeration, Lighting, Air Conditioners, Ventilation, Simple and Complex Set Top Boxes (STB). The main product groups where there was a large potential for environmental gains were:

- *Washing Machines and Dishwashers, TVs, PCs, Imaging Equipment, Lighting, Motors, Laundry Driers, Vacuum Cleaners, Simple and Complex STB, DVDs/Video/Games Consoles:* because of their significant materials and EOL impacts, these ERPs would benefit from consideration of materials, EOL ecodesign strategies and tradeoffs e.g. substitution (for hazardous/limited substance avoidance), lifetime extension, miniaturization, durable modular designs to minimize resource use/waste, reuse and recycling. *At present, existing mandatory instruments do not provide the platform for enabling these improvements.*
- Environmental benefits can be realized for *printers*, where associated consumables have a significant impact e.g. paper for printers.
- *Air conditioning and refrigerating and freezing equipment:* refrigerants with global warming potential/ozone depleting impacts are significant. While aspects of these are being considered under separate instruments already, there are still opportunities for material substitution to green refrigerants that eliminate or considerably reduce these impacts. Further, there is potential for improved EOL management for fixed installation refrigerators and resource efficiency benefits for Refrigerated Display Cabinets.

In all the cases above, the economic assessment indicated that there is good potential to realize environmental improvement without incurring significant long-term economic costs, and in many cases net lifecycle economic benefits are considered possible. In some cases measures to achieve overall lifecycle benefits are considered likely to lead to some short-term costs to manufacturers / producers (e.g. associated with incorporating alternative materials, product re-design or production process changes). However, the nature of manufacturing and markets for many product categories (e.g. very rapid technological development, relatively high economies of scale in production) is assumed to lead to

the rapid uptake of new technologies and processes, with related costs likely to fall in line with this uptake.

The reasons for why there has been very limited regulation of non-energy issues under the Ecodesign Directive were listed as:

- The *policy focus* has been on product groups with high “energy in use” impacts; this provides part of the explanation as to why IMs have focused on these aspects.
- It is assumed that actors are in compliance with the WEEE and RoHS Directives, the REACH Regulation, and regulations connected to air/ozone emissions, without further investigations on whether this is actually the case. The WEEE and RoHS Directives cover most of the regulated product groups. There is also some political resistance to further substance restrictions.
- There are *enforcement concerns*. A credible method has not yet been recognized that can support enforcement of a lifecycle ecodesign approach and in particular benchmark improvement targets e.g. for materials. There are particular concerns with enforcement and market surveillance regarding improvements to lifecycle stages operating outside the EU, especially when relating to requirements in the WTO-administered agreements. It is noted however, that experiences with the WEEE and RoHS Directives show that parts of a method do actually exist. Yet, EU rule-setting and enforcement of product requirements has so far been focused on the final product going onto the EU market so this can be tested for compliance using national market surveillance systems. With a large proportion of products sold in the EU being (wholly or partially) manufactured outside EU and especially in the Far East, requirements and enforcement for materials and production would need to be part of a coordinated international effort.

The study looks at opportunities to address non energy in use impacts, and the feasibility of different options. It is concluded that:

- at a *generic level*, a range of mandatory and voluntary instruments options can be used separately or in combination. Mandatory instruments – e.g. IMs set through the Ecodesign Directive – can be used for the most significant impacts and also supported by voluntary instruments to drive continuous improvements over an agreed phased basis. Examples are:
 - Voluntary Agreements (VAs).

- Industry standards e.g. IEC 62430 Environmentally conscious design for electrical and electronics products and IEEE 1680 Environmental Assessment Standard for Electronics Products.
- Labeling schemes with strong market uptake e.g. Blue Angel (for printers), EU Eco label (for washers, dishwashers, PCs, TVs or light bulbs), or EPEAT (monitors).
- Existing industry measures, e.g. extended warranties and Technology Roadmaps.
- Green Public Procurement (GPP) as a market driver.
- Beyond energy in use, embedded energy impacts across the life cycle (i.e. the Carbon Footprint (CF)) are also missing from IMs. For some product groups – e.g. TVs where production GHG impacts are arguably as significant as in use – this may be a way to capture the full energy impacts vs. trying to prioritize one stage over the other.
- at the *big picture level*, an integrated ecodesign-related instrument run through DG Environment could enable ecodesign to be prioritized in product standard-setting and streamline compliance / enforcement frameworks that are currently spread over several instruments. However, this is not likely to be feasible, and pragmatic instruments utilizing the existing structures are recommended.

Five ERPs – TVs, PCs, Imaging Equipment, Commercial Refrigeration, and Lighting – were chosen for detailed analysis of the potential improvements related to non-energy in use aspects, and what instruments to apply. Some specific policy options discussed in the study are:

- *Horizontal IMs with a declaration of fluorinated greenhouse gas emissions* (GHG)/ abatement rates, in order to reduce GHG emissions of fluorinated process gas at LCD production stage in display products (e.g. TVs, laptops and PC monitors).
- *RoHS extension*, in order to restrict mercury in display products, and liquid mercury in lighting.
- *WEEE extension to promote EOL recycling of commercial refrigeration* (which is currently excluded).
- *Voluntary agreement (VAs)* to trigger incorporating design for recycling related ecodesign requirements. Opportunities are relevant for complex STBs, Imaging Equipment, TVs, monitors and PCs. VAs for consumer electronics in general could require mandatory ecodesign requirements among VA signatories. In the VAs, generic eco-design requirements using the IEC 62430 standard as a baseline

could be made mandatory and customized to suit specific ErPs using the more detailed IEEE 1680.1 (PCs) and developing IEEE 1680.2 (Imaging Equipment) and IEEE 1680.3 (TV). The Commission has recommended the importance of using IEC62430 to address materials and waste aspects when signaling agreement to the VA for complex STBs, which is considered to provide a precedent.

The report discusses how a key *enforcement* feature of all these instruments is the requirement for *robust compliance testing standards and procedures* both for the producers to *check internal compliance* as well as for *market surveillance* authorities. Of several improvement options identified in the report testing standards are not yet available. The instruments and enforcement proposed aims to most efficiently utilize existing legal precedents and systems – e.g. extensions to WEEE and RoHS – were relevant to facilitate the addition of ecodesign requirements. However, additionally, much development work will be required, where testing standards and procedures are not already available.

Irrespectively of the barriers presented above, the approach for incorporating the ecodesign improvements recommended for the five product groups is possible. The most challenging issues from an enforcement perspective and ways to overcome them are identified as:

- Improvement options that address *the impacts of component production* (e.g. LCD production in TVs) that occurs outside the EU are a difficulty for the CE Conformity Assessment market surveillance approach currently used. It is stated that the Biofuels Directive provides a precedent for making requirements on non EU based production but such an approach requires a standardized declaration scheme for fluorinated GHG emissions / abatement rates to be developed.
- VAs could more easily implement generic design for recycling or related requirements, which face market surveillance problems when specified as a legal requirement. It is discussed how VAs already incorporate the role of an independent inspector, who at their own discretion audit compliance with industry and could give a compliance / non-compliance statement with respect to generic requirements, based on a product check. Therefore, making the application of a generic eco-design standard such as IEC 62430 a mandatory requirement for all signatories of a VA shifts the market surveillance responsibility to the independent inspector, instead of making it a legal act.

The study proposes a pilot to trial the most promising approaches. PCs, TVs and Printers are suited to be test cases as the IEEE 1680 ecodesign standards are developing (with the PC draft available). The authors claim that key stakeholders – e.g. DG ENTR/ENER, DG Environment, EEB, and Digital Europe – could participate in pilots/trials.

Some interesting findings in the report are:

- It is possible to set requirements related to all kinds of relevant environmental aspects, but there are enforcement concerns, since new declaration schemes, certifications schemes, and standards will be needed to prove compliance and measure various aspects. Previous policy initiatives (the RoHS Directive, standards for sustainable bio fuels etc.) have showed that this can be done in practice.
- Some identified improvement potential includes: removing hazardous substances such as organohalogens and mercury restrictions (TVs, PCs etc.); requirements related to design for disassembly, re-use and recycling (TVs, PCs, laptops, monitors); EOL disassembly to enable easy removal of mercury backlight (TVs); use of recycled plastics (TVs, PCs, monitors); use of bio based plastics; lifetime extension (e.g. through warranties) (Tvs, PCs, monitors); waste reduction (obsolete power supplies) (laptops and monitors); duplexing as default in B2B (imaging equipment); toner and ink cartridge remanufacturing and reuse (imaging equipment); mercury restrictions to promote substitution (lighting); non-household lamps EOL recovery (lighting); design for disassembly, re-use and recycling (e.g. commercial refrigeration); material substitution to green refrigerants (commercial refrigeration).
- Current IMs do not address embedded energy across the life cycle.
- In line with a previous EEB study (see below) the study finds that many preparatory studies underestimate the lifecycle environmental impacts from the production phase, outcomes in preparatory studies are compared to various LCA studies. This seems to be the case for several consumer electronics (PCs, laptops, TVs and monitors).
- The regulation of raw material and production phases outside the EU requires international coordination. The lack of rules on setting an Ecological profile is seen as a missed opportunity. It is stated that the Ecoprofile option has not been applied in practice “...as energy in use has been the priority focus for the Preparatory Studies in the main to date and also a feasible agreed Ecological Profile to suit Commission policy and enforcement requirements as well as industry has not been

proposed.” It is further stated that: “Practically, the European Commission wants to adopt measures and requirements, which can be checked on the final product as distinct from a market surveillance approach. This largely rules out any “ecological profile” data of upstream processes. Overall, this is a missed opportunity as well as a source of confusion given the Directive clearly defines the Eco Profile with a lifecycle multi impact approach based on significance. A crude option could be development of standard benchmarks defined in a database that must be met with data being provided by producers in a format that could be checked using market surveillance (e.g. volume of x material used/semi conductor produced).” In the study, a specific example of a potential IM discussed is: “Declaring the GHG emissions of panel production;” which could be based on the IEEE1680.3 draft, which requires a supplier letter and a manufacturer declaration (details are given in the report. Enforcement in Europe might require a CEN standardization mandate). Further, the report discusses a generic option for IMs, which has been proposed in a preparatory study for one product group: The mandatory use of ECMA 341 or IEC 62430, to address several environmental aspects in a checklist style. It is stated: “Actually, the ERP does not foresee such a checklist approach as the “ecological profile” refers to measurable, quantifiable figures. However, the Preparatory Study pointed out, that such a checklist (and entries to be disclosed publicly) would at least draw the product developer’s attention to important design aspects, but the environmental effect of this circumstance cannot be quantified.”

- “Lifetime expansion” is an overlooked issue in the assessments of product groups. Therefore, ideas on extended warranties or technical options to increase durability/reliability have not been properly investigated.
- The study looks at the potential for biobased plastics. In some cases it is discussed how such plastics may be an option to reduce fossil fuel consumption, but they may have undesired effects for recyclability, something that needs to be investigated further.
- Options to improve EOL treatment and recyclability are discussed, such as the design aspects listed in IEEE1680.3. The potential to set requirements for disassembly time is discussed; it is considered a grey area because it is not specifically mentioned in the Ecodesign Directive.
- In the cases with few manufacturers of components worldwide, the EU could try and engage them in voluntary agreements rather than

by setting ecodesign requirements that can be challenged; especially if requirements relate to PPMs (see chapter 6).

- Costs of substance restrictions can probably be kept low in many cases as systems for dealing with such measures are already set up by industries to handle requirements in the RoHS Directive.
- Rules stipulating recycled content would impose costs. In many cases there are however costs benefits in the long and medium term from standards on mandatory requirements on recycled content, these could lead to the establishment of efficient recycling markets and become a win-win situation.
- The above may apply also for renewable (bio based plastics; especially if petroleum prices will rise in the future.
- The fact that current products was often put on the market before the RoHS Directive entered into force means that higher recycling costs for these products are expected, and the recycled material may not be used for as many applications as plastics without the substance phased out from RoHS. Some producers are therefore hesitant to make use of recycled material unless the quality can be assured.
- Extended product lifetime could be beneficial as it would be beneficial for e.g. energy use, material and reduced transport needs in many cases. However, there may be negative effects as well, such as extra costs from repairs, environmental impacts of transport for repairs, and of course higher upfront costs for products.
- In many cases, procurement is probably a better tool than the Ecodesign Directive to promote life extension, take-back, and refurbishments in the B2B sectors.
- Design for improved disassembly can probably lead to significantly reduced life cycle costs in some cases.

Lighting is an area under rapid technological development, where there is a high potential for product synergies to stimulate innovation. The report holds:

“The European Ecolabel criteria for light bulbs and related assessment and verification requirements are valid until August 2011 and criteria are currently under revision. The focus has been so far on energy efficiency, low mercury content, use of recycled packaging (65%), quality of light and life span of between 5 and 9 years (10,000 hours with lumen maintenance over 70%). Going forward the environmental (and possibly cost) benefits of direct linkages between ERP specific ecodesign measures and the Ecolabel criteria should not be underestimated. In areas such as lighting where quality is essential to ensure the uptake of new technologies (i.e. CFLs and future LEDs) the role of existing labels, technology roadmaps backed up by Government

and trade associations is essential to provide the necessary set of benchmarks. A voluntary ecodesign guide for light bulbs under ERP and/or the inclusion of non energy related criteria (in line with the Ecolabel) in the benchmarks section of the future/revised regulations on tertiary and domestic lighting could be envisaged and made possible via the development of test standards and methodologies in the priority areas for action identified above (mercury and materials)."

Regarding economic implications of potential requirements, some issues are of special interest:

- It is stated in the report that in highly competitive markets producers may hesitate to take the lead, which may inhibit the use of voluntary agreements. This is especially true for "high volume-low cost" product markets, which are characterized by small profit margins.
- For product groups which use petroleum based materials (including plastics), certain metals, as well as rare-earth minerals etc. there could be significant long-term benefits for manufacturers in identifying alternative (substitute) materials, not least given global price volatility in relation to many materials, and particularly where raw materials represent a relatively high proportion of overall product costs.
- Design for recycling, de-materialisation, product light-weighting can all bring about significant environmental benefits (e.g. resource use reductions, reduced transport related impacts etc.) and also reduce life cycle costs for industry (and consumers). There is potential for a win-win situation environmentally and economically. However there may be some initial costs associated with design and modification of production processes, and communication about the long-term/lifecycle benefits of change may be necessary.
- Successful implementation of design and production related environmental improvements may depend on harmonization with existing design cycles / production processes: where changes can be built into existing product design and production management cycles, cost minimization and take up by producers is more likely.
- Life cycle costs including production and EOL may be reduced even where production costs / purchase price rises, for example where product design or material use improves product lifetimes and/or facilitates repair or recycling. Lifecycle cost "trade-offs" are therefore possible. An issue here is that cost "burdens" may increase in one part of the supply chain / phase in the lifecycle, but be significantly reduced at another stage. Measures to help even cost-benefit balance

across the lifecycle may need to be considered if IMs are to succeed. Understanding where costs are would be helpful.

Regarding the interactions with other instruments, it is stated that:

- Eco-labels, IT declarations etc. provide best practice ecodesign criteria and benchmarks that may be applied when setting IMs under the Ecodesign Directive. Schemes with high market penetration (e.g. the Blue Angel) will have legitimacy among industries.
- It is stated that optional criteria and best practice benchmark as may be identified in the preparatory studies and used in various ways: *“Optional criteria can be added based on best practice and on a phased basis these improvements can be incorporated. Procurement standards and other incentives can be used to drive the market towards the optional improvements. For example, this would be suited to driving uptake of green refrigerants in commercial refrigeration.”*
- One way of working with the ecological profile is to link it to relevant industry standards that producers should comply with. Some of the aspects in these standards may be transformed into specific IMs that must be complied with.
- While benchmarks (e.g. numbers of best practice among products on the market) are only indicative now, there should be stronger mechanisms to make them binding over time.

2.2 EEB study from 2010

Another relevant study was commissioned by the European Environmental Bureau, and performed by researchers at Lund University.⁸² The main objective of the study was to evaluate the effectiveness of the Ecodesign Directive to stimulate improvements along the entire life cycle of products, for all relevant environmental aspects. Three data collection strategies were employed to meet the objectives:

⁸² van Rossem *et al.* 2009.

1. A review of relevant reports and academic literature.
2. A qualitative review was made of the application of the MEEuP methodology, and the proposed IMs, for four product groups: 1) domestic lighting, 2) televisions, 3) refrigerators and freezers, and 4) personal computers and monitors. At this time IMs for three product groups were finalized. Relevant LCA studies for these product groups provided input to the analysis. Proposals and comments made by consultants during preparation phase were analysed.
3. Anonymous interviews with three experts in the field of life cycle assessment (LCA) studies, all knowledgeable about the MEEuP, was conducted to obtain their views on the MEEuP methodology and its implications for the development of IMs.

Table 2. Stage of IM finalization for four product groups at time of the study

Product group	Personal computers & monitors	Televisions	Domestic refrigerators and freezers	Domestic lighting
Preparatory study	Completed	Completed	Completed	Completed
Consultation Forum review of Working Document	Completed	Completed	Completed	Completed
Regulatory Committee Endorsement	Not started	Completed	Completed	Completed
Adoption by Commission	Not started	Completed	Completed	Completed

When reviewing the process of developing IMs in the different stages (from the preparatory study to draft regulations), a steady downgrading was noticed: from considering a total and integrated life cycle methodology, towards a focus on mainly minimum energy efficiency rules addressing a part of the use phase. In other words, the early assessments often included a wide scope of environmental issues, but final rules only applied to a few selected issues, mainly energy efficiency in the use phase. This trend was found in all the product groups reviewed in the study. The reasons for this, and some examples, are given below.

A first issue concerns the importance of the MEEuP and the EcoReport. The MEEuP and especially the EcoReport tools are critical in the process of setting IMs. The outcome of the EcoReport for a specific product group will steer consultants towards proposing IMs that are in line with the outcome. This outcome and IMs proposed by consultants will subsequently influence the work of the Commission, the Consultation Forum and the Regulatory Committee in developing IMs. While it is stated in the report that no “perfect” methodology can be proposed as

any methodology will have benefits and drawbacks, the analysis revealed several problematic issues connected to the EcoReport:

Secondly, the importance of energy in the use phase of the life cycle is somewhat overestimated. This followed from comparisons with other LCA studies, and comments from consultants that have worked on the preparatory studies. This is especially relevant for PCs, monitors and televisions. For PCs and probably also televisions with semi-conductor devices, the production phase may be as relevant as the use phase, and potentially even more relevant in some cases. While some studies claim that the life cycle energy use of a computer is dominated by the production phase (83%) as opposed to the use phase (13%), the application of the EcoReport tool in personal computers and monitors found that 73–90% of the total life cycle energy use of computers and monitors is found in the use phase. The study discusses why there is such a large difference. A closer look at the EcoReport tool indicates that many upstream processes are not included when using this methodology. This would mean that specialty chemicals (requiring high purity levels which in turn require substantial energy demand) and processes in semiconductor manufacturing are not included in the manufacturing phase of the product life cycle.⁸³ This partly explains the differences in the numbers discussed in the previous section, but not all of it. Another major influence with regard to the large differences is the choice of expected product life that is used to calculate use phase energy demand. Some studies use a three-year lifespan for desktop computers, or less,⁸⁴ while the consultants used a lifespan of 6.6 years for desktops, and 5.6 years for laptops. This obviously influences the importance of the use phase, compared to the other life cycle phases, as calculations on energy use will relate to the calculated running time of the equipment. Thus, there is evidence that the studies are excluding some parts of the production processes and that the choice of expected product life span are sometimes unrealistic. Indeed, some consultants engaged in the preparatory studies were surprised by the outcome based on the methodology applied (as evidenced by comments in their reports). For instance, the Fraunhofer Institute, in the preparatory study on televisions, noted that the manufacturing process “does not put forth a high impact as we would have expected from our experiences in assessing manufacturing

⁸³ According to Williams (2004), the processes associated with producing microchips account for 27% of the total energy needed to manufacture a computer.

⁸⁴ Williams and Hatanka 2005.

processes” (Stobbe 2007:7). They further stated that they would have expected the processes to be more energy intensive than actually reported and explicitly point out that “VHK [the methodology applied] does not include the upstream processes for raw material refinery of steel, plastics, electronics etc., except for glass (which is highly processed glass) and is therefore also underestimated” (Stobbe 2007:13). Additional problems mentioned by the consultants included problems to allocate components to the input categories of the EcoReport input table, especially for displays and electronic boards of LCD televisions.

Energy efficiency measures targeting minimum efficiency standards for PCs and laptops stand out as the most feasible and sufficient intervention in the case of the EcoReport outcome, “overshadowing” other aspects. In contrast, a study by Williams (2004) suggests that more efforts should be made to encourage reuse of the whole product or its energy intensive components, and improve the efficiency of manufacturing processes. The chosen life span and the exclusion of upstream processes can thus have significant impact on the outcomes, and associated proposals for policy measures.

Another concern with the EcoReport tool was the exclusion of hazardous substances. This concern was expressed by the consultants performing the preparatory study for computers and monitors, who in one case stated that “the EcoReport tool does not explicitly handle flame retardants and they are therefore not pointed out as focus areas in task 5 [Environmental Impact Assessment], but they are still of environmental importance for all the products in the study” (TCO *et al.* 2007: 200).

Thirdly, another concern, which was not quantified in the report, relates to chosen default scenarios for recycling rates of materials as described in the MEEuP and EcoReport. The EcoReport assumes that the recovery, reuse and recycling targets in the WEEE Directive are to be used as the default scenario. But these targets only represent the targets that separately collected WEEE must achieve. Thus, if only 1 tonne of WEEE is collected then 750 kg must be recovered and of that 700 kg should be reused or recycled (see the requirements in the WEEE Directive). If 10% of the WEEE arising are collected and the remaining 90% are disposed, the 10% collected could still meet the recovery and recycling targets, as these only apply for collected WEEE. In other words: no consideration of the actual collection rate is included in the EcoReport. It simply assumes that recycling targets will be achieved for

each product.⁸⁵ While the effect of this unclear treatment of end-of-life scenarios needs to be further assessed to determine how it influences calculations of life cycle impacts of different product groups, it is likely that incorporating collection rates in the calculations will show environmental impacts from end-of-life life cycle phase to be more important than currently established.

Fourthly, a “passing the buck strategy” through reference to other environmental legislation was noticed in the report. There is an evident confusion regarding the scope and objective of the Ecodesign Directive. Some EU official documents refer to it as a life cycle tool, whereas others refer to it mainly as a tool for improved energy efficiency. The relationship between the Ecodesign Directive and other directives remain unclear. What can be noticed in several preparatory studies is that consultants do not propose IMs for certain environmental aspects, instead referring to the use of other EU directives to deal with these issues. This is especially relevant for dealing with chemicals and toxicity, where consultants often refer to the REACH Regulation and the RoHS Directive as better legal tools to address these issues. However, these are horizontal laws; REACH applies to a large number of substances and regulates their handling and use for several purposes, whereas RoHS set restrictions on six substances for all the product groups under its scope. The Ecodesign Directive could complement them by looking at chemicals relevant for individual product groups. However, several reasons exist for why it is difficult for consultants to address chemical and toxicity issues (e.g. lack of data and methodologies). The hesitation to propose IMs for these issues is therefore understandable.

The issue of how generic requirements would be applied through the setting of IMs has always been surrounded by uncertainty. While specific requirements would force the manufacturer to address a specific parameter, e.g. energy efficiency; then generic requirements could – potentially – be used to induce ecodesign practices and life cycle thinking among manufacturers. The main concern with generic requirements is that it must be easy for the manufacturers to know what to comply with. A related concern is that authorities in all EU member states must interpret and apply the requirements in similar ways. Therefore, legal re-

⁸⁵ Collection rates in Europe range from approximately 25%–60% of expected total WEEE (Huisman, Magalini *et al.* 2008). This means that between 40–75% of these products are being disposed in landfills or incineration facilities; exported for recycling or reuse outside of the EU, or recycled in proper treatment facilities in the EU but unaccounted for or treated in substandard treatment facilities.

quirements cannot be too vague, or open to ambiguous interpretations. The analysis of the four product groups performed in the study found few proposals for generic ecodesign requirements. In the case of televisions, the consultants recommended that television manufacturers should make an assessment of their products based on the ECMA 341⁸⁶ or IEC 62430 standards. These are, essentially, checklists for general design practices. Such requirements would force television design teams to consider environmental aspects, which cannot be addressed by specific ecodesign requirements. However, this requirement was subsequently dropped. Industry stakeholders expressed some support for the use of such standards, but stated that there are uncertainties regarding how a manufacturer would document and demonstrate compliance with such a standard. However, some examples of generic requirements related to information is available. In the case of domestic lighting, a requirement that the mercury (Hg) content should be indicated on the packaging was integrated into the final regulation.⁸⁷

Apart from barriers mentioned above the study discussed other reasons for why it is difficult to set IMs for all relevant life cycle environmental impacts. According to stakeholders, taking part in the legislative processes, incorporating a larger number of environmental issues increases the complexity of negotiations, making it difficult to enact any IMs at all. Thus, incorporating many environmental aspects risks delaying the legislative process significantly. Somehow energy performance is an easier parameter to deal with than other environmental aspects because there are established practices and standards for measurement, and often numerical values can be used.⁸⁸ It is often hard to establish requirements without having appropriate measuring methods that can be used when calculating targets. For instance, there is a lack of standards related to reusability, remanufacturability, recyclability and recoverability, not to mention toxicity reduction.

⁸⁶ While IEC 62430 could be referenced in IMs, ECMA standards cannot be referenced due to EU standardization policy and law, see van Rossem *et al.* 2010.

⁸⁷ A potential concern is that there is no obligation in terms of font size, which could mean that the information will be difficult to assess for consumers.

⁸⁸ However, there may be a large difference between what is measured for the appliance according to the measurement standards, and how much energy the consumers are really using to run the appliance in reality, as this depends on the behavior of the consumer.

2.3 Finnish study on lots 15–18

A Finnish study⁸⁹ covering four product groups (lots 15–18: solid fuel small combustion installations, laundry dryers, vacuum cleaners, and complex set-top boxes) published in 2010, made these observations:

- The preparatory studies are very different, despite the existence of the common MEEuP (now MEErP) methodology. This makes it difficult to compare information in the studies.
- Some preparatory studies lack peer-reviewed LCA reports; more use of such studies can ensure quality of data, and allow for more life cycle aspects to be included and assessed in the studies.
- The system boundaries are often not clearly defined; this can affect the outcomes of the studies.
- In the studied product groups, “energy in the use phase” is the main environmental impact, but other important aspects have often been excluded from the studies without clear explanations. For some product groups there are important environmental impacts associated with the production and end-of-life phases, as well as material use.

2.4 German study on laptops 2012

A recent report on laptops⁹⁰ lend some support to the importance of the production phase for some consumer electronics, as discussed in some of the studies discussed above: it is stated that the production phase accounts for over 56% of the total greenhouse gas emissions; a significantly higher impact than the use phase. Moreover, it is stated that the environmental impacts of the production phase of a notebook are so high, that they cannot be compensated in realistic time-periods by energy efficiency gains in the use phase: in case of a 10% increase in the energy efficiency of a new notebook as compared to the older one, replacement of the older notebook can only be justified after 33 to 89 years. It is concluded that policies should *above all try to prolong the useful life-time of a notebook*. Therefore, the study recommends that the

⁸⁹ Mälkki *et al.* 2010.

⁹⁰ Öko-Institut e.V./ Fraunhofer IZM 2012.

focus of mandatory product policy for ICT should be expanded to measures related to possibilities of hardware upgrading, modular construction, recycling-friendly design, availability of spare parts, standardization of components and minimum warranty periods.

2.5 Japanese study on replacement of consumer products

The studies above point to some peculiarities in the outcomes of the preparatory studies. A forthcoming Japanese study⁹¹ is interesting as it elaborates on when – from the consumer’s perspective – it is preferable to replace a product with a more energy efficient one, from the viewpoint of reducing energy consumption. The study discusses several complexities that will affect the outcome, including:

- Is the replaced product used often or not? Is it replaced with a new product? Is it replaced with a top performing product?
- What is the annual energy efficiency improvement for the given product group (this is important, because a rapid development could mean that it is beneficial to delay changing the product for a number of years to get a replacement with much better energy efficiency performance; whereas in the case of a mature group with small annual improvements it could be beneficial to switch directly)?

It is stated that *“In practice, it is difficult to scientifically or objectively determine future energy efficiency improvement rates.”* Still, some consumer products undergo rapid changes – at the time an evaluation is made – whereas others do not provide indications for an assessment.

Three product groups were assessed (TVs, refrigerators, ACs). Regarding the findings it is stated:

“In general, replacement of refrigerators after 8–10 years of use was preferable⁹² even if the replacement product was larger. Replacement of air conditioners was not preferable if the unit was used less than average and the consumer replaced an average one with a new average one or if the consumer already owned a TR product. Replacement of TVs tended to become not

⁹¹ Tasaki, T. *et al.* forthcoming.

⁹² A main reason is that the annual energy efficiency improvements for refrigerators are small.

preferable if the TV was not used often or if the consumer replaced the TV with a larger one. The necessity of accounting for various replacement options was confirmed. Moreover, the conditions under which replacement was not preferable in terms of energy consumption alone also apply if resource consumption and GHG emissions are taken into account.”

The research indicates that from the consumer’s perspective extending the lifetime makes sense for some product groups, but not for others, depending on several factors. However, there are several question marks and uncertainties and therefore a need for more research on these issues.

2.6 The CSES evaluation 2012

CSES’ major evaluation of the Ecodesign Directive was finalized in March 2012.⁹³ The conclusions in relation to the topic of this report are:

- There are definitely potential for “non-energy in use” requirements for a significant number of product groups. This does not mean it is easy to set such IMs.
- It appears as if the Commission/Regulatory Committee has in some cases chosen not to set IMs for non-energy in use related measures, for reasons related to possible implications for industry competitiveness and the effects on SMEs.
- It appears as there is scope for non-energy in use related IMs, which may support the SCP/SIP action plan in several ways, e.g. the following types of IMs could be of relevance for this purpose:
 - Information on hazardous substances in products, as it could aid better EoL management and recycling; some actors have proposed the Ecodesign Directive is better suited than other regulations to help providing harmonized requirements.
 - The development of generic ecodesign requirements more generally, e.g. related to product information.
- The metals industries argue that the recyclability of materials is not properly considered in the MEERP methodology.
- Remanufactured products may not be able to meet strict requirements, e.g. tier 2 requirements, even if remanufactured

⁹³ CSES/Oxford Research 2012.

products are preferably to new ones (even if they are not as energy efficient as other products, they have other life cycle benefits, such as those related to recycled materials and embedded energy in materials). *Exemptions for remanufactured products may therefore be necessary in the future.*

- There is an institutional learning process going on in relation to the whole Ecodesign Directive process and the setting of requirements for product group; actors are moving up the learning curve. This means that actors may soon be ready to deal with new types of requirements. The report points out that methodological development and data collection have been strongly devoted to energy efficiency.
- The study points to the chicken-and-egg problem:⁹⁴ *“The Preparatory Studies are not able to suggest any requirements relating to other environmental impacts, if the necessary data do not exist, including where suitable measurement methods and testing standards are not available. On the other hand, finding data on other environmental impacts is not considered an urgent priority, if these are not identified as being significant and if there is no envisaged legal requirement, there is no incentive to develop the metrics and collect the data, especially on more complex environmental issues.”*
- Speeding up the process of setting related to non-energy related aspects would greatly be enhanced through collecting better data and through the development of new standards, and new auditing and certification schemes.
- Even if other legal instruments (RoHS/WEEE/REACH etc.) are better equipped to deal with some issues in practice, it does not mean that it is easily done to use them for certain purposes. There is scope for better coordination within the Commission.
- The issue of complex products and the system perspective is discussed, e.g.:
 - Is a focus on the product level appropriate for products used in buildings where energy optimization should be at the level of the whole building and where different climatic conditions mean that EU wide measures may not be appropriate?

⁹⁴ This problem is relevant also in other areas of policymaking. For instance, in GPP it is often claimed that any requirements used should be possible to follow up. However, manufacturers will not introduce systems to follow up requirements *until there is a clear demand for them*, as they are costly to develop. See Dalhammar and Leire 2012.

- What are the implications of separate Implementing Measures covering only the heating part, or just the cooling or the ventilation parts, of e.g. HVACR equipment? Especially if a fourth set of IMs might govern motors and a fifth set of IMs the fans inside the equipment. It is crucial that the various sets of IMs are complementary.
- If the system or parts of it are covered by other forms of regulation, mandated CEN standardization processes or voluntary processes, what are the implications for standards set under the Ecodesign Directive? In the case of construction products, the industry considers that existing legislation – the Construction Products Regulation and the Energy Performance of Buildings Directive – are adequate tools to address energy and other environmental issues and establishes the framework for setting eco-design requirements through CEN standards.
- It is possible that the interaction of the various parts is such that the most efficient levels for particular parts may not be the most efficient for the system as a whole? The problem of complex products can then easily become a problem of systems.
- In spite of the above, for some product groups that are parts of systems the above may not be a large problem. Air conditioners and boilers are examples of product groups where IMs set through the Ecodesign Directive should not be problematic from the system perspective. Further, in many cases it makes sense to set minimum standards at the individual product level, especially in view of the important variations in how directives such as the EPBD Directive is applied among Member States.
- It is proposed that the Working Plan is the best place to address the issues above. Working with “product families” is seen as a potential way forward.
- Regarding the policy mix and how well the Ecodesign Directive interacts with other instruments, it is stated that the interaction with the Energy label is crucial, and in general seems to work quite well. It is recommended that the legal standards in these two instruments are pursued in a single process to optimize complementarities between push and pull and ensure real differentiation.
- The interface between the Ecodesign Directive and eco-labels and GPP is not optimal. The poor complementarities with the EU eco-labeling scheme – legal standards in IMs are in some cases more demanding than the eco-label criteria – is partly due to lack of information sharing, and different time schedules. Better

coordination and sharing of data and technologies is necessary in the future. Regarding GPP, The Commission has referred to benchmarks identified in the preparatory studies in their communications, but there seems to be limited use of these in GPP practices. There seem to be a lack of coordination between the DGs working with the Ecodesign Directive and GPP respectively.

- In line with the EEB study above, it is stated that some issues fall between various units in the Commission, partly because there is some confusion regarding the exact objectives of different legal acts. The importance of seeing that other instruments (WEEE, RoHS, REACH etc.) are working as intended during the consultancy studies is stressed; preparatory studies should not just state that rules are not necessary because there are other instruments that can deal with some issues.
- The fact that the RoHS Directive has set limits for mercury in compact fluorescent lamps, while the Ecodesign Directive have mandated information about the content on mercury in the lamps is seen as an example of how the legal instruments can work in synergy.
- Standards to establish material efficiency of products are of specific importance if we are to set relevant IMs.
- The need for declaration schemes for establishing recycled content is necessary in many cases if we are to set IMs for these aspects, but this could lead to substantial cost increases and many cases of non-compliance, especially in fragmented markets with large global supply chains, and in industries with many SMEs.
- The administration of the Directive within the Commission is insufficient because of lack of staff. Introducing non-energy in use requirements may therefore be counter-productive without more resources being added.

2.7 Aalborg studies on TVs and washing machines

A study on TVs published 2012⁹⁵ looked at ecodesign requirements for televisions (TVs). The main aim was to investigate the scope of the Implementing Measures (IM), how ambitious the requirements of the IM are, and to what degree they can promote eco-innovations of TVs. Some of the main conclusions are:

- The preparatory study and IM have not been able to take into account new emergent technologies such as TV's based on LED technology. This also means that the legal standards are "outdated" already when they enter into force, since manufacturers can easily comply with them due to technological developments. The long legal process exacerbates this problem. However, there are potential trade-offs involved as small producers may find it more difficult to comply with stringent requirements.
- Some IMs could definitely have been more ambitious, such as requirements regarding on-mode power consumption.
- The set IMs have a narrow focus on energy consumption during the use phase, as opposed to ecolabel criteria for TVs that have requirements related to e.g. content of mercury, flame retardants, life time extension, and dismantling.
- A significant market trend is towards bigger and bigger flat screens. The eco-labels address this through setting maximum upper limits through energy consumption, but the IMs do not. If we are setting requirements in a way that allows bigger screens to have a bigger energy consumption, then the market trend with bigger and bigger screens turned on for longer periods means that the energy savings have "disappeared" (all things being equal) – or perhaps even that the energy consumption from TVs will grow. There is a need to investigate the consumer and market trends, if the intended potentials of energy savings are to be achieved – and not be counteracted by rebound effects.

Therefore, the requirements will succeed in getting the worst performers off the market, but is clearly limited in terms of life cycle scope and will fail to trigger genuine innovation. Further, product integration is not

⁹⁵ Huulgaard and Remmen 2012.

considered as a potential for environmental improvements, though there are such tendencies (e.g. TV with DVD, USB, etc.; within the next couple of years integration of TVs and the internet will probably be common). Product integration offers a potential for environmental improvements both in terms of energy efficiency and material savings. Embedded energy in materials is another “blind spot”: it can become significant in the future with the increasing use of high energy intensive materials such as aluminum, etc.

A study on household washing machines⁹⁶ analyses how nine European and Nordic policy instruments interact to reduce the environmental impact from household washing machines and how they encourage eco-innovation. The policy instruments are: the Eco-design Directive, the EU energy label, the WEEE Directive, the RoHS Directive, the REACH Regulation, the EU Ecolabel, the Nordic Swan, Green Public Procurements (GPP), and Voluntary Environmental Agreements (VA). The objective of the study is to investigate how the synergies and coherence between the instruments can be improved in order to minimize the environmental impacts from all life cycle stages of household washing machines.

A general finding was that the synergy between the various instruments is rather poor in the case of washing machines. In the case of the Ecodesign Directive, implementing Measures for household washing machines only cover the use stage with requirements for energy efficiency and water consumption. The other life cycle stages, which include the use of resources and hazardous substances, production, transport, reuse and waste, are not regulated, under the presumption that other instruments such as WEEE and RoHS Directives can deal with such aspects. However, the WEEE Directive has not provided significant incentives for manufacturers to incorporate considerations on material use and waste in the design stage. Thus, there is potential to set requirements related to resource efficiency and end-of-life management under the Ecodesign Directive.

Among the voluntary instruments, the eco-labeling schemes have the most comprehensive life cycle perspective, but the criteria have been outdated for years and have thus not provided strong incentives for industries to engage in sustainable design practices. The Eco-labeling criteria in the Nordic Swan and the EU Eco-label are outdated; the latest revisions are from 2004 and 2001 respectively. Some of the worst per-

⁹⁶ Bundgaard *et al.* 2013.

forming washing machines on the market regarding energy and water consumption are labeled with the Nordic Swan, as parameters like allergy are prioritized compared to water use in the Nordic countries.

While final conclusions on the effect of the Eco-design Directive on household washing machines cannot be established, all household washing machines on the Danish market in 2011 live up to the new requirements. The next tier of IMs, which enter into force in 2013, are more ambitious and will remove almost 30% of the bottom of the current market in terms of requirements for water consumption and 73% of the market in terms of energy consumption.

2.8 JRC studies

The recent JRC studies in the project “Integration of resource efficiency and waste management criteria in European product policies – Second phase”⁹⁷ provide crucial input to the topic of this report. The aim of the project was to develop methods for the integration of material resource efficiency in EU product policies, and to identify and assess potentially relevant requirements for the European product’s policies. Among other things, the studies discuss definitions of key concepts (e.g. reusability, recyclability etc.), calculation methods for e.g. (potential) recyclability, recycled content, outlines potential requirements – e.g. on declaration of content, recycled material, disassembly time etc. – for selected product groups, and discusses what type of industry standards (such as ISO standards, existing or under development) that may be used to prove conformance with certain requirements.

As the reports are very information-rich, we only summarize some of the issues here. We focus on the second report that discusses how the methodology may be applied for three product groups, including examples of potential legal requirements, which are also potential requirements that can be set as IMs under the Ecodesign Directive, at least in the medium or long term.

In the second study,⁹⁸ methods for identifying relevant materials, with high associated environmental impacts, and the products that embed them are outlined. 36 product groups covering both energy-using

⁹⁷ In the projects there were three final reports from the second phase, and one executive summary: Ardente *et al.* 2012; Ardente and Mathieux 2012a; 2012b; 2012c.

⁹⁸ Ardente and Mathieux 2012a.

and non energy-using products were evaluated against 8 criteria, to find suitable cases of relevance. The outcome of the analysis is the selection of three case studies that cover some of the parameters, based on relevance and data availability:

- “Imaging equipment” product group (limited to the analysis of the recycled content)
- “Washing machine” product group (for the analysis of RRR, use of relevant resources, use of hazardous substances and durability)
- “Liquid Cristal Display (LCD) TV” product group (for the analysis of RRR, use of relevant resources and use of hazardous substances).

The study further makes an analysis of potential product requirements concerning resource efficiency and waste management parameters, based on a survey of ecodesign criteria developed in environmental labeling schemes and scientific literature. Based on expert judgment, a typology of 20 possible criteria was proposed, consisting of declarations, threshold criteria, and provision of information, and implementation of design alternatives for ecodesign (see figure).

Table 3. Typology of ecodesign requirements (source: JRC 2012)

Typology of Ecodesign requirement		Parameter potentially influenced by the requirement:				
Typology	Sub-typology	RRR	Use of priority resources	Recycled content	Use of hazardous substances	Durability
Declaration of indices (RRR rates, RRR benefits rates, Recycled content, Recycled content benefit)	General indices	X	X	X		
	Indices restricted to some specific material (e.g. RRR rates or Recycled content restricted to plastics, CRM, etc.)	X	X	X		
Threshold of indices (RRR rates, RRR benefits rates, Recycled content, Recycled content benefit)	General indices	X	X	X		
	Indices restricted to some specific material (e.g. RRR rates or Recycled content restricted to plastics, CRM, etc.)	X	X	X		
Design for recycling	Use of compatible materials (or forbid jointly use of materials that are not compatible for recycling)	X				
	Use of materials more recyclable	X	X			
	Reduce number of contaminants (labels, glue, solders, etc.)	X				X
Design for disassemblability / dismantlability	Time based index (e.g. dismantling of a component)	X	X	X	X	
	Mass / Time based index	X	X	X	X	
	Non destructive disassembly (for repair/ substitution)	X				X
	Reduction / simplification of fastening (e.g. reduction of number and typologies)	X	X		X	X
Availability of spare parts						X
Warranty						X
Indices for durability		According to standardized measurement of performances (when available)				
Dematerialization	Reduction of the weight of materials	X	X			X
	Design of components for optimal use of materials	X	X			X
Declaration of substances	BOM of product or parts (at different level of detail)	X	X		X	
	Relevant substances (e.g. CRM to be recycled)	X	X		X	
	Pollutants (e.g. flame retardants), which interfere with EoL treatments	X	X		X	
Threshold of substances	Relevant substances (e.g. CRM to be recycled)	X	X		X	
	Pollutants (e.g. flame retardants), which interfere with EoL treatments	X	X		X	
Marking / labelling /tracing	Easy identification of recyclable materials / parts	X	X	X	X	
	Identification of pollutants	X	X	X	X	
	Use of innovative technologies for the automatic sorting systems (tracing substances, magneticpowders, etc.)	X	X		X	
Provision of information		X	X	X	X	

A methodology for identifying and assessing potential requirements is introduced, and specific potential requirements for the product groups are presented. The authors claim it possible to assess the performance of products according to resource efficiency parameters using available data (or easily available data), and that the method applied results in the identification of potentially relevant products requirements.

2.8.1 *Imaging equipment*

For imaging equipment, it is assessed that significant (from 3% to 10%) reductions of life-cycle energy consumption could potentially be achieved by setting a requirement concerning the use of variable percentages (from 10% to 30%) of recycled plastics during the manufacturing. This is based on a study of a specific product. A specific example of a requirement and verification criteria is outlined.

However, potential difficulties related to the verification process should be considered. This mean that such requirements are better applied in voluntary instruments such as eco-labeling. A comprehensive market analysis is recommended to assess the availability of recycled plastics for the manufacturing; the technical feasibility of using recycled plastics in the product; and the impact that such requirement on a single product category alone may have on displacing the existing flows/volumes of recycled plastic rather than increasing total amount of recycled plastics.

2.8.2 *Washing machines*

The study is based on two product cases, scientific literature, and information from recyclers. The identified “hot spots” of washing machines are: counterweights (which largely influence the mass indices), printed circuit Boards and electronics (relevant for some impact categories and for the content of critical raw materials), and the motors (relevant for the environmental impacts of copper and of some rare earths, potentially embedded in high efficiency motors). The analysis identifies and assesses some potential ecodesign requirements. Among these, disassemblability requirements (on the Printed circuit Boards, motors and LCD-screen, if any) are identified as potentially being the most relevant due to the contribution to the improvement of the performances of the product during End-of-Life treatments, thanks to the increase of the recycling rates of some relevant materials (copper and precious metals). Some additional requirements concerning the provision of information

(about relevant materials in the washing machine) and declarative and thresholds requirements of some recyclability indices are also analysed.

Requirements selected as potentially relevant for the WM case study

- Improvement of the disassemblability of PCBs.
- Improvement of the disassemblability of the LCD screens (when present in the WM).
- Improvement of the disassemblability of the motor for the recovery of copper, steel and neodymium (when present).

Additional potential product's requirements

- Provision of information (on key components as PCB and motors).
- Declaration and/or thresholds for the RRR⁹⁹ and RRR benefit rates.
- Improvement of the product durability.

Such requirements may have several benefits, not least that they would allow for selective dismantling and the recycling of rare earth elements (REE) and other valuable resources. Further, they could reduce the risk of contamination during recycling. In several cases however, there is not enough available information to make quantitative assessments of the implications of such requirements in the short and long term (the study also discusses various scenarios related to future recycling practices). One category of requirements discussed is related to disassembly time. Several such potential requirements – and associated verification methods – are outlined in the study.

Another type of requirement relates to the content of materials. Such information may be valuable for recycling activities, but often it is difficult to assess this as we do not yet know e.g. how easy it will be to use recycled materials, not least since recycling of REEs and other materials are only at the pilot stage yet. It is however vital that recyclers obtain more information about rare materials, in order to allow for new types of recycling. One potential requirement outlined concerns the declarations on the existence of REEs and CRMs in products.

⁹⁹ “RRR” is the acronym: Reusability/Recyclability/Recoverability. In the JRC report, these are not considered “physical” properties of the product but they are “potentials”, meaning “engineering” properties related to the characteristics of the product and the available technologies (as opposed to the % of recycled content in an existing product). RRR cannot be directly measured (e.g. by a technical instrument or a laboratory test), but can be indirectly calculated. The reports have indexes for each parameter: reusability, recyclability, recoverability. Also some combined indices (reusability/recyclability and Reusability/Recoverability) are discussed.

Declarative requirements may be preparatory to requirements on threshold requirements. The main aim is to induce EoL considerations already at the design stage.

2.8.3 LCD-TVs

Some potential product requirements are discussed with the aim of supporting the improvement of the current End-of-Life scenario and to make it more competitive in the future. These requirements include: the improved disassemblability of key parts (fluorescent lamps, Printed circuit Boards, LCD screen and polymethyl methacrylate board). The disassemblability of such parts allow the preparation of waste for further recycling processes, currently under research and/development, as the recycling of rare earths from lamps and of indium from LCD screens. Further potential requirements for LCD-TVs, such as the threshold for the “recyclability rate” of plastic parts and the declaration of content of indium in the product are discussed and illustrated.

Potential IMs discussed are declarations of Indium content; marking of large plastic parts; and a guarantee on recyclability rate index. Types of verification techniques outlined include declarations and calculations, sometimes with the use of existing standards, technical documentation, and laboratory test reports.

2.8.4 Some observations

The authors claim that the analysis of case studies shows that the methods are applicable to the products under scope with available data and it is possible to analyze the performance of products on the basis of the various indices including: RRR rate (including RRR for plastics and/or CRMs), RRR Benefit rates, Recycled content, Recycled content Benefits, presence of hazardous substances in components. It is also shown that the methods can be used to transparently identify potentially relevant product requirements, and to assess their potential benefits. Requirements should be assessed considering the whole life cycle of the product, including use phase and any other relevant phase, in order to minimize trade-off and optimize global environmental benefits.

The potential requirements on maximum disassembly times are interesting because they show how requirements that may be applied though the Ecodesign Directive, or in eco-labelling, can complement the extended producer responsibility (EPR) Directives – including the WEEE Directive – in a very specific way; the latter has not set out requirements

on maximum disassembly times. Were such standards to be set under the Ecodesign Directive, the various directives would complement each other and provide synergistic effects. This is in contrast to the view that the Ecodesign Directive and the WEEE Directive should promote different objectives (we provide an analysis of this issue in Annex III).

It is claimed in report no 2 that we have limited knowledge on the costs of ecodesign activities (p. 68). A question mark however, concerns how relevant the costs of design activities are for requirements that would relate to e.g. recycled content, or material declarations on components and hazardous substances, which may be more related to costs of materials, and costs of obtaining information from suppliers. The study is positive regarding the potential for manufacturers to obtain supply chain data on materials and substances (p. 68) whereas other studies are stressing the rather high costs of information collection. Among the potential benefits associated with ecodesign requirements, the study mentions (p. 69):

- Cost reductions, associated with use of recycled materials that can cost less, better/less use of raw materials, improve logistics and energy savings.
- Increased revenues, as eco-designed products may provide greater satisfaction to consumers, who are increasingly sensitive to environmental issues; some eco-designed products can generate economic benefits for the buyers, such as lower energy consumption, and can contribute to their loyalty to the manufacturing company.
- Non-economic benefits for the organization: ecodesign activities allow the firm to play a proactive role with respect to regulations; ecodesign can enhance the firm's image and improve relationships with various stakeholders.

Further benefits may come from innovations. For instance, better material declarations and information on substances may lead to improvement of recycling technologies for various materials and substances.

The study presents a rough estimation of the costs of associated with different types of requirements (see figure). However, the study contains no detailed investigation of the costs and benefits associated with the potential requirements discussed.

Figure 1. Potential costs/benefits related to the typologies of products' requirements (Source: JRC 2012)

Typology of ecodesign requirement	Estimated cost category
Declaration of indices	A
Threshold of indices	B/C
Design for recycling	B
Design for disassemblability / dismantlability	B
Availability of spare parts	A / B
Warranty	A / B
Indices for durability	A
Dematerialization	(*)
Declaration of substances	B
Threshold of substances	C
Marking / labelling / tracing	A / B

Legend:

A. low costs/efforts

B. Minor to medium costs/efforts

C. Medium to high costs/efforts

(*) difficult to be estimated

An interesting feature in the study is that it includes scenarios for new types of treatment at the EoL stages, and discusses the implications.

2.8.5 Stakeholder comments: interesting issues in relation to methodologies and the policy mix

The stakeholders provided comments on the draft reports, and these comments and answers from the JRC research team are provided in the Summary report.¹⁰⁰ A few issues are of special interest for our purposes. Not least some issues related to *coherence between various methodologies*, and the *interactions of policy instruments and directives*.

Orgalime (p. 48) raises some questions in relation to the methodology used and its relation to the Ecodesign Directive:

“The draft JRC methodology does in our view not sufficiently take into account the criteria of the Ecodesign Directive, and more particularly the life cycle approach of the Directive and its requirement of demonstrating “a significant potential for improvement in terms of its environmental impacts without entailing excessive costs” (art.15 Ecodesign Directive).”

The JRC research team responds (p. 48) that:

“The proposed methodology concerns several product policies, including those in the scope of the EcoDesign Directive. Methods developed in the Project Phase II are based on a life-cycle approach, thus in line with the Ecodesign Directive. The proposed methods allow to identify potential requirements based on a life-cycle assessment. Case studies show that it is possible to assess the benefits of the potential requirements, and hence their significance. Requirements can also be compared to benefits related to Implementing measures already adopted under Ecodesign. The relevance of requirements is related to selected impact categories. Potential costs have been qualitatively assessed, according to the objectives of the project, more oriented on the development and testing of methods and identification of potential requirements. The project was not meant to carry out a full Impact Assessment of the potential requirement identified.”

Regarding the relation to the MEERP methodology, the research team states (p. 48) that:

“The MEERP methodology and EcoReport tool has been used when possible (e.g. as for recycled content benefits). In addition to MEERP and the EcoReport tool in it, LCA methodology have been further used in order to appropriately capture some material efficiency aspects. The proposed methods are complementary to the MEERP and potentially suitable for integration into this methodology.”

¹⁰⁰ Ardente and Mathieux 2012c.

Orgalime also has a comment on the risks of JRC developing a parallel methodology (p. 49):

“The development and application of a parallel methodology that singles out resource efficiency or waste management parameters from the products’ wider environmental, economic, social and functionality parameters risks leading to misleading and conflicting results, including from an environmental point of view. It especially risks leading to a negative impact on the ongoing Ecodesign implementation on energy efficiency, which represents a priority topic under the Resource Efficiency Roadmap in itself.”

The JRC team states that (p. 49):

“Identification of potential product policy requirements on material efficiency in that case studies of this project is not in conflict with other energy-efficiency requirements. The potential requirements are complementary. In addition, should any potential requirements on material efficiency identified be applied to any EU product policy in future, they will need to be in line with all the relevant provisions (e.g. on functionality, life cycle cost and life cycle environmental assessment) specified in the EU product policy they are considered for application (e.g. Ecolabel, Ecodesign, etc.).”

Another stakeholder comment relates to the potential trade-off between durability and energy efficiency (p. 49):

“The proposed methodology on “durability” of products particularly conflicts with the ongoing implementation of the Ecodesign Directive on energy efficiency in our sector, as the energy efficiency performance of a product continuously improves from one generation to the next.”

The JRC team answers (p. 49) that:

“The developed method (see also application to a case study in Report n°1) proved that under some conditions, the prolongation of the operating life of a product can lead to overall environmental (including energy) benefits. Further to this, and in line with any other potential requirements considered under EU product policy, policy makers can exercise judgement as to the timing of potential requirements in order to eliminate/minimise trade offs, if any.”

The research team states that some IEC/ISO standards can be applied, but implies there may be a need to revise existing standards, or design new standards, in order to have relevant methods for measurements and showing compliance with potential codesign requirements. In relation to potential requirements for maximum allowed disassembly time

(see above) the research team states (p. 18) that: *“Standards for measurement of dismantling time could be mandated to CEN/CENELEC.”*

It should be noted that the study looks at hazardous substances mainly related to EoL phases. It is stated by the JRC research team (p.28) that:

“...hazardous substances were considered only for the EoL phase since it was judged that only this phase could be more synergetic with and avoid duplication with existing legislation (e.g. ROHS, REACH, WEEE). Relationships with these pieces of legislation and product policies will have however to be investigated in the future.”

2.9 Teknikföretagen study

Teknikföretagen¹⁰¹ performed a study, published 2011, based on interview with membership companies in order to find out their views on the ErP process. Some findings are of special significance for this study. On the issue of scoping the product group in studies, it is stated:

“The companies interviewed would like to see both “broader” definitions as regards aspects and “narrower” definitions as regards products:

In many of the preparatory studies conducted the interviewed companies feel that the definitions tended to be broad, i.e., that they sometimes involve a function rather than a product type. This kind of broad definitions can force exceptions as the study proceeds, which potentially will delay the process. The interviewed companies would like to have “narrower” definitions in the sense that what is today part of one preparatory study or implementing measure should be divided into two or more implementing measures or preparatory studies.

The interviewed companies would like the preparatory study or implementing measure that deals with their product to cover the entire spectrum of relevant ecodesign aspects, including those that can be covered with horizontal implementing measures, such as standby. In this way, it can be said that the companies would like to see “broader” preparatory studies or implementing measures, i.e., by having all relevant ecodesign aspects brought together in a preparatory study or implementing measure.”

Regarding the “regulatory threat” it is stated that:

¹⁰¹ Association of Swedish Engineering Industries.

“Companies previously subject to such legal requirements felt less threats and challenge from the type of requirements that the implementing measures involve. Some of the interviewed companies affected by similar requirements previously point out, however, that the first time they were subjected to requirements on energy efficiency, for example, they saw them as tough and hard to achieve, but at present, knowing that they were able to meet the previous requirements, they do not see ecodesign requirements as so great a challenge. The opposite is true of companies active in sectors where this type of issue was not previously on the agenda. One variant of the above holds for companies where, e.g., energy requirements have long been a selling argument or where there have been demands from the market, e.g., during negotiations. Based on the interviews conducted, there seems to be a certain difference between manufacturers of what is typically seen as a class of consumer product and what is typically seen as B2B products, where the consumer products have often already focused on energy as a sales argument and in some cases through other legislation.”

Regarding products that are “part of a system” it is stated:

“Manufacturers of “plug-in appliances” feel it easier to fulfil the requirements than companies making products that are part of systems or need to be installed. This may in part be due to that companies manufacturing products in systems feel that there are many factors outside their control that influence the energy efficiency or other burden on the environment. The demand for “plugin appliances” is more isolated, to such an extent that the connection between cause and effect is felt to be more distinct. It may also have something to do with “plug-in appliances” being more visible as compared to, say, pumps, so that the focus on energy and burden on the environment was placed earlier on “plug-in appliances.”

Some recommendations made in the report, of special significance for this report, are:

- *Flexible application of the method:* Create flexibility in the application of the MEEuP (now MEErP) method as to the parts of the life cycle being studied in order to speed up the preparatory study process and also make sure all relevant parts are included.
- *Horizontal and vertical implementing measures:* To avoid suboptimal results, it should be possible for requirements in vertical implementing measures to take priority over those in horizontal ones. This is in line with the procedures in other product legislation.

Another recommendation is to *supplement the current system with an industry-driven standardization process*, more similar to the process under the New Approach, where lawmakers may choose which technical standards to adopt from those identified in the standardization process.

It is pointed out that consumer behavior and installation of equipment can be of as much importance as product design for the environmental performance of products per se.

2.10 Swedish Chemicals Agency study “Bättre EU-regler för en giftfri miljö”

A recent study by the Swedish Chemicals Agency discusses rule addressing chemicals, and chemicals in articles, including various EU product laws and their interaction with rules on chemicals.¹⁰² Some conclusions of the study is of great interest for the purpose of this study:

- The EU rules on chemicals in products are complex and difficult to grasp. REACH has some effect on chemicals in goods, the Product Safety Directive has an influence on chemicals that pose health risks, and there are additional Directives for specific product groups (e.g. toys, electronics, vehicles, packaging). The Ecodesign Directive has potential to address chemicals in products to larger extent than today.
- KEMI concludes that the Ecodesign Directive is not well suited to address chemicals, and that specific directives aimed at selected product categories is probably a better approach.
- Eco-labeling and GPP are seen as viable ways forward to complement mandatory rules on chemicals in products.
- Sweden should promote an EU strategy to close the loop in a resource efficient manner. This would include a better coordination between product related legislation and legislation delaying with chemicals and safeguard recycling practices that do not compromise health or the environment. The following objectives are crucial:
 - Substances that makes recycling difficult should not be allowed.
 - Policies for improved recycling should focus on materials that are important resources, and which do not contain hazardous substances.
 - Similar requirements should be put on virgin and recycled material.

¹⁰² Kemikalieinspektionen 2012.

- A review of policies should be performed to evaluate:
 - which policies are most effective to regulate substances during their life cycle?
 - which policies can provide synergies between objectives related to chemicals and those relating to resource efficiency?
 - how can we ensure the rules are not in conflict?
- The Commission does not really have the resources to deal with chemical issues, and there is no set methodology that may be applied during the preparatory studies to deal with chemical issues in a coherent manner.
- The general conclusion is that “substances in products” is not the type of design parameter that would call for an extension of the Ecodesign Directive. However, if regulation of chemicals in new types of product groups is called for, the Directive provides one opportunity, but specific directives (like RoHS or the Toy safety Directive) are often more relevant approaches.
- A potential problem with regulating chemicals through the Ecodesign Directive is that this will lead to a very strong presumption of harmonization, and it will be very difficult to enact national rules on chemicals for the product group in question.¹⁰³
- It is stated that one can compare two main options: 1) a combination of various laws that relates to different aspects of a product group (recycling, hazardous substances, energy efficiency etc.), or 2) one legal act that weighs and regulates all these aspects from a life cycle perspective. The report concluded that the second option is theoretically attractive (only one piece of law to abide to, CE marking as a presumption of conformity etc.) but seems very hard to achieve in practice. It is further stated that it will be hard in practice to weigh different environmental and health aspects against each other.
- In light of the above, the report recommends that extending existing rules for chemicals (like REACH) is a better way to address chemicals in products than using the Ecodesign Directive, especially as the latter option requires better methodologies to avoid ad-hoc assessments and regulations. Currently, resources to undertake more stringent

¹⁰³ However, even without such a strong presumption, any national rule on chemicals must “pass the test” of the general rules of the TFEU, if they are legally challenged.

examination on chemicals in products during preparatory studies and the legislative process appear to be lacking.

- The report discusses how it is therefore more relevant to address resource issues than chemicals in the Ecodesign directive. *A very interesting observation is that it may be relevant to look at chemicals mainly when they are of high relevance for resource efficiency, e.g. when they have a high impact on recycling practices.* Various types of requirements on information about hazardous substances may be a viable option. The report implies that horizontal measures, covering several product groups may become relevant in the future.

2.11 The Swedish Chemicals Agency study “Material Recycling without Hazardous Substances – Experiences and future outlook of ten manufacturers of consumer products”

Another study commissioned by KEMI¹⁰⁴ raised two specific questions:

1. Which possibilities and hindrances exist for manufacturers and distributors when using recycled materials in light of the potential existence of hazardous substances in the recycled materials?
2. What strategies and approaches do manufacturers and distributors have to collect and manage information on substances in products and materials, and what are the benefit and cost of taking such approaches?

In total, ten companies (considered proactive in relation to at least one issue above), representing four product groups, were interviewed.

Substantial differences between companies were found regarding their ambitions for the increased use of recycled materials. While the interviewees from the interior products sector and from the clothing and shoes sector indicated their intention to increase the use of recycled materials, the situation is different in the toy sector; some companies do not intend to use recycled materials due to very strict chemical safety requirements. The ambition of interviewed companies in the EEE sector

¹⁰⁴ Tojo and Thidell 2012.

varies. For one company, the priority shifted from the increased use of recycled materials to material safety due to REACH and RoHS.

The main barriers for increased use of recycled materials include risk of contamination, costs associated with avoidance of such risks, and limited availability. For some recycled materials, most notably plastics, it is difficult to find material that complies with quality requirements

The interviewed companies see future opportunities in overcoming the barriers. Increased use of recycled materials depends on the development of cleaner material streams, which require cleaner input materials, development of better separation/cleaning technologies, and standards for recycled materials.

The companies have taken different approaches in managing chemical information in products. The main costs related to chemical information management in products are personnel costs and chemical analyses, but there are no detailed cost estimations. It was found that chemical information transfer to professional customers and consumers takes place mainly on demand, and few requests come from the waste sector.

Most companies interviewed, regardless of the sector, believe there will be increased use of recycled materials in the near future. The reasons for this include societal pressure for environmental improvement and resource efficiency, the use of recycled materials as an alternative source of raw materials, and the potential for reasonable prices in the future.

One company pointed to the increased interest in recycling and increased amounts of recyclable materials in products as indirect consequences of the introduction of producer responsibility. The increasing utilisation of recycled materials goes hand in hand with both technical developments (such as sorting and cleaning of mixed materials) and new material collection systems according to some interviewees, and phasing out questionable substances and materials can make recycling easier in the future. Traceability and better control of raw materials rather than products – vis-à-vis hazardous substances – will make recycled materials more useful also in new applications.

In the absence of traceability and proper controls on raw materials, there is a risk of large quantities of materials that would, through contamination, need to be down-cycled, or worse, discarded.

A general expectation among the interviewed companies is the future development of new technologies and practices for making recycled material more useful for high quality products. This would mean that the recycling industry would play a prominent role as supplier of raw materials of well-defined properties and chemical compositions.

An expected parallel development relates to the communication of chemical contents of products, components, and materials. A common understanding of the necessity for trust and transparency in supply chains will probably lead to an increased use of electronic systems and standardized common formats for the exchange of information. It is likely that the alternative, an increased use of tests and control system, would be very costly.

The study highlights several issues of importance for policy makers in order to stimulate non-toxic material cycles:

- Continuing legislative drive in reducing the use of hazardous substances, managing information on chemicals in products and stimulating efficient resource use.
- Developing standardized test methods suited for recycled materials.
- Increasing traceability of material content.
- Improving technical development and R&D.
- Enhancing enforcement of existing legislation.

2.12 TemaNord study on public policy for ecodesign

A TemaNord study from 2008¹⁰⁵ found that:

- companies constantly improve the design of their products but mainly for other reasons than environmental protection
- most interviewed companies claim that they could do more improvements for environmental benefits, but there is no incentive. Regulations generally aim too low. Taking ecodesign initiatives that go beyond legal standards can entail risks
- the interviewed companies were more positive towards legislation than expected. Companies that provide products performing well from an environmental perspective generally look favorably upon legislation, not least since it forces less progressive competitors to work hard to fulfill legal requirements
- progressive companies are hesitant to invest more in ecodesign as their competitors can be free-riders; legislation is therefore seen as a better way forward than voluntary initiatives in many cases

¹⁰⁵ Jönbrink and Melin 2008.

- best practice should inform legislation: weak legislation provides legitimacy to laggards,¹⁰⁶ while failing to provide incentives for ecodesign to progressive firms. The legislators need to have contacts with individual firms during the legal standard-setting process as industry associations are not necessarily representing the “top performers” in the sector
- in some areas, like chemicals, legislation may be the only way forward, as consumers do not have enough knowledge to drive developments
- legislation – and compliance mechanisms – should be harmonized within the EU, and rules for EU and non-EU firms must be applied in a similar manner. There are concerns – not least when it comes to rules on chemicals in products – that EU firms have a disadvantage compared to non-EU firms; the latter can import a product produced outside the EU, “escaping” the EU rules
- GPP is generally conducted in a poor way: this means that the potential to drive ecodesign through procurement is often wasted.

2.13 Interesting findings in other studies

Some specific discussions of relevance found in other studies are:

- A recent review of waste policy instruments¹⁰⁷ discusses how the next logical step to promote the waste management hierarchy is to ban not only landfill but also incineration (incl. energy recovery) of certain materials, which would lead to a de facto requirement for material recycling. The potential environmental benefits are considered to be large. Preliminary analysis shows that this will increase waste handling costs but that the additional costs are rather modest compared to the environmental benefits. The study however calls for further analysis of which materials – and which quantities – that are of most interest. Another concern is that the policies may cause the spreading of toxic substances in existing materials. The implications for the Ecodesign Directive is that IMs could support the developments through setting requirements that reduces the costs of

¹⁰⁶ An interesting observation is that some companies claim that their products are sustainable because they comply with the requirements under the Ecodesign Directive.

¹⁰⁷ Ekvall and Malmheden 2012.

recycling (e.g. by maximum disassembly times) or by phasing out and/or tracing/controlling substances in materials.

- The complexities involved in the relations between waste rules and the REACH Regulation's are of high importance for the treatment of material streams and recycling; once a material is no longer to be considered waste, it may be regulated under REACH (REACH is not applicable to waste, see Art. 2.2). There is currently much confusion regarding the relationship between the different rules and the classification of materials. While new rules and standards for when waste are no longer to be considered waste are being developed for certain material streams at the EU level,¹⁰⁸ these will not solve all the uncertainties involved.¹⁰⁹ These issues may become very relevant for rule-making under the Ecodesign Directive if rules are set for recycled content, or information requirements for recycled content. The coordination with the setting of EoL criteria will be crucial.

2.14 Analysis of the studies: main policy implications

The studies have informed us about why resource use has not been addressed in the IMs. The methodology applied and other factors bias the overall picture: the importance of other environmental aspects in other life cycle phases is downplayed. Further, energy in the use phase is highlighted as the main issue, rather than energy use in other parts of the life cycle and energy embedded in materials and components. The problems in pursuing generic ecodesign requirements, and most notably requirements that would make manufacturers make use of ecodesign tools and checklists, severely hampers the original intent of the Directive.

The Directive as applied, thus far, may be helpful in making products more energy efficient, but is unlikely to result in a paradigm shift towards sustainability in product design, and will not strongly promote life cycle thinking. As products become more energy efficient, and product cycles become shorter due to requests for novelty, the relative importance of regulating energy in the use phase will decrease, and it will be more interesting to look at issues like recyclability, recycled content, and measures to increase the lifetime. This also mean that supplier dec-

¹⁰⁸ Such criteria are set for iron, steel and aluminum through Regulation 333/2011. Attempts to set standards for plastics appear to have run into several problems, however.

¹⁰⁹ See Mohlander 2011; see also Naturvårdsverket 2012.

laration schemes (e.g. to guarantee the quality of material or provide guarantees that material is recycled), material declaration and bill of material requirements, extended warranties and repair obligations, and requirements related to quick disassembly times (which highly influences the costs of recycling practices), will become increasingly interesting. The studies reveal that the issue of chemicals in products – and the risk to spread toxics – pose a significant barrier towards further development in recycling of materials the importance of increasing the lifetime of product will increase. This implies that we need general policies to deal with these chemicals, and that there could be a case for addressing these issues in the preparatory studies, e.g. by scanning which chemicals that pose a barrier for recycling for the product group in question.

Further, several studies – most notably the DEFRA and JRC studies – indicate that new types of environmental requirements that relate to resources and toxic content seems to make both (socio)economic and environmental sense, but without making more detailed cost-benefit calculations. Several studies also propose potential requirements for a number of product groups. In some cases the studies do not propose specified IMs, but outlines “hot spots” – i.e. various environmental aspects throughout the life cycle and associated design considerations – that provide guidelines for policymaking.

The JRC study shows that the setting of new types of requirements is possible, as is verification methods related to them. Some of these requirements and associated verification methods are possible to apply with the existing standards and tools, whereas some may require the development of new standards, certification schemes, and calculation methods. The existing problems do not seem to be insurmountable; IMs for new types of requirements that are verifiable can be set. A weakness is however that there has been no deeper analysis of the costs and benefits of proposed potential IMs in any of the studies, nor a more elaborate study of the implications of competitiveness, most notably for SMEs. Further, the JRC study does not provide a deeper analysis of all kinds of relevant IMs that could be envisioned under the Ecodesign Directive.

The JRC study also shows how IMs can complement the rules in other Directives; the example of maximum disassembly time being a good example of how the Ecodesign and WEEE directives can be mutually supportive. This is in line with our views that all policy instruments should support the overall objective of providing incentives for Ecodesign. This is discussed in Annex III.

The study by Kemikalieinspektionen discusses how the preparatory studies should probably focus mainly on chemicals that influence the

recycling potential, rather than trying to set more elaborate chemical related requirements for the respective product group; such elaborate rules, it is claimed, may be better set through specific directives. This is a rather reasonable view. Requirements – whether these are related to information on chemicals in materials and components, or chemical restrictions – could be set when such standards are required to ensure recyclability. A method for this – based upon quantitative and qualitative methods – may be developed. If manufacturers are able to fulfill such standards in e.g. eco-labeling schemes it is easier to argue that new legal standards are not unreasonable to set, especially if a substantial time period is given before the rules come into force. However, we believe that there could also be reason to elaborate on criteria for voluntary information on chemicals through benchmarking, e.g. with eco-labeling and public procurement criteria. Manufacturers who can deliver such solutions should be rewarded, e.g. through GPP practices.

The CSES study elaborates on the interplay between the Ecodesign Directive and other EU policies. It appears as if the interaction with energy labeling works quite well, whereas the interaction with eco-labeling is poor. It further appears as if learnings and benchmarks identified in the preparatory studies are not used in public procurement, hinting at a potential to improve this interaction.

3. Benefits and drawbacks of addressing resource issues in the Ecodesign Directive

In this chapter the potential benefits and drawbacks of addressing resource issues coherently through the Ecodesign Directive are outlined.

3.1 The potential benefits of using the Ecodesign Directive to address resource issues

3.1.1 *Benefits compared to a progressive use of economic instruments*

Most academic literature point to economic instruments as the main instruments in an effective resource use policy:¹¹⁰ putting a price on resources provides the base for an effective resource policy. However, there are two main problems with this preferred approach:

- *Political feasibility*: It is hard – not to say impossible – to enact such economic instruments in the current political and economic context.¹¹¹
- *The need for international coordination*: Many authors argue for international coordination of economic instruments that put a price on resources.¹¹² One reason is that any country – or potentially the EU as a whole – who enacts resource related economic instruments

¹¹⁰ E.g. Bleischwitz and Bringezu 2007:2011.

¹¹¹ The same debate is ongoing in relation to GPP; many economists advocate for economic instruments as a potential alternative to GPP in some cases as they are theoretically most cost-effective in some cases. However, many economic instruments are impossible to adopt, whereas GPP offers a viable way forward. This implies that there is a need to evaluate which instruments that can be implemented in the current political setting, cf. Dalhammar and Leire 2012.

¹¹² E.g. Bleischwitz and Bringezu 2007;2011.

will probably put their industries at a competitive disadvantage, at least in the short and medium term.

Regarding the first issue above, we can be rather certain that it is easier to use legal standards to address these issues than to try and adopt economic instruments. The Ecodesign Directive is in place, and has the potential to address a wider set of environmental aspects than is currently the case. In any case, what we should definitely not do is to “duck the issue” by stating that other instruments are better placed to address resource use without making a realistic analysis of how/if/when such policies can be enacted.

Regarding the second issue, we can be rather certain that no such international coordination will take place, not even on a longer time-scale. Also industry reports – who have usually promoted actions at the international level and the joint use of economic instruments – have started to question the conventional wisdom. As held by WBCSD:¹¹³ *“Even though most global problems may benefit from global rules and agreements, we have learned how difficult it is for multilateral institutions to persuade sovereign states with different capacities, challenges and responsibilities into binding agreements.”*

Some benefits of binding regulatory standards are that:

- they will – unlike taxes and charges – not necessarily put EU manufacturers at competitive disadvantage¹¹⁴ because they apply equally to all products put on the EU market
- unlike taxes and other economic instruments,¹¹⁵ mandatory standards tend to be taken up in other jurisdictions, who want to be sure that their industries can compete on the global market. They have “extra-territorial effects.”

¹¹³ WBCSD 2012.

¹¹⁴ A more nuanced discussion on this is given in later chapters in the report.

¹¹⁵ Many successful economic instruments – e.g. the Swedish CO₂ tax – have not been taken up by that many other countries. In contrast, product regulations are spread to other jurisdictions to a large extent, because of their trade related effects (for a discussion and examples see e.g. Dalhammar 2007a; Blind 2012). Onida (2004) discusses how EU member states’ initiatives in waste (chemical/product policy forces the Commission to consider EU policies to avoid distortions to the Internal market; once EU rules and standards are in place, other economies often adopt similar policies. The fact the EU Internal market is the world’s largest (in terms of purchasing power) means that most global manufacturers will comply with them.

Thus, the use of mandatory ecodesign standards can in fact provide many benefits in comparison with those instruments that are usually proposed as the main elements in a policy mix for resource efficiency. The benefits of legal standards are probably even more relevant if they can be effectively combined with industry standard-setting.

While the EPR directives are most suited to deal with recycling issues, the Ecodesign Directive could obviously fill a role. For instance, it could:

- mandate certain percentages of recycled content in product categories where this is relevant
- address the content of chemicals in products and materials – for instance by banning certain chemicals in certain products and/or requiring BOMs that will provide information on chemicals in products of relevance to recycling
- complement EPR rules through rules on e.g. dismantling times, as proposed by the recent JRC report.¹¹⁶

This does not mean that the Ecodesign Directive should be viewed mainly as an alternative to economic instruments; the different instruments should – ideally – complement each other. But *the Ecodesign Directive can provide one of the few potential ways forward in EU resource policy*. Further, there is little evidence that economic instruments promote more radical technological innovation, though they can be effective in diffusion of new technologies; regulatory standards have a better track record in this respect.¹¹⁷

3.1.2 The importance of Ecodesign as multi-return strategy

A recent report has identified several so-called “multi-return strategies” to boost resource efficiency.¹¹⁸ It is claimed that:

“These so-called “multi-return” strategies address multiple resource categories and several issues related to resource efficiency by identifying the one key driver behind them all. This approach aligns various resource use targets and captures them through one focused policy intervention.”

¹¹⁶ Ardente and Mathieux 2012a.

¹¹⁷ Tillväxtanalys 2012.

¹¹⁸ BIO Intelligence Services *et al.* 2012.

One identified multi-return strategy was “Product re-design for longevity and recycling.” The authors state that:

“This is not really one strategy, but a bundle of strategies, to be developed for groups of products. Tackling this will have several effects: Reducing the use of toxic materials; increasing the use of biodegradable materials; increasing longevity, repair-friendliness and reuse of products; increasing recyclability by design; improving energy efficiency in production and use of products.”

The Ecodesign directive could – in combination with other instruments act as the main tool for such developments. While other EU regulations – not least the WEEE and Waste Framework (WFD) Directives – do claim to promote Ecodesign in various ways, they will not effectively deliver it, for several reasons. The WFD encourages member states to encourage ecodesign, while also warning for measures that constitute trade barriers, but is unlikely to be effective in providing incentives for concrete policy measures.¹¹⁹ The WEEE Directive will not promote ecodesign unless the IPR elements are strengthened,¹²⁰ but will anyway mainly relate to the design for re-use and recycling, not for a broader set of ecodesign practices.

Thus, there seem to be no alternative “main strategy” to promote ecodesign practices on a broader scale in the EU at the moment than the Ecodesign Directive. A more progressive use of GPP and technology procurement¹²¹ is an option, but this would be hard to realize in practice.

3.1.3 Supply chain measures, verification and traceability issues, and life cycle information

Involving supply chains in resource use policy is vital for several reasons, most notably:

- Many reports have stated that there is probably *much inefficiency throughout supply chains*. Even in cases where the product manufacturer has improved the resource efficiency in production and design, there may be inefficiencies throughout supply chains. Poor

¹¹⁹ The general “recommendations” for member states are probably insufficient to provide incentives for stronger policies in most cases.

¹²⁰ Van Rossem 2008.

¹²¹ For a recent review of experiences and how procurement can be combined with other policy instruments see Dalhammar and Leire 2012.

coordination between actors throughout the chain may lead to unnecessary resource waste. Better information and monitoring throughout supply chains may therefore be crucial in order to boost resource efficiency.

- Potential resource use related mandatory requirements – such as recycled metal in products and packaging – *can not be established through product inspections; they require certificates, and verification measures throughout supply chains*. Thus, data, and control mechanisms throughout supply chains will be crucial. The same goes for chemical content: knowledge on chemicals in products is crucial in order to establish if – and for what purposes – materials can be recycled.¹²² There is thus a need to have a better knowledge about material quality and chemicals, which will usually require supply chain related measures.
- Several producers currently try to reduce their vulnerability – in terms of potential resource scarcity – through increasing the number of suppliers.

The Commission's policy documents have stated that supply chain communication is crucial for resource use policy:

“Increasing the flow of information on resource risks and cost-effective efficiency opportunities between commercial partners in supply/value chains that leads to the uptake of new sustainable practices and stimulates breakthroughs in innovation.”¹²³

Also WBCSD has stated that measures stimulating resource efficiency not only in the product design and use, but also through the supply chain is key for future resource efficiency improvements.¹²⁴

However, current policies have so far not been main drivers for this. There are exceptions to this – such as in chemical policy, where the REACH Regulation and the RoHS Directive¹²⁵ have driven requirements in supply chains (however, it appears as if there are many problems with non-compliance and false statements of conformity). In these cases, the producers will act as “regulatory surrogates”, pushing requirements

¹²² Thidell and Tojo 2012.

¹²³ European Commission 2011a.

¹²⁴ WBCSD (2012).

¹²⁵ There are several other Directives that are also relevant here, such as the Toy Safety Directive.

through supply chains.¹²⁶ In essence, it means that the economic power of producers may provide environmental outcomes

However, in general there is a lack of policies to stimulate supply chain measures. A recent report establishes that producers have not stepped up their supply chain efforts in the way expected in recent years despite fears of threat to resource security.¹²⁷ Thus, we will need more policy drivers. The Ecodesign Directive holds the potential to pioneer more supply chain measures. There are even some expectations among stakeholders that the Ecodesign Directive could be “the pioneer instrument” for driving supply chain measures, paving the way for other instruments.¹²⁸

The Directive can also act as a driver for better environmental data. In 2006 the IPP Working Group on Product Information concluded:¹²⁹

“...the potential for making product information work for the environment is a long way from being achieved, in spite of more than a decade of work. The investment of effort on product information could be very cost-effective in delivering improvement for policy implementation and market efficiency. However, under present conditions, the market on its own is unlikely to deliver good product information: the barriers in this field are steep and the drivers are weak. Work is needed to create the right frameworks and to apply the necessary influences.”

This situation has not really changed. Often retailers and consumers are not in a position where they can demand information from the producers, and producers seldom see any business benefits in providing life cycle data. Therefore, a kind of policy intervention would be required to move forward. Research also indicates that mandatory environmental information schemes, for instance on the release of chemicals from manufacturing, is an effective way to stimulate pollution reductions, as several interest groups will put pressure on producers to improve their practices.¹³⁰

When the Ecodesign Directive was enacted, many stakeholders saw the Ecological Profile as a key ingredient and a way to trigger producers to present life cycle data. The (non-)use of the Ecological Profile is therefore a missed opportunity in the IMs set through the Directive.¹³¹

¹²⁶ Gunningham and Sinclair 2002; Dalhammar 2012.

¹²⁷ EEf. (2012). Monitoring supply chains; maximizing resilience. Report.

¹²⁸ As stated by interviewees in Machacek 2012.

¹²⁹ IPP Working Group on Product Information 2006.

¹³⁰ Webb *et al.* 2006.

¹³¹ Machacek 2012.

In the Resource Efficiency Roadmap it is stated:¹³²

“Milestone: By 2020, citizens and public authorities have the right incentives to choose the most resource efficient products and services, through appropriate price signals and clear environmental information. Their purchasing choices will stimulate companies to innovate and to supply more resource efficient goods and services. Minimum environmental performance standards are set to remove the least resource efficient and most polluting products from the market. Consumer demand is high for more sustainable products and services.”

While the chances of correct price signals to internalize externalities are rather slim, the potential is there to use the Directive to provide information to both consumers and professional users, such as public procurers and recycling facilities; these actors could then make use of this information for their specific purposes. There may however be a need to provide this information through other directives addressing specific product groups. The Construction Products Regulation (305/2011/EU) will be used to provide information about construction products, though it is not yet evident exactly what kinds of requirements that will be put upon manufacturers. The Swedish Chemicals Agency has discussed the potential need for specific EU directives addressing also other product groups that contain hazardous substances, such as textiles.¹³³

3.1.4 Strengthen life cycle thinking and ecodesign practices, a more extended producer responsibility (EPR), and individual producer responsibility (IPR)

“Life cycle thinking”¹³⁴ (LCT) is a qualitative concept that is built on a specific way to view environmental problems; research has indeed showed that when people started to work with LCA methodologies, it did change the way they viewed environmental problems.¹³⁵

The Ecodesign Directive is originally rooted in what we may refer to as the “LCA/LCT community” but has since been a key policy also within

¹³² European Commission 2011b.

¹³³ Kemikalieinspektionen 2012.

¹³⁴ While many EU policies directly refer to life cycle thinking (the Waste Framework Directive refers as one reason for deviating from the Waste Management Hierarchy, see Art. 4.2), the concept is not defined anywhere (for a discussion on what the concept means and how it can be applied in law see Dalhammar 2007a; 2012).

¹³⁵ Heiskanen 2000. See also Dalhammar 2007b.

what we may label the “energy/climate community”.¹³⁶ There are reasons to believe that these two communities still do not quite understand each other. The poor track record on IMs related to non-energy use (i.e. the absence of such requirements) are clearly not in line with the original intent of the Directive, and the Commission’s repeated claim that a full life cycle perspective is taken is therefore a bit peculiar.¹³⁷ The “energy/climate community” on the other hand tends to see non-energy related issues as a distraction that may slow down the process and lead to even more conflicts. Some people has proposed that calculating the energy/CO2/money savings associated with recycling can be one way to “bridge” different positions.¹³⁸

If we are serious in promoting life cycle thinking and embed ecodesign practices in industry, there are however few alternatives to using the Ecodesign Directive more progressively, e.g. by pushing new types of requirements on product design and life cycle information.

When it comes to EPR schemes, the current policy focus on resource issues has lead to a renewed interest in strengthening such schemes. While we do not – for reasons outlined in Annex I – believe that the Ecodesign Directive’s standards can *replace* the incentives for design changes that are promoted through the EPR Directives¹³⁹ (especially the WEEE Directive), there are reasons to believe that the EPR Directives and the Ecodesign Directive can be *complementary* in many ways. The JRC¹⁴⁰ has recently outlined potential standards that can be set through Ecodesign Directive that is in line with this view; for example, standards that make it easier to dismantle used products.¹⁴¹

The issue of pursuing IPR¹⁴² better in the EPR Directives – as well as general suggestions to promote more incentives for individual producers to engage in ecodesign – has recently emerged in many policy docu-

¹³⁶ We could argue that the “chemical” community has recently been interested in promoting their agenda through the Ecodesign Directive as well (this has been evident at some meeting in Brussels. See also the report from Kemikalieinspektionen in chapter 2). While these communities are hard to define, their existence and priorities are often acknowledged in policy discussions. At the EU level, some interviewees refer to a lack of understanding between DG TREN and DG ENV, cf. Machacek 2012.

¹³⁷ Van Rossem *et al.* 2010. The CSES study does shed light on this: the COM seems to claim that they take a life cycle perspective during the process, yet choose to focus on certain aspects when setting IMs, see CSES/Oxford Research 2012.

¹³⁸ Machacek 2012.

¹³⁹ Researchers and practitioners have proposed that this is viable way to go, but as shown in Annex I it is a problematic view that is not consistent with EU waste policy and the wordings in the various waste directives.

¹⁴⁰ Ardente and Mathieux 2012a.

¹⁴¹ See chapter 2.

¹⁴² See Annex I for a short introduction to the IPR concept.

ments. While the issue of “IPR in EPR” has not been discussed much in later years, this has now changed. Industry associations,¹⁴³ certain producers,¹⁴⁴ and governments are currently promoting IPR, or proposing that the possibility of strengthening IPR requirements in EPR schemes be reassessed. For instance, the UK government has proposed that “*The Government will investigate the feasibility of applying the principle of Individual Producer Responsibility (IPR) more generally to the Waste Electrical and Electronic Equipment (WEEE) system...*” as part of the UK resource security action plan, and a recent inquiry was recently delivered on this topic.¹⁴⁵

There are signs that producers that would previously look upon EPR rules as a burden (because of incurred cost) now start to view the take-back of resources as “a right”,¹⁴⁶ and IPR would strengthen the tie between producers and “their” resources.

There is considerable potential to set IMs that would strengthen the incentives for ecodesign and product differentiation among producers. Such options may include measures for identification of products (e.g. RFID tagging), measures for reduced recycling time, and measures to ensure recyclability. There are also potential to set requirements – e.g. through stipulating “ecological profile” types of requirements and various kinds of generic requirements on information – to stimulate life cycle thinking more generally, and the uptake of LCA related tools.

3.1.5 The competitive positioning of EU industries

As discussed in chapter 1, more and more actors seem to view stringent energy efficiency standards as a potential source of competitive advantage for EU industries. Especially Germany pushes for more stringent and flexible standard-setting; possibly encouraged by recent research claiming that product regulations may correlate positively with increased competitiveness of domestic firms.¹⁴⁷ The discussion so far however, relates mainly to energy-related standards. We know far less

¹⁴³ E.g. FEAD 2012.

¹⁴⁴ See Annex I.

¹⁴⁵ IPR Working Group 2012.

¹⁴⁶ See Annex I.

¹⁴⁷ Blind 2012; Böhringer *et al.* 2012. The strict energy and climate targets in Germany are probably the main explanation for the lobbying efforts, however.

about standards for resource use more generally. However, Bleischwitz and Bringezu¹⁴⁸ propose that:

“...regions – and in particular resource-poor regions – may benefit from increasing material and resource productivity, at least with regard to their import dependencies and costs to purchase commodities and probably also with regard to innovation.”

They go on to argue that:

“Our results suggest that there is a moderate positive relationship between the material productivity of economies and the score value of the growth competitiveness index ... The higher the level of material productivity the higher the level of competitiveness.”

They however claim that industries often have limited knowledge on total material costs along life cycles, and that the awareness among managers and companies to pursue material efficiency is still relatively low. They draw on conclusions from a study by Rennings and Rammer from 2009,¹⁴⁹ which found that just 3% of German companies have conducted significant undertakings to increase material efficiency, though sales per employee in those companies are approximately 15% higher than in average industries. It is proposed that these findings indicate a gap between current awareness and potential benefits that needs to be tested by more in-depth research.¹⁵⁰

There are some low hanging fruits to pick in terms of improved resource efficiency over the product life cycle (cradle-to-cradle). Potential savings are also associated with addressing embedded energy in materials and components. Furthermore, new business models and offerings are also a potential source of competitive advantage. This is discussed in chapter 3. A DEFRA study finds that IMs related to resources and recycling may be both economically and environmentally beneficial.¹⁵¹

As stated previously, one potential benefit for EU industries when applying mandatory standards rather than taxes is that the rules apply equally to EU and non-EU producers. There are however drawbacks to mandatory standards as well, as will be discussed later in this chapter.

¹⁴⁸ Bleischwitz, R. and Bringezu, 2011.

¹⁴⁹ Rennings and Rammer 2009.

¹⁵⁰ Bleischwitz and Bringezu 2011.

¹⁵¹ Global View Sustainability Services 2011.

3.1.6 Extraterritorial reach of EU standards: using trade-related concerns to spread EU product policies

The extraterritorial reach of policies – i.e. whether policies enacted in one jurisdiction will influence actors in other jurisdictions – is rather high in product policy. Thus, while jurisdictions outside the EU may not be interested in adopting EU policies in general, they often adopt product-related policies similar to those in the EU. Further, all producers that wish to export to the EU¹⁵² need to comply with EU legal requirements. Therefore one potential benefit of setting ecodesign standards related to resources is that it would trigger changes also outside the EU. The EU would set an example not only as a forerunner, but actors outside EU also have an economic interest in adhering to EU standards. This is however a “double-edged sword” as the extra-territorial application of laws can trigger legal and political conflict (see coming sections in this chapter and chapter 7).

3.1.7 Concluding remarks

The bottom line here is that if are to effectively address resource use within the EU – with instruments that provide *genuine incentives for change rather than merely indicators and general recommendations* to stakeholders to work with resource efficiency – through ecodesign there are few instruments that are possible to implement.¹⁵³ The Ecodesign Directive is one of the few alternatives. When looking at the intent when the Directive was first proposed, and the potential for setting cost-efficient regulations connected to standard-setting, it also makes sense to exploit the Directive’s full potential.

Regulations of some form are needed to make progress. Also business organization has started to advocate stronger policy interventions to deal with climate change and resource use in the last couple of years. Without proper policies there is no business case for resource efficiency. As held by WBCSD:¹⁵⁴

¹⁵² The EU Internal market is the world’s largest market in terms of purchasing power.

¹⁵³ The same has been discussed recently in the context of public procurement: other instruments may suit better to deal with certain sustainability challenges, but these instruments are virtually impossible to implement; many actors claim there is little use in analyzing and promoting instruments that will never be implemented; see Dalhammar and Leire 2012.

¹⁵⁴ WBCSD 2012.

“...Since the 80s, the notion spread that less government intervention is better for business and economic growth. Yet the resulting deregulated world, with its weak financial and multilateral governance, has a mixed record of progress. It also accumulates economic distress, social tensions and increased environmental risks. It deals badly with the magnitude, depth and urgency of our systemic challenges. Letting the “invisible hand” of the market sort out winners and losers in a vacuum of externalities, with a blind eye to the growing social inequality and the overuse of discounted natural resources, quashes the business case for the main beneficiaries to give up their power and initiate the changes. It only breeds the pursuit of business-as-usual, and resistance to change, except in the case of a close and direct crisis. In the current financial context, greener technologies and sustainable, inclusive business solutions are at a disadvantage when tested for short term returns. Their business case will not happen at scale and speed unless governments introduce measures to lower their barriers of entry and raise the costs, or remove the license to operate stranded assets and harmful practices. Markets are merely man made. ... Governments and business must pull vigorously in unison to boost sustainable business solutions with smart policy solutions.”

Further, promoting resource efficiency through the Ecodesign Directive can pave the way for other types of policies, as it promotes institutional learning regarding what works and not in resource policy. While there may be good reason to address resource use issues through the Directive it may however be wise to advance stepwise and avoid measures that may have large unforeseen effects.

3.2 Potential drawbacks and barriers of using the Ecodesign Directive to address resource issues and their credibility in the current policy setting

Several main problems must be resolved if the Directive is to be used as a main tool for improved resource efficiency. These issues are often used to lobby against the inclusion of a life cycle orientation in the IMs and addressing resource use. The main argument and problems are outlined below, together with a qualitative analysis of the strengths of the arguments.

3.2.1 *Delaying the process*

On top of the list of concerns is that more focus on non-energy related requirements would stall the process even further. It is difficult enough as it is to set the standards for energy in the use phase, although there are often established methods for measurement etc. Incorporation of more issue could seriously delay the process even more. It will also open

the arena for heated discussions on prioritization of environmental aspects, potential trade-offs between environmental parameters, whether there are relevant indicators that can be used to set standards, and the need for proper – yet cost-effective – measurement methods. These arguments are valid indeed. The inclusion of more proposed IMs for non-energy issues would certainly lead to much controversy and arguments over whether some requirements are desirable, measurable and enforceable. However, there are some reasons why the further inclusion of non-energy related aspects may not be as problematic as imagined, and it may even provide some benefits:

- The serious delays depend partly on the fact that the process is constructed in a way that makes it easy to obstruct it.¹⁵⁵ If changes are introduced as proposed,¹⁵⁶ the process can be speeded up.
- There seem to be a lot of institutional learning going on concerning non-energy aspects.¹⁵⁷ As with the application of new standards in all areas of policymaking, there are issues in the initial phase that can be resolved over time.
- Since the coordination between many EU policies is poor,¹⁵⁸ integration of non-energy aspects provide an opportunity to coordinate various areas of criteria setting and provide better inter-departmental coordination. Currently, the energy labeling and the IMs under the Ecodesign Directive seem rather well coordinated, whereas the coordination of standards set under the EU ecolabeling scheme and the Ecodesign Directive is poor. Thus, there is potential to improve EU environmental policy at the general level. There are also much potential for joint learning between standard setting processes under the Ecodesign Directive and public procurement; both struggle with the issues of how to deal with various life cycle impacts and evidence of compliance.¹⁵⁹ In a similar vein, there are many opportunities for joint learning between the Ecodesign processes and the REACH Regulation and WEEE Directive.

¹⁵⁵ Siderius 2012.

¹⁵⁶ Ibid.

¹⁵⁷ CSES/Oxford Research 2012.

¹⁵⁸ For instance, the relation between IMs and the EU eco-label is very problematic – e.g. because the legal standard is stricter than the ecolabel standard – for several product groups, see CSES/Oxford Research 2012.

¹⁵⁹ See Dalhammar and Leire 2012.

- Staff constraints are a serious issue, and also one explanation for delays. Including non-energy aspects could make the need for more staff even more obvious, thus strengthening the case for more staff in the COM.
- The poor quality of some consultancy studies has been mentioned as one reason for delays.¹⁶⁰ Including resource efficiency may make the task even more demanding, but of course may also provide an opportunity to reconsider the set-up of studies and the choice of consultants.

The “delaying the process” argument is valid, but as seen above there could be benefits to including resource efficiency as well. There are also ways to overcome some of the hurdles, e.g.:

- By setting limits for which non-energy relates aspects to consider during consultancy studies, the task can be made more manageable.
- One option proposed by EEB¹⁶¹ is to set non-energy relates aspects through a joint process where similar product groups with similar characteristics – such as similar material streams – are evaluated in a joint process. This will improve the cost-efficiency of the procedures. The negative side is that this would make it more difficult to address issues specific to a given product group.

Further, while it is easier to define the top performer on the market in terms of energy efficiency than for other aspects, relevant information on other aspects should be accessible in e.g. eco-labeling schemes.

3.2.2 Barriers for innovation

A powerful argument is the “barriers to innovation” argument: by setting standards relate to resources and materials, there is considerable risk of standards that limits innovation and/or increase costs.

Generally, recent research seems to indicate that product and service regulation seems to be positively correlated with domestic industry competitiveness.¹⁶² This is often considered to be a bit surprising as regulation may hinder innovation activities. The main – tentative – explanation given is that such regulations may increase costs in the short

¹⁶⁰ Siderius 2012.

¹⁶¹ EEB 2012; Machacek 2012.

¹⁶² Blind 2012; Böhringer *et al.* 2012.

term but provide direction for productive investments in the longer term. There are also additional explanations, such as:

- Most product regulations are carefully designed not to hinder innovation. For instance, they may forbid undesired materials and chemicals, but not specify what materials that must be used.
- Since product related rules and other standards are often spread to other jurisdictions, a certain “first mover advantage” effect for domestic industries is to be expected.¹⁶³
- For EPR legislation and other recycling schemes, there are dynamic effects: recycled material can cost more under an initial period but once recycling schemes are set up and fully functioning recycled material may be cheaper than virgin material.¹⁶⁴
- The “trade-off” effects where important functional aspects of the product are said to be compromised by environmental rules and standards are often possible to solve through technical solutions.¹⁶⁵

However, the argument that rules may hinder innovation is still valid, and not least so when we set new types of legal requirements where we do not fully know the effects for market players; this could be the case for certain requirements related to resource use. Not least the IT industry is concerned about ecodesign standards as a barrier to innovation.¹⁶⁶ The counter-argument is of course that rules related to resource use may also help to trigger innovations in various ways. Most fundamentally, this debate points to the importance of designing proper standards and proceed carefully and stepwise in the policymaking process.

¹⁶³ Cf Blind 2012. Research in the field of industry-driven standardization also point to first mover advantages, see DIN German Institute for Standardization 2000. A notable trend in later years is that several Asian governments have become more active in standardization policy; one main reason for this is to ensure that the interests of domestic industries are actively promoted, see Tillväxtanalys 2012b.

¹⁶⁴ E.g. Ministry of Environment 2009.

¹⁶⁵ Cf. Dalhammar 2007b.

¹⁶⁶ Macharek 2012.

3.2.3 Trade barriers, preference for international standards and schemes, and the extra-territorial application of EU rules

The WTO-administered agreements have had an important impact of the text of the Ecodesign Directive. When the Directive was proposed the potential “life cycle reach” of the directive was considered quite far-reaching, but after legal review several changes were made to the Directive text, which limits the scope for IMs.¹⁶⁷ Not least the “PPMs issue” (discussed in chapter 7) has influenced the Directive text. In essence, the PPMs issue concerns the right to regulate any processing and production methods (PPMs) applied in the product life cycle, unless these are influenced indirectly through product design. The shared idea among most policymakers is that EU can – or should – only regulate the product design;¹⁶⁸ even if legally possible, regulating PPMs is considered problematic by many researchers for other reasons.¹⁶⁹

Discussion on trade barriers will probably come to the fore if resource use issues are regulated under the Ecodesign Directive. The main contentious issues include:

- Certain types of requirements may act as trade barriers; not least rules (e.g. requirements on recycled content) that require certification and similar documentation throughout supply chains.
- Information related requirements may be considered substantial trade barriers, and there is also a question of the legality of information requirements related to PPMs.
- In connection to the above, it is often claimed that EU corporations will have benefits as they often influence various rules and standards used to prove conformance.¹⁷⁰
- The extra-territorial reach of EU policies is a sensitive thing, legally and politically. The discussion regarding inclusion of aviation in the EU-ETS scheme has showed just how sensitive these things are.¹⁷¹ In principle, these types of rules do not “force” any EU rules onto manufacturers other countries, but since compliance with EU rules

¹⁶⁷ This is analyzed in more detail Dalhammar 2007b. See also chapter 4.

¹⁶⁸ Egelund Olsen *et al.* 2006.

¹⁶⁹ Bhagwati and Mavroidis 2007.

¹⁷⁰ Cf. Egan 2002.

¹⁷¹ See e.g. ENDS Europe 2012a.

are required in order to have access to EU markets, it is a “de facto” imposition of external rules.

- Developing countries tend to resist life cycle related standards for several reasons; including 1) the fact that they reflect EU sustainability priorities and 2) that their industries – on average – are more polluting than EU firms.¹⁷² This applies to mandatory, voluntary and semi-voluntary standards alike.¹⁷³
- Questions concerning IMs relation to other international conventions.

Apart from the above, there are some question marks regarding to what extent the text of the Ecodesign Directive allows the setting of requirements related to resource use, as will be discussed later in this report.

As discussed previously, trade may also be a powerful force for the spreading of mandatory and voluntary product standards; EU rules on products are frequently applied by other states.

3.2.4 *Clashes between policy objectives*

The potential clash between different environmental aspects is a concern. It is likely that there are some inherent conflicts between different environmental objectives. Sometimes conflicts are possible to solve technically (short term or long term), which reiterates the importance of involving experts in the policy process.

There are some examples of such clashes mentioned in the policy debate:

- *Durability and upgradeability* can be problematic: if new products are more energy and resource efficient, the importance of prolonging the life time is questionable for some product groups. This depends on both product group and user patterns. Recent research have however worked with methods to establish whether replacement of older products are beneficial or not,¹⁷⁴ and this is a crucial area for further research. The research indicates that extending the life time makes environmental sense for some product groups, but not for others,

¹⁷² de Haes 2004; Dalhammar and van Rossem 2010.

¹⁷³ Semi-voluntary standards are standards that are in principle voluntary, but in practice corporations must use them; e.g. because it is a requirement in order to do business, or because their use is associated with large cost savings. Cf. Dalhammar and van Rossem 2010.

¹⁷⁴ Tasaki *et al.* forthcoming.

depending on several factors. However, there are several question marks. For instance, it appears as if many new products are less durable than older ones, and often requires the changing of large modules when repaired.¹⁷⁵ This is probably not included in many calculations. A study of laptops showed that it does not make any environmental sense to replace it with a new one. Rather, we should try to take measures to prolong its lifetime.¹⁷⁶ This should be the case for some product groups. However, if we look into the future products will become more energy efficient, and therefore the importance of other environmental aspects will increase for many product groups, and it will probably be desirable to extend the product lifetime in many cases.

- *Banning certain chemicals in products may impede the functions* in certain respects. This should however be possible to establish through studies, and there is also the possibility to grant exemptions (the RoHS Directive provides an example of how this can work in practice; a problem is however that it has often taken a long time before manufacturers are informed whether exemption is granted).
- Recycling can be problematic, which has implications for some potential requirements such as requirements on recycled content: in some cases, it is doubtful if improved recycling is environmentally beneficial to e.g. incineration. Generally, it appears as if metal recycling is usually beneficial, whereas the benefits of recycling of other materials are often contextual (depending e.g. on transport distances).¹⁷⁷ However, as it is hard to establish long term costs and benefits of recycling schemes and associated markets for recycled materials, a long term and dynamic perspective is crucial when using evaluation tools like LCA and cost-benefit analysis (CBA).

However, these – real and potential – conflicts are not specific to the Ecodesign Directive: they can be found both within various legal directives¹⁷⁸ and between various directives. We should however be cautious

¹⁷⁵ This is discussed in some trade journals, see e.g. Stådje 2010, who claims that the claimed energy savings will not be realized if new technology is fragile and breaks down easily. We have however not found any relevant research on this topic.

¹⁷⁶ Öko-Institut e.V./ Fraunhofer IZM 2012.

¹⁷⁷ The debate over when “life cycle thinking” can be a reason to deviate from the waste management hierarchy shows the complexity of the issues, see Dalhammar 2012.

¹⁷⁸ Dalhammar and Leire 2012.

in believing that potential trade-offs are always possible to measure and therefore possible to regulate in an “optimal” way.

3.2.5 Competitiveness

Product standards, mandatory or voluntary, related to resource use may affect the competitive position of EU industries positively or negatively. Some potentially positive relationships are:¹⁷⁹

- Generally, resource related standards may enhance resource security and reasonable material costs for EU industries, e.g. through:
 - improving supplies of recycled materials, through standards related to recycling and chemicals in products, etc.
 - contribute to new markets for recycled material, urban mining and similar
 - stimulate the development of new, less resource-intensive business models.
- Innovation effects: innovation may be stimulated as companies devote more resources to ecodesign and resource efficiency; this seems to be positively correlated to competitiveness in general.¹⁸⁰
- Supply chain innovations: certain requirements may enhance resource use efficiency in supply chains and, also provide manufacturers with more information about resource use throughout supply chains, which may lead to better business decisions.
- It is likely that EU standards will in many cases be followed by countries outside the EU; this could lead to potential “first mover advantages” for EU firms.
- Legal and voluntary standards may – in combination with other instruments – also lead to new business models and ways to deliver services in a more resource-efficiency way.

¹⁷⁹ Most of the issues raised here are informed by interviews and discussions with different stakeholders.

¹⁸⁰ Rennings and Rammer 2009; Blind 2012.

On the negative side, there are some very serious concerns:¹⁸¹

- Industries may move outside EU to avoid certain rules and inspections.
- SMEs may have a difficult time obtaining the data required, compared to larger firms.
- Some types of requirements, such as declarations on recycled contents, will require supply chain issues and declarations from suppliers. Firms outside EU may provide false certificates; it will be difficult to inspect them as they are outside the jurisdiction of EU countries. This puts EU firms at a potential disadvantage.

3.2.6 Chemicals in products

Unknown chemicals in products are seen as barriers to recycling mandates and requirements on recycled content.¹⁸² This has been the subject of some policy debate recently. However, it appears as if the discussion needs to be nuanced: it seems as if the original source of the material (i.e. the product/packaging being recycled) is crucial as these are regulated in different ways which affect the content and purity of materials, and the same goes for the re-use/recycling/recovery options (various options on final use of materials require various levels of purity etc.).

The main implications are that:

- identification of chemicals that can be a barrier to recycling should preferably be assessed in all consultancy studies
- IMs should, when possible, address such chemicals through banning or setting limits for their content, or at least promote this through other benchmarks applied through other instruments (see next chapter). One option is to mandate information about the content through IMs: this information can be used e.g. in public purchasing schemes to reward front-runners, or by recyclers in some cases.

In essence, this means that in some cases we may need policies to obtain knowledge about – and control – chemicals in the materials before e.g. recycled content requirements can be set, or alternatively to set rules for

¹⁸¹ The issues raised here are informed by interviews and discussions with different stakeholders.

¹⁸² Ardente and Mathieux 2012.

the use of certain materials. We should however be careful and not grant this as a general exemption to setting recyclability requirements.

Denmark's recent decision to "challenge"¹⁸³ harmonized EU rules is interesting for several reasons. In the context of the Ecodesign Directive, a relevant discussion is whether the Ecodesign Directive could – as other directives such as the Toy safety Directive already do – complement horizontal rules (most notably REACH) through setting rules on chemicals that are product group specific. An associated question is whether the consultancy studies should look more into chemicals and toxicity and whether there is a need to develop the methodology in this respect.

3.3 Concluding remarks

As is obvious, substantial introduction of resource related requirements in IMs has many potential benefits, but also disadvantages. Of special importance is the problem of further delaying the policy process, the potential risks to innovation processes, and the risks for competitive disadvantages to EU industries. It is however important to note that:

- similar concerns have been voiced when most comparable regulatory reforms were launched, including the various EPR Directives, the REACH Regulation and the RoHS Directive. The warnings – predicting large trade concerns, barriers to innovation etc. – were manifold when these instruments were introduced. While the implementation of these policies have not always been smooth, and compliance is far from perfect, few actors now seem to suggest we should scrap them, and the environmental benefits are obvious. The compliance with e.g. RoHS and REACH are expected to improve as systems for supply chain data, and compliance mechanisms, improve
- as pointed out by CSES evaluation, addressing resources is a "chicken-and-egg" situation; we can hardly expect perfect indicator systems and means of compliance until we have started to set requirements in the policy process.¹⁸⁴ For instance, few companies will devote resources to set up supply chain initiatives – which are

¹⁸³ ENDS Europe 2012b.

¹⁸⁴ CSES/Oxford research 2012.

- costly – until there are clear rules in place, or at least a clear message that rules will come in the near future
- there are – generally speaking – few feasible alternative options to the Ecodesign Directive to (effectively) address resource use at the EU level.

Therefore, with clever policy design, and a stepwise process with institutional learning among actors, none of the barriers seems insurmountable. However, while there may be good reason to address resource use issues through the Directive it may however be wise to advance stepwise and avoid measures that may have large unforeseen effects.

The JRC studies provide examples of how implementing measures and verification can be designed. It is likely requirements for recycled content are potential IMs that are most tricky to implement, because it must usually rely on systems of self-declarations; product inspections can not reveal the percentages of recycled content in most cases. Further, such requirements will no doubt be politically controversial. However, the concerns related to the use of self-declarations – and their trustworthiness – in the context of the Ecodesign Directive has many similarities with current issues related to REACH/RoHS. Also in public procurement, supplier declarations are a cause of concern, as the potential to challenge supplier declarations are very limited.¹⁸⁵

¹⁸⁵ Dalhammar and Leire 2012.

4. What role for the Directive in a policy mix for resource efficiency?

This chapter discusses the policy mix and various approaches to the coordination of policy instruments to achieve desired policy outcomes. We first discuss these issues on a general level. We then review the evidence regarding interactions between the Ecodesign Directive and other policy instruments, some emerging issues, and the potential for “new” types of interactions. We then go on to discuss the complexities of the “extended product” approach, and the “system” approach; shall we try and regulate mainly the product in a narrow sense, or take into account how the product functions within a larger system of products, functions and systems? In relation to this, some comments on multifunctional products are also provided. Finally we discuss the link between legal standard-setting and industry-driven standardization.

4.1 Introduction: approaches to instrument coordination in product policy at a conceptual level

Most energy-related policy instruments are part of a policy mix. These may include a whole set of policies in a so-called “energy transformation program,” or a more limited set of policies. For instance, the Japanese Top Runner approach is complemented by related policy instruments, including information to consumers, the use of Top Runner legal standards in GPP, award schemes, and a tax reduction scheme for cars.¹⁸⁶ Some of these instruments are mandatory, e.g. in the sense that information must be provided by manufacturers, while others are voluntary in terms of participation (including the labelling scheme and the award scheme for retailers). The Green Procurement Law in Japan was im-

¹⁸⁶ Siderius and Nakagami (forthcoming).

portant as it promoted earlier application of environmental technologies, because the law came into force before the target years set for the Top Runner programme.¹⁸⁷

Often, ideas on policy mixes provide a rather “narrow” perspective, where not all types of potential interactions are discussed. For instance, there may be an analysis of how various EU directives interact at the technical level, which provides only on aspect of the integration. In order to solve the puzzle of satisfying the needs of an ever-growing world population within ecologically literate boundaries, we will need to be cleverer in designing intelligent policy mixes in the future, and widen our vision of interactions.

Below, some main ideas on how product policy instruments may interact at the conceptual level are proposed.

4.1.1 Coordination for innovation among all producers

The “ideal” way of looking at the interaction of standards set in various policies are to view them as having slightly different functions in relation to e.g. more and less progressive manufacturers, cf. table.

Figure 2. Policy instruments and environmental performance of product groups over time (source: Dalhammar 2007b)

¹⁸⁷ Tojo 2005.

The figure depicts the “ideal” situation for a given product group. The figure at the top represents the product group at the initial policy stage. Legally binding product standards (for instance concerning chemical content, recyclability and energy efficiency) are used to cut off the worst performers from the market, whereas eco-labeling, procurement and other policies are used to stimulate the design, marketing and diffusion of products with superior environmental performance. Over time, the interactions of the different instruments will improve the environmental performance of the products group, and allow for the setting of stricter mandatory standards on product performance (represented by the figure at the bottom).

The different instruments tend to interact over time, in different ways, for instance:¹⁸⁸

- Voluntary initiatives and economic instruments will often lead to legislation at a later stage, as progressive companies may lobby for this in order to avoid other enterprises being free-riders.¹⁸⁹
- Non-regulatory initiatives might also cause or have the potential to cause trade distortions, thereby triggering a need for regulations to promote a more level playing field.
- Voluntary initiatives will prove that certain measures are possible at reasonable costs, and thereby combating industry arguments that regulations will be too burdensome. Thus, they can pave the way for legal standards.
- Voluntary systems may provide benchmarks for legislation. For instance, criteria in eco-labeling schemes may over time be incorporated in laws and become the legal standard.

The main role of the mandatory standards is to eliminate the least energy efficient products and to push eco-innovation among the laggards, whereas other instruments may stimulate eco-innovation among front-runners. An “optimal” way to strengthen policy is to coordinate the stringency of requirements among policy instruments, and to regularly update criteria in both ends in order to push developments and provide continuous incentives for eco-innovation.

¹⁸⁸ Dalhammar 2007b.

¹⁸⁹ Free riders in this context are companies that benefit from a voluntary industrial scheme (because binding rules are avoided, and the image of the sector is improved) but do not share the costs that participants in the scheme pay.

The intended interaction of product policy instruments outlined above is considered quite often in the field of national/EU energy efficiency policy, especially in the context of market transformation programs and technology procurement. It is more seldom that strategies in other areas – such as chemicals policy – are well coordinated.

4.1.2 *Horizontal and vertical instruments*

Another way to look at the interaction is to look at policies that are directed towards single product groups as a complement to horizontal rules. REACH is the main EU instrument to address chemicals. It will influence chemicals in products both indirectly, as it regulates chemicals throughout supply chains and through the specific information requirements related to products in other articles (see Articles 7 and 33 in REACH). However, REACH's rules on chemicals in products are deficient, and the rules on provision of information on request (Art. 33) (which are also rather weak) do not properly include some actors such as recyclers. Rules for specific product groups could be used to address (to some extent at least) such shortcomings. As changes to REACH are very cumbersome process, product-specific rules set through specific directives or the Ecodesign Directive can also be more flexible to implement.

4.1.3 *Coordination for addressing life cycle aspects in various life cycle phases*

Some environmental and social aspects are difficult to address through legal requirements. These may typically include PPMs (see chapter 6) in product chains (child labour, labour rights, emissions during manufacturing, cutting of rainforests etc.). Other instruments may constitute a better way forward. For instance, eco-labeling criteria often include PPMs. GPP is often viewed as an instrument that may be used to address issues that are difficult to address through mandatory standards.¹⁹⁰

¹⁹⁰ Bauer *et al.* 2009; Dalhammar and Leire 2012.

4.1.4 Promoting new business models

New business models – based on delivering efficiency, e.g. in the case of ESCOs and CMSs, or supplying functions rather than ownership, e.g. in the case of carpooling – are considered key to deliver growth in a world with a growing population.¹⁹¹ Many new approaches and ideas are found in the IT sector. These business models tend to be hard to enforce through legal standards, and procurement may be a better option to stimulate such models.¹⁹²

4.1.5 Coordination for radical innovation

Another type of interaction concerns radical innovation. Most traditional policy instruments can not stimulate radical innovation. For instance:

- Legal standards can only address specified, identifiable entities. This means that they can address established product groups but are often ill suited to address product groups where the speed of innovation is quick. It is also difficult to set rules for environmental impacts of services. Further, it is difficult – for legal and political reasons – to mandate the use of functional solutions, such as the use of “thin clients” instead of PCs, even if such solutions exist and are preferable from the environmental viewpoint.
- Eco-labels are also bound by the need to establish certain criteria for defining the product group which means that more radical solutions may not be eligible for labeling, even if better from a sustainability viewpoint. Another problem may be that the criteria set (e.g. on biodegradability, recycling etc.) may exclude new, better solutions.

This means that procurement policies, R&D support, and competitions and awards may be crucial complements to the traditional policies, in order to support radical solutions.

¹⁹¹ Ellen MacArthur Foundation 2013; WBCSD 2012.

¹⁹² See the discussion in Dalhammar and Leire 2012.

4.1.6 Push and pull instruments to promote eco-innovation

Instruments should also be combined to promote both a regulatory push and market pull function (cf. figure). Further, general drivers should be combined with more targeted approaches to support new technical solutions and niche markets.

Figure 3. Policy instruments for eco-innovation (source: Machiba 2011)

4.1.7 Various instruments covering different environmental aspects of a given product group

The perhaps most common way to look at various environmental product policies is to see them as complementary: they cover certain environmental aspects of a given product group. For instance, the Ecodesign, RoHS and WEEE directives in many cases regulate the same product groups, but address different environmental aspects in the life cycles of EEE. However, while this approach is rather straightforward, there is still confusion in practice. van Rossem *et al.* (2010) have discussed how the interaction between the EU DG's/staff handling the WEEE, RoHS and Ecodesign directives is often poor, which leads to confusion and often

varying ideas on what the Directives should actually achieve.¹⁹³ Most notably, there are different ideas on what the main purpose of the Ecodesign Directive is.

4.1.8 Concluding remarks

In product policy, the interactions between various instruments along various dimensions – as outlined above – should be considered properly. In practice, the coordination of various mandatory and voluntary standards tends to be sub-optimal at both the EU and domestic levels.¹⁹⁴ This reflects the nature of policymaking: actors have to fight hard and long to implement policies at all, and the coordination and interaction between various public bodies are poor.

4.2 Interactions between the Ecodesign Directive and other product policy instruments

4.2.1 Current state of play

According to recent general evaluations and conducted case studies,¹⁹⁵ the following main conclusions can be drawn regarding the interplay between the Ecodesign Directive and other laws and policy instruments:

- *Energy labeling*: At the EU level it appears as if the Ecodesign Directive and the energy label is well coordinated, though not without problems. One cited example in interviews concerns the use of logarithmic scales when setting requirements, to dis-encourage the use of large appliances; different approaches have been applied in energy labeling and the IMs under the Ecodesign Directive in some cases (i.e. there are differences in practices, depending on the product group in question; the interaction between IMs and energy labeling works better for some product groups than for others). Thus, there is potential for even better coordination.

¹⁹³ van Rossem *et al.* 2010.

¹⁹⁴ Dalhammar 2007b.

¹⁹⁵ See e.g. CSES/Oxford Research 2012; Andersen and Remmen 2012; Bundgaard *et al.* 2013; Global view sustainability services *et al.* 2011.

- *Eco-labeling*: The (lack of) coordination between the Ecodesign Directive and the EU eco-label is problematic and needs to be improved. There is also an obvious need to update some eco-labeling criteria in both EU and regional/national/regional schemes for many products. Thus, there is often a concern that the coordination when it comes to setting energy efficiency standards is lacking, and there is a need to coordinate labeling and Ecodesign studies at the EU level. For most product groups, the eco-labeling schemes however cover many environmental aspects whereas the Ecodesign Directive usually only regulate energy efficiency in the use phase (and sometimes water efficiency, and only occasionally other aspects). This means there will be no interplay at all for issues not related to energy in the use phase. Further, both the Ecodesign Directive and eco-labeling schemes have the potential to develop new types of criteria related to e.g. durability and recycled content.
- *The WEEE and RoHS Directives*: There have always been concerns regarding the interplay, and risks of “double regulation”, in relation between the three “EEE” directives. The major conclusion seems to be that no major “issues” are involved – i.e. no major problems or overlaps. However, “the passing the buck” strategy has been identified as an issue in the preparatory studies: consultants refer to the WEEE/REACH/RoHS as the relevant instruments to address certain environmental aspects, rather than examining if relevant requirements can be set under the Ecodesign Directive.¹⁹⁶
- *Public procurement*: There seems to be a very poor interplay between the Ecodesign Directive processes and GPP. For instance, one idea has been that benchmarks identified in preparatory studies could be used in GPP, but there seem to be very few examples of this actually taking place.

4.2.2 Emerging issues

A number of issues have recently emerged, regarding the interplay between the Ecodesign Directive and other instruments. With the widening of the scope of the Ecodesign Directive and the development in other areas of EU environmental law, there are many potential instruments that can interact, and most likely more and more issues will come up in the future.

¹⁹⁶ Van Rossem *et al.* 2010.

Figure 4. Examples of instruments interacting in product policy

Some emerging issues include:

- *The Ecodesign Directive and REACH*: Recyclers are not included as stakeholders that have a right to information about chemicals in articles in REACH Art. 33. As both the WEEE and REACH rules are sometimes considered inadequate in providing the information on toxic components to manufacturers needed for improved recycling, there is potential for setting IMs under the Ecodesign Directive as a complementary action.
- *The Ecodesign Directive and waste policies*: There are many potential synergies between the Ecodesign Directive and the Waste Framework Directive (WFD), and other waste related rules. Most notably, the standards for when waste are no longer considered to be waste¹⁹⁷ may be important for development of rules also under the Ecodesign Directive, if we are to set standards for recyclability and recycled content. Another concern has emerged in relation to the set-up of so-called Eco parks around Europe; these are parks that stimulate the re-use of various products and thus help to reduce

¹⁹⁷ See articles 6 and 39 in the WFD. Standards are developed for certain metals; see http://ec.europa.eu/environment/waste/framework/end_of_waste.htm [2013-06-29]. There are plans to develop standards for other materials as well but it is a complex issue. Whether there are any potential clashes between rules set at the product level and rules developed for materials streams remain to be seen.

waste streams.¹⁹⁸ While more and more municipalities are interested in such parks, a main concern is that products made today are often of poor quality and not as long-lasting as older products.¹⁹⁹ This means that we need to design more durable products if such initiatives are to be successful in the future; economic instruments, new business models and ecodesign regulations can aid this process.

- *The Ecodesign, EPBD, and Energy Efficiency Directives*: The different directives should interact well, but there is little knowledge on how this coordination can be optimal. The metrics for estimations are different (expressions on energy efficiency of products during use, maximum kWh/square meter in buildings etc.), and there is limited knowledge on how the laws may function together and guide the various stakeholders towards better solutions (e.g. how the end user may choose appliances that suit the building, considerations on ventilation etc.). The existence of products whose use will sometimes require additional ventilation (see later in this chapter) will further complicate the situation.
- *The Ecodesign Directive and building products*: Building products are regulated in several laws, most notably the CPR (previously CPD), but also addressed through several voluntary schemes. Not least the declaration of chemical content has been the subject of several schemes (such as BASTA²⁰⁰). A key question concerns the interaction of instruments if various building technologies are regulated through the Ecodesign Directive. This complexity is reduced if the Ecodesign measures mainly regulate energy efficiency related issues. However, the WFD mandates better collection and treatment of construction waste, which means that regulating the design of various construction products makes sense when relevant, in order to improve collection, separation and recovery and recycling practices.²⁰¹

¹⁹⁸ See for instance [http://www.bruxellesenvironnement.be/uploadedFiles/Contenu_du_site/Professionnels/Formations_et_s%C3%A9minaires/Conf%C3%A9rence_Pre-waste_2011_\(actes\)/p2-posters-good-practices.pdf](http://www.bruxellesenvironnement.be/uploadedFiles/Contenu_du_site/Professionnels/Formations_et_s%C3%A9minaires/Conf%C3%A9rence_Pre-waste_2011_(actes)/p2-posters-good-practices.pdf) [2013-06-29].

¹⁹⁹ Some representatives for Swedish municipalities have expressed concerns that investing in such parks makes no long term sense if future products are of poor quality, see Svensson *et al.* 2013.

²⁰⁰ See <http://www.bastaonline.se/english/bastaonline/aboutbasta.4.386979f513a1a34373978f.html> [2013-06-29].

²⁰¹ Art. 11.2 stipulates that “Member States shall take the necessary measures designed to achieve that by 2020 a minimum of 70% (by weight) of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the List of Wastes shall be prepared for re-use, recycled or undergo other material recovery (including backfilling operations using waste to substitute other materials).”

- *Ecodesign requirements and pilot recycling projects:* As will be discussed in the chapter 10 on electric motors, there are several ongoing test projects that try to establish if certain new types of materials (such as REEs) can be recycled in a cost-efficient manner. In some cases, it may be relevant to set mandatory ecodesign standards now to enable cost-effective recycling when the products come to the e-o-l stage in the future (see chapter 10 outlining the electric motor case).

4.2.3 *Potential for development*

A major question is if we could develop our ideas on synergies further, and include more instruments in the mix. Some potential issues to consider are:

- *The Ecodesign Directive, green public procurement and technology procurement:* GPP and subsidy schemes mainly take place at the national level. Public procurement for innovation (PPI) schemes – including technology procurement – have been used successfully in the past in countries like the US and Sweden. Such initiatives have received increasing interest lately due to the renewed interest in demand-driven innovation among OECD countries.²⁰² These types of policies are interesting as they can stimulate more radical improvements of new technologies. Only a few European countries have well developed programs for PPI, however. A more strategic use of such programs at the EU level could potentially provide a competitive advantage for EU industries over time.²⁰³ They can also aid in the development of new solutions, not least for environmental and design issues that are difficult to address through legislation. There is probably a large opportunity to strengthen the coordination between preparatory studies and the identification of benchmarks on one hand, and the development of GPP criteria for certain product groups. The issue is however complex as the COM is considering the development of EU-wide GPP criteria in the future (as opposed to the current situation where most criteria are developed at the national level). Potential synergies include:

²⁰² Technopolis 2011; OECD 2011; Kahlenborn *et al.* 2011.

²⁰³ Eliasson 2010.

- Best practices identified in preparatory studies that can not be legally required may be pushed through procurement.
- If preparatory studies identify a large potential for technological improvement in a given product group, technology procurement could be an option to realize the potential.
- If cases when the Ecodesign Directive can mainly regulate products, or extended products (see the discussion later in this chapter), procurement can be applied to promote new system solutions.
- *The Ecodesign Directive and recycling and take-back:* JRC have provided interesting ideas on how the Ecodesign Directive can complement the horizontal rules in the WEEE Directive, through IMs related to maximum recycling times, information that better enables recycling through information on certain components or the content of REEs, and rules on toxicity that can aid recycling practices. There are probably additional potential for creative rule-setting. For instance, IMs related to warranties or life span can stimulate design for longevity and aid take-back through provision of new B2B relationships. In the future, tagging of certain products can be an option, though it is probably too costly to set up such schemes today for most product groups.
- *The Ecodesign Directive, the RoHS Directive and the REACH Regulation:* REACH has rules that relate to chemicals in products and the right to information for some substances (for some actors), but the rules are considered insufficient, and poorly enforced. The RoHS Directive regulates a number of substances for a selected number of product groups; the Ecodesign Directive scope covers additional product groups. The Ecodesign Directive could complement the REACH/RoHS rules through setting additional rules for chemicals for certain product groups, when this would be required to stimulate recycling and contribute to cleaner materials streams. If this is to be done in a more systematic way it would probably require that methodologies are developed within the MEErP, or through special methods, provisions or instructions for consultants.
- *Ecodesign requirements, eco-labeling criteria and GPP:* Generally, there is much potential to improve the interaction of these instruments, in several ways. This is especially the case at the EU level. Among some EU member states there are ongoing initiatives to improve the coordination between eco-labeling and GPP.
- *Embedded energy:* Long term, there is potential for the Ecodesign Directive and energy labeling to work with embedded energy and

energy saved (and CO₂ savings as well) due to increased recycling of materials. Most likely, there is a need for both better data and well developed calculation methods to proceed in this area. The Ecodesign Directive can help pave the way for such developments.

4.2.4 Concluding remarks

At the EU level it appears as if the Ecodesign Directive and the energy label is well coordinated. The (lack of) coordination between the Ecodesign Directive and the eco-label on the other hand is problematic and needs to be improved. GPP and subsidy schemes mainly take place at the national level. Public procurement for innovation (PPI) schemes – including technology procurement – has received increasing interest lately due to the renewed interest in demand-driven innovation.²⁰⁴ These types of policies are interesting as they can stimulate more radical improvements of new technologies.

A main issue concerns to what extent the Ecodesign Directive should set more radical requirements and be a stronger driver for innovation than is currently the case. This role could also be taken by other instruments if we design clever instrument interactions for stimulating innovations.

4.3 The “extended product” approach, system orientation, and multifunctional products

An open issue is how to deal with products that are part of systems. The MEErP report²⁰⁵ discusses the “extended product” approach, whereas there is discussion on a wider “system approach” in relation to the application of the Ecodesign Directive to some product groups, such as pumps and circulators. With the future regulation of various components in buildings, there will be an even greater need to deal with such matters. Some of the main concerns are:

- *How do we define the regulated entity in terms of components, product, function and system?* A system approach may be necessary since the performance of a given product depends on how it functions together

²⁰⁴ Technopolis 2011; OECD 2011; Kahlenborn *et al.* 2011.

²⁰⁵ Kemna *et al.* 2011.

with the system and maintenance and user behavior influences the performance. But a system approach requires different scoping methods and methodologies, and may encounter barriers related to legal design (it is easier to regulate a well defined unit, such as a single product).

- *How do we deal with a situation where two very different types of products affect each other's performance* (e.g. washing machines and detergents) but where legal standards are set at different forums without much coordination? For some product groups the capacity to improve the technology is limited, unless changes take part in other product groups.
- *The use of some products will mean that other products are required*, which will lead to more environmental impacts. For instance, the use of gas ovens often require more ventilation and thus more energy; this should be considered when requirements are set, and imply that some products should perhaps be “penalized” in some way. This has been suggested for gas ovens, but some stakeholders argue that such regulations are problematic as not every home with gas hobs also has ventilation, and nor do only homes with gas hobs have ventilation.²⁰⁶
- Regarding appliances in buildings, there are many different issues that needs to be dealt with, for instance:
 - “Built-in” intelligence in appliances and how these function together with the building.
 - The need to have appliances designed to suit the needs of passive houses and other types of energy efficient buildings (current appliances may not fit well).
 - Different directives use different metrics, which could be problematic. For instance, the EPBD Directive has energy requirements related to square meters, which is different from the metrics applied in the Ecodesign Directive: this do not provide good guidance for choosing the right appliance for the building. Further, both these Directives should function together with the Energy Efficiency Directive.²⁰⁷
- An issue that could be interesting in the future concerns how one regulatory intervention may affect the baseline of another one. For

²⁰⁶ For more details see DEFRA 2012.

²⁰⁷ Regarding standards for the sustainability of buildings (developed by CEN/TC 350) this problems is addressed by looking at the whole building system, see http://www.cen.eu/cen/Sectors/Sectors/Construction/EPB/Pages/CEN_TC350.aspx [2013-09-17].

instance, if appliances like electric motors, TVs, refrigerators, and boilers are regulated, this should affect the baseline (and BAU scenarios) applied in White Certificate schemes.

In the MEerP report,²⁰⁸ various elements of a “product system” and the technical and economic opportunities of moving from products to systems are outlined. It is claimed that while taking a “system perspective” is beneficial it may not always be legally possible under the Directive. In any case, the “extended product” approach is recommended.²⁰⁹

According to our discussions with people in national industry associations, there are differing views among the member industries regarding the benefits and drawbacks of a “system orientation”, and for this reason many industry associations abstain from making concrete recommendations on whether and how to implement a systems approach. Further, producers of “plug-in appliances” seem to have fewer concerns with legal requirements as these products are often well defined.²¹⁰ It further seems that the “systems approach” is controversial for some product groups, but less so for others.²¹¹

System approaches may provide certain benefits to producers. More and more money tend to be made on the services related to products (maintenance, repair, new business models etc.), and most manufacturing firms have increased the business offerings related to services in the last decades.²¹² In fact, the transition to a mindset of “servicization” may constitute a huge challenge for many traditional manufacturing firms.²¹³ A system approach can help to bring about new business models and new revenue streams. However, it can also constitute a challenge for some firms. Industry seems somewhat split on the issue of “regulating systems”/“adopting a systems perspective in regulation.” Whereas some industries prefer a more system-oriented approach, others see this as risky and prefer the “single product” approach.²¹⁴

A related discussion relates to *multi-functional products*. Multi-functional products – which usually offer one main function but adds

²⁰⁸ Kemna *et al.* 2011.

²⁰⁹ Cf. the IMs for electric motors where the variable speed drive was considered in the setting of requirements. Grundfos lobbied for the extended product approach in this case, cf. Grundfos 2008.

²¹⁰ See Teknikföretagen 2011.

²¹¹ CSES/Oxford Research 2012.

²¹² NUTEK 2008.

²¹³ Dalhammar, Långström *et al.* 2011.

²¹⁴ Teknikföretagen 2011.

one or several extra functions – can be a strategy for dematerialization (e.g. if the camera in the cell phone means that people do not buy cameras; if it is easy for a student to use a laptop as a TV, he/she may not buy a TV; an integrated TV/DVD may be beneficial cf. to the use of two products). However, in practice the opposite may be true if multi-functionality compromises e.g. the energy efficiency of the product without providing dematerialization benefits (people still buy many different products, e.g. both a cell phone and a camera). Multi-functional products also pose challenges to product requirements set through eco-labeling and legislation, as the functional unit to apply is not evident. Research on Japanese practices has revealed that the issue of multi-functionality is addressed differently in different mandatory and voluntary standard-setting schemes (Top Runner, eco-labeling etc.).²¹⁵

There are probably few laws that would mandate or encourage design for multi-functionality. This would probably lead to legal design challenges. Few industry standards seem to promote multi-functional thinking during the design process. IEC 62430 is an exception.²¹⁶ In the list of examples of possible considerations in the design and development process, it states: “*Functionality; considering opportunities for multiple functions, modularity, automated control and optimization; comparing the environmental performance to that of products tailored for specific use;*” (B.4, a).

With the emergence of new types of products (e.g. computer TVs), which cross the boundaries of previous product groups, and the planned regulation of building components under the Ecodesign Directive, the issues above need to be dealt with in a coherent manner, and new types of methodologies should be developed. This implies that more work is needed to integrate such concerns in the MEERP and the preparatory studies.

²¹⁵ Tasaki *et al.* 2011.

²¹⁶ IEC 62430. Environmentally conscious design for electrical and electronic products. (Ed 1.0).

4.4 Supporting standards

As stated in the limitations, this study will not discuss the links between legal requirements and industry-driven standardization. However, a few general observations will be made here:

- Industry driven standardisation is a crucial but often neglected factor for innovation and economic development.²¹⁷ Standards may be of different types (product standards, process standards, management standards, measurement standards, and so on) and may differ in terms of coercion (e.g. mandatory, voluntary, semi-voluntary²¹⁸). Standards may both hinder and aid innovation, depending on the circumstances. They are however often very important – even crucial – for product and service development as they provide a platform for innovative activities and international transfer of technologies. Most actors agree that the European standardisation system has been crucial in removing technical barriers to trade, and has played a vital role in ensuring the free movement of goods between Member States. The international standardisation system has been even more crucial in removing barriers to trade. Regarding standardisation projects initiated by the Commission, there are documented cases of both successes and failures.²¹⁹
- The landscape of standards seems to change, not least in the IT area, with more standard development taking part in new forums. Many governments, not least among Asian countries, are currently becoming more active in standardisation in order to secure the interests of domestic industries.²²⁰

In relation to the issues discussed in this report, some key issues regarding the interplay between legal requirements and industry-driven standardisation are:

²¹⁷ DIN German Institute for Standardization 2000.

²¹⁸ See Dalhammar and van Rossem 2010. “Semi-voluntary” implies that the use of a standards is in principle voluntary, but in practice the manufacturer have strong incentives to apply it because of market requirements (e.g. requirements from customers) or legal requirements (the use of a standard is the best way to prove legal compliance).

²¹⁹ See Borras 2003.

²²⁰ Tillväxtanalys 2012b.

- As discussed in the JRC studies, there are potential requirements related to recyclability, disassembly time, toxicity etc. that can be implemented and verified by using existing standards and calculation methods, or that can use standards built on existing ones. Other types of requirements may need the development of new types of standards in order to make relevant calculations and tests, and prove conformity.
- The JRC and DEFRA studies, as well as many preparatory studies, make references to existing standards that can be used as methods to prove conformance. Some of these – e.g. ISO and IEC standards – can be adopted as harmonized standards to prove conformance under EU standardization policy.²²¹ Others, such as ECMA and EPEAT standards, cannot be used directly in EU standardization policy (but can form the basis for other standards that can prove compliance).
- The broad scope of the Ecodesign Directive – covering products ranging from IT equipment to building envelopes – makes the standard-setting process a complex task.

The above implies that a key thing when addressing new types of environmental aspects under the Ecodesign Directive is that coordination with standardization policy is necessary. Whatever requirements that are set, there is a need to have standards in order for manufacturers to prove conformance with legal requirements. Mandates to the three designated European Standardisation Organisations (ESOs)²²² may be necessary in order to develop relevant standards. Standards developed by e.g. EPEAT, ECMA and IEEE can be used as a basis in this process. Improved coordination between the ESOs and IEC/ISO may be a good idea.

4.5 Concluding remarks

As outlined, policy instrument interaction can be complex, and this complexity will increase in the future. The issue of system boundaries – what is the unit of regulation when products are part of larger systems – will further complicate the policy process.

²²¹ For a review of these issues see van Rossem *et al.* 2010.

²²² CEN, CENELEC and ETSI.

Setting new types of environmental requirement through the Ecodesign Directive can greatly enhance the effects of other instruments: the proposals from JRC to set maximum disassembly time for products provide an example how ecodesign requirements can aid recycling and the objectives of the WEEE Directive. More such synergies exist; a few of them are discussed here, while other will be evident in the future.

However, there is no doubt that that setting new types of requirements through the Ecodesign directive will also increase the complexity of mastering the policy interactions. This means that:

- it would be wise to proceed stepwise
- careful consideration should be given to the weighting of potential benefits versus increased complexity.

5. Resource efficiency and Eco-labelling

5.1 Introduction

In this chapter, it is examined if and how resource efficiency parameters are integrated in four voluntary schemes: the Nordic Ecolabel and the EU Ecolabel, EU's Green Public Procurement (EU GPP) criteria and the American Electronic Product Environmental Assessment Tool (EPEAT). The purpose of the study is to identify and explore existing resource efficiency parameters in the instruments and how these can be further unfolded. Further the purpose is to investigate if experiences from the ecolabels can be used when incorporating resource efficiency requirements into the Ecodesign Directive.

5.1.1 *Link to the Ecodesign Directive*

As outlined in chapter 4, ecolabels are policy instruments intended to stimulate the consumers to buy cleaner products and increase the uptake of these on the market. The environmentally best performing products can be awarded with ecolabels. It is the intention that the ecolabels should represent the uppermost part (10–20%) of the products on the market in terms of environmental performance²²³ and stimulate the design, marketing and diffusion of products with superior environmental performance. There is an intended synergy between the ecolabels and the mandatory policy instruments, the Ecodesign Directive, where the latter sets minimum environmental requirements and the ecolabels represent the top performers. Over time ecolabels are to raise the bar for best environmental performance of the products, and at the same time mandatory policy instruments such as the eco-design directive are increasing the minimum requirements by banning the worst performing

²²³ EU, 2009.

products on the market.²²⁴ In relation to resource efficiency aspects, ecolabels could pave the way for resource efficiency requirements in the Ecodesign Directive in the future.

5.1.2 Joint Research Centre's work on ecolabels and resource efficiency

A study of resource efficiency criteria in the EU ecolabel has been conducted by the European Joint Research Center (JRC) as part of the larger project on *Integration of resource efficiency and waste management criteria in European product policies*.²²⁵ The study included a review of the criteria in the EU Eco-labelling schemes targeting: reusability, recyclability, recoverability, recycled content, priority resources, hazardous substances and durability for both energy related products and other types of products.²²⁶ The main result was that criteria on reusability, recyclability and recoverability were found for some product groups especially computers, televisions and imaging equipment. The criteria in the EU Ecolabels was already targeting reusability, recyclability and recoverability within the following categories: design for disassembly, minimum threshold criteria for reuse, recycling, recovering, reusability of components, recyclable and reusable materials, hazardous substances, recycled content in packaging, recycled content in product parts, durability, increased warranty time, availability of spare parts, reparability upgradability, and consumer information on maintenance and good practices to increase product life-time.²²⁷ This study adds to the results of JRC study by including a review and analysis of the Nordic Ecolabelling criteria, European GPP criteria and the EPEAT criteria in addition to the EU Eco-label criteria, and systematically elaborates resource efficiency criteria of the four instruments and four product groups.

²²⁴ Huulgaard and Remmen 2012.

²²⁵ Ardente *et al.*, 2011a; 2011b; 2011c; 2012a; 2012b; 2012c.

²²⁶ Ardente *et al.*, 2011a; 2011b.

²²⁷ Ardente *et al.* 2012b.

5.2 Methodology

The chapter is based on case studies of four product groups. The product groups included are: imaging equipment, computers, windows and floor coverings. The four product groups have been selected to represent best cases of integration of resource efficiency criteria in the four instruments. Further the four product groups represent two very diverse product categories; electrical and electronic equipment and construction products. The case studies therefore are intended to map out the most comprehensive criteria covering resource efficiency of the four instruments and to cover a broad range of resource efficiency criteria due to the diverse product categories covered. The product groups have been selected based on the JRC study and in dialog with relevant actors involved in the work on the Ecolabels. Further EPEAT criteria are only developed for a limited number of product categories and only electronic product, which has also affected the choice of product groups. The criteria in the four instruments for the four products have been reviewed and categorized according to the resource efficiency parameters developed by JRC, but additional categories have also been added as the four voluntary instruments cover resource efficiency parameters adding to the JRC categories.

The chapter includes a short presentation of the four instruments investigated. Following this, the voluntary resource efficiency criteria of the four product groups are reviewed and analysed. The chapter is finalized by a short discussion and conclusion of the main results.

5.3 The policy instruments

This section provides a short introduction to the four voluntary instruments included in the chapter; the EU ecolabel, the Nordic Ecolabel, the EU GPP and EPEAT along with a listing of the criteria documents included in the study.

The EU Ecolabel

The EU Ecolabel, formerly known as the Flower, was established in 1992. The aim of the EU ecolabelling scheme is to *“encourage sustainable production and consumption of products by setting benchmarks for the good environmental performance of products and services based on the top performers on the market.”*²²⁸ The EU ecolabelled products should be among the 10–20% best performing products on the market, and the environmental performance should be seen in a life cycle perspective.²²⁹ The EU Ecolabel is to be consistent all over the EU and EEA countries, and the target is that national schemes should be harmonized with the EU Ecolabel. The EU Ecolabel has been approved by all Member Countries and is a result of a common policy. The EU ecolabel included in this chapter are: draft criteria for the EU Ecolabelling of Imaging Equipment,²³⁰ the EU Ecolabelling of Notebook Computers²³¹ and Personal Computers,²³² the EU Ecolabelling of wood floor.²³³

²²⁸ EEB, 2008.

²²⁹ European Union, 2009a.

²³⁰ European Commission, 2012.

²³¹ European Union, 2011a.

²³² European Union, 2011b.

²³³ European Union, 2009b.

The Nordic Ecolabelling

The Nordic Ecolabelling, formerly known as the Nordic Swan, was established in 1989 by the Nordic Council of Ministers. The Nordic Ecolabelling is organized in cooperation between the five Nordic countries, i.e. Denmark, Norway, Sweden, Finland and Iceland. All five countries have a national ecolabelling secretariat responsible of each their area of products and services. As with the EU Ecolabel the purpose of the Nordic Swan is to inform consumers about the product/service with the least environmental impact in its category, including concerns about health and high quality, and through consumers' choice encourage producers to develop and retail products with better environmental performance.²³⁴ The Nordic Ecolabel criteria included in this chapter are: Nordic Ecolabelling of Imaging equipment,²³⁵ Nordic Ecolabelling of Computers,²³⁶ Nordic Ecolabelling of Windows and Exterior Doors,²³⁷ Nordic Ecolabelling of Floor Covering.²³⁸

5.3.1 Green Public Procurement

Green Public Procurement (GPP) is defined as the process, where public authorities seek to procure goods, services and works with a reduced environmental impact from a life cycle perspective²³⁹ and is a voluntary instrument. Due the vast quantities of products purchased by public authorities, Green Public Procurement (GPP) can be an important tool and can help develop a market for products with better environmental

²³⁴ Miljømærkning Danmark, 2010.

²³⁵ Nordic Ecolabelling, 2007.

²³⁶ Nordic Ecolabelling, 2009.

²³⁷ Nordic Ecolabelling, 2008.

²³⁸ Nordic Ecolabelling, 2010.

²³⁹ European Commission, 2011, p. 4.

performance.²⁴⁰ At EU level, criteria for Green Public Procurement (GPP) have been developed for 21 product groups.²⁴¹ The GPP criteria are based on available scientific data and information, existing eco-labelling criteria and information provided by stakeholders. Hence, a considerable overlap with the GPP criteria and the ecolabelling criteria might be expected. The EU GPP criteria consist of core criteria, which are fit for any contracting authority in the member states, and comprehensive criteria for those wishing to purchase the environmentally best performing products on the market.²⁴² The focus will merely be on the comprehensive criteria as the study strives to map out the most comprehensive criteria on resource efficiency. The EU GPP criteria included in this chapter are: windows, glazed doors and skylights,²⁴³ hard floor-covering,²⁴⁴ office IT equipment²⁴⁵ and a criteria proposal for imaging equipment.²⁴⁶

5.3.2 *Electronic Product Environmental Assessment Tool (EPEAT)*

The EPEAT programme was launched in 2006 as an environmental rating system, which so far has criteria for computers, imaging equipment and TVs covering all lifecycle phases of the products. The EPEAT labels on computers and imaging equipment have from 2010 been introduced worldwide.²⁴⁷ EPEAT provides three rating categories, gold; silver; and bronze. Products are qualified according to two types of criteria: *Required* and *Optional*. For a product to be awarded with the label the product must comply with all the required criteria, but whether the product is rated gold, silver or bronze depends on how many of the optional criteria the product meets.²⁴⁸ In the following presentation of resource efficiency criteria, only the gold rated criteria are included as the intention is to gain experiences from the most comprehensive examples of resource efficiency requirements. The criteria are continuously being tightened; meaning that a gold rated product can become silver

²⁴⁰ European Commission, 2011.

²⁴¹ European Commission, 2013.

²⁴² European Commission, 2011.

²⁴³ European Union, 2013b.

²⁴⁴ European Union, 2013c.

²⁴⁵ European Union, 2013a.

²⁴⁶ eceee, 2012.

²⁴⁷ epeat, 2013a.

²⁴⁸ epeat, 2013a.

rated if it does not improve the products environmental profile. The EPEAT criteria included in the review are: epeat Computer-Display Criteria²⁴⁹ and epeat Imaging Equipment Criteria.²⁵⁰

5.4 Product categories

This section provides a short introduction to the product groups and products covered within the criteria documents for the four product categories: computers, imaging equipment, windows and floor coverings. The four product categories cover slightly different products and product groups. However, as the purpose of this chapter is to review and analyse the requirements on the resource efficiency, and not make detailed comparison between the instruments, it is assessed that the difference in the products covered will not affect the overall results. A more detailed overview of the product categories and the criteria documents are provided in appendix 1.

The Nordic Ecolabel, EPEAT and GPP criteria for Office IT equipment cover personal and portable *computers*, whereas the EU ecolabel is split into two different criteria sets for personal computers and for portable computers.

EU eco-labelling and EU GPP criteria for *imaging equipment* do not exist at the moment. However, draft criteria documents have been developed and are applied in this chapter. The Nordic Ecolabels covers: copier, digital duplicators, facsimile machines, multifunctional devices, printers, scanners and extra equipment. EPEAT covers: printers, copiers, scanners, facsimile machines, multifunction devices, mailing machines and digital duplicators. The EU ecolabel and EU GPP cover printers, copiers and multifunctional devices. Hence, the Nordic Ecolabel and EPEAT cover a broader selection of product types. They cover in total seven

²⁴⁹ epeat, 2013b.

²⁵⁰ epeat, 2013c.

product types, whereas the EU Ecolabel and the EU GPP cover three product types.

The Nordic eco-labelling for *floor coverings* includes floors for indoor use such as: bamboo floorings, solid wood, parquet, laminate, linoleum and carpeting. Some criteria are designed as score points, so that to get awarded the floor covering must exceed a certain limit. The EU eco-labelling criteria for floor coverings are divided into three criteria documents: textile floor coverings, wooden floor coverings, and hard coverings. However, only wooden floor coverings are included in the review. EU GPP criteria exist for hard floor coverings, however as this product group is not included in the Nordic Eco-labelling it is not part of the review.

The Nordic Ecolabel and the EU GPP have developed criteria for windows. The Nordic eco-labeling criteria for windows also cover exterior doors. EU GPP covers windows, glazed doors and skylights.

5.5 Resource efficiency criteria

In the overview of the criteria of the four product groups, attention is given to resource efficiency parameters other than those related to energy consumption. Emphasis will be on criteria aiming at enhancing reuse and recycling of resources and product parts, and those extending the lifetime of the products. Therefore the following section is not a full account of all criteria in the ecolabels but simply those focusing on the resource efficiency.

5.5.1 Resource efficiency categories

The JRC has developed potential categories for Ecodesign requirements for resource efficiency²⁵¹ presented in table 1. The categories, with some alterations, have been used to categorize the criteria in the four instruments investigated. However, the instruments contain criteria falling outside the categories in the JRC eco-design parameters for resource efficiency. Table 1 moreover presents a brief overview of how and whether the ecolabel requirements of the four product categories investigated cover the parameters suggested by JCR. The overview shows that many ecolabel criteria for especially computers and imaging equipment

²⁵¹ Ardente *et al.*, 2011.

already cover the JCR suggested categories. Different versions of these overviews are presented in the study conducted by the JRC including additional typologies of ecodesign requirements.

Table 4. Potential requirement to be implemented in the Ecodesign Directive (Ardente *et al.*, 2011b) and criteria in the GPP, the Ecolabels and EPEAT, which already address these issues

Potential Requirements from JCR	Categories applied	Included in ecolabels for (x)			
		Computers	Imaging equipment	Windows	Floors
Declaration of the reusability Benefit Ratio	Reusability ratio, recyclability ratio and energy recoverability ratio				
Declaration of the Recyclability Benefit ratio					
Declaration of the Energy Recoverability Benefit Ratio					
Threshold of the reusability Benefit Ratio			X		
Threshold of the Recyclability Benefit ratio		X	X		
Threshold of the Energy Recoverability Benefit Ratio					
Manual disassembly of key components	Manual disassembly	X	X		
Declaration of the recycled content of plastics	Declaration and threshold of recycled materials	X	X		(X)
Threshold of recycled content of plastic		X	X	X	(X)
Manual disassembly of components containing hazardous substances	Disassembly				
Content of hazardous substances into key components	Hazardous substances	X	X	X	X
Limit of hazardous substances into plastic		X	X	X	
Bill of Materials (BOM)	Bill of materials		X	X	
Identification of plastic components	Identification of plastic components	X	X	X	
Contamination of plastics	Contamination of plastics	X	X	X	
Monomaterial	Mono-material	X	X		
Compatibility of labels with recycling	Not included no criteria were found				

5.5.2 Resource efficiency criteria within the JCR categories

Reusability ratio, recyclability ratio and energy recoverability ratio

Reusability, recyclability and recoverability (RRR) represents different levels in the waste hierarchy where the five steps are: (1) prevention, (2) reuse, (3) recycle, (4) recovery and finally (5) disposal. It is recommended that criteria within this category should be prioritized according to the waste hierarchy, i.e. reuse should be prioritized before recycling, and recycling should be prioritized over energy recovery. The parameters reusability, recyclability and recoverability rates can be regarded as umbrella categories, as other parameters affect the ability/potential of the product or its materials to be reused, recycled or energy recovered. This particularly accounts to disassemblability, material contamination and material degradation.²⁵²

Neither of the ecolabelling criteria covers the JCR category of *Declaration* of RRR ratios. The Nordic Ecolabel and EPEAT, however, set criteria for the *Threshold* of material recovery for computers. They require that 90% of the weight of plastics and metals in the enclosure of the computer can be recovered. Energy recovery is excluded from these ecolabel criteria, as it is considered the least resource efficient option. It is worth noting that the criteria are set for the recyclability of the materials in the enclosure and not the recyclability of the entire product, as recyclability of materials and of the whole product are two distinct things.

As expressed by Ardente *et al.* (2011), “The “recyclability of materials” is strictly related to the inherent chemical/physical properties of the substance and the available technologies for its treatment at the End-of Life (EoL).” Whereas “the “recyclability of a product” is, instead, a more complex matter, that considers the properties of the materials but additionally takes into consideration how the different materials and components of the product are assembled.”²⁵³ For the recyclability of the materials in the enclosure to be 90%, it strictly only requires that the materials are not contaminated in a way that destroys their recyclability potential. Yet, for 90% of these materials to actually be recycled also depend e.g. on which materials are combined and how they are combined.

Moreover the ability or potential to recycle the product depends on which recycling technologies are available (mechanical thermal or chemical treatment options). Hence, the recycling potential can change

²⁵² Ardente *et al.* 2011b.

²⁵³ Ardente *et al.*, 2011b: 34.

over time if improved recycling technologies are developed. Finally a precondition for any reuse, recycling or recovering of materials is that the materials are collected and treated correctly. EPEAT gold also sets a threshold of 90% reusability and/or recyclability requirement for imaging equipment. Here reusability and recyclability are combined, even though they are different. To reach high reuse rates will require pre-treatment i.e. manual disassembly and separation of reusable parts.²⁵⁴

Table 5. Declaration and threshold of reusability, recyclability & recoverability

Declaration of Reusability, recyclability and recoverability	Threshold of Reusability, recyclability and recoverability
Computers	(NE and EPEAT) 90% by weight of plastics and metals in the enclosure and chassis must be technically suitable for material recovery. Material recovery does not include the recovery of thermal energy through incineration.
Imaging equipment	(EPEAT) minimum 90% reusable/recyclable.
Windows	
Floor coverings	

Disassembly

JRC includes manual disassembly as a possibility for future requirements to resource efficiency in the Ecodesign Directive. In terms of repair and replacement of worn out parts manual disassembly is highly relevant. However focusing on disassembly at the product's end of life, it could be questioned why only manual disassembly is in focus when there are indications that the automated or destructive disassembly systems are likely to replace the manual disassembly systems (Masanet *et al.*, 2002) in many developed countries as it is not considered economically feasible. However, certain manual disassembly processes are likely to subsist in Europe due to requirements in the WEEE Directive on disassembly of hazardous components. It might be relevant to set requirements targeting automatic disassembly or merely easy disassembly. Further the criteria found in the voluntary instruments are not limited to manual disassembly and therefore the category is termed disassembly.

The Nordic Ecolabelling, the EU Ecolabelling and EPEAT set criteria for design for easy disassembly for both computers and imaging equipment, whereas EU GPP only sets this criterion for imaging equipment. The

²⁵⁴ Ardente and Mathieux, 2012c.

EPEAT criteria is very generic whereas the Nordic Ecolabel, the EU Ecolabel and GPP set more detailed criteria emphasising that it should be easy for a qualified or professionally trained personnel to dismantle the products with tools usually available. The criteria regarding disassembly is targeted both towards increased recyclability but mainly towards improved options for reuse and prolonged durability, i.e. improving the ability to repair, replacement of parts and upgrading. Easy disassembly thus aims at increasing the durability and reusability of the product.

The EU Ecolabel specifically encourages the use of screws and snap-fixes especially for parts containing hazardous substances. This criterion is primarily aimed at improving the recyclability of products by making it easier to separate and remove specific parts and with as high quality as possible (metals, plastics, contaminated parts) even if the separation method is mechanical, i.e. a shredder. The EU ecolabel emphasize that value components in the computers should be easy to remove manually.

EPEAT specifically restricts the use of glued and molded metals. This is an example of a requirement aiming at improving the recyclability by both enabling easy disassembly and also reducing the contamination of the materials in the product.

Disassembly is not extensively addressed for windows and not at all for floor coverings. The Nordic Ecolabelling criteria for windows and exterior doors sets one criteria targeting disassembly namely that it must be possible to separate glazing from metals and plastic for recycling. Disassembly is not addressed in terms of improved possibilities for repair or upgradability, which was the case with imaging equipment and computers. Windows is also a product category, which requires fewer upgrades and which have substantially longer life spans. However, disassembly could be further addressed for both windows and floor coverings.

Table 6. Manual disassembly

Easy disassembly – Improve options for recycling and repair	
Computers	<p>(NE) A qualified person, working alone, must be able to disassemble the product. The manufacturer must ensure that disassembly of the unit is possible and compile disassembly instructions.</p> <p>(EPEAT) Moulded/glued in metal eliminated or removable</p> <p>(EPEAT) Easy disassembly of external enclosure</p> <p>(EU E) Easy dismantled by professionally trained personnel using the tools usually available to them, for the purpose of undertaking repairs and replacements of worn out parts, upgrading older or obsolete parts, and separating parts and materials, ultimately for recycling or reuse.</p> <p>Screws and snap-fixes are encouraged.</p> <p>Circuit boards and other precious metal-containing components shall be easily removable using manual separation methods.</p> <p>(GPP) Connections shall be easy to find, accessible with commonly available tools, and as standardised as possible.</p>
Imaging equipment	<p>(EU E, GPP) Shall demonstrate easily dismantling by professionally trained personnel with tools usually available, to ensure repair and replacement of parts, upgrading parts and for separating parts and material for recycling or reuse.</p> <p>(NE) Subassemblies (casing parts whose weight exceeds 10 g) made of mutually incompatible materials must be separable or connected by separation aids or all materials must be easily separable by means of recycling technology.</p> <p>(EPEAT) Easy disassembly.</p>
Windows	<p>(NE) It must be possible to separate glazing from metals and plastic for recycling.</p>
Floor coverings	

Declaration and threshold of recycled materials

The EU Ecolabel and EPEAT set criteria for the use of recycled plastics in both computers and imaging equipment. The EU Ecolabel and EU GPP set a threshold requirement of not less than 10% recycled plastics for both product categories, whereas EPEAT awards the products according to the rate of recycled plastics included, thereby requiring a declaration of the contents. The most ambitious example of requirements to the recycled content is found in EPEAT for imaging equipment, where a minimum of 25% post-consumer recycled plastics is required. The Nordic ecolabel set a cautious criterion for imaging equipment, where one part > 25 g must contain reused or recycled plastic. Yet, there is no threshold to the contents. In next Nordic Ecolabel for computers requirements to the computer being made of recycled plastics has been suggested.²⁵⁵ In addition to requirements for the contents of recycled plastics EPEAT requires *a minimum content of biobased plastics* in imaging equipment, but no establishment or threshold on the minimum content of this.

²⁵⁵ Nordic Eco-labelling, 2009.

The Nordic Ecolabelling for windows sets threshold criteria for the content of recycled material. It requires that 30% of non-renewable materials should be recycled materials for windows. The EU GPP for windows states that extra points can be awarded to products in proportion with their recycled content. The Nordic Ecolabelling for floor coverings sets criteria for both threshold and declaration of recycled content. It requires that 50% of synthetic fibres must be recycled materials and further additional point is scored if the floor contains recycled materials. In terms of declaration criteria the proportion of recycled wood should be specified. Both ecolabels set general criteria for all materials included in the product. For floor covering the criteria are more specifically targeting synthetic fibres and wood but also sets declaration requirements for all materials specifying which materials are renewable, non-renewable, and recycled. Further, the recycling process must be described.

By setting requirements to the use of recycled and biobased plastics, supplementing requirements to recyclability of the plastics, the voluntary instruments help increase the demand for secondary materials and thus promote this market.²⁵⁶ An interesting aspect is that there are only requirements to the contents of recycled plastics and not metals. The reasons may be that the market for recycled metals is more developed than the market for recycled plastics, because of recycled metals' higher value and quality.²⁵⁷

One challenge of setting criteria for recycled materials is that currently there are no reliable technologies for an analytical assessment of the recycled content in the products. It implies that verification can be a challenge and is dependent on supplier declarations.²⁵⁸

²⁵⁶ Ardente and Mathieux, 2012c.

²⁵⁷ Ardente and Mathieux, 2012c.

²⁵⁸ Ardente *et al.*, 2011a.

Table 7. Declaration and threshold of content of recycled plastic

	Declaration of the recycled content	Threshold of the recycled content
Computers	(EPEAT) Declaration of postconsumer recycled plastic content (%).	(EU E) The external plastic case of the system unit, monitor and keyboard shall have a post-consumer recycled content of 10% by mass. (GPP) The external plastic case of the system unit, monitor and keyboard has a post-consumer recycled content of > 10% by mass. (EPEAT) Higher content of postconsumer recycled plastic .
Imaging equipment	(EU E) The total post-consumer recycled content and the reuse content of the plastic parts shall be declared in the user information.	(EU E) Plastic parts shall have 10% (by mass) of recycled or reused content. (NE) At least one part heavier than 25 g must contain reused plastic or post-consumer and pre-consumer recycled plastic. (GPP) The external plastic casing parts shall have in total a post-consumer recycled and/ or reused content of not less than 10% by mass. (EPEAT) Minimum 25% content of postconsumer recycled plastic. (EPEAT) Minimum content of bio based plastic material.
Windows		(NE) Components of window, balcony door or exterior door such as the frame casement or door leaf that are made of non-renewable materials must comprise at least 30% by weight recycled materials. (GPP) Additional points will be awarded in proportion to the recycled content of material used.
Floor coverings	(NE) Specify the proportion of recycled wood raw materials. (NE) Specify which materials are renewable and which non-renewable materials are recycled. Describe the recycling process.	(NE) Synthetic fibres must comprise at least 50% recycled raw material or fulfil the requirements for the specific fibre type (originating from post-consumer products). (NE) Additional points can be scored if the floor contains recycled raw materials.

Hazardous substances

The requirements for hazardous substances in the Nordic Ecolabel, the EU Ecolabel, and guidelines for GGP are first and foremost in place to avoid the exposure of humans and the environment to hazardous substances. It will also have trade-off to the end of life phase and theoretically provide better opportunities to recycle the materials, when setting stricter requirements to hazardous substances. A detailed overview of the requirement to hazardous substances is provided in appendix 2.

The EU GPP, ecolabels and EPEAT for computers and imaging equipment includes an elaborated list of requirements for hazardous substances and mixtures both information requirement, threshold requirements and exclusion of certain substances. The requirements are both general requirements and requirements for specific materials and components such as plastic, batteries and backlight. Many of the criteria in the Nordic Ecolabel, the EU Ecolabel, and guidelines for GGP are listed

according to the REACH Directive's risk phrases, but for most criteria in the instruments a list of exemptions exists. In the EU ecolabel criteria for imaging equipment one of these exemptions take into consideration the use of reused materials by setting less strict requirement to the content of hazardous substances. Thereby the stricter requirement to hazardous substances does not eliminate the possibility to include reused materials in the product, which is of importance if a market for reused materials should be developed. Requirements to the content of mercury or exclusion of intentionally added mercury in backlights and displays are included in EPEAT, Nordic Ecolabel and the EU ecolabel for computer and GPP-AC for imaging equipment. The RoHS Directive, with a maximum concentration value of 0.1%, already restricts Mercury. However, exemptions are made concerning various types of lamps. The voluntary instruments remove the exemptions and thus strengthen the requirement in the RoHS Directive.

An important issue in relation to hazardous substances is where chemical requirements should be included in the Ecodesign Directive or if chemicals should solely be regulated through the RoHS Directive and the REACH Regulation. Hence, instead of including requirements for chemicals in the Ecodesign Directive, an expansion of RoHS should be proposed. A study has already been conducted on the subject matter²⁵⁹ making the following main suggestions: (1) Substances meeting the criteria for classification as dangerous in accordance with Directive 67/548/EEC, (2) Substances meeting the criteria for classification as substances of very high concern (SVHC) in accordance with REACH, (3) Substances which have been found as contaminants in humans and biota, and (4) substances which can form hazardous substances during the collection and treatment of waste electrical and electronic equipment.²⁶⁰ Further the study suggests specific substances to be included in the RoHS Directive.

Criteria on hazardous substances are also included in the Nordic Ecolabelling and EU GPP for windows. A list of general criteria on hazardous substances is included prohibiting certain chemicals in the windows; the release or leaching of certain chemicals from the product under normal use condition; and certain chemicals in packaging. Further, chemical products (paint, adhesive, sealants, putty, etc.) in the finished window

²⁵⁹ Gross *et al.*, 2008.

²⁶⁰ Groos *et al.*, 2008, p.1.

must satisfy certain requirements. The Nordic Ecolabelling sets criteria for chemical substances in plastics, however, differentiating between virgin and recycled plastic and thereby not hindering the use of recycled plastic in labelled products. Further the use of mercury asbestos is restricted in plastics by the Nordic Ecolabelling and lead is restricted in plastic by EU GPP. The EU GPP also sets restricting to the use of chemicals in e.g. paint, adhesive, sealants, and putty. Pressure impregnations are not permitted and the use of nanomaterials should be documented.

Both the Nordic and EU Ecolabel set criteria general for hazardous substances both restricting individual chemicals and according to the REACH classifications. Further the Nordic Ecolabel restricts the use of impregnated wood and the EU and Nordic Ecolabel set requirements to the substance used in coating and surface treatment.

Bill of Materials

Bill of Materials (BOM) is defined in Ardente *et al.* (2011b) as a “*document that synthesizes a detail of the product's composition.*”²⁶¹ BOM is identified in scientific literature as an important source of information: in order to conduct life cycle assessments, to measure the product's recyclability, recoverability and the recycled content in the design stage, and to identify priority resources and hazardous substances in the product, which should be taken into consideration in the end of life phase. Hence BOM can be seen as a premise for other requirements to improve a product's resource efficiency as it helps to make the necessary information accessible. In order for BOM to be part in improving resource efficiency, the knowledge should be applied in the waste treatment process.

In the voluntary instruments no full BOM requirements exist for computers, imaging equipment and floor coverings. Yet, an interesting criterion in the Nordic Ecolabelling for windows is the product description criterion stating that the materials and chemical products of which the window comprises should be specified including a percentage weight. It also to some extent applies to the criterion in the Nordic Ecolabelling for floor coverings on specifying the type of wood. These criteria are to some extent in line with the concept of BOM as defined above.

There are no BOM requirements in EPEAT, but a requirement to an inventory of intentionally added chemicals related to the category haz-

²⁶¹ Ardente *et al.*, 2011, p. 13.

ardous substances. Due to the complexity of the supply chain of electronic and electrical equipment, this is an issue that is complex to approach²⁶² especially for small producers as they might not have the ability to force these requirements on to their larger suppliers. This might be an issue where the larger producers will have better possibilities.

Ardente *et al.* (2011b) makes a more detailed identification of elements considered critical and important to include in BOM. It includes the following components: materials typology, employed masses, connections among different materials and placement of the components in the assembly/ disassembly process, and content of hazardous or other substance that negatively affect RRR.²⁶³ It is further proposed that BOM includes a disassembly scheme and a disassembly report.

Ardente *et al.* (2011b) also suggest that priority resource should be identified and listed in BOM to ensure their reuse or recycling. However, this requires a high level of detail as priority resources often occur in very small quantities. Hazardous substances also require a high level of details, as they, even in small amounts, are harmful to humans and the environment during the use phase and end of life. Overall the information included BOM can be broader than the information requirement currently found in the Nordic Ecolabelling for windows. However, it is a first step to set criteria for BOM for products and it could be of interest to further examine how these criteria have been implemented and verified for ecolabelled windows and floor coverings. Within the Nordic Ecolabelling of computers it has been suggested to include requirements to the use of rare metals,²⁶⁴ and in this regard BOM could be a tool to approach this.

²⁶² epeat, 2013d.

²⁶³ Ardente *et al.*, 2011b, p.22.

²⁶⁴ Nordic Ecolabelling, 2009.

Table 8. Bill of material

Bill Of Material	
Computers Imaging equipment	(NE) The licence holder must have a traceability system for the production of the Nordic Eco labelled product. (EPEAT) Inventory of intentionally added chemicals residing in the product.
Windows	(NE) Specify material and chemical products of which the window comprises including a percentage weight of each material and component. It is not necessary to specify the percentage weight for chemical product such as adhesives and surface treatment.
Floor coverings	(NE) Specify the type of wood raw material.

Identification of plastic components

The Nordic ecolabel includes criteria for the identification of plastic components for all product groups except floor coverings, as the floor in the Nordic Ecolabel cannot be made of plastic. Similarly the EU ecolabel criteria only cover wood floors and this product group is thus not relevant for this category. For windows, computers and imaging equipment the Nordic Ecolabel (and EU GPP for windows and computers) require that plastic parts above 50 g/25 g, must be visibly labelled for recycling according to ISO 11469, Generic identification and marking of plastics products.²⁶⁵ The standard provides a system of uniform marking of products from plastics. The marking is intended to help identify different plastic types and parts to ensure correct handling during waste recovery or disposal.²⁶⁶ It implies that plastic parts are labelled with a material identification marking allowing for the visual identification of polymer types implying that the marking can only read manually.

An assessment of how ISO 11469 is actually being applied during the waste handling and treatment has been made by Masanet *et al.* (2002). This study assessed the effectiveness of the ISO 11469 and other design for recycling. The study showed that when the plastic parts were manually sorted, the use of ISO labels were in fact an effective strategy for improving the recyclability of plastic parts, but the study also indicated that up to 20% of the ISO labels were incorrect. For automatic sorting systems the ISO labels had no effect as these sort according to the plastic's mechanical, optical and electrostatic properties. Hence, the effectiveness of the requirement in Nordic Ecolabel and EU GPP on marking of plastic parts will depend on the sorting systems and in worst case it will not have any effect on recyclability and thereby resource efficiency.

²⁶⁵ CEN, 2000.

²⁶⁶ CEN, 2000.

Table 9. Criteria for identification of plastic components

Identification of plastic components	
Computers	(NE) Plastic parts heavier than 25 g must carry permanent labelling specifying the material in accordance with ISO 11469 and ISO 1043 (EPEAT) Marking of plastics. Manual separation of plastics. (GPP) marking of plastic parts > 25 g identifying the material in conformity with ISO 11469:2000
Imaging equipment	(NE) Labelling of plastic parts at least in accordance with DIN/ISO 11469:2000 (larger than 25 g or with a flat area larger than 200 mm ²). (NE) Plastics used must be marked in accordance with the currently applicable version of the EU Directive 97/129/ECC (packaging) or marked in accordance with ISO-11469.
Windows	(NE, GPP) Plastic parts (>50 g) must be visible labelled for recycling in accordance with ISO 11469.
Floor coverings	

Contamination of plastics and Monomaterial

Requirements regarding contamination of materials are relevant for the recyclability, as the potential for recycling is reduced if incompatible materials are combined after disassembly, resulting in material degradation. Material *degradation* also affects the recycling negatively, as it concerns the destruction of the properties of the materials in the recycling process.²⁶⁷ This is thus more related to the addition of different contaminants to especially plastics, and examples of criteria aiming at this is the Nordic ecolabelling and EPEAT criteria regarding paints and coatings on plastics in computers. Apart from affecting the recyclability and recoverability, contamination of materials are also relevant for user health and thus for the reusability of the product. Material degradation can likewise affect the reusability if the materials lose quality after wear.

In terms for monomaterials the Nordic Ecolabelling for both computers and imaging equipment set requirements to the use of compatible plastic types, and for the enclosure a requirement of the use of a maximum of two types of polymers that are separable (also a GPP award criterion for computers). EPEAT for computers similarly requires “*a reduced number of plastics*.” This type of requirement is an approximation to the JRC parameter “*Monomateria*”, and the Nordic ecolabelling and GPP award criteria are assessed to be the best examples of this to date.

²⁶⁷ Ardente *et al.*, 2011b.

Table 10. Resource efficiency criteria for contamination and monomaterials

	Contamination	Monomaterial Improves recycling potential
Computers	(NE) Large plastic parts (> 25 g) must not be painted or metallized (notebooks are exempted from this). Chlorine-based plastics must not be contained in the enclosure and chassis. (EU E) Plastic parts shall not contain chlorine content greater than 50% by weight. (EPEAT) Large plastic parts free of PVC[C10] (EPEAT) Elimination of paints or coatings that are not compatible with recycling or reuse	(NE) Plastic parts heavier than 25 g must compose of one polymer or compatible polymers, except for the enclosure, which shall consist of no more than two types of polymers that are separable. (NE) Plastic parts (> 25g) may contain metallic inlays provided that these can easily be separated without the use of special tools. (EPEAT) Reduced number of plastic material types. (GPP) Plastic parts shall be of one polymer or compatible polymers. Cover shall consist of no more than two types of polymers, which are separable.
Imaging equipment		(NE) Single plastic casing parts heavier than 25 g must be made of a homopolymer or copolymer. Polymer blends (polymer alloy) are permitted. (NE) Combined plastic casing parts heavier than 25 g must be made of four or fewer types of mutually separable polymers or polymer blends.
Windows		
Floor coverings		

5.5.3 Voluntary instruments' criteria beyond JRC

Sustainable sourcing of materials

The sustainable sourcing of materials covers, as the name also states, more than resource efficiency. However, there is an interface between sustainable material sourcing and resource efficiency, an example being extended use of reused wood contributing to reducing deforestation.

Criteria for sustainable sourcing of materials are product specific, but could be relevant for electronics targeting for instance conflict minerals. However, this is not the case so far, and for that reason computers and imaging equipment is left of the table below.

Table 11. Criteria for sustainable materials

	Certified forest	Recycled wood/ plant materials	Sustainable wood
Windows	(NE) At least 70% of the solid wood must come from certified forest.		(GPP) Timber used shall come from legal sources. (GPP) The final product made of wood, wood fibres or wood particles stemming from forests verified as being sustainably managed so as to implement the principles and measures aimed at ensuring sustainable forest management, on condition that these criteria characterize and are relevant for the product. (NE) Ensure that wood raw materials do not originate from forest environments meriting protection due to their high biological and/or social value.
Floor coverings	(NE) At least 30% of the wood must come from certified sustainable forests. (EU E) A certain percentage of wooden products must originate either from sustainably managed forests certified by independent third party or from recycled materials. The requirements have been tightened continuously and from 1 January 2013, at least have 70% of any solid wood and 40% wood-based.	(EU E) Recycled wood and plant materials (for laminate flooring and multi-layer wood coverings) Post-consumer wood, chips or fibres applied in the production of wood-based materials (input), shall at least comply with the provisions in the EPF industry standard, as reported in paragraph 6 of document "EPF standard for delivery conditions of recycled wood" of 24 October 2002.	(NE) The raw material and bamboo must be legally felled /harvested and must not derive from forest environments, natural environments or agricultural areas with high bio and/or social protective values. (EU E) The producer shall have a policy for sustainable wood procurement and a system to trace and verify the origin of wood and tracking it from forest to the first reception point. (EU E) The origin of all wood shall be documented. The producer must ensure that all wood originate from legal sources. The wood shall not come from protected areas or areas in the official process of designation for protection, old growth forests and high conservation value forests defined in national stakeholder processes unless the purchases are clearly in line with the national conservation regulations. (EU E) All cork, bamboo and virgin wood must originate from forest that are managed so as to implement the principles and measures aimed at certifying sustainable forest management.

Criteria on sustainable sourcing of materials only apply to windows and floor covering. The main focus of the criteria is targeting sustainable wood, bamboo and cork. The Nordic Ecolabelling for windows and floor coverings set threshold requirements for the amount of wood deriving from certified forests. The EU ecolabelling for wood flooring also sets threshold requirements to the amount of wood used from forests. However, these are tightened continuously during the period where the criteria are valid. EU ecolabelling for wood floor also requires that the producers have a policy for sustainable wood procurement and a system, which can track and verify the origin of the wood. For floor coverings bamboo and cork is also covered.

This criterion targeting sustainable materials and more specifically sustainable wood, bamboo and cork is of course quite product specific and linked to the fact that windows and floor coverings can be comprised partly or completely by wood. The GPP for windows mainly sets threshold requirements to the use of wood from certified forest and requirements, which ensure that the wood derives from managed in a

sustainable way. Further the Nordic Ecolabelling for floor coverings also includes criteria targeting renewable materials stating that 50% of the materials by weight should be renewable.

A further criteria is *renewable materials*, where the Nordic eco-label set threshold requirements that at least 50% by weight of the floor covering must comprise of renewable raw materials.

Efficient use of resources during the use phase

Efficient use of resources during the use phase is included for the imaging equipment category in which paper and ink are used. The ecolabels and GPP address this differently, but all schemes set requirements to the capability of duplex printing and printing of two or more sides on one paper. EPEAT, EU Ecolabel and GPP-CC set requirements to duplex printing as default.

However, it could also be relevant for computers, windows and floor coverings. Examples are: computers default print settings as double-sided and the floor's surface treatment's effect on the use of water and soap during cleaning.

Table 12. Requirements for efficient use of resources during the use phase for EU ecolabel (EU), Nordic Ecolabel (NS), Green Public Procurement Core Criteria (GPP-CC), Green Public Procurement Award Criteria (GPP-AC) and EPEAT

	Cartridge	Paper
Computers		
Imaging equipment	<p>(NE) Products with combined toner cartridge may be accepted if the cartridge is not designed to prevent reuse.</p> <p>(NE) Collected toner cartridges, drum kits, light-sensitive drums and residual toner containers collected by the licence applicant or the representative of the licence applicant must be reused or recycled.</p> <p>(GPP) Monochrome high volume inkjet cartridges with a performance of minimum 1,500 page yield shall be available for IM of printing speed of 30 ipm or more.</p>	<p>(EU, GPP) The capability to print/ copy two or more pages on one sheet of paper as standard features,</p> <p>(NE, GPP, EU) Duplex availability covering appliances with a maximum operating speed of more than: NE 45 images per minute (imp), EU 17 ipm, GPP-CC 25 (A4).</p> <p>(NE) Appliances with operating speeds of 20 to 44 sheets per minute must have a double-side copy unit (duplex) as extra equipment for subsequent upgrading if the user so wishes.</p> <p>(EU) (GPP) Automatic double-side print/ copy unit as default setting.</p> <p>(EU) Should display, when printing one-side that this contribute to higher environmental impacts.</p> <p>(EU) Capability of processing recycled paper.</p> <p>(GPP) Points can be awarded to imaging equipment devices based on their performance regarding the maximum number of pages which are printed after the user has cancelled the printing process for monochrome one side printing.</p> <p>(EU, GPP) (NE) Must accept remanufactured toner and or ink cartridges and be designed in a way that takes reuse of toner and/ or ink cartridge into consideration.</p>
Windows		
Floor coverings		

Durability

Various criteria were found in the voluntary instruments targeting durability. The criteria are presented in table 10 and divided into the following categories: direct criteria on durability of the product, extended warranty, upgradability and repair, spare parts and modularity. The categories are closely interlinked and therefore they are all dealt with within the overall category durability. All criteria strive to extend the life span of the product thereby preventing electronic waste. Durability is also related to the previous category disassembly where criteria targeting easy disassembly for repair and upgradability were included. Initially, durability was not part of JRC's first resource efficiency parameters, but in 2012 JRC investigated the possibilities of assessing the environ-

mental benefits of increased durability; different measures to increase durability; and possible requirements aimed at increasing durability.²⁶⁸ In relation to this study, experiences from the voluntary instruments can provide insight into possible ways to set these requirements.

Requirements on durability are set to imaging equipment in both the Nordic Ecolabel and the EU Ecolabel but differently. The EU Ecolabel's durability requirements are aimed at the cartridge and the reusability of this, whereas the Nordic Ecolabel requirements are aimed towards quality assurance and maintenance of the entire product. Durability criteria for windows and floor coverings regard measures to prevent early wear.

Extended warranty was included in the EPEAT criteria for computers of three years or as a service arrangement. The EU Ecolabel for imaging equipment included an extended warranty of five years and finally the Nordic Ecolabel for windows included a 10-year warranty for parts of the windows (thermo panels and wood rot). The length of the warranty will of course be product specific as evident in the criteria examined. Further it is also strongly related to the availability of spare parts.

Criteria for upgradability and repair were only found for computers and imaging equipment. However, this type of criteria could also be relevant for windows and floor coverings like for instance upgradability to a higher energy class. Upgradability as a means to increase durability was found in Nordic ecolabelling, EPEAT and GPP criteria and covers general criteria on upgradability with common tools and more specific criteria such as easy expansion of the computer's memory and replacement of computer's batteries.

Both the EU Ecolabel, the Nordic Ecolabel and EPEAT require that spare parts and components for repair are available for 5, 5 and 3 years, respectively. Determining the scope of the needed inventory of components can be a challenge; on the one hand components should be available to enable repair, but on the other hand the risk is that a too large inventory of components will be outdated and never utilized. This is counterproductive from both an economic and a resource efficiency point of view. This needs to be considered when setting future requirements for spare part availability.

Modular design and easy disassembly enables upgrading and repair and are thus prerequisites for lifetime extension. Modular design is only required in the ecolabels (EU Ecolabel, Nordic Ecolabel and EPEAT) for

²⁶⁸ Ardente and Mathieux, 2012a.

computers, and this is linked to upgradability and repair requirements. For computers there are specific requirements for upgradability with common tools and/or consumer instructions in all ecolabels and this may reflect the rapid technological development of computers, which spurs high replacement rates of computers. Upgradability can potentially reduce the frequency of replacement. Also for imaging equipment the EU and EPEAT set requirements to reparability and upgradability.

Table 13. Durability criteria for the four product groups

	Durability	Extended warranty	Upgradability and repair	Spare parts	Modularity
Computers		(EPEAT) Additional three year warranty or service agreement.	(EPEAT) Upgradeable with common tools. (GPP) Memory must be easily changed or upgraded. (NE) Replacement of battery must be possible. (NE) Upgradability. without special tools (e.g. working memory expansion and more).	(EU E and GPP) Availability of spare parts for at least 5 years after end of production. (EPEAT) Availability of replacement part.	(NE) Modular design to support upgradeability. The user shall be able to replace the modules without the use of special tools and it shall be possible to upgrade the computer by: Working memory expansion; Installation, exchange and expansion of mass storage; Installation and/or exchange of CD ROM, DVD and hard disk drive (The design of notebooks must permit performance expansions (upgrades). (EPEAT) Modular design.
Imaging equipment	(EU) Design of the cartridge should promote its durability. Devices and practices that would prevent its re-utilisations should not be presented or applied. (NE) The licence holder must guarantee that the quality of the product is maintained throughout the validity period of the licence. (EPEAT) Early failure process.	(EU) Extended five years warranty.	(EPEAT) Product upgradability.	(EPEAT) Product spare parts availability. (EU, GPP) Supply of spare parts and infrastructure for repair of minimum 5 years after end of production. (NE) The availability of spare parts must be guaranteed for at least five years after production. (NE) The licence holder must offer service and support.	
Windows	(NE) Requirement to the treatment of the wood to ensure longer life span. (GPP) The bidder must ensure that maintenance recommendations are provided with the product.	(NE) 10 years guarantee, covering function, thermo panes and wood rot.			
Floor coverings	(NE) Different requirements to wear resistance for different types of floor coverings.				

Waste from manufacturing

The Nordic ecolabelling for windows and exterior doors, the Nordic Ecolabelling for floor coverings and the EU Ecolabelling for wood flooring also set criteria for improving resource efficiency during manufacturing. The Nordic Ecolabelling for windows and exterior doors sets some overall criteria for the separability of the waste fraction from the production and the handling of hazardous waste. Further it sets criteria for the handling of the individual materials at end of life. The individual criteria apply to the entire production process in the fabric where the eco-labelled products are manufactured and they also apply to subcontractors' production of insulation units, casement and frames.²⁶⁹

The Nordic Ecolabelling for floor coverings requires that the manufacturer should provide a declaration that the production waste is recycled. The EU Ecolabel, on the other hand, focuses on the recovery of by-products from the production processes. By setting criteria for the production process the environmental labels also broadens up by including the production processes and not merely the product.

²⁶⁹ Nordic Ecolabelling, 2008, p. 13.

Table 14. Criteria for waste from manufacturing

Waste from manufacturing	
Computers	
Imaging equipment	
Windows	<p>(NE) Where applicable the different types of waste from the productions must be separable. A plan for separating waste at source must be drawn up.</p> <p>(NE) Environmental hazardous waste must be treated and dealt with in accordance with the authorities prevailing regulation.</p> <p>(NE) Standard window panels: glass waste must be recycled.</p> <p>(NE) Selective glass (coated window panels): glass waste must be recycled if suitable facilities exist in the country of manufacturing.</p> <p>(NE) Aluminium waste and other metal waste must be recycled.</p> <p>(NE) Plastic waste must be recycled with some exemptions.</p> <p>(NE) Material or energy recovery of all wood and wood-based waste, excluding impregnated wood.</p> <p>(NE) Impregnated wood, discarded windows, chemical residues and their packaging and other materials must be deal with in accordance with the authorities' regulation or stipulations.</p> <p>(NE) Environmentally hazardous waste must be collected by an approved waste management company.</p> <p>(NE) Residual waste must be collected by an approved waste management company.</p>
Floor coverings	<p>(NE) Declaration from the manufacturer that production waste is recycled.</p> <p>(EU E) The applicant shall provide an appropriate documentation on the procedures adopted for the recovery of the by-products originated from the process. The applicant shall provide a report including the following information: kind and quantity of waste recovered, kind of disposal, and information about the reuse (internally or externally to the production process) of waste and secondary materials in the production of new products.</p>

Reuse, recycling/recovering systems and take-back requirements

The Nordic Ecolabelling for computers, floor coverings and windows includes a criterion that national legislation, regulation or agreements within the sector regarding recycling systems should be followed. The Nordic Ecolabelling for windows further sets a criterion to have in place a system that ensures collection for recycling of plastic windows. It is not known why only plastic windows are targeted in this criterion. The WEEE Directive is at place to regulate electrical and electronic equipment waste at EU level. However, the related products and materials used in imaging equipment, like toner, ink modules, and containers, are not regulated by the WEEE Directive and here the Nordic and EU Eco-labels set up criteria to a take-back system or return system for these items. Further the Nordic Ecolabel for imaging equipment requires that a system to be set up for consumer durables to ensure the reuse or recovery. Being a global label, EPEAT requires provision of a product take-back service for computers.

It is beyond the scope of this chapter to investigate empirical experiences with this system, but in practice following the European take-back system (the WEEE collection system) will most likely be sufficient to live

up to this requirement. Windows and floor coverings have much longer lifetimes than e.g. computers, so a take back system may be difficult to implement. Hence, collection of industry experiences with this requirement will be useful for an assessment of the effectiveness of especially the take-back criteria for windows. Nordic Ecolabel for floor coverings includes two criteria regarding design for the end-of-life phase of floors. The floor coverings should be designed in a way, where they will not be classified as special waste and require special waste treatment. Moreover, the manufacturer has to declare compliance with this criterion.

Table 15. Take back requirements; reuse, recycling and recovering systems; and waste treatment

	Take-back requirements	Reuse, recycling and recovering systems	Waste treatment
Computers	(EPEAT) Provision of product take-back service. Auditing of recycling vendors.	(NE) National producer responsibility regulations, legislation and/or agreements with the sector regarding recycling shall be met.	
Imaging equipment	(EU E) Take-back system for the return of toner/ink modules and toner/ink containers supplied or recommended by the applicant for use in the product back to the applicant in order to channel such modules and containers to reuse and/ or material recycling (free of charge). (NE) A return system must be offered for recycling combined toner cartridges and information to the consumer on this issue must be provided.	(NE) The licence applicant and/or its local representative must have a system in place ensuring that consumer durables and parts that wear out as far as possible are sorted and recovered/ reused. Consumer durables and parts that wear out are those parts that service personnel replace when the machine is serviced or that can be replaced by the consumer after reading the instructions for use.	
Windows	(NE) Windows made of plastic shall be covered by a system that ensures collection for recycling.	(NE) Relevant national regulation, legislation and/ or agreements within the sector regarding the recycling system for products and packaging shall be met. (GPP) The bidder must demonstrate that the contractor for retro-fitting or refurbishing window installations has in place effective policies and procedures to ensure that post-consumer waste is properly dealt with in a sustainable manner, such as recycling or diverting from landfill where possible.	
Floor covering		(NE) Relevant national regulation, legislation and/ or agreements within the sector regarding the recycling system for products and packaging shall be met.	(NE) The floor coverings must not be classed as special waste or require special waste treatment in any Nordic country. (NE) Declaration from the manufacturer that the floor covering does not give rise to special waste or require special waste treatment in any Nordic country.

Packaging

The EU Ecolabel sets criteria for the packaging of computers and imaging equipment being made of recycled or biodegradable material, more specifically cardboard boxes must consist of 80% recycled material, and 75% of the materials in plastic bags must be recycled, biodegradable or compostable.

Table 16. Packaging

Packaging	
Computers	(EU E and GPP) 80% recycled material in cardboard boxes when used as packaging. 75% recycled material, biodegradable material or compostable material in plastic bags when used as final packaging.
Imaging equipment	(EU E) 80% recycled material in cardboard boxes when used as packaging. 75% recycled material, biodegradable material or compostable material in plastic bags when used as final packaging. (NS) Plastics used for packaging the equipment (including toner powder containers) must not contain chlorinated polymers.
Windows	(NE) Relevant national regulation, legislation and/ or agreements within the sector regarding the recycling system for products and packaging shall be met.
Floor coverings	(NE) Relevant national regulation, legislation and/ or agreements within the sector regarding the recycling system for products and packaging shall be met. (EU E) Packaging must be made out of one of the following: easily recyclable material, materials taken from renewable resources, materials intended to be reusable.

Consumer information

The Nordic Ecolabelling includes criteria for all four product groups regarding consumer information, which is intended to help improve resource efficiency. The EU Ecolabel also has this type of criteria for all products except windows. Criteria on consumer information include information on recommended maintenance, cleaning, and refurbishment, which could help prolong the lifetime of the product. Further the Nordic Ecolabelling and the EU Ecolabel include criteria on what should be done with the product by the end of life, and the EU Ecolabelling also include an indication of the expected life time of the product and an indication of the recycling or disposal.

The consumer is an important player when striving to improve resource efficiency, as the first prerequisite for extending the lifetime of the products is that consumers behave accordingly. Likewise, reuse and recycling of products depend on the consumer to discard the product correctly. Informing about availability of spare parts, upgradability options and maintenance is a way to promote optimal consumer behaviour for improved resource efficiency.

Table 17. Consumer information on resource efficiency

Consumer information	
Computers	<p>(NE) Availability of spare parts. Upgrading possibilities. Batteries and correct disposal of these. Product has been designed to permit reuse and recycling of parts. Advice on how used products and packaging are recycled or disposed of in an environmentally acceptable way. Manufacturers take-back and how consumers can use this. Service and support functions. (EU E) Who to contact/where/how/who is qualified to repair and service the notebook/PC. End-of-life instructions for proper disposal at civic amenity sites or through retailer take-back schemes. (EU E) Provision of clear instructions to the end-user in the form of a manual to enable basic repairs to be undertaken.</p>
Imaging equipment	<p>(EU E) Information on the environmental relevance of paper consumption. That cartridge is designed for reuse. Instructions on how to maximise the environmental performance of the imaging equipment (paper management, energy efficiency, waste management). (NE) Information on the use of double-sided copying, the present of a duplex unit or its availability as an upgrade and information that it saves the environment and money, about where used products and packaging can be deposited, about the return system for recycling combined toner cartridges on disposal of used OPC kit/ photosensitive drums, toner container and containers for used toner that used batteries should be disposed of in accordance with local legislation. Recommendation that ecolabelled paper be used. Warranty period Information that offers supply of spare parts for 5 years. (GPP) User instructions for green performance, covering paper management functions, energy efficiency functions, waste management of the product and the ink and/or toner cartridges (written and digital). Additional interactive training instruction should be provided regarding the paper management functions, energy efficiency functions, waste management of the products and of consumables ink and/ or toner cartridges via a software or website.</p>
Windows	<p>(NE) Details of what should be done at end of life. (NE) Information on the recommended maintenance.</p>
Floor coverings	<p>(NE) Recommendations to cleaning and maintenance. (NE) Information on how to extend the life of the floor covering through refurbishing such as sanding and polishing. (EU E) Recommendations for the use and maintenance of the product, any possible indication on the product's potential life expectancy, and an indication of the route of recycling or disposal.</p>

5.6 Lessons related to the Ecodesign Directive

The following will shortly discuss the criteria on resource efficiency found in the voluntary instruments and their possibility to be applied in the Ecodesign Directive's IM. The policy instruments examined characterize the environmentally best performing products on the market and therefore the criteria from the voluntary instruments cannot be directly transferred to the Ecodesign's IM that ban the worst performing products. Further, the product groups are diverse and the different categories for resource efficiency are not relevant to all product groups.

The review of the criteria targeting resource efficiency in the voluntary instruments showed, in line with the previous studies conducted by JRC that various criteria for resource efficiency already exist targeting resource efficiency both within those categories covered by the JCR and additional ones.

5.6.1 *The resource efficiency criteria found in the voluntary instruments*

Both declaration and threshold criteria to RRR ratio could be transferred to the Ecodesign Directive's IM. No declaration criteria to RRR ratio were found in the voluntary instruments. However, declaration criteria can be an important mean to gain knowledge on an issue and to use for setting up meaningful criteria in the future. A possibility could be to begin setting declaration criteria and then later threshold criteria. It should be acknowledged that because e.g. 90% of the product is reusable, recyclable or recoverable, it is not certain that the 90% of the product will be reused, recycled, or recovered, hence there might be a considerable difference between the theoretically possible RRR ratio and the actual RRR ratio. The actual RRR ratio will depend on additional parameters such as: collection, consumer behaviour, and that the product gets the correct waste treatment to ensure RRR. Further in future requirements to RRR ratio it is recommended that they are made according to the waste hierarchy, hence prioritising reuse before recycling and recycling before recovery.

Easy or manual disassembly can help improve the possibility for repair and upgradability extending the products life and improve the durability of the product and could also be a possible category to transfer to the Ecodesign Directive. However, it can be questioned if requirements to manual disassembly at the end of life are of high importance when automatic disassembly is common. Therefore it could be relevant to set requirements to both easy disassembly for reuse and repair and easy disassembly for end of life. When setting requirements to the latter, it has to be taken into consideration what is currently the most commonly used disassembly process used in the waste sector for the product in question but also which it will be in the future, in order to ensure its effectiveness.

Criteria for the declaration and threshold of recycled plastic were found in the voluntary instruments. However, other materials could also be targeted such as e.g. speciality metals. Setting criteria for the threshold of recycled materials can help create a market for these materials.

However, before transferring these requirements to the Ecodesign Directive IM then it is important to assess to what extent the manufacturers can handle the increases in demand that a requirement would create. Again a possibility could be to begin setting declaration requirements and then tighten them continuously by setting threshold requirements.

Hazardous substances is a complex category which is already covered by REACH Regulation and the RoHS Directive and setting requirements to hazardous substances in the Ecodesign Directive might create an overlap to these regulations and directive. Nevertheless, it is an important topic in order to improve resource efficiency as hazardous substances can significantly hinder both reuse, recycling and recovery of materials.

Visual marking of plastics parts according to certain ISO standards were included in many of the voluntary instruments. However, this merely has an effect when the waste is sorted manually. Therefore before setting criteria for visual marking of plastics in the Ecodesign Directive or prolonging the criteria for marking of plastic in the voluntary instruments, it is recommended to further examine to what extent the waste is manually sorted for the product group in question and how the future development might be. Hence, the effectiveness of the requirement in the Nordic Ecolabel and the EU GPP on marking of plastic parts will depend on the sorting systems and in worst case it will not have any effect on recyclability and thereby resource efficiency. Further alternative marking methods should be examined, than those included in the voluntary instruments, which would be possible to apply in e.g. automatic sorting systems.

Criteria were also found targeting contamination of materials such as: limiting or restricting the chlorine content in plastic, PVC, and the use of paint and coating. Especially limiting of paints was documented in Masanet *et al.* (2002) to be an effective strategy to improve the recyclability of plastic. Though, it might also be relevant for other materials and worth implementing in the Ecodesign Directive.

Monomaterials were targeted in the voluntary instruments setting criteria to a number of different polymers used in the product, the use of compatible polymers, and reduced numbers of plastics. It is not only the type of plastic or polymers which impact plastics recyclability but also the colour of the plastic. Further, there are also practical issues related to the sorting and recycling process that challenges the process. Therefore, requirements to monomaterials might be possible to transfer to IM of the Ecodesign Directive but requires a dialogue with the waste handlers to ensure the effectiveness of the requirement.

Resource efficiency criteria outside the suggested JCR requirement

Sustainable sourcing of materials covers more than just resource efficiency. It was merely the EU GPP and the EU and Nordic Ecolabelling for windows and floor coverings that included criteria on sustainable sourcing of materials. The criteria were quite product specific and including criteria on: renewable materials, recycled materials, certified forest and sustainable wood. The category could be relevant for other product groups setting criteria for e.g. conflict minerals both in the voluntary instruments but also in the IM of the Ecodesign Directive. Setting this type of requirements in the Directive would require that supply of sustainably sourced materials could keep up with an increase in demand.

Energy consumption in the use phase is an aspect, which has been widely covered by existing IM in the Ecodesign Directive, but it is also relevant to target other resources in the use phase. An example is the Nordic and EU Ecolabelling criteria for imaging equipment, where a more efficient use of paper and ink cartridges is promoted. These types of requirements are already included in the draft of the Voluntary Agreement for imaging equipment within the Ecodesign Directive (duplex availability, default duplex setting, and information requirements targeting resource efficiency).²⁷⁰ However, the category is also highly relevant for other product groups. Another example of requirements within this category could be to set a requirement to an automatic detergent dosing system for washing machines avoiding over-dosage and overconsumption of detergents.

Criteria for the waste from manufacturing were found for windows and floor coverings. By including requirements to the manufacturing the labels expand the scope from a product focus towards a production focus. The Ecodesign Directive, as the name states, mainly sets requirements to the design of the product, however targeting the environmental performance of the entire product life cycle. Therefore setting direct requirements to the manufacturing process might be outside the scope of the Directive. However, design requirements to the product that might improve the manufacturing process would be highly relevant.

Criteria targeting durability were not included in the applied overview of potential requirements from the JRC, but the issue has been included in their later work.²⁷¹ The voluntary instruments included gen-

²⁷⁰ eceee, 2011.

²⁷¹ Ardente *et al.*, 2012a.

eral criteria on durability, warranty, upgradability and repair, spare parts, and modularity to ensure upgradability and repair. Improved durability, extending the products life, is part of waste prevention and thereby improvement of resource efficiency and it should be included in future resource efficiency requirements in the IM and the experiences from the voluntary instruments should be utilised. However, it is important to ensure that prolonging the life span of the product is the environmentally best solution in a life cycle perspective, e.g. that possible environmental benefits are not evened out by increased energy consumption of the older product compared to a newer more energy efficient product.

Take-back system and reuse, recycling and recovering are partly covered by the WEEE Directive, as previously mentioned, and setting criteria in the Ecodesign Directive on take-back systems and reuse, recycle and recovery systems might for electronic and electrical equipment provide an overlap to the WEEE Directive. However, the intended eco-design effects of the WEEE directive is not working properly and this might also be relevant for product categories not covered by the WEEE Directive or for consumables used in the product such as cartridges for imaging equipment.

Criteria on packaging were included for computers and imaging equipment and partly for windows and floor coverings. Transferring these types of requirements to the Ecodesign Directive might again provide an overlap to the European Directive on packaging and packaging waste.²⁷² Hence it could be questioned if the Ecodesign Directive would be the right place to incorporate requirements for packaging as the Directive on packaging and packaging waste already aims to limit the production of packaging waste by promoting recycling, reuse and recovery.²⁷³

Criteria on consumer information on resource efficiency were included in many of the voluntary instruments examined. In the effort of improving resource efficiency, the consumers are important actors. The consumer is crucial in improving resource efficiency during the use phase such as printing double-sided, maintaining the windows to extend their life span, and upgrading their existing products instead of buying new ones. They are also important actors in a products end of life as they shall ensure correct disposal of the products and this is a precondition for proper

²⁷² Europa, 2011.

²⁷³ Europa, 2011.

waste handling. Therefore requirements on consumer information on resource efficiency are important requirements to include in future IM in the Ecodesign Directive. Further consumer information is also an issue emphasised in the Framework Ecodesign Directive.

Additional resource efficiency categories

Besides the many criteria targeting resource efficiency in the voluntary instruments examined, additional categories exist which were not included in the review. Therefore this section will shortly elaborate on three addition categories including: priority resources and critical metals, dematerialisation, and system thinking.

The voluntary instruments investigated do not sufficiently consider specialty or precious metals. Specialty metals are often used in high-tech products in small amounts to enhance a specific performance.²⁷⁴ It also includes metals, which are considered critical by e.g. the European Commission such as: antimony, beryllium, cobalt, fluorspar, gallium, germanium, graphite, indium, magnesium, niobium, platinum group metals, rare earths, tantalum and tungsten.²⁷⁵ Precious metals are traditionally metals with a high value such as: ruthenium, rhodium, palladium, silver, osmium, iridium, platinum and gold.²⁷⁶ The EU Ecolabel for computers consists a criterion targeting precious metals stating that, "*Circuit boards and other precious metal-containing components shall be easily removable using manual separation methods.*" Further in the next revision of the Nordic Ecolabel criteria for computers there are going to be considerations as to how and whether to incorporate requirements or restrictions to the use of rare metals, which is included in the European Commission's list. One of the large challenges with recycling of rare earth metals and other critical materials are that it is often not profitable as they are found in very small quantities and complex systems²⁷⁷ making it an even more important issue to target through legislation. Further the current WEEE legislation focuses on mass recovery, recycling and reuse, which does not favour precious and specialty metals often found in small amounts in the products.²⁷⁸

²⁷⁴ Reck and Graedel, 2012.

²⁷⁵ European Commission, 2010a.

²⁷⁶ UNEP, 2011.

²⁷⁷ Pathan *et al.*, 2013.

²⁷⁸ Reck and Graedel, 2012.

Criteria targeting dematerialisation were not found in the review of the four product groups and four voluntary instruments. Dematerialisation can be the integration of different function into one product such as the smart phone which now includes several functions such as a calendar, an alarm clock, a camera, and a music player to name a few. Or it could be the shift from a product to a service like from the external hard disk to online services such as Dropbox and Share files. There are large possibilities to reduce material consumption through dematerialisation; however, it requires that the additional function in e.g. a smart phone does not become an addition to owning a camera or a paper calendar.

Another aspect, which is not covered by the voluntary instruments, is system thinking, understood as how different products influence each other as a whole in a system. Since products often are part of a large system they will affect the overall performance of that system, so the individual product's resource efficiency should be improved but also that the entire system. An example of a Directive characterised by system thinking is the Building Directive. The Building Directive sets overall requirements to the system, the house, and individual requirements to the individual components. A large inclusion of system thinking in both the voluntary instruments and the Ecodesign Directive could be encouraged and between different regulations and voluntary instruments.

5.7 Conclusion

Many different requirements on resource efficiency already exist in the Ecolabels, EU GPP and EPEAT, which underline that it is possible to set and implement requirements on resource efficiency and that there are vast amounts of knowledge, which can be transferred and used in the future work with setting requirements for resource efficiency in the Ecodesign Directive. Hence if it works for Ecolabels it is likely also to work as requirements in the Ecodesign Directive's IM. In an adapted, less ambitious, version, as the synergies between the voluntary instruments and the minimum requirements should be preserved. It is important to emphasise the different scales of setting requirement in the voluntary instruments targeting a limited section of products compared to setting requirements to all products produced or imported in the EU.

Further the voluntary instruments examined could consider expanding their categories also considering: system thinking, critical and precious metals, and dematerialisation. Further sustainable source of mate-

rials could be expanded to other materials than wood, bamboo and cork and include issues such as conflict minerals.

The review of the voluntary instruments also showed that there are still challenges related to the verification of some of the criteria targeting resource efficiency, such as e.g. the amount of recycled materials in the product. These challenges need to be approached before the criteria are transferred to the Ecodesign Directive. Further the importance of having an updated view on the current and future status of the waste management sector and the exact treatment process of the product is important to avoid setting criteria which are not effective, as could be the case with the visual marking of plastic merely suited for manual sorting process. Lastly, there are overlaps to other legislation also covering issues related to resource efficiency such as: the REACH Regulation, the RoHS Directive, the WEEE Directive and the Packaging Directive, which should be assessed before requirements are implemented in the Ecodesign Directive's IM.

6. Legal issues in relation to resource requirements set under the Ecodesign Directive

In this chapter we will review the legal dimension of potential IMs related to resource use. We will first discuss the core issues in relation to the international trade agreements administered by the WTO. We will then analyze the text of the Ecodesign Directive and the potential implications for setting requirements related to resource use and efficiency. Finally, we discuss the link between member state rules and EU rules.

6.1 The WTO-administered agreements

There are several potential linkages between IMs related to resource use and WTO regulations. We will only discuss the most vital ones here.

6.1.1 *The PPMs issue*

The most prominent issue concerns the potential to regulate processing and production methods (PPMs). The GATT Agreement makes several references to the “like products” concept. For instance, in Art. III.4, it is stated that:

“The products of the territory of any contracting party imported into the territory of any other contracting party shall be accorded treatment no less favourable than that accorded to *like products* of national origin in respect of all laws, regulations and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution or use. The provisions of this paragraph shall not prevent the application of differential internal transportation charges which are based exclusively on the economic operation of the means of transport and not on the nationality of the product.”

The main controversy surrounds whether “likeness” only refer to physical characteristics, or if it is possible to set different legal standards – and differentiate between products, e.g. banning the imports of certain products – depending on how a product is produced. The issue has been

subject to hundreds of academic articles but since there is limited case law, the issue is not yet settled. The shrimp/turtle case²⁷⁹ seems to open the door for PPM-like legal standards under certain circumstances. However, Bhagwati and Mavroidis (2007) argue that while PPM-related rules may possibly be allowed under GATT, they may still be politically and economically controversial, and therefore it is probably a bad idea to pursue such regulations.

In reality, many policymakers believe (wrongly) that PPMs are explicitly forbidden by WTO rules,²⁸⁰ and tend to be careful with setting such rules. Thus, EU laws tend to regulate the physical composition of products, and the downstream processes (waste handling etc.) and avoid regulating upstream processes such as raw materials extraction, emissions during manufacturing, and transport.

Clearly, the wording of the Ecodesign Directive has been influenced by the PPM issues.²⁸¹ Most notably, in Annex I, Part 1, 1.1, it is stated that *“In so far as they relate to product design, significant environmental aspects must be identified...”* Several other wordings throughout the Directive also seem to rule out the application of PPM-related rules in IMs. The somewhat “limited” definition of “life cycle” in Art. 2 – which appear to exclude e.g. raw material extraction – is probably also influenced by PPM considerations. It is therefore rather clear that only environmental aspects related to product design can be regulated through the Directive; *upstream processes can only be regulated indirectly, through product design provisions, which may influence the production in some cases*. In principle, it should not be possible to require PPM-related information from producers, either, unless it is related to product design. *It should for instance be possible to require PPM related information in order to prove compliance with product design requirements. For instance, it should be possible to mandate information to prove that a product contains a certain percentage of recycled content.* The somewhat limited potential to regulate all types of PPMs also implies that there is a role for GPP and eco-labels to play in pushing PPM related criteria (as will be discussed later in this chapter).

This means that upstream processes like raw material, extraction and various production phases and associated impacts, cannot easily be reg-

²⁷⁹ United States – Import Prohibition of Certain Shrimp and Shrimp Products. WTO case Nos. 58 (and 61). Ruling adopted on 6 November 1998.

²⁸⁰ Cf. Egelund Olsen *et al.* 2006.

²⁸¹ Dalhammar 2007b.

ulated under the Ecodesign Directive, except indirectly if they are influenced through rules on product design. In principle, it should not be possible to require PPM-related information either. In other words, requirements should be put on the product content and function, including potential for disassembly and recycling and other functions related to the downstream processes.

In relation to the studies by JRC and Global view sustainability services *et al.* (see chapter 2 for more details) which outline potential IMs related to resources, we can notice that:

- The JRC studies do not outline any potential IMs that would regulate PPMs.
- The other study discusses at least one PPM-related requirement, namely IMs related to declarations about emissions of fluorinated GHGs at the production stage. This is clearly a PPM criterion that would most likely be hard to enforce through IMs under the Ecodesign Directive.

6.1.2 The TBT Agreement

The TBT Agreement must be considered, most notably Art. 2 on “Preparation, Adoption and Application of Technical Regulations by Central Government Bodies”. It contains several relevant rules, e.g. that the EU should notify WTO of proposed government policies and standards, and that the EU should when possible, make use of international standards if such exist.

Art. 2.2 contains a general provision to avoid technical regulations that constitute unnecessary obstacles to trade:

2.2 Members shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade. For this purpose, technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment would create. Such legitimate objectives are, inter alia: national security requirements; the prevention of deceptive practices; protection of human health or safety, animal or plant life or health, or the environment. In assessing such risks, relevant elements of consideration are, inter alia: available scientific and technical information, related processing technology or intended end-uses of products.

In general, the TBT rules should not hinder EU to set progressive rules and standards, but Art. 2.2 implies a proportionality test to ensure

that rules are not more trade restrictive than necessary. This raises the issue of whether other policies than the Ecodesign Directive are possible to apply to achieve certain policy objective.²⁸²

The TBT Agreement also contains other rules – e.g. Art. 12 on differential treatment of developing countries – that are of potential relevance. In reality however, it is not likely that the TBT Agreement is major barrier towards resource use related rules standards, provided that other WTO members are treated in the same way (see e.g. Art. 2.1), i.e. non-discrimination.²⁸³

The overall conclusion is that it is not likely that the TBT Agreement will act as a barrier towards requirements under the Ecodesign Directive.

6.2 The Ecodesign Directive

Of the provisions in the Ecodesign Directive, position papers and interviewees have stressed the importance of Art. 15 regarding requirements related to resource efficiency (see also chapter 8).

In Art. 15(2) of the Directive it is stated that in order to qualify for IMs under the Directive a product groups would have to meet some criteria:

- a. The product shall represent a significant volume of sales and trade, indicatively more than 200,000 units a year within the Community according to the most recently available figures.
- b. The product shall, considering the quantities placed on the market and/or put into service, have a significant environmental impact within the Community, as specified in the Community strategic priorities as set out in Decision No 1600/2002/EC.
- c. The product shall present significant potential for improvement in terms of its environmental impact without entailing excessive costs, taking into account in particular: (i) the absence of other relevant Community legislation or failure of market forces to address the issue

²⁸² The issue of how the “proportionality test” is performed by WTO panels are somewhat debated and will not be discussed here.

²⁸³ This does not necessarily mean that the outcome is the same for all countries due to rules- (cf. e.g. the Shrimp/Turtle case) – it is possible that producers in some countries have better potential to comply with EU rules than others – but the EU should provide the same opportunities for compliance to all WTO members. Thus, “non-discrimination” is related to opportunities, but not to outcomes.

properly; and (ii) a wide disparity in the environmental performance of products available on the market with equivalent functionality.

There are some question marks concerning the interpretation of these rules. Leaving the discussion on “volume”²⁸⁴ aside, the issue of “*significant environmental impact within the Community*” is the first point for discussion. The benchmark is that the potential should be more than 1,000 PJ/year.²⁸⁵ First of all, a reasonable interpretation is that the environmental potential should be realized within the EU, and that potential benefits outside the EU should not count. We may criticize this state of affairs but the rule seems clear in this respect. Thus, one potential “hurdle” is that only environmental improvements within the EU should be counted. Even if EU rules will provide benefits also outside the EU, these should not be included in the calculation.

Several interviewees (see chapters 8 and 9) stress that resource use requirements may have a problem to pass this hurdle, because in general the environmental impact is rather small. For instance, REEs are used in very small amounts. This could mean that the environmental impact is small, even if there is a significant improvement potential and costs of requirements are low.

The second hurdle concerns “*significant potential for improvement without entailing excessive costs.*” The benchmark is that at least a 20% improvement potential is possible.²⁸⁶ While not expressively stated, it is likely that also this rule refers to benefits within the EU.

However, the rules above are difficult to interpret in relation to resources; they are easier to apply to energy efficiency calculations. First of all, the benchmarks are not necessarily relevant when considering “non-energy in use aspects.” It is for instance difficult to establish how “significant” the ban of a substance in a product is, when looking at the health and environmental effects (which are often hard to establish and put a price on). When a substance poses a barrier to recycling practices it may however in some cases be possible to estimate the benefits of removing it, even in terms of energy savings (embedded energy), and/or increased recycling levels and associated benefits etc. In other cases – e.g. rules on prolonged product life, which can be related to rules on longer guaran-

²⁸⁴ There are some complaints from industry about the way that “units” are defined, in order to allow the regulation of a wider number of product groups, but we will not get further into that discussion here.

²⁸⁵ Global View Sustainability Services *et al.* 2011.

²⁸⁶ *Ibid.*

tee periods – it may be possible to estimate energy savings, but the calculations may have to be based on uncertain assumptions (e.g. regarding the potential energy/material improvements in future products put on the market).

Secondly, the environmental benefits and the cost/benefit ratio of certain requirements related to improve recycling will be difficult to evaluate due to dynamic effects. For example, numbers from Japan shows that recycled paper initially was more expensive than conventional paper, but became cheaper than conventional paper over time.²⁸⁷ This is rather typical in waste policy, where dynamic effects may lead to reduction of costs for new systems, and a static use of LCAs and cost-benefit analysis (CBA) may therefore not provide a basis for a good policy.

The above seem to imply that Art. 15 is written with energy related requirements in mind.

If we are to develop generic requirements related to e.g. design checklists and ecological profiles, BOMs and so on, the long term implications may be even harder to relate to the requirements in Art. 15.

In any case, some types of requirements that have a huge environmental potential would probably be allowed even if the legal text is interpreted in a “reductionist” way. Several potential requirements that would boost recycling could probably be warranted, especially if the volumes are high. *One genuine problem concerns mandatory standards set now that could boost recycling in the future.* It is likely that e.g. REEs and other materials can be cost-efficiently recycled in the future as there are ongoing pilot projects to test new recycling methods, and prices of REEs are expected to rise. The cost of future recycling practices will be influenced by the product design now, as the design influences the potential to identify and separate materials. However, *even if producers can make design alterations at a very low cost today to allow more cost-efficient recycling in the future, it is not clear if this is allowed under Art. 15.* If such requirements would not be allowed, the potential for strategic, long term ecodesign policies are clearly very restricted. The potential options are to a) make an “extensive” interpretation of Art. 15 in the Directive, or b) alter the wording of the Directive, which is unlikely in the short term. Since there are currently several proposals to alter the

²⁸⁷ Ministry of the environment. (2009). Green public procurement in Japan. Tillgänglig: http://www.globalecolabelling.net/docs/japan2009/09kobejapan_the_green_purchasing_law_and_promoting_green.pdf [2012-06-04].

least life cycle cost concept, it would probably be a good idea to deal with these – and related – issues in conjunction to this issue.

The importance of the legal text should not be overestimated: it is likely that the initial stakeholder meetings and preparatory studies influence the overall direction of the process, without too much attention being paid to the exact wording of the Directive. The interviews (see chapter 9) also indicate that industry will probably not be willing to enter into major legal fights with the Commission. However, if IMs start to address toxicity and resources to a much larger extent than today, the situation might change and legal issue may be brought up more often.

Further, political resistance towards certain requirements may mean more than whether these comply with the letter of the law in practice. The proposed inclusion of aviation in the EU-ETS scheme has showed how contentious the issue of “imposing” EU rules is on other jurisdictions.

6.3 National policies and harmonization of EU product regulation

The real and perceived conflicts between objectives related to trade vs. environmental protection is one of the main themes in the globalization debate. Trade-related rules may hinder countries from setting their own rules in some cases, but at the same time trade-related concerns may also lead countries to adopt stringent legal standards.²⁸⁸ In the context of product policy, some specific issues are:

- The need for harmonization of various national standards – including voluntary, semi-voluntary,²⁸⁹ and mandatory standards – is important, as various standards constitute a trade barrier. However, harmonization may come at a cost, for instance:
 - Progressive countries will hesitate to set new standards.²⁹⁰ This will reduce the dynamics of environmental policymaking and

²⁸⁸ This was discussed in previous chapters.

²⁸⁹ Voluntary standards may include labels (including eco-labels), industry standards and certification schemes. Semi-voluntary standards are standards, which are in voluntary in theory but mandatory in practice; cf. Dalhammar and van Rossem 2010. For instance, large corporations may require that suppliers use certain standards. Another example of semi-voluntary standards are harmonized standards set under EU's New Approach Directives.

²⁹⁰ Neumayer 2001.

- means that there are fewer countries that lead the developments; progress towards sustainability is slowed down.
- The obvious solution is to set progressive standards through international forums, but this inevitably lead to standards that are “watered down” and generally, not stringent enough to drive progressive eco-innovation.
 - Progressive industry-driven standardization, which includes sustainability aspects, is an alternative that is sometime suggested; however, the inclusion of sustainability criteria in industry-driven standardization is progressing slowly, and will probably continue to do so without stronger incentives.²⁹¹
 - Generally speaking, legal harmonization comes at the cost of diversity; harmonized standards restrict the use of targeted national policies.²⁹²
 - While legal standards – such as IMs under the Ecodesign Directive – may act as barriers to trade, they also have benefits, not least because they create certainty among market players. It has been discussed how voluntary schemes – eco-labels, certification schemes etc. – may actually pose a larger barrier to trade than mandatory rules.

Within the EU, most product-oriented laws in the EU are enacted under Art. 114 of the TFEU (Art. 95 of the old Treaty) and thus aimed at harmonization. Progressive European nations therefore have limited possibilities to lead the way through the enactment of national laws. This state of affairs leads to some concern as research shows how important it is for progressive states to lead the way as front-runners that promote new environmental innovations.²⁹³ Law and policy-oriented research also stress the importance of progressive leading European nations to enact new policies, thereby providing incentives for the European Commission to adopt EU legislation.²⁹⁴ National regulations in EU member states often motivate the European Commission to initiative EU rules. Denmark’s recent announcement on national rules on phthalates, in potential breach of harmonized EU rules, is example of a measure that – though unpopular among many

²⁹¹ Naturvårdsverket 2006.

²⁹² McDonald 2005.

²⁹³ See e.g. Jänicke, and Jacob 2004.

²⁹⁴ See e.g. Onida 2004; Heldeweg 2005; Jordan *et al.* 2003; Rittberger and Richardson 2003.

stakeholders – may significantly bring EU chemical policy forward.²⁹⁵ There are double reasons for the Commission to do this; first of all, it may wish to adopt European rules and policies that are closer to the state-of-the-art when it comes to environmental protection, and secondly, harmonizing EU legislation may aid in reducing trade distortions from national initiatives.

Thus, although harmonizing EU product legislation reduces trade barriers and makes it easier for many industries to access the European market, the harmonization process is increasingly questioned. The European Commission is not unaware of this. In several documents they have stressed that rules that the aim to promote the Internal Market must not suppress national policies and stifle innovations too much. It is however not easy to strike a proper balance.²⁹⁶ Industry often promotes industry-driven standardization and the preference for the use of global standards (whether mandatory or voluntary standards), or at least EU standards, rather than national policies as the way forward for product regulation. We may however question how stringent environmental criteria will ever find their way into global product standards without strong national and European policies driving such developments.

6.4 What is harmonized?

Without getting too deep into the issue of legal harmonization, it is relevant to understand that this topic is often very misunderstood in policy debates. There is often a belief that whenever a product group is regulated under EU law, national rules are not allowed for this product group. However, in reality most EU laws only harmonize certain aspects of the product design and function, depending on the intent of the EU law, the legal basis of the TFEU,²⁹⁷ and the wording of the legal text.²⁹⁸ For this reason, when a particular environmental aspect of a product is not regulated under the Ecodesign Directive, some industry stakeholders have sometimes wanted the Commission

²⁹⁵ ENDS Europe 2012b.

²⁹⁶ Dalhammar 2007a.

²⁹⁷ Many stakeholders overestimate the importance of the legal basis *per se*, see Annex I and Jans and Vedder 2012.

²⁹⁸ For a deeper discussion on the topic of legal harmonization in product law see e.g. Wiers 2003; Dalhammar 2007b; Jans and Vedder 2012.

to state that the aspect has been considered in the legal process but that regulating it is not necessary.²⁹⁹ This would mean it is easier to argue that national rules are not necessary.

In short, legal harmonization is a complex topic, and the EU applies several techniques for legal harmonization with different implications.

6.5 The link to industry-driven standardization

As discussed previously not all types of standards can be used under EU standardization policy.³⁰⁰ One study discusses the potential to make use of IEC62430 to show compliance with various criteria related to ecodesign and resources³⁰¹ – and more generally to prove that life cycle thinking has been applied to the design, with the use of IEEE's standards to adopt requirements to specific product groups. Here we should notice that the IEC standards may be used to show compliance in accordance with EU standardization policy.³⁰² However, there may still be problems when it comes to the interpretation of the requirements of the standard: it is crucial that it is interpreted in a similar way across jurisdictions.

When it comes to the IEEE/ECMA standards however, they can not be used to prove compliance with EU laws according to EU standardization policy, so new international or European standards would have to be developed for this purpose.

6.6 PPMs in GPP and eco-labeling

As discussed previously in this chapter, the potential to regulate all types of PPMs through the Ecodesign Directive is limited; PPMs not related to the product design and characteristics, or PPMs that cannot be addressed through setting requirements related to product design, can probably not be addressed through the Directive. This implies that there is a role for GPP and eco-labels to play in pushing PPM related criteria.

²⁹⁹ Dalhammar 2007b.

³⁰⁰ See van Rossem *et al.* 2011 for more details.

³⁰¹ See Global view sustainability services *et al.* 2011.

³⁰² See van Rossem *et al.* 2011.

PPMs are commonly applied in eco-labels, and whereas there have been discussion on whether this is in line with WTO laws in the past, there seems to be consensus that the issue is not so controversial anymore.

EU case law has established that PPMs can in principle be addressed in public procurement, under certain circumstances. Support for this can be found in e.g. the *Wienstrom*,³⁰³ *Dutch Coffee*,³⁰⁴ *Preussen Electra*,³⁰⁵ and *Concordia*³⁰⁶ cases.³⁰⁷

6.7 Concluding remarks

While there are several potential legal barriers, the main barrier towards addressing resource issues through the Ecodesign Directive is probably article 15 in the Directive.

To some extent, it appears as if the initially rather strong opposition to EU product, fuel and chemical regulations (e.g. the WEEE, RoHS and Ecodesign Directives, the directives related to biofuels, and the REACH regulation), have somewhat faded in later years. This implies that the acceptance for regulating new types of product groups, or new aspects within product groups, may diminish over time as actors get accustomed to dealing with requirements.

It should be noted here that the various legal rules discussed above are unclear and should be understood in their political context. The discussion on including the aviation sector in the EU-ETS has showed how politically charged the extraterritorial application of EU rules is. Some of the rules proposed in various studies – such as material declarations, requirements on recycled content and so on – will inevitably trigger international conflict.

Another issue concerns how important the legal rules really are in the EU process of setting IMs for various product groups. Some people are of the opinion that much of the potential requirements will be decided within the policy process, mainly by engineers, without much reference to legal limitations. While this is probably true for many existing regulations set under the Directive, which mainly set rules for energy in

³⁰³ Case C-448/01.

³⁰⁴ Case C-368/10.

³⁰⁵ C-379/98.

³⁰⁶ C-513/99.

³⁰⁷ For a recent commentary see SOU 2013:12, Bil. 11 a.

the use phase, this state of affairs can change if rules start to address resources, chemicals and so on. The industry is stressing the importance of Art. 15³⁰⁸ and we can probably expect much more focus on legal issues if we extend the range of proposed IMs.

³⁰⁸ See for instance ORGALIME 2012.

7. Resource policies and competitiveness

This chapter discusses how IMs related to resource use can affect the competitive position of EU industries. We first discuss introduce the topic more broadly, before discussing the general link between resource efficiency and competitiveness, followed by a discussion on the link to new business models. We then discuss how various product standards may provide benefits to European industries through competence building. Finally we discuss the link between mandatory product standards and competitiveness.

7.1 Introduction

The link between resource standards and competitiveness has been brought up earlier in the report (see sections 3.1.5, 3.2.2, 3.2.5, 4.3 and 4.4). Potential implications are:

- Recent empirical research has looked into the so-called Porter hypothesis that environmental policies and regulations can in some cases boost the competitiveness of domestic industries. While the evidence is hardly conclusive, several studies find that policies that stimulate innovation and investment in innovative capacity can be beneficial.³⁰⁹ Product standards seem to be positively correlated with improved competitiveness of domestic industries, even if they entail compliance costs in the short term, as they direct investments towards areas that may provide long term benefits.³¹⁰ The fact that product standards easier spread to new jurisdictions than other types of standards also means that setting of product standards through law could potentially provide some first mover advantages (or at least that competitors will also share have similar costs).

³⁰⁹ Böhringer *et al.* 2012.

³¹⁰ Blind 2012.

- Resource efficiency is generally well correlated to increased competitiveness at the firm level³¹¹ and may provide benefits also at the macro level (see also chapter 2 for more details).³¹²

Product standards related to resource use may affect the competitive position of EU industries positively or negatively. Some of the potentially positive relationships are:

- Generally, resource related standards may enhance resource security and reasonable material costs for EU industries, e.g. through:
 - improving supplies of recycled materials, through standards related to recycling and chemicals in products, etc.
 - contribute to new markets for recycled material, urban mining and similar
 - stimulate the development of new, less resource-intensive business models.
- Innovation effects: innovation may be stimulated as companies devote more resources to ecodesign and resource efficiency; this seems to be positively correlated to competitiveness in general.³¹³
- Supply chain innovations: certain requirements may enhance resource use efficiency in supply chains and, also provide manufacturers with more information about resource use throughout supply chains, which may lead to better business decisions.
- It is likely that EU standards will be followed by countries outside the EU; this could lead to potential “first mover advantages” for EU firms.
- Standards may – in combination with other instruments – also lead to new business models and ways to deliver services in a more resource-efficiency way.

On the negative side, there are some very serious concerns:

- Industries may move outside EU to avoid certain rules and inspections.
- SMEs may have a difficult time obtaining the data required, compared to larger firms.

³¹¹ Rennings and Rammer 2009.

³¹² Bleischwitz, R. and Bringezu, 2011.

³¹³ Rennings and Rammer 2009; Blind 2012.

- Some types of requirements, such as declarations on recycled contents, will require supply chain issues and declarations from suppliers. Firms outside EU may provide false certificates; it will however be difficult to inspect them as they are outside the jurisdiction of EU countries. This puts EU firms at a potential disadvantage.

7.2 Resources and company strategies: the link to competitiveness and innovation

As discussed in chapter two, companies may gain competitive advantage from addressing resource efficiency, but rather few firms do have well developed strategies. Bleischwitz and Bringezu state that:

“Importing costs for raw materials and semi-finished goods are a key variable for the competitiveness; for the EU, the value based share of the top-ten raw material imports in total imports grew between 1998 and 2004 from around 8% up to 13%.”

They discuss the need for need to strengthen producer responsibility with materials stewardship, and state:

“In total, resource productivity underlines a new category of innovation that can be characterized as “material flow innovation.” It captures innovation across the material value chains of products and processes that lower the material intensity of use while increasing service intensity and well-being. It aims to move societies from the extract, consume, and dispose system of today’s resource use towards a more circular system of material use and re-use with less resource use overall. While the established categories of process, product and system innovation [...] have their merits, the claim can be made that given the pervasive use of resources across all stages of production and consumption a new category will have to be established to capture innovation activities...”

They list several areas of potential development:

- Substituting environmentally and resource intensive materials with new materials, functionally new products and functionally new services leading to lower demand.
- Establishing life-cycle wide processes of resource efficiency e.g. by more sustainable mining, systems-wide efficient production and application of materials and strategies such as
 - Enhancing re-use and recycling.

- Recapturing precious materials from previously open loop systems (e.g. critical metals, phosphorus).
- Functionally integrating modules and materials in complex goods (e.g. solar cells integrated in roofs).
- Increasing the lifetime and durability and offer related services.
- Transforming infrastructures towards a steady-state stocks society e.g. via improved maintenance systems for roads and buildings as well as developing new resource-light buildings and transportation systems and other network goods (such as waste water systems).

A recent McKinsey report³¹⁴ also stress the importance for firms to *consider resource related risks and opportunities*. Improved resource productivity can develop a structural cost advantage and capture growth opportunities, not least in developing markets. It can also reduce risks. Industry leaders may be interested in shaping standards related to measurement of product chain footprints. The report stresses the need for companies to develop strategies in four areas to contribute to a circular economy vision. These include design rethink based on a LC perspective, reuse materials, but keep quality and serviceability; shift business models towards “user” (as opposed to “consumer”) models, based on function oriented business models; improve efficiencies along materials streams (design, delivery, recovery, processing etc.), and; new collaboration among industries to make things happen.

A DEFRA (2012a) report on resource security discusses viable business strategies to deal with potential resource scarcity and/or higher resource prices. Viable business strategies mentioned include lean production, materials substitution, prolonging product lifetime, and selling services instead of goods. The simplest way for business to manage risk is to make efficient use of the resources; PSS solutions are an option. Upgrading, repair, PSS solutions, take back schemes are other options. Also commercial partnerships between manufacturers and waste management firms, to secure components for re-use and materials for recycling, are seen as a viable way forward. It is concluded that there are some barriers where governments can probably help SMEs through intervention. Such internal barriers include: Perception of high upfront costs; difficulties in making rational decisions, due to complexities of

³¹⁴ McKinsey Global institute 2011.

information to calculate costs and benefits over time, and; lack of prioritization to address an issue within a firm.

The DEFRA report also stresses that there are many opportunities, for instance, the fact that REE recycling rate is less than 1% for many REEs. Also DEFRA stress the potential business opportunities related to recycling opportunities and the development of new materials. It is claimed that UK businesses can save an estimated 18 billion pounds annually.

7.3 Business models, service offerings, and link to other policy instruments

Several reports state that new business models based on functional solutions is key to address the resource challenge.³¹⁵ It also seems that profits for many manufacturing firms are strongly tied to their development of service offerings; indeed, a large challenge for manufacturing firms is to change mindset to become more service oriented. In a report from the UK, the importance of service offerings was noted: *"...there is a growing trend for UK manufacturers to offer services on the back of their manufacturing activities. Two thirds of manufacturers now offer services to complement their product offerings, with many seeing this service offering as their primary tactic to defend their business against competition from low-cost producers."*³¹⁶

Machiba stresses the need for systemic innovation (cf. figure).

³¹⁵ E.g. Ellen MacArthur Foundation. (2013).

³¹⁶ ADS *et al.* 2012. See also NUTEK 2008.

Figure 5. Conceptual distinction between incremental and systemic eco-innovation (source: Machiba 2011)

This issue was discussed in section 4.3. Clearly, many companies see benefits from taking the systems approach under the Ecodesign Directive, as it could aid in the development of systems solutions.

7.4 The macro level: life cycle approaches, standards and competitiveness

A recent Canadian report³¹⁷ outlines the importance of a national program for development of *life cycle competencies to deal with emerging legislation, and industry initiatives*. The report lists several recent initiatives that may pose market barriers for actors without proper competencies, highlighting the need for better knowledge regarding LCA, LCC, EPD, TCA, and similar methods. Among listed initiatives government initiatives – such as France’s Grenelle 2 Act related to Carbon footprinting and EPDs – but also industry driven schemes related to LCA, labeling and eco-efficiency are mentioned. The report claims that Europe is ahead in many areas and recommends a national program to catch up. As discussed in section 4.4 there is also evidence that some governments become active in standardization, partly to make sure that the interests of domestic corporations are taken into account.

³¹⁷ National Round Table on the Environment 2012.

National product standards of different kinds can have very detrimental effects on trade as they induce high transaction costs for foreign industries (including costs for legal assistance to identify relevant requirements and costs for product certification).³¹⁸ In Europe however, EU-wide standards have started to replace national standards to an increasing extent. This is both because of regulatory efforts in the EU, and due to increased cooperation of European standard-setting bodies. The growing output of EU standards means that other states are increasingly utilizing European standards as well, and European standards are often influential in international standard setting. Egan states that this fact often gives EU firms a strategic advantage, and that EU firms have increased their efforts to have greater influence over European standardization.³¹⁹ Furthermore, US and Japanese industries have also increased their lobbying efforts in Europe in order to increase their influence over legal and voluntary standards. As national, regional and international standards are increasingly tied together, firms need to develop strategies to influence standard setting at the various levels.³²⁰

Also other types of policies may be used to create competitive advantages for domestic firms, not least public procurement policies. For instance, US policies on “domestic content” in procurement, and other types of US public policies, aid US enterprises in winning public contracts both in the US and in other jurisdictions.³²¹

7.5 The relationship between mandatory standards and competitiveness

As stated above, recent research finds that product policies can have a positive effect on competitiveness of domestic firms.³²² While mandatory standards related to energy efficiency probably has a positive impact on the competitiveness of domestic firms, this may not be equally true for all types of obligatory standards: after all, more energy efficient products are related to monetary savings, whereas other types of standards – recycled materials in products, chemical content, etc. – may not

³¹⁸ UNCTAD 2006; Faure 2000.

³¹⁹ Egan 2002.

³²⁰ Egan 2002.

³²¹ See the literature review in Dalhammar and Leire 2012.

³²² Blind 2012.

provide savings for the private or professional purchaser. In the long run, efficient recycling markets may provide cost savings for firms, but this is hard to establish in advance.

A relevant question is whether only domestic industries bear the costs of the requirements. This would typically not be the case, as requirements would apply equally to products imported to the EU. However, only when criteria are possibly to control through assessment of the physical product can a level playing field be assured. When it comes to potential legal standards like requirements on recycled content, it is usually not possible to establish conformance through product checks: supply chain measures like declarations are required. If third party verification schemes³²³ are not applied, it will be hard to establish conformance with any certainty: self-declarations are not always trustworthy. EU firms could be at a possible disadvantage. The above means that for some types of legal standards, domestic firms may have some disadvantages in comparison to other firms. One way forward is to support legal standards through other types of policies as well, e.g. providing benefits in public procurement for advanced practices. Firms that provide third party verifications may be granted certain advantages in this process.³²⁴

However, the general impression is that progressive manufacturers are rather positive towards new legal requirements, as long as they are applied in a reasonable manner and there is proper market surveillance in place. A study by Teknikföretagen³²⁵ mentions that firms, being subject to regulation for some time, are less concerned about the effects of new requirements than other firms, as they know that they can comply at reasonable costs. A Nordic study³²⁶ also confirms that progressive companies may in many cases welcome stricter legal standards. It is stated:

“The interviewees were more positive towards legislation and regulation than expected. It was obvious that companies providing environmentally good products see stricter legislation as a positive thing, making their competitors work even more to fulfill them. For some issues, such as chemical substances where it is possible that the customers do not have enough knowledge to make demands, legislation is seen as the only way to improve the products. Companies not already providing environmentally good products see legislation as the only reason to improve their products, asking “why

³²³ It should be noted that 3rd party verification will not solve the problem as it can not be trusted in all cases.

³²⁴ This may require some changes to EU procurement law, but this is outside the scope of this study.

³²⁵ Teknikföretagen 2011.

³²⁶ Jönbrink, and Melin 2008.

should we use money and effort to create something which is not asked for by anyone?" They think that if a law tells them what to do, it is the same for their competitors. But if they do it unilaterally, they only see a cost that the competitors don't have. The recommendations are therefore to let best practice guide legislation. Weak legislation gives legitimacy to lagging companies, while it doesn't encourage good companies to do better. Doing this, it is also important for authorities to have contacts with individual companies rather than industry associations, as the latter normally represent the middle or lower range, rather than the top."

Progressive companies are most favorable to new legislation, not only because such legislation may be a competitive advantage for them, but also because they have noticed that legislation can be a driver of innovation. Blind has argued that product regulation is well associated with industry benefits. He argues that the probable reason is that product regulation – even if it leads to higher costs in the short term – directs investments in a profitable direction. Another reason, evident from other literature,³²⁷ is that product policies tend to diffuse to other jurisdictions in way that other policies do not.³²⁸ Simply put:

- National product policies may be taken up by other jurisdictions, as they need to ensure that domestic firms can comply with requirements in different markets.
- National policies within the EU tend to trigger the development of new EU laws and policies, as the Commission wants to avoid Internal Market distortions through harmonizing legal standards.
- Once there are EU standards in place, most global companies will have to follow the standards as the EU is the world's largest market (in terms of total GDP).

Thus, in most cases legal product standards set within the EU do not constitute a long term threat to EU firms. There may however be exemptions to this rule, most notably when it is difficult to check compliance of firms operating outside the EU. Some rules in the REACH Regulation may be an example of this – especially if the market surveillance is poor.

The big "winners" from stricter legislation are likely to be advanced companies that are already experiencing demands for greener products from consumers, professional purchasers and regulators. Companies

³²⁷ Onida 2004; Dalhammar 2007a.

³²⁸ For instance, the Swedish CO₂ tax has not been taken up by many other countries.

providing expensive but high-quality products may gain both on stringent legislation and on laws built on a systems perspective. It is probably not a coincidence that Northern European based manufacturers often approve of stricter regulations.³²⁹

7.6 The link to industry-driven standardization and the New approach

While some companies are generally favorable to new legislation, if designed and implemented properly, other industry representatives believe that the most favourable legislation is the one that makes best use of industry-driven standardization. They therefore support the New approach³³⁰ and similar types of approaches where there is a strong interplay between legal requirements and industry-driven standardization.³³¹

7.7 Surveillance and monitoring

Usually, industries supporting stringent regulations see proper market surveillance as a necessary component of a legal regime; otherwise non-compliant products are allowed to enter the market, while non-compliant producers must not bear the costs of the compliant ones.

7.8 Concluding remarks

In this chapter we have outlined potential benefits from product standards. In theory, there should be a possibility to set resource efficiency standards under the Ecodesign Directive that could provide benefits for EU-based industries in several ways. However, the potential benefits are probably very contextual, depending on both the product group and what kind of product standards that are set. Some standards may actually put EU industries at a disadvantage. The best way to explore the issue is through interview with stakeholders in industry, which we do in chapter 9.

³²⁹ Jönbrink and Melin 2008.

³³⁰ For information about the New approach, see <http://www.newapproach.org/> [2013-07-01].

³³¹ Dalhammar 2007b.

8. Views of national representatives

This chapter accounts for the main results of a limited interview study with member state representatives, the European Commission, and one NGO.

8.1 Objective and methodology

An interview study with ten people (eight national representatives from eight EU different EU countries, one person in DG Environment, and one NGO representative) was performed as part of the project.

The interviews were done to explore the views to a number of themes in relation to the Ecodesign Directive, including the innovation effect of IMs, the least life cycle cost methodology, and the potential to include resource efficiency type of requirements. For a full review of the results see Machacek (2012). Here we only refer to issues relevant for the scope of this report and thus mainly refer to resource efficiency issues. It should be noted that the interviews were conducted during the summer of 2012, before the final JRC reports were published (though the first project report had been published).

8.2 Main findings

In general, the interviewees considered that the Ecodesign Directive had high acceptability among the stakeholders. It was however not seen as a strong driver of innovation as it was “*chasing the market*,” often setting requirements that are outdated by the time they entered into force. There seems to be a strong *agreement that energy labeling is the strongest contributor to innovation related to energy efficiency*, though one interviewee was positive that the Ecodesign Directive could take this role in the future. Several interviewees stated that new approaches and LCC calculation methods, such as the Top Performer approach proposed by Germany, could move things forward, and aid in the setting of more progressive legal standards.

8.2.1 The life cycle perspective

All respondents recognized that the Directive has potential for applying a wider a life cycle (LC) perspective than is currently done, whereby some interviewees were more explicit in saying for instance, that the Directive is based on a LC perspective or, as phrased by three interviewees: that it has a clear potential for, and that good efforts are made to, consider the entire LC even if it has not lived up to its full potential yet.

Two member state representatives stated that the Directive can address issues such as recycled content, recyclability and reuse, with practicality being the impeding element in the implementation. The *practicality is predominantly attached to the challenge of measurement*, which was a point raised by several interviewees. One interviewee stated that *“until [the] LC [perspective] can be measured, energy efficiency will continue to remain the overall target due to the practicality attached to it.”* One member states representative stated that “material selection” should be part of the considerations. A representative for one member state highlighted the importance of the simplified LCA being conducted under the Directive; it could inhibit efforts to take a “comprehensive” life cycle approach.

A nuanced position regarding ecodesign being able to address every product was presented by one respondent: it was stated that no subtleness in the definition of the conditions for a good ecodesign product candidate *“could result in an easy counter argument for those who are not in favour of extending the environmental dimension or scope.”* In the definition of an adequate ecodesign product candidate, two aspects are most important according to the interviewee: On one hand, *priority resource use aspects that need to be addressed absolutely are to be identified*. Further, it needs to be established *which aspects, amongst those identified, are better addressed by ecodesign and which ones would benefit of being addressed by other instruments*, such as by EMAS, and BREFs. The interviewee highlights that one NGO currently investigates the condition for the relevant inclusion of products in the Ecodesign scope neglecting to advocate Eco-design as “the silver-bullet to all our problems.”

One interviewee discussed the potential for a stronger life cycle perspective in more length. He stated that the Directive *“allows for other dimensions to be addressed”* and that this is *“dependent on the understanding of “significance”*” [in Art. 15 of the Directive, see also the discussion in chapter 6]. To date, the “significant impact” of an environmental aspect is identified first and then, in a next step, the improvement option and feasibility are investigated (see chapter 6). *The potential environmental influence of the Directive would be slightly different if “signifi-*

cance” was not understood as the absolute environmental impact only but as the “improvement potential.” On the example of resource use, a criterion, which is not as significant as energy use today, but shows significant improvement potential, *the significance could be addressing the improvement potential rather than the absolute environmental impact per se.* This change in the selection filter would open opportunities to claim for additional environmental requirements, including for instance the case of REE. It is known that their mining and processing is highly energy-intensive and requires significant input of chemicals. Furthermore, REE has been prioritized within the classified group of critical materials,³³² but the fact that they are used in small amounts in products means that they will never be able to compete in terms of absolute environmental impact with energy use. In contrast, if the significance was understood as the improvement potential of REE in one appliance, then, even if the REE absolute impact is minor, the improvement potential might be large, compared to energy use, of which the absolute impact could be very important but its improvement potential could be more and more limited as tougher and tougher requirements are envisaged in the future. The interviewee said that due to the filter – or the selection criteria -applied, the environmental dimension is immediately stopped because significance is addressed as the absolute environmental impact. A change in the interpretation of this filter could open the range of the environmental dimension, which could be addressed rather than leading systematically to an investigation of resource use.

8.2.2 Addressing resource related issues through the Directive

Most respondents agreed that the Directive has not lived up to its full potential yet regarding resource efficiency, with some interviewees taking a more positive stance. One interviewee considered resource efficiency to be “the next logical step after energy efficiency,” while one interviewee stated that the Directive is not directed towards resource efficiency as a primary objective but has nevertheless addressed water in e.g. dishwashers and washing machines, as it is measurable. One national representative was however quite skeptical when it comes to addressing resource issues under the Directive, due to a lack of available

³³² Buchert *et al.* (2009).

and accepted indicators to measure resource efficiency. The respondent further stated that the improvement potential regarding resource efficiency and the rebound effects are hard to measure and constitute weak points in product legislation, reinforcing that “neither consumption nor user dynamics can be controlled.” Nevertheless, and as pointed out by one interviewee, the inclusion of the criterion of critical raw material within the MEErP³³³ presented an important starting point towards addressing resource efficiency through the Directive.

One interviewee stated that EoL management and resource use aspects were identified as constituting good candidates for new IMs related to resources, specifically the 3 Rs, and hazardous material, which is addressed by RoHS and chemical content, targeted by REACH.

Three options were mentioned as a way to increase RE, including:

1. Restriction of the share of a certain material used in the specific ErP
2. Requirement of a minimum share of recycled material in the ErP
3. Concentration of the specific material in the ErP.

According to one national representative, considering the tools with which the Ecodesign Directive operates, the third option above appears to be the easiest to implement. Option one and two could be implemented in the form of horizontal measures, in the case option two by requesting that recycled content should be e.g. 35% at a certain year. The DG Environment representative in principle agreed with this approach to address resource efficiency and implied that it could be quickly implemented; this was however in stark contrast to one national representative. Both agreed however that option two above would bring up the challenge of verification in the form supply chain certificates of some kind. One national representative discussed how this would provide an opportunity to enter into product chains through the Directive; due to the limitations posed by product measurements (as product checks can not estimate recycled content for many materials). With a view to the global supply chain, one national representative pointed to the high volume of semi-finished goods which are imported into the country and the entropy related to their import, which should also form part of the discussion on increasing resource efficiency.

³³³ Kemna *et al.* 2011.

The importance of semi-finished goods imports in this discussion was also raised as a crucial factor for e.g. the power tool industry. A significant share of product components comes from abroad [outside the European Union]. One interviewee stated that we can come to a situation where producers request information in accordance with requirements in the Directive and then realize that their global supply chain can easily maneuver them into a failure in complying. Against this background, the importance of ensuring the practicability of the requirement attached to measuring the resource efficiency of a product can be better understood. The practicability extends to the data, namely specific versus generic data that is needed to measure and meet the requirement.

Some interviewees discussed how resources may be communicated as embedded energy, which seems to be an approach increasingly applied by NGOs in their attempt to address resources and raise awareness. Another, already applied approach, to improve resource efficiency, as highlighted by one interviewee, is the “total cost of ownership method.” It has been addressed in the work [on setting IMs under the Ecodesign Directive] for transformers,³³⁴ appliances, which are made of copper with an iron core, which is magnetic. With a view to tendering, and taking into account the very explicit trade-off between material efficiency and energy efficiency, optimum material choice balanced with desired energy efficiency to obtain a certain return on investment, is already applied with transformers. One respondent suggested, “this approach could be taken up in legislation.” The method investigates how economically viable it is to put more amounts of copper or iron into the transformer to obtain a more efficient performance.

Addressing resource efficiency in different LC phases, one interviewee drew attention to the problem of overreliance on the performance of the WEEE Directive when conducting preparatory studies for different lots, in the context of the policy mix idea; the interviewee stated that: “*it is taken for granted that everything is treated according to WEEE and discussions are relatively quickly off the table. (...) Not every [energy-related] product is a hundred percent compliant.*” The respondent suggested that the extent to which the WEEE Directive can handle the par-

³³⁴ A transformer is defined as a “device that transfers electric energy from one alternating-current circuit to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage. Transformers are employed for widely varying purposes; e.g. to reduce the voltage of conventional power circuits to operate low-voltage devices, such as doorbells and toy electric trains, and to raise the voltage from electric generators so that electric power can be transmitted over long distances.” (Encyclopedia Britannica Inc. 2012).

ticular aspects of a product group should be checked in the preparatory study. The DG Environment respondent also introduces the concept of “EoL efficiency” which represents one option to address resource efficiency in the EoL phase. The concept takes all costs from buying virgin material to EoL into account and the optimal EoL treatment of a material is being calculated by comparing the result to the cost of the virgin material. The evident challenge is linked to data availability.

In summary, the majority of respondents agreed that the Ecodesign Directive has potential for facilitating resource efficiency improvement and is principally well suited to address resources. One interviewee stated that the selection and avoidance of particular materials are considered useful elements of the Directive; however it has not yet reached its full potential. One interviewee sees the challenge in translating the results of the method development into adequate and practical requirements, re-iterating that the methods need to be strong enough to generate an impact. One interviewee stated the important role of market surveillance. The NGO respondent is convinced that the full potential of ecodesign has not yet been explored, specifically with a view to critical materials, where improvements could be achieved as to the conceived design of the product, namely to ensure an easy disassembly at EoL to facilitate reuse and recycling, and regarding the information requirement on materials used in each product and their physical location. The latter point is to be understood as a precondition to complement the weight-based WEEE qualitatively, which was explored in a DG ENV-JRC collaboration on the assessment of the “resource use environmental impact” [and resulted in a Product Environmental Footprint Guide by Manfredi et al. (2012)].

Some other relevant views expressed by the interviewees were:

- One interviewee stated that we need to have a better ideas on what resource issues that are best addresses by the Ecodesign Directive, and which ones that should be addressed by other instruments. EoL aspects and certain resource use requirements may be a good starting point for regulations on the Directive.
- One respondent noted the addition of critical raw materials as parameter in the proposed MEErP,³³⁵ as a first step, and therefore

³³⁵ Kemna et al. (2011, pp. 31) stipulate in the report on the MEErP methodology that “analysts that will carry out preparatory studies should consider CRM [Critical Raw Materials], if applicable, as a new element of the MEErP, for example to check design options that substitute or make it easier to recover CRM components.”

considered critical raw materials a logical starting point for the future regulatory efforts.

- Three interviewees stated that we need to work with long term target setting, preferably based on functional considerations. The outcome or function should be regulated, not the product itself.
- One respondent pointed out that a vision of the future product could probably be “communicated” through the Directive, stimulating more radical innovation.
- One interviewee stated that for many politicians the link between resource efficiency and energy efficiency is not clear.
- In some regions, the view of the Ecodesign Directive is rather negative as the Directive does not support ongoing waste recycling initiatives.

8.2.3 *Proposals from the interviewees*

Some interviewees provided additional proposals on the way forward to address resource efficiency, including:

- One interviewee specifically mentioned that longer periods for compliance could work better with the industry design cycles, and therefore IMs could be made more stringent if longer periods for compliance were set.
- Resource related aspects could be regulated in a horizontal way, spanning several products groups in the same study and same IMs. One example would be e.g. a requirement that the level of recycled content must be 35% for some product groups.
- One interviewee stated that it may be effective to try to communicate resources as “embedded energy,” in order to improve acceptance for such parameters being included in assessment and potential requirements, as energy and CO₂ emissions are easier to calculate, and there are set EU targets for those parameters.
- Against the background of a need for a more coherent combination of the existing product policy instruments one interviewee discussed how the policy mix could be fostered by an approach which calls for a basic set of requirements jointly reflected in Ecodesign, the EU Eco-label and GPP; to be measured against the same, common methodology applicable to the identified requirements and a common revision process which is to be applied simultaneously for all three instruments. This could be helpful both for energy efficiency standards and standards related to resources.

- One national representative emphasized the immense legislative work that accompanies a treatment of products on a product-by-product basis, and highlighted the lengthiness in the process attached to achieving consensus, which can result in outdated measures at the time of adoption. This view is also shared by another representative, which suggests two options as remedies: one, in form of an 80/20 approach, with the aim to capture most issues during the work on the IMs and the remaining in the following years, and the other in form of an increase in EU resources targeted towards the work on Ecodesign to facilitate a more rapid approach, with the justification being the good return expected from the measures.

8.3 Discussion

Several interviewees pointed out that the interpretation of the “significance” requirement in the Ecodesign Directive may be crucial for the setting of some new types of IMs related to resource issues. This may indeed provide a challenge in the future. This is discussed in chapter 7. Several interviewees stressed the problem of measuring recyclability and similar concepts, but it is possible that the situation has changed with the recent JRC reports that deal with these issues.

We can notice that there are slightly diverging views on the need for methodological development. It seems that issues related to recycling and critical materials are the logical starting points for future standard-setting. In order to show the importance of resource issues, measures such as outlining the saved energy from recycling, and embedded energy in materials and components, may be a good starting point.

Virtually all interviewees saw a potential to address resource efficiency aspects through the Directive, but there were diverging views regarding how difficult this would be. Clearly, addressing recycling in various ways seemed to be the aspect with highest acceptance. Potential requirements included easiness-to-disassemble/design for dismantling, mandated requirements on recycled content, and phasing out chemicals that pose a barrier to sound and cost-efficient recycling.

9. Views of industry representatives

In this chapter we account for the results of an interview study with representatives from industry. The main aim was to get expert opinions on the potential to set requirements related to resources through the Ecodesign Directive, and the potential implications for EU industries.

9.1 Objective and methodology

In order to obtain views also from industry, a limited interview study was conducted during April 2013. The process started with the development of an interview protocol, which can be found in Annex II. The protocol is based on the analysis in the previous chapters, and includes a number of themes related to resource efficiency and the Ecodesign Directive. Further, the interviewees were asked to comment on a number of potential IMs – based on ideas from various reports such as the JRC reports and other reports discussed in chapter 2 – in order to obtain direct input on potential legal requirements.

Altogether, there were seven interview sessions with nine interviewees (as two of the interviewees were interviewed together). The interviewees include five people from corporations and four people representing national industry organizations in the EU. The interviewees were selected because they were considered to have significant experience with working with the Ecodesign Directive and related issues – such as technical compliance and standardization – and related policies (e.g. REACH, RoHS, WEEE, energy labeling), and pilot projects. Thus, they are experts in the field. Initial contacts were made with twenty experts, and depending on their availability during April (which was the deadline for the study), and their assessment on whether they contribute to the study, 9 interviews could be conducted during the given time period.³³⁶

³³⁶ Several interviewees were not available before May 2013.

The interview time was in the range 45 minutes – 4 hours. Some interviews were followed up by emails to clarify unclear issues.

The interviewees (five) from corporations represented four companies: two corporations that mainly sell on the B2B market, and two firms that mainly sell on the B2C market. All the interviewees have significant experience in working with ecodesign issues and legal compliance.

Obviously, the interviews can only provide the views of a limited number of experts. Still, as the interviewees from industry have significant experience from ecodesign and recycling projects, the interviews can provide an initial expert opinion on some key issues. The interviewees from industry also devoted significant time to the interviews, providing a lot of data.

The industry interviewees all come from large corporations. The “SME perspective” is mainly provided by interviewees from the industry associations.

In general, the interviews with the industry representatives provided the most useful information, because these interviewees:

- are more open to new regulations, even seeing some potential benefits associated with certain legal standards
- have been involved in relevant projects, such as pilot projects to stimulate recycling of their products, and associated design solutions that allow the use of recycled content, and therefore have experiences of testing new solutions
- have relevant experience of legal and technical compliance related to various product policies.

9.2 Main findings

9.2.1 *Preference for global and European standards*

Most interviewees stated a preference for global standards for ecodesign; this applies both to mandatory standards and various technical standards (set through standardization). However, the interviewees also acknowledged that the EU cannot wait for the rest of the world in many cases but must pursue its own policies. Several interviewees stressed the need for taking an EU approach and avoiding national and regional initiatives to the extent possible. One example mentioned concerns France’s current initiatives to develop a LCA methodology for la-

belonging; it could be better to have one EU standard rather than several national standards.

However, some interviewees mentioned that public procurement could be a tool applied by national governments to move things ahead when there is no possibility to have legislation, provided that compliance is checked properly (see more on this below).

9.2.2 Benefits for EU industries of the Ecodesign Directive

One question asked whether the Ecodesign Directive – as used up to date – has provided benefits for EU industries. Most interviewees did not view the directive as negative for EU industries, and some saw it as beneficial for certain industries. According to one interviewee legislation can be beneficial but *“the legal developments are too slow to provide competitive advantage for us [EU industries] ... everyone has plenty of time to prepare for new standards.”*

One interviewee thought that EU’s product related legislation may have provided EU industries with some strategic advantages, as they are sometimes better prepared than competitors to deal with new types of requirements on products. One interviewee however stated that often EU product policies are seen as providing disadvantages for EU firms, not least as non-EU firms will be less subject to control and surveillance mechanisms. The perception is that often, EU laws are drafted without taking the need for a level playing field into account.

One comment was that some individual industries probably push for stricter mandatory standards under the Directive, but that these probably have limited influence on national authorities; when the latter push for stricter legal standards at the EU level it is usually due to strict national targets for energy efficiency, rather than as part of an industry agenda.

Other comments were:

- For industries with regional product platforms, it is often hard to say how much EU legislation affects other jurisdictions over time.
- Market surveillance and quick closing of loopholes (e.g. quickly addressing IMs that are unclear on the energy efficiency target or measurement of product energy efficiency) are crucial for making sure EU industries have benefits from the Directive, or for making sure EU industries are not put in a competitive disadvantage due to EU rules.

9.2.3 Improvements of the processes for setting ecodesign requirements

Not surprisingly, the interviewees stated that they wanted a quicker legislative process. Some interviewees also demanded a better closing of legal “loopholes”; examples were given where mandatory energy efficiency standards were formulated in a way that allows different interpretations and measurements. It was concluded that such loopholes must be closed quickly and that the Commission must deal with this and not leave it to standardization bodies to deal with such issues when they develop harmonized standards.

Another concern was the diverging views within the Commission, and diverging views among ministries from the same country, regarding the application of the Ecodesign Directive.

One interviewee said that there must be better coordination between legal requirements and the development of harmonized standards for measurements: the standards take too long to develop. It would be beneficial if harmonized standards could be in place at an earlier date in order to allow for better control of legal compliance.

9.2.4 Potential benefits for EU industries from new types of requirements related to resources set under the Ecodesign Directive

There were slightly diverging views on whether new types of rules could provide benefits for EU industries. One objective was that *manufacturers bear the costs for new product design and legal compliance but will not reap the benefits* (as recyclers and municipalities may control the material and thus reap the benefits; this is discussed more below). Some interviewees complained that they do not have access to the material at the end-of-life stage; such access is crucial for providing the right incentives. Some interviewees stressed that it was the poor design and implementation of the WEEE Directive that was the main problem; redesigning and implementing the WEEE Directive would be a better way to go than to rely too much on the Ecodesign Directive, which should be viewed as a complementary policy to drive design for recycling.

However, *some interviewees acknowledged that new mandatory standards could help the EU recycling industry in several ways*, for instance by a) providing materials with less unknown substances, and/or b) provide better access to certain materials. *In time, this could benefit also EU manufacturing industries as they may get better access to recycled material at reasonable prices.* However, one interviewee stated that the

idea that this would provide benefits for EU manufacturers specifically is not realistic, as all recycled resources will be available on the global market. In the past, we have seen that e.g. China – with access to cheap labour – will make use of materials stockpiled in the EU.

It was also acknowledged that the WEEE Directive has been very positive for the recycling industry. One concern from an interview was however that the EU would mandate collection and recycling of materials where it is hard to find any use; then they would just be stockpiled. Another interviewee however said that this should not be viewed as a problem. The WEEE Directive has provided impetus to entrepreneurs to upgrade the recycled material, and therefore to create new markets. Materials are therefore seldom stockpiled in practice; once they are there, various actors will try to upgrade and find a market for them.

The main consensus however seem to be that prices of materials and raw materials is currently the main driver for both design and recycling developments, rather than legal rules. Only in exceptional cases has legislation been a larger driver than cost issues. One interviewee stated that for materials and substances where material costs already influence design considerations substantially, there may be little need to regulate it. Several interviewees were concerned that regulations could provide the wrong incentives if not well thought through.

One interviewee stated that certain types of requirements on “pure” materials – free from certain substances – if set under the Ecodesign Directive, could be a help for EU manufacturing industries. The background is that some products can be manufactured in the EU but only sold outside the EU, but the opposite can also be true: if some substances are banned in the EU, manufacturing may move outside the EU. Typically, dangerous substances will then enter the product in small amounts. If the Ecodesign Directive sets low thresholds for such substances, new manufacturing methods may have to be developed, and manufacturing may stay within the EU. The use of Arsenic (As) in some glass products was given as an example of potential application. A problem foreseen, however, was that such rules would have to pass the “significance” test in Art. 15 of the Ecodesign Directive.

Additional comments included:

- Requirements should be related to technical performance and function: if they are measurable, the compliance can be tested, and products can be withdrawn from the market. Companies can direct attention to non-compliant products entering the market. In contrast,

some generic requirements can often be interpreted in many different ways.

- In the beginning, RoHS-compliant components were more expensive than the alternatives. Now, the opposite is true, as most manufacturers want to be RoHS-compliant. Therefore, banning of certain substances and materials through the Ecodesign Directive could lead to similar developments in the component market in the future. However, most materials and substances are in the product for a reason, as they fulfill specialized functions, making it difficult to regulate them in some cases.

9.2.5 *Do EU firms reap benefits if EU is a first mover in ecodesign standard-setting?*

One question queried about potential benefits for EU industries if EU act a first mover in setting ecodesign standards – both mandatory and voluntary types of standards – listing aspects such as development of life cycle competencies, influencing EU standards than can become global standards, and so on. The interviewees had diverging views on the topic. Some opinions were:

- Some companies are active within standardization and it can be a benefit for them. But it also entails costs for manpower and development of expertise.
- It is often good for domestic firms that their member state is active within EU standardization.
- It is good that the EU has the possibility to set its own standards; otherwise it may have to apply international standards that do not suit EU industries.
- It is certainly positive for industries if we have EU standards rather than diverging national standards.
- EU firms have benefits, but also additional costs; we are involved in costly processes to create standards that other jurisdictions can make use of.
- If the European standards related to the WEEE Directive and WEEE treatment in general becomes global standards, it would be beneficial to our company.
- We have to remember that the market for materials is international; “closing the loop” is a vision that can only be realized at the international level.

- The Ecodesign Directive's legislative process is long, but the implementation time is short, so we need to know what requirements to expect to be ready in time.
- More transparency is required in standardization, especially if SMEs are to be ready for new requirements.
- Setting standards first in the EU can benefit EU-based industries selling in the EU in some cases, cf. to non-EU firms selling on the EU market. EU-based SMEs however have no benefits as they do not usually take part in standardization processes.
- Standardization tends to devote much attention to measurement criteria. It would be good if they could devote more attention to technical requirements as such.
- If EU is slightly ahead of other jurisdictions it can be good, but if we are too far ahead it will be costly.

9.2.6 General comments on the JRC report

Only a few interviewees had read the JRC reports (discussed in chapter 2). Some comments on the JRC reports were:

- The reports are very “atomistic” in their approach; the regulation of certain aspects is discussed, but there is no holistic perspective on ecodesign.
- Some types of requirements proposed can work, and makes sense in some cases, but many of the proposed issues are probably “dead ends” in the sense that they do not lead to differentiation among producers, or provide continuous incentives for ecodesign.
- One interview stated that the JRC report misses the obvious links with the WEEE Directive: some potential requirements only make sense if corresponding changes are done in the WEEE Directive.

One interviewee stated that “more is not necessarily better,” as too many requirements make the whole compliance process more complex.

9.2.7 Comments on various potential IMs

Technical guarantees on life length – “technical durability”

Some interviewees stated that technical guarantees on life length – where manufacturers provide technical documentation to prove that a product will likely last for a certain number of “uses” (e.g. counted as hours with maximal energy use or similar) – could make sense for some

product groups. It could make sense for e.g. vacuum cleaners or washing machines, as these are products that consumers tend to change only when they brake down. Further, these types of machines are only used for a limited part of their lifetime (a vacuum cleaner is used until it is broken down, but it is only in actual use during a very limited part of its lifetime), which means that even if new products emerge with better performance it may make some sense to prolong their lifetime.

However, such requirements would not make sense for product groups where consumers change products even when the old ones are working, such as mobile phones or laptops. Also for large industrial systems there may be reason for upgrades before the system is approaching its potential lifetime. In these cases it may be a very bad idea to ask for technical guarantees for longer life lengths, as it would lead to “over engineering” which equals waste of resources and money. The interviewees however acknowledged that there could sometimes be a “chicken-and-egg” problem here: if products are designed for longevity, customers may be interested in using them longer, and PSS business models could become more attractive.

For product groups that are not mature but under rapid technological development it makes less sense to set guarantees for long life length, for several reasons.

Longer consumer guarantees

One type of IM discussed in some reports concerns longer consumer guarantees. The main idea is to set a mandatory requirement for producers: when consumers ask for longer guarantee periods than currently given, they should be provided with such guarantees (e.g. up to three years guarantee instead of one year). The main idea is that this would stimulate design for longevity. However, the interviewees were concerned that such measures would provide the wrong incentives. For instance, consumers would have little reason to take care of products where the guarantee period is very long. Another issue is that it’s the “use time” that is important (cf. above) rather than years per se. Another objection was that setting such requirements under the Ecodesign Directive would blur the line between the ecodesign rules and regulations related to consumer protection (of which some are set at the EU member state level).

BOM requirements

There were some diverging views on the potential for BOMs of different kind. Several interviewees stressed the intellectual property (IP) dilemma and stated that the potential to set requirements on the provision of

information about content etc. would be very limited. Some interviewees were more positive – and did not view IP issues as a large problem³³⁷ – and stated that their experience was that recyclers could probably make use of certain types of information provided by BOMs.

Regarding more information to recyclers, there were some diverging views on information that help to provide better disassembly and recycling. Some interviews stated that recyclers had different practices when it comes to disassembly, had already invested in their current facilities, and therefore their practices would not be changed due to information that could aid in recycling more valuable materials. Other interviewees however stated that if recyclers get more information, it may influence their investment in technologies for the next investment cycle.

One interviewee stated that the RoHS Directive, the REACH Regulation, and US laws on conflict minerals – and in the future also expected forthcoming EU laws on conflict minerals – means that some BOM information already exists or are under development. He stated that we could build on these and possibly require more information in the future. However, he cautioned that the current types of requirements were more of the yes/no nature (i.e., is this substance present in the material? Do these substances come from country X?); BOMs related to e.g. recycled content, and requirements to inform about how much recycled content there is in a product would be much more complex. One potential problem would be to guarantee how much recycled content it is in a given product (this is discussed below).

Some interviewees thought that it was reasonable that manufacturers provided information about the amount and placing of critical materials, such as certain REEs.

Maximum disassembly times

Virtually all interviewees were very negative towards the idea of maximum disassembly times. Some interviewees found it strange that the JRC reports had discussions on the potential to mandate maximum disassembly times, because whatever “technical” requirements the product may comply with, the “real-world technologies and practices” among recyclers will anyway decide the disassembly time and the costs of recycling. Thus, it was seen as a requirement that could be burdensome to comply with, but providing few real benefits. Another concern was that

³³⁷ This probably depends a lot on the industry sector as IP issues are of larger importance in some sectors.

requirements would be put so that manual disassembly would be required even if not practiced at some facilities.

One interviewee thought that RFID tagged to the product – with information about material content etc. that could aid recycling practices – could become a requirement in the near future for some products. The person did not see manual disassembly as something positive but rather that we should move towards non-manual shredding practices; RFID information could aid in developing shredding practices where valuable materials are not lost. It was argued that requirements on maximal disassembly times would be at best of little relevance, and in worst case it could even constitute obstacles towards better recycling.

Requirements on recycled content

Most interviewees thought that any mandates on percentages of recycled content in the product would be either unworkable or undesirable. One issue was the need for supply chain certifications that could be problematic for EU industries because:

It is easier to inspect EU industries than industries outside the EU; Suppliers will often provide false statements. Third party verification is a potential solution but will probably not work as it would be administratively burdensome, and worse: the verifications can often not be trusted either.

One interviewee stated that their company was always keen to increase recycled content, and that there had been several initiatives within the company to improve recycling, but that current laws often lead to administrative burdens that prove very costly, reducing incentives for more use of recycled content. Some examples given:

- *RoHS Directive*: While Art. 4 in the RoHS Directive provides opportunities for re-use of old parts (see Art. 4.5), there are administrative rules (e.g. notification of consumers) that makes such practices burdensome.
- *Waste shipment*: EU rules for shipment of waste³³⁸ often require paperwork and notifications in several EU countries, leading to a lot of administrative costs, and posing a barrier to optimal recycling.

³³⁸ The main legislative act is Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste.

- *WEEE*: It is often very burdensome to prove that metal waste has been upgraded to useable material; then it is not worth the effort to recycle it.

Other question marks concerning requirements on recycled content mentioned are:

- *Separate material streams*: Often, producers of virgin materials mix the material with recycled material (copper is an example); rules on recycled content would mean that the material streams should be kept separate which may entail costs.
- *Using averages*: in many cases manufacturers know more or less how much recycled material they make use of under a specific time period (for some material streams), but it is much more difficult to know exactly how much of recycled material that goes into a batch of products. Thus, compliance with recycled content rules can hardly be provided on a product, or product batch, level.

Another concern was that requirements on recycled contents would mess up the markets for materials as it inevitably affects supply and demand.

Banning certain chemicals

The banning/restriction of certain chemicals that poses a barrier towards recycling for a given product group was considered acceptable by most interviewees, if alternative designs exist at reasonable cost. The interviewees preferred horizontal regulations like RoHS and REACH but could accept bans or substance restrictions for specific product groups in some specific cases. However, some interviewees thought that REACH/RoHS deal with most relevant substances, and therefore there were very few cases where this would be relevant. They saw substances in old products (containing substances that are now banned) as the main problem for recycling. Some interviewees also preferred addressing problematic substances through other legal acts.

Critical materials

Several interviewees thought that critical materials could be regulated, e.g. by:

- making manufacturers provide information about content of certain materials and where it is found in the product
- rules on design that would better allow recycling of such materials.

Horizontal IMs

One proposed way forward (see chapter 2) on IMs related to resources and recycling has been the use of horizontal mandates, addressing several product groups with similar characteristics. This means that time-consuming studies on several single product groups can be avoided. One interviewee stated that it may be difficult to set such requirements for many product groups because materials are often applied for a very specific purpose, which varies between product group, and even within products groups.

Promoting PSS

The interviewees saw few potentials to set requirements that would strongly promote PSS and functional solutions. Another concern was that PSS solutions may not always be good for promoting durability because a) the owner may have little reason to be careful with the product, and b) the consumer who has a PSS solution tends to want the latest product; therefore PSS can lead to constant changes of technical solutions.

The positive element of PSS solutions for manufacturers is that they would get their products back and be able to utilize the materials themselves.

One interviewee stated that most manufacturing firms move towards a service orientation with PSS elements, but this is a long term process where legal rules can only provide limited impetus.

Other proposals

One interviewee stated that RFID tags with information about the product composition and design should be a possibility in the near future, at least for some product groups. These could significantly improve recycling practices. Intellectual property rights issues could be a problem in some cases, and RFID probably works better for some product groups than others. The interviewee also thought that RFID tags could aid the development of better shredding practices, and may make manual assembly unnecessary.

9.2.8 *Regulate now in order to recycle later*

Some of the interviewees were given the background on the electric motor case (discussed in chapter 10) and asked how they viewed the issue of regulating the product now so that recycling of REEs would be easier in 10–15 years, when we may have developed cost-efficient recycling solutions. In general, the respondents were positive towards rea-

reasonable requirements. One interviewee said that two kinds of legal requirements could be applicable:

1. If there are critical REEs in the product, the manufacturer must provide information about the substances (type and weight, and position)
2. Certain types of requirements on design to promote future recycling can be set if reasonable (no plastic coating etc.).

However several interviewees stated that all requirements must be relevant and set for a reason. Art. 15 was not considered a problem (i.e. is the environmental aspects “significant” enough to address?) as industry have little reason to enter into legal fights with the Commission.

9.2.9 B2B vs. B2C

The final consumer for given product group may influence what kind of requirements that are reasonable. For instance, many private consumers have little use of most environmental information; providing it to professional consumers can make more sense. Also when it comes to requirements on technical life length etc. the type of consumer may be of importance.

B2B firms often work hard to get the end-of-life products back, and have much better possibilities than B2C firms of getting products back and reap the benefits of design for recycling and re-use. In the B2B sector, energy efficiency is also much more important than in the B2C sector; consumers seldom care about the energy prices. In general, the importance of “leveling the playing field” is much more important in the B2C sector. In the B2B sector, consumers are scrutinizing every aspect of the product.

In the B2B sector customers ask for energy efficiency. Most systems delivered tend to use a lot of energy. The requests have often been driven by increases in energy prices. This means that legal ecodesign standards on energy efficiency are not a bad thing for business. We may see customers demanding resource efficiency in the near future.

One interviewee stressed the difference between energy efficiency and resources, more generally: energy efficiency is often not calculated in the price. On the contrary, less energy efficient products tend to be cheaper. Regarding resources, the price must always recuperate the price of embedded resources.

9.2.10 Socioeconomic benefits vs. business' benefits associated with resource efficiency and recycling

Several interviewees agreed with the proposition in some reports (see chapter 2) that setting stricter requirements to promote more recycling of materials would probably be good from a socioeconomic point of view. However, the interviewees stated that, from their viewpoint, there are some main concerns with such rules. The main concerns were:

- The industries will bear the costs of such measures whereas other actors (e.g. municipalities, recyclers) will reap the benefits. Several interviewees mentioned the problem of the implementation of the WEEE Directive, and more specifically the problem that producers can not get back their valuable materials at the end-of-life phase, as an example of how current policies may provide very limited incentives for producers to engage with ecodesign.
- When it comes to products with short life cycles, investments in design of products that are easier to recycle could make some business sense, especially if manufacturers themselves may be able to derive some of the value from the end-of-life products. But when it comes to products that have a life span of 10–15 years, however, it makes little business sense to invest in design measures that may eventually pay off; the time horizons are too long to be part of a business decision.

In other words, socioeconomic benefits may not be well corresponded with economic benefits for manufacturers. This of course could mean that there is possibly a socioeconomic case for setting legal standards that supports resource efficiency, but manufacturers would prefer policies that more clearly make a link between sustainable solutions and economic benefits for firms.

9.2.11 Policy mixes

In general, there was some agreement that the interaction between the Ecodesign Directive and energy labeling is working, and that these two instruments have been implemented in a reasonable way.

Regarding resource related requirements – such as demand for recycled content – public procurement was seen as a potential instrument to drive ecodesign practices when legal standards are difficult to implement. However, some interviewees cautioned that currently there is no control of the criteria set up in procurement, which can disadvantage the

best performers; the poor compliance checking was labeled “a disgrace” by one interviewee. Another interviewee expressed similar views on GPP and stressed that their company did not promote third party verification to prove compliance under the Ecodesign Directive, but that it could sometimes be more useful to apply third party verification in order to provide evidence of complying with GPP criteria.

Several interviewees were positive towards more policies to promote recycling but said a mix of policies were required, and that the Ecodesign Directive was not the most suitable policy instrument. The poor promotion of IPR in the WEEE Directive was viewed as a problem, as were the burdensome EU rules for shipment of waste.

Several interviewees stressed that the resource prices would always be more important than any legal requirements to promote recycling. One interviewee however stated that the WEEE Directive and other EPR Directives have played a crucial role in starting up markets for recycled material: by forcing actors to recycle material they have secured that there are large amounts of material available, and producers and recyclers have looked for business opportunities.

One interviewee stressed that we are at a stage where we need much more pilot projects on how we can recycle more materials: the results can be used in standard-setting under e.g. the WEEE and Ecodesign Directives. For some product groups and materials, we do not know yet what we can require, so test projects are required before legal standards can be set. The EU and EU member states should invest significant amounts of money into research on materials and recycling.

One interviewee stated that soon we will have had 1–2 cycles of regulation for the product groups and the worst performers will be gone from the market. This means that it will be increasingly important to identify and reward the best performers in the coming years.

9.2.12 The system dimension

Not surprisingly, actors had slightly different opinions on the “system dimension,” i.e. whether IMs should primarily target the single product, apply the “extended product approach,” or even apply a systems perspective. Some of the opinions were:

- One manufacturer stated that their products work within a system, but that they can not influence the whole system: if their product is placed in a building, they have little influence on how the building is designed and run. Therefore, regulators should look at how products

do function as part of a system when setting requirements, but mainly address the product as such with the requirements.

- One representative for a national industry organization stated that they generally support the system perspective, as this can be helpful for companies in developing new types of solutions and services. Interestingly, the same person stated that domestic companies in their country tend not to compete on price but on differentiation (providing products at the top end of the market). Areas where the systems perspective is very interesting include heating, ventilation, and lighting, as consumers will probably ask for new types of functions and comfort in the near future. A systems perspective in the legal design can aid the process of developing new solutions and business models.
- A representative for another national organization stated that there members have very different opinions when it comes to the “systems perspective,” therefore, the national organization chooses to not pursue any agenda on this issue.
- In B2B, “the system” can be different for every single sale made, and tailor-made for the customer. Then it is hard to use the system thinking when setting standards.
- One interviewee whose company sold large installations stated that in the current approach the performance of fans, motors etc. where regulated through separated lots. The company would however prefer to have legal standards for the whole installation in order to be able to maximize synergies.
- One interviewee stated that far too often a whole product is discarded because one part stops working (e.g. a hard drive in a computer). This means that in reality, the life span of single parts decide the life span for the product as a whole. This means that legal requirements or other drivers may be necessary in order to optimize products and systems.
- A potential problem with the systems approach is that it can be more difficult to check compliance; this could be a challenge for market surveillance practices.

9.2.13 Implications for SMEs

One question concerned if resource requirements would have special implications for SMEs, and what kind of rules that would be most problematic. The general answer seems to be that all kinds of requirements that entail large administrative burdens would be most problematic,

such as detailed requirements on technical documentation. Generally, requirements on energy efficiency are not so burdensome because it is easy to measure. With complex regulations, large firms have an advantage over smaller firms.

Other opinions were:

- While there has been suggestions that some legal requirements should only apply to larger firms this would be insane: requirements put on products put on the Internal Market must be coherent and applied equally to all actors and products.
- There need to be much more targeted approaches for SMEs: just providing information about upcoming legal requirements is not enough. In many cases personal contacts are required for effective knowledge transfer.
- Already with existing EU rules, many SMEs find it almost impossible to comply, so we must be cautious when setting new ones.

9.2.14 Article 15 in the Directive and other legal issues

Article 15 of the Ecodesign Directive could provide a barrier towards certain requirements, but formal legal disputes over the legality of future requirements are not expected by the interviewees: stakeholders usually do not enter into such disputes. Further, since there will be so much attention given to resource efficiency in the coming years, stakeholders will probably not argue the importance of addressing resources per se. Still, all relevant requirements should pass Art. 15, so it could become an important “screening” factor in practice.

Regarding WTO issues, some interviewees mentioned that regulating PPMs is out of the question, but no other major barriers were foreseen in connection to WTO rules.

Intellectual property rights issues were mentioned by some interviewees as a potential barrier towards information requirements and BOM-related demands, whereas other interviewees did not see these issues as a main barrier. One interviewee stated that such issues are of much greater importance for some product groups than for others.

9.2.15 Additional comments

One interviewee claimed that EU environmental product policy has been implemented backwards: it would have been preferable to start with the Ecodesign and RoHS Directives and REACH, before designing the WEEE

Directive. This would have meant that substances could have been designed out, and design considerations could have been set, before WEEE was implemented. This would have allowed a better regime for producer responsibility, and that some old products with hazardous substances have been removed from the market before producer responsibility schemes are set up.

One interviewee stated that horizontal requirements – as have been implemented for standby energy efficiency – for several product groups can be tricky in the area of materials and resource efficiency; materials are often applied for specific purposes, and product uses varies greatly.

One interviewee stated that we should be careful in promoting a “Nordic” agenda: Ecodesign requirements must be set at the EU level.

One interviewee claimed that it is more important to provide incentives to develop the recycling industry – which is not considered very innovative – than to regulate the products.

The Ecological Profile is a key element in the Ecodesign Directive but has not been used in practice. This is a shame, but perhaps shows how hard it is to set new types of requirements. There is potential to develop e.g. supply chain declarations. In many cases, the companies themselves could make good use the information, which makes it more acceptable to have legal requirements.

One interviewee stated that any product that complies with all EU rules can hardly be produced cheaply. Some imported products are probably not compliant. We may have to “educate” consumers to look for quality and be less focused on costs.

9.3 Discussion

The interviews provided some very interesting insights. The main learnings are:

- The types of requirements that can/should be put on products vary a lot depending on product group, as characteristics such as technical solutions, user patterns, and type of business (e.g. B2B or C2C) are of importance.
- Among the potential requirements that was deemed OK in some cases by several of the interviewees were:
 - durability requirements (if they can be proven by technical documentation)

- removing certain substances from some product groups (to improve recycling)
- undertake cost effective design measures to improve future recycling (this could include the banning of certain types of design – such as plastic coating – if evidence it is not necessary, and other designs does not lead to high additional costs)
- provide information about certain critical materials (e.g. rare REEs) and where they are placed in the product, and also other types of BOM requirements.
- Requirements in REACH/RoHS/US laws on conflict minerals have meant that there are now information formats that provide the foundation for more “BOM type” of requirements. However, keeping track of recycled materials, or providing information about material composition is probably much more complex than simply stating if certain chemicals are present in the product or not.
- Among requirements not considered highly feasible and/or desirable are:
 - longer guarantees provided to consumers
 - maximum disassembly times
 - requirements to provide evidence that ecodesign was considered during the design process (since it is hard to monitor and show compliance for such requirements)
 - requirements on percentages of recycled content in the product. If such rules it is crucial that requirements are designed in a correct way. In many cases it may be difficult to have different systems for monitoring and handling virgin materials as compared to recycled materials, which have implications for the possibilities to prove that products are compliant.
- The Ecodesign Directive can not be “the” main driver for resource efficiency and improved recycling, but it may help in some cases. Many interviewees point to the WEEE Directive, other waste regulations, and resource pricing, as proper tools to stimulate resource efficiency and better reuse and recycling.
- Article 15 of the Ecodesign Directive could provide a barrier towards certain requirements, but formal legal disputes over the legality of future requirements are not expected by the interviewees: stakeholders usually do not enter into such disputes.

A bit surprisingly, many interviewees were clearly in favor of promoting individual producer responsibility (IPR), stating that if the producer may not get any benefits from a better design the incentives for ecodesign are

non-existent; this seems to reflect the renewed interest in IPR more generally, which in turn seems to have been triggered by higher resource prices. Several interviewees did not believe that the WEEE Directive and the way it is implemented would change, while others thought this could happen over time. One interviewee had little hope that IPR would ever be implemented in a way that would be beneficial for manufacturers, and provide incentives for ecodesign. In B2C firms, there is little scope for PSS/leasing type of solutions either, limiting the potential of the manufacturer to get back valuable material. In the B2B sector the possibilities are much greater to stimulate such solutions, and in general manufacturers and system providers are looking at ways to get back their valuable resources.

10. Case study on electric motors

This chapter accounts for a case study on the potential inclusion of permanent magnet motors in the Ecodesign Directive regulation for electric motors. It is based on a literature review and semi-structured interviews with experts.

10.1 Introduction

The installed base of industrial electric motors in Europe amounts to approximately 85 million, of which about 85% are standardized “general purpose” motors, which vary in output range from 0.75 kW up to 300 kW. In 2008, they accounted for an energy consumption of about 900 TWh with their main applications in pumping, ventilation, compressors, and conveyor belts.³³⁹ Electric motors are broadly categorized into direct current (DC) and alternating current (AC) motors, whereby the first group comprises permanent magnet (PM) motors and the second, induction motors, as depicted in the figure.

³³⁹ Grundfos 2008.

Figure 6. Electric motor categorization (source: De Almeida et al., 2008)

The electric motor product group regulation 640/2009 entered into force in July 2009 (Lot 11) and set minimum requirements for the ecodesign of electric motors and the use of variable speed drives (VSDs).

The EC regulation is more limited in its scope as compared to the international standard IEC 60034-30. Actually, the regulation in place is not comprehensive enough to account for the total energy efficiency potential savings, which could possibly be achieved among all electric motors, as not all types of motors are covered. Therefore, a preparatory study on lot 30, which aims at identifying the potential for environmental improvement of other motor products outside the scope of Regulation 640/2009 has commenced.³⁴⁰ Among these products are so-called permanent magnet (PM) motors,³⁴¹ which are very interesting for the purposes of this research project, for several reasons. They contain REEs, which have been identified as critical materials in the medium term based on supply risk, demand growth and recycling restrictions.³⁴² REEs are an essential material in the manufacture of permanent magnets used in PM motors, the latter of which are under discussion of being regulated in Lot 30. Of particular interest for increasing resource efficiency of REEs is ecodesign parameters related to “raw material selection and use” and “EoL”/“recycling”. If such measures are considered in the design process, this would potentially enable both for a careful consideration of REE use, and for a design which could facilitate their reuse and recycling, given that economically feasible technologies for recycling of REEs were to be commercialized in the near future.

³⁴⁰ Official Journal of the European Union, 2009b and De Almeida et al., 2012a.

³⁴¹ Permanent magnets are an essential part of these motors, as they create the rotational motion.

³⁴² Buchert et al., 2009 and Technology Metals Research, 2011.

The employment of REEs substantially contributes to achieving better energy efficiency in PM motors. The production of these magnets commonly entails the use of power metals of REE, which are classified as chemicals under REACH, such as Dysprosium (Dy), which is a less abundant heavy REE,³⁴³ and Neodymium (Nd), and Praseodymium (Pr), light REE, whereby Pr can substitute Nd by up to 6% in these magnets.³⁴⁴ Dy is used to keep the magnetic properties of Nd at high temperatures.³⁴⁵

10.2 Objective

The main aim of the study was to provide more insight into the issues discussed in the report through the study of a specific product group.³⁴⁶ The objective was to see how the Ecodesign Directive could promote eco-innovation for resource use in PM motors, and to:

- Investigate what kind of requirements related to resource use of REE are of relevance for permanent magnet electric motors, and Obtain input from experts on the feasibility of outlined potential requirements, and the most important drivers for eco-innovations.

10.3 Methodology

The study was carried out in the period May to September 2012, during which work on this lot had also commenced. Draft documents in line with the MEerP methodology had been prepared for the first preparatory study stakeholder meeting which was held on the 26th of June, 2012. The study is based on the following steps:

³⁴³ The REE consist of the 15 elements of the lanthanide series plus Scandium and Yttrium. (Connelly and Damhus, 2005) The Oddo-Harkins rule which suggests that atoms with even masses are more abundant than those with odd masses, applies to the lanthanide series. (Palme and Beer, 1993 and Walker, 2010) This lower crustal abundance of heavy REEs and the fact that China has a quasi monopoly in their supply and outside of China the REEs are contained in minerals which have not been commercially processed, explains their high market price in a time of high demand. (Hatch, 2012).

³⁴⁴ Roskill, 2011.

³⁴⁵ Du and Graedel, 2011.

³⁴⁶ For more details see Machacek 2012. Here we only account for the main results of the study.

- A review of literature and technical documents.
- A first set of empirical data for the case was obtained through discussions at the first stakeholder meeting in June 2012.
- Based on learnings from literature and discussions, a questionnaire was drafted. It was sent out to representatives of PM motor producers and motor industry federations who participated in the preparatory study. Three manufacturers filled in the questionnaire.
- Based on the insights gained, a list of potential requirements to enhance resource efficiency for PM motors was drafted.
- Three in-depth, semi-structured interviews with material experts – namely one representative from a European PM manufacturer and two representatives from academia, all of whom collaborate in the REEgain project³⁴⁷ – complemented the data collection for the case study. The experts were asked to evaluate the list of potential requirements that could be set to improve resource efficiency for the motor group.

10.4 Main findings

The potential in terms of the improved energy efficiency level which can be attained by PM motors means that their market share is expected to increase with further commercialization, resulting in increased supply, and a price decrease for such motors. Against the background of increased demand for REE, combined with global supply imbalances and unavailable post consumer recycling options for REE, their substitution in the magnets is currently being investigated in several pilot projects. Replacing REEs with other materials however can come with a performance loss in the PM motor (i.e. reduced energy efficiency due to a reduced energy density in the magnet and more material use). Therefore, increasing the recyclability of PMs is of interest, if technically and economically feasible at the point in time of interest, as it could provide a stable supply of REEs and thus, enhances their continued use to achieve more energy-efficient motors.

With to-date inexistent methods for post consumer rare earth element recycling, one technological niche is constituted by the Siemens led motor recycling project which investigates options for the extraction of

³⁴⁷REEgain (Source: <http://www.reegain.dk/>) [2013-06-20].

REE from electric motors. Also the Danish REEgain project represents a technological niche, as various representatives from industry and academia collaborate to investigate both different processing options for rare earth ores and the recycling of REE. These projects could provide insight into the viability of new design solutions to improve recycling in the future, which could include:

- A redesign of PMs to:
 - improve the resource efficiency of the REE by concentrating them in the magnet, and/or change the shape of the magnet, and/or facilitate their recycling and to allow for their easy removal from a motor and reuse in a new one.
- Another potential radical novelty would be the exploration of energy-efficient ways for post-consumer recycling of REE from PM.

The manufacturers rank fluctuating prices of REE as a high impact factor for innovation activities. The impact of *uncertainty* – which is defined as insecurity about environmental pressures and requirements – on innovations is less clear as manufacturers had diverging views.

Design rules, derived from engineering practices and regulatory standards, and production practices influence innovations as well, even if they are solely of medium importance. Thus, the *anticipated extension of the electric motor product group regulation* to PM motors and its influence on PM motor innovation activities appears to be of less importance to manufacturers than a) the price development of the magnets containing REE and b) market demand. It is noted that an inclusion of new EU energy efficiency ratings would accelerate innovations.

The interviewees saw a potential for designing motors to allow for better recycling of materials, also REEs, once they are at the EoL stage. There are potential requirements that can be set through the Ecodesign Directive, though probably not at this early stage, to allow for recycling. The pilot projects discussed above as well as ongoing material research is expected to provide insights that could lead to design considerations.

There are currently many uncertainties. These include if – and how – the magnetic properties of REEs and combinations of materials will last if the material is crushed into a material mix, or if the material must be separated into pure streams. The latter option would require much more energy at the recycling stage.

Further uncertainties are that:

- the future economic viability of recycling cannot be established now as we do not know about future prices for raw materials or the costs of recycling, or future technological developments
- the future environmental viability of recycling is not easy to establish either as it depends on several factors.

The table below outlines potential IMs for the product group, based on interviews with material experts. The color code is used to reflect our analysis on the potential for setting this requirement: most feasible legal standards are marked in green and indicated with a perceived feasibility rating in crosses (+++), to-date least realistic options are highlighted in red and one cross only (+). Numbers in brackets next to the rating in crosses refer to the related comments on the perceived feasibility, outlined at the end of the table.

Table 18. Electric motor categorization (source: De Almeida et al., 2008)

	Potential legal standards	Instrument with potential to facilitate the standard	Perceived feasibility in permanent magnet motors
Design			
Bill of Materials	Product composition	Ecodesign Directive	+++ ⁽¹⁾
Design for dismantling	Modularisation	Ecodesign Directive	+++ ⁽²⁾
Design for recycling	Change in the PM material	Ecodesign Directive	+ ⁽³⁾
	Material concentration	Ecodesign Directive	++ ⁽⁴⁾
Recycled content	Horizontal approach: e.g. 30% of a specific material are to come from a recycled source.	Ecodesign Directive – Supply chain certification	+ ⁽⁵⁾
Manufacture			
Material restriction	Chemical content	RoHS and REACH	++ ⁽⁶⁾
Material streams	Purity in material stream	Ecodesign Directive	+ ⁽⁷⁾
Use			
Energy efficiency	Stricter energy efficiency requirements	Ecodesign Directive	+++ ⁽⁸⁾
End of life			
Reusability, Recyclability, Recoverability	Take-back obligation	WEEE combine with Ecodesign Directive	+++ ⁽⁹⁾

Source

⁽¹⁾ It characterizes the composition of a product and constitutes the main data source for the environmental assessment of the product at design stage. (Ardente, 2011a).

⁽²⁾ To date, only about 10 to 15% of machines with REE (typical hard disc magnets) can be recycled, the remainder ends up as dust in scrap yards or as pollutant in steel melts. Design for dismantling appears to be a good starting point for increasing REE resource efficiency of permanent magnet motors.

⁽³⁾ At the time of the study it was perceived as very difficult to change the permanent material to allow for a later reuse. (Pryds, 2012).

⁽⁴⁾ When the interviews were conducted, options to concentrate the permanent magnet material rather than spreading it within the magnet were being explored. If the attempt will be successful, it could facilitate resource efficiency. (Froböse, 2011).

⁽⁵⁾ To-date recycling options are being explored. (Pryds, 2012) Applying a recycled content standard will depend on finding economically feasible recycling options.

⁽⁶⁾ To-date NdFeB magnets are the worldwide best magnets (Pryds, 2012). They are produced from powder materials, which are classified as chemicals under REACH (Anonymous representative of a European permanent magnet producer, 2012).

⁽⁷⁾ Most NdFeB magnets are sintered magnets which means their production involves the mixing of magnetic powder material, which is then pressed, and heated (Pryds, 2012). Different processing methods are explored at the moment but to date, achieving more purity in the material stream seems not feasible.

⁽⁸⁾ The author perceives this legal standard to have the highest potential regarding resource efficiency improvements within the timeframe until REE recycling options are discovered. As permanent magnet manufacturers are price sensitive, an increase in REE prices naturally triggers either a turn towards other technologies (ferrite magnet example by anonymous permanent magnet manufacturer representative, 2012) whereby their energy efficiency might be lower (leading to more resource use of other materials with less energy density resulting in bigger appliances), which would lead in turn to increased efforts in reducing the use of REE (if possible) and/or improve their use. Eco-innovations could be the result of these efforts.

⁽⁹⁾ Despite the long lifetime of motors, it need to be ensured that they are returned to the producers at their EoL and that producers take them back. This is the precondition for any resource efficiency improvement of REE in permanent magnet motors.

10.5 Analysis

The interviews indicate that ecodesign requirements can indeed speed up innovation in the sector, though material costs are a highly important driver for change in permanent magnets. Several interesting potential IMs were identified, such as BOMs to promote future recycling (when new technologies may allow for profitable recycling if the motors are easy to disassemble), and prevent that permanent magnets are for instance covered by plastic, which would ease recycling practices.

It appears as if a more developed set of requirements cannot be set under the Ecodesign Directive until pilot projects and ongoing research have provided more insights on the technical and economic viability of REE recycling. However, certain types of requirements that can allow for recycling in the future should – in principle – be possible to be set under the Directive already now. These include:

- Some kind of generic requirement that producers should show how they take design for recycling into account in the design process.
- BOM-related requirements, where information about key materials and their positions³⁴⁸ are provided. These could be relevant for recyclers.
- Additional information to recyclers that are relevant for allowing cost-effective recycling.

One interesting issue concerns the time aspect: According to one interviewee representing a manufacturer, *the long life length of the products (ca. 15 years) means that customers are not very interested in paying extra for products that are designed to allow for recycling*. This means that we can probably not expect supply and demand factors to “ensure” that recycling solutions are being developed. Government funding for pilot recycling projects and various policies to induce design for recycling – for instance through the Ecodesign Directive – is probably a necessary element of a successful policy for improved resource use. Another implication related to the time aspect is that *the costs of recycling practices in the future will be influenced by the design choices now, when products are put on the market*. This implies that the design should be influenced now to allow for recycling in the future. There could however be legal barriers for such rules, as discussed in chapter 6. The interviews revealed that the issue on design for future REE recycling is very relevant also for other product groups like wind power technology and magnetic resonance imaging, to mention but a few other product groups using REEs.

The idea of a take-back obligation – or take-back contract – is interesting as it could indeed provide incentives for redesign among manufacturers. If they know they will get their material back, they have more incentive to design a motor from which materials can more easily be recycled.³⁴⁹ The long time scales involved (i.e. time before the motors are at the EoL stage) however mean that future recycling options and associated costs and benefits are rather uncertain; when compared to products with shorter life spans, e.g. laptops or cell phones.

An interesting issue in relation to policy mix considerations is that ongoing pilot projects and material research will provide crucial input to legal processes. This implies that governments and the EU should support interesting pilot projects to support recycling of REEs and other materials.

³⁴⁸ We have not analyzed the importance of trade secrets in the study.

³⁴⁹ See also the discussion in Annex I.

11. Main conclusions and recommendations

This chapter presents the conclusions and recommendations, and some areas where there is need for further research.

11.1 Conclusions

The Ecodesign Directive provides one of the available policy options to address resource efficiency through EU law. Doing so entails both potential benefits and potential disadvantages. The interviews with industry provided some detailed information and examples of the potential to set certain types of rules. In many cases the potential for rule-setting are very dependent on the product group. For instance, durability requirements make a lot of sense for e.g. vacuum cleaners, but can be counter-productive for some product groups (over-engineering entails wasted resources). If requirements are appropriate for the product group at hand, and designed properly, there is little reason to believe that they would be damaging for EU industries. However, based on the interviews, some types of rules – e.g. requirements on recycled content in products, and maximum disassembly times – may be difficult to apply. This does not necessarily mean that such rules are not feasibly, but could imply that requirements on recycled contents should be phased in slowly.

The case study on electric motors provides some interesting learnings, most notably that we could be more strategic in policymaking: it may be wise to set design rules now to allow for recycling later on, when product become waste in 10–20 years. By encouraging proper design and better information about where materials and components are found, we can “invest in the future.” However, there is also a need for more pilot projects to establish what kind of materials that can be recycled, and to cut costs of recycling practices. In some cases we need to know more about recycling options before being able to set rules.

Most interviewed industries do not fear new requirements as long as they are relevant, well designed, and do not cause unnecessary administrative burdens. It should be noted that interviewed industries are ra-

ther “progressive”; there is however a good reason to listen to the front-runners rather than the laggards. We should acknowledge that policy-makers should take the situation for SMEs into account. This means that rules should be designed to minimize the administrative burdens for firms. However, there is reason to believe that SMEs need more direct (personal) contact with industry associations in order to prepare for new standards (mandatory and voluntary ones), and both governments and industry associations may have to develop new strategies for better communication.

We can note that some interviewees hint that the interest of addressing resource efficiency through the Ecodesign Directive partly reflects the fact that the WEEE Directive and the way it is implemented has failed to provide the right incentives for Ecodesign. A genuine dilemma is that – as things stand today – many manufacturers (especially in the B2C sector) have little chance to profit from improved design practices themselves. Manufacturers will bear the costs whereas other actors with access to the EOL material will benefit from the improved design.

A conclusion is that taking “a system orientation” look at how the product interacts with other products and the larger system, when undertaking preparatory studies and suggesting requirements, can entail benefits for industry in the long term. This does not mean that it is always possible to regulate “the system”, however. But assessing the interactions, and market trends, can assist in setting rules that promote innovation, not least if requirements originate more from defining functions rather than being modeled from established product groups.

The overall conclusion is that there is reason to start working more coherently with resource efficiency requirements under the Ecodesign Directive, but that it is wise to “advance slowly” to avoid setbacks. Below, we discuss some potential ways forward.

11.2 Recommendations

The recommendations below are divided into short and long term recommendations, and complementary actions.

Short term actions

Some ways forward are:

- *Consider new types of legal standards:* According to the industry representatives, certain types of requirements are more acceptable than others. The preparatory studies could review the potential for such requirements. The consultants should be encouraged to propose new types of requirements even if not all of them can be applied in the final requirements. Benchmarks – e.g. a review of the best performers on the market – should be part of the studies, and more measures should be taken at the EU level to ensure that such benchmarks are considered in the application of other instruments like GPP. There could be reason to look at e.g. durability requirements for some product groups where the technological developments are slow and the user behavior relevant. Regarding information, it may be relevant to examine:
 - if the manufacturer must account for critical materials and components
 - if the manufacturer should provide information about where these materials can be found, in order to enable future cost-efficient recycling
 - if certain design solutions (e.g. coatings and material mixes) should not be allowed as they may impede future recycling efforts.³⁵⁰
- *Methodologies must be developed:* The MEErP methodology has started to deal with some issues such as critical materials. Further, there is a need for methodologies to deal with the problems associated with the “system orientation” discussed above. This need extends to such methodologies both at the general level to deal with conflicting aims and measurement methods of different EU policies and laws, and within the context of the Ecodesign Directive.
- *Chemicals in components and materials:* Chemicals that can be a barrier to recycling should be identified and assessed in all consultancy studies. This implies both that we need general policies to deal with these chemicals, and that there could be a case for addressing these issues in the preparatory studies, e.g. by scanning which chemicals that pose a barrier for recycling for the product group in question. IMs

³⁵⁰ The established existence of cost-effective alternative design solutions are necessary; otherwise no such bans can be mandated.

should, when possible, address such chemicals through banning or setting limits for their content, mandate the provision of information, or at least promote this through other benchmarks. There may not be available data on some of these issues, so interviews with companies and recyclers could be part of the methodology.

- *Rules now to enable recycling later:* For some substances and materials, such as REEs, there are pilot projects on recycling, and cost-effective recycling within the near future is possible. This however depends on future costs of raw materials and recycling practices, and whether there is innovation in recycling technologies. However, there could be reason to already set rules now that would allow for cheaper recycling in the future. Such rules may relate e.g. to material declarations, or banning plastic coatings, to better allow for cost-efficient future recycling.
- *No more “passing the buck”:* during the preparatory studies, consultants should not be allowed to state that WEEE/RoHS/REACH takes care of some issues, nor should they be allowed to simply refer to theoretical recycling scenarios etc. *The EU must invest more in the preparatory studies:* The US invests more resources in their studies than EU does. It can pay off to do so in the EU as well, and especially so if we are to integrate new types of environmental aspects.

A main concern is however the political acceptability of some types of rules is low, and the concern that all industries may not be able to comply. These issues can be addressed through different strategies, such as:

- *Several tiers of requirements with checkpoints:* By setting long term targets through several tiers of requirements, industry has sufficient time to adopt practices and set up systems for information, finding suppliers of recycled material and so forth. Some industries and member states may be reluctant because of concerns that some industries can not comply. The introduction of checkpoints, where requirements can be made more or less progressive due to market developments, could partly solve this dilemma.
- *Benchmarks and the use of other instruments:* Preparatory studies can provide benchmarks, for instance through identifying the best performers in terms of recycled content, material declarations etc. If there is resistance towards setting IMs in some cases, the benchmarks may be used in other instruments such as public procurement to trigger developments. This requires that benchmarks are actually employed in other instruments, and mechanisms to ensure this should be developed.

Long terms actions

Potential long term actions include:

- *Make use of new instruments to promote resource efficiency:* Some instruments are hardly discussed at the EU level. For instance, technology procurement has a good track record in the US and Sweden, and is an obvious complement to the Ecodesign Directive due to its proven ability to trigger the market introduction of more energy-efficient appliances.
- *The wording of the Ecodesign Directive:* It seems as if the wording of the Directive, most notably Art. 15, may impede the setting of some types of strategic requirements that may enable better recycling in the future. If so, a change in the wording should be considered. This is clearly a major issue, and it should therefore be dealt with in conjunction with other similar issues related to the application of the Ecodesign Directive in the future; such as the inclusion of “a top runner” type of concept, and the interpretation of “least life cycle cost.” Another problem with Art. 15 is that its reference to “significance” may actually hinder rules that can be very beneficial simply because the issues addressed are not very “significant” in comparison with other environmental aspects. Further, it may be very difficult to establish how significant a rule that promotes resource efficiency really is as we do not have complete information about critical materials; future recycling options etc. Changing the text of the Directive could address this.
- *Develop the WEEE Directive and other EPR directives to promote individual producer responsibility:* The Ecodesign Directive can not make up for shortcomings in other directives. We urgently need to stimulate the economic case for Ecodesign. Promoting individual producer responsibility³⁵¹ is one course of action, though there are no easy ways to do it. Green public procurement (e.g. award criteria for manufacturers providing better information on the materials in the product) and certification schemes for testing the quality of EoL materials,³⁵² could be other options.

³⁵¹ There is much confusion on what individual producer responsibility is; it does not have to entail individual take back schemes. See more on this in Annex I.

³⁵² Such schemes have been discussed in the UK. If they can be tied to some kind of rewards for manufacturers they will provide incentives for design.

Complementary actions

Among complementary actions we can identify:

- Establish pilot projects and research to examine the potential to cost-effectively recycle critical materials like REEs.
- Establish research in new materials and better design.
- Review the need for (European) standardization to contribute to new requirements through timely introduction of new standards (see below). This may entail new mandates to the European standardization bodies.

11.3 Need for further research

There are a number of issues that need to be researched further. These include:

- An improved understanding and idea on how the different policy instruments should interact to deliver resource efficiency, therefore we need to both elaborate on:
 - the role of different instruments and their interactions, and which instruments should trigger more radical innovations.
- An examination of the implications on industry competitiveness (short and long term) related to resource efficiency requirements, for manufacturers and other actors. This could entail both historical case studies and studies on single product groups.
- We need to have a better overview of what kind of industry-set standards there are related to resources, in connection to design, measurement, and indicators. We also need to look at the need to develop new types of standards that can be applied in EU standardization policy.

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Annex I Product categories

Product groups on floor coverings in the EU Ecolabel, the Nordic Ecolabel, the EU GPP and EPEAT

Instrument	Valid/ published	Product groups	Products covered related to computers
EU Ecolabel	2011–2014	Notebook computers	Notebook computers, tablet personal computers.
EU Ecolabel	2011–2014	Personal computers	Desktop computers, thin clients, displays and keyboards.
Nordic Ecolabel	2009–2014	Computers	Stationary and portable computers including (integrated) desktop computers, gaming consoles, notebook computers, tablets, small-scale servers, thin clients, workstations, small-scale servers
EU GPP	2012	Office IT equipment	Personal computers, (integrated) desktop computers, thin clients, computer displays, keyboard, external power supply, notebook computers, tablets, monitors, discrete graphics processing unit.
EPEAT	Unknown	Computers and displays	Notebooks, desktops, work stations, thin clients and PC displays.
Instrument	Valid	Product groups	Products covered related to imaging equipment
EU Ecolabel (draft)	Unknown	Imaging equipment used in office	
Nordic Ecolabel	2007–2014	Imaging equipment	Copier, digital duplicator, facsimile machine, multifunctional device, printer, scanner, extra equipment.
EU GPP (draft)	Unknown	Imaging equipment in offices	Printers, copiers and multifunctional devices.
EPEAT	Unknown	Imaging equipment	Printers, copiers, scanners, facsimile machines, multifunction devices, mailing machines and digital duplicators.
Instrument	Valid	Product group	Products included
Nordic Ecolabel	2010–2014	Floor coverings	The floor covering must be intended for indoor use and suitable for a concrete, timber joist or similar subfloor. Examples of floor coverings include bamboo flooring, solid wood, parquet, laminate, linoleum and carpeting. Excluding: mineral floor coverings (stones and clinker), seamless floor coverings that are applied as a curing liquid, floor covering having a supporting function and floor covering with integrated heating.
EU Ecolabel	2010–2013	Wood floor coverings	Wood and timber coverings, laminated floorings, cork coverings and bamboo floorings.

Product groups on windows covered by the EU Ecolabel, the Nordic Ecolabel, EU GPP and EPEAT

Instrument	Valid/ published	Product groups	Product definition
Nordic Ecolabel	2008–2014	Windows and Exterior Doors	Fixed and opening windows, window doors and exterior doors. The frame, door leaf or window casement may comprise of wood, wood-aluminium, aluminium, plastic or composite material.
EU GPP	Unknown	Windows	Windows, glazed doors, and skylights.

Annex II Criteria for hazardous substances in the voluntary instruments

	Light	Plastic parts and coating	Batteries	General criteria
Computers	(EU) Notebooks: Limitations to the content (<0.1 mg) of mercury per lamp in the backlights of LCD displays. (NE) Mercury in backlighting in notebooks is prohibited. Backlighting in displays and other computers must not contain more than 14 mg mercury. (EPEAT) Elimination of intentionally added mercury used in light sources. (GPP) The backlighting of LCD monitors shall not contain mercury.	(NE and GPP) Plastic parts over 25 g must not contain certain halogenated flame retardants		(EU E) Prohibition of a list of hazardous substances in accordance with classification in REACH.
Imaging equipment	(GPP) Imaging equipment devices in which mercury or its compounds is not intentionally be added to the backlights displays used. (EPEAT) Use of non-mercury containing light sources.	(NE) Plastic parts over 25 g must not contain chlorinated polymers (exemption are casing parts that are demonstrably reused). (NE) Plastic must not contain additives with some risk phases according to REACH (GPP) Plastic parts heavier than 25 g do not contain substances or preparations with some risk phrases according to REACH. (GPP) The external plastic casing, the cables and the recommended for use by the manufacturer cartridges of weight 25 g or more of the imaging equipment offered does not contain brominated aromatic substances used as flame retardants nor PVC. (NE) Flame retardants used in plastic components must be declared and characterized by their CAS number.	(NE) Batteries used must not contain cadmium, mercury, lead, and their compounds, except for impurities which cannot be avoided technically.	(EU) Exclusion and limitations of substances and mixtures in the product in accordance with some risk phrases in REACH. A list of exemptions exists including amongst other materials with recycled or reused content, where there requirements are set up. (NE) Additives contained organohalogen are not permitted, including flame retardants. (NE) Flame retardants used in plastic components must be declared and characterized by their CAS number (EPEAT) Reduction of substances on the EU REACH Candidate List of SVHCs. (EPEAT) Elimination or reduction of BFR/CFR/PVC contents of products

Plastic parts and coating	Surface treatment (impregnation)	Manufacturing	General criteria
Windows	<p>(NE) Restriction of hazardous substances in non recycled plastic.</p> <p>(NE) Restrictions of hazardous substances in recycled plastics.</p> <p>(NE) Mercury and asbestos must not be used to produce chlorine for making plastics.</p> <p>(GPP) Lead and its compounds must not intentionally be added to the plastics and coating used in windows.</p>	<p>(NE) Certain classified chemicals cannot be used during manufacturing.</p> <p>(NE) Chemicals used in the manufacturing must not be classified as carcinogenic, mutagenic or toxic for reproduction (with some exceptions).</p>	<p>(NE) Following substances are prohibited: halogenated organic solvents, APEO, APD, PFAS, phthalates but not sealants (but restrictions on phthalates in sealant), Halogenated flame retardants, boron compounds, bisphenol A.</p> <p>(NE) Following substances are prohibited: halogenated organic solvents, APEO, APD, PFAS, phthalates but not sealants (but restrictions on phthalates in sealant), Halogenated flame retardants, boron compounds, bisphenol A.</p> <p>(GPP) The final window product will not release or leach out any substances or preparations under normal usage conditions that are listed according to certain listed R-phrases.</p> <p>(GPP) The final window product will not release or leach out any substances or preparations under normal usage conditions, that are listed according to certain H-phases.</p> <p>(GPP) Chemical products (paint, adhesive, sealants, putty, etc.) in the finished window must satisfy on the following two requirements: The product may not be classified as environmental hazardous according to the EU Directive 1999/45/EC, or The product may contain a maximum of 2% by weight of substances classified as environmental hazardous according to EC Directive 67/548/ECC.</p> <p>(NE) Requirements for the handling of certain classified chemicals.</p> <p>(NE) Thermal insulation materials must not contain halogenated flame retardants containing borax or boric acid.</p> <p>(NE) Halogenated plastics and timber that is treated with wood preservatives/ biocides must not be used in packaging.</p> <p>(NE) Documentation of nanomaterials</p>
Floor covering	<p>(EU E) Wooden flooring shall not be impregnated.</p> <p>(EU E) Requirements to the addition of dangerous substances in coating and surface treatments.</p> <p>(NE) The total quantity of chemicals in the surface treatment product that are classified as dangerous for the environment (R50, R50/R53, R51/53, R52/53, R52, R53, R54, R55, R56, R58, R59) must not exceed 5% by weight or 7 g/m².</p>		<p>(NE) Restriction of hazardous substances according to REACH.</p> <p>(NE) Chlorinated/brominated paraffins, halogenated flame retardants, organic tin compounds, phthalates and fluorinated compounds must not be actively added.</p> <p>(NE) Cadmium, lead and mercury must not be actively added.</p> <p>(NE) Prohibition of biocides with the aim of procuring a disinfectant or antibacterial treatment/surface.</p> <p>(NE) No actively added nanoparticles.</p> <p>(NE) Requirements to floor covering that have additives that contain formaldehyde (release of formaldehyde).</p> <p>(NE) Limitation to the use of biocides in wool fibres.</p> <p>(NE) Limitations to the use of antimony in polyester fibres.</p> <p>(NE) Prohibition of lead-based pigments in polypropylene fibres.</p> <p>(EU E) Poste-consumer wood, chips or fibres shall at least comply with the provision in the EPF industry standard. Limits to the amount of arsenic, cadmium, chromium, copper, lead, mercury, fluorine, chlorine, pentachlorophenol (PCP) and tar oils.</p> <p>(EU E) Requirements to the addition of dangerous substances for adhesives.</p> <p>(EU E) Requirements to the addition of dangerous substances plasticisers.</p> <p>(EU E) The product must not contain halogenated organic binding agents, azidirin and polyaziridins as well as pigments and additives based on lead, cadmium, chrome (VI), mercury and their compounds, arsenic, boron and copper, organic tin.</p> <p>(EU E) Only biocidal products containing biocidal active substances included in Annex IA of Directive 98/8/EC, and authorised for use in floor coverings, shall be allowed for use.</p> <p>(EU E) The product shall not contain GMO wood.</p> <p>(EU E) No substances or preparations that are assigned, or may be assigned at the time of application, to certain risk phrases (or combinations thereof) may be added to the wooden product.</p> <p>(EU E) Solid wood, after logging, shall not be treated with substances or preparations containing substances that are included in certain lists.</p>

Annex III Individual producer responsibility (IPR) in the WEEE Directive

By Carl Dalhammar, IIIEE, Lund University

There are different views regarding the IPR concept and its application e.g. in the *"Idea Catalogue for Greening of EEE,"* so therefore some reflections on IPR below. Different opinions are fine as to whether IPR is a good thing to promote in the context of the WEEE Directive, but the opinion that *"the WEEE Directive was never intended to be a strong driver for design changes"* is unexpected both assessed from the regulation itself and other EU Directives and related policy documents. Further, I am skeptical towards the argument that ecodesign issues should be promoted merely through the Ecodesign Directive and the RoHS Directive, and therefore be left out of the WEEE processes. Since there are already a number of publications on the topic I refer to these for more thorough discussions on the IPR concept, and reviews of EPR schemes that have a more clear orientation towards IPR.

There will always be different opinions on these issues and due to changes in resource prices and advances in recycling technologies – and possibly also because of new business models being developed – it is likely that the views and opinions will be substantially different in the coming years. However, different opinions are found in all policy areas. The important thing is that 1) our opinions are based on solid evidence – whether research or practical experiences – and not on uninformed/ideological positions, and 2) we take a long term perspective. The latter is important in waste policy and specifically EPR policies as it often takes time to develop cost-efficient recycling systems, and therefore CBAs and other evaluation methods based on existing practices provide limited guidance for policymaking.

EPR and IPR

First of all, there are differing views on the objectives of the extended producer responsibility (EPR) concept.³⁵³ The early writings on EPR stressed the importance of “product oriented” waste policies; the key was to provide producers to make design changes to avoid unnecessary materials, remove toxics that inhibit recycling etc. We have seen that these policy measures can be effective for waste avoidance and changed design for product groups like packaging. It is more difficult to provide incentives for changed design for complex products, for several reasons.

Thus, providing incentives for design changes was always a key issue when the EPR concept was originally elaborated. Many authors rather put focus on other benefits of the EPR concept, such as the potential to raise revenue for waste collection and recycling without raising taxes. Lifset and Lindhqvist raise the question if the producer responsibility policies in Europe have come to a turning point, where it needs to be decided what exactly EPR should entail, as the original intentions on design have become lost in transposition.³⁵⁴ Several authors are proposing that all references to the WEEE Directive’s influence on product design be removed from the legal text and instead be addressed through the ErP and RoHS Directives. The main argument is that the WEEE Directive should focus on addressing the impacts associated with the end-of-life phase of the products life cycle.³⁵⁵ Further, some argue that legal rules on design should primarily be set under art. 114 (previously Art. 95) of the Treaty of the Functioning of the European Union (TFEU).³⁵⁶

IPR, no matter how we define the concept, is crucial if we are to provide incentives for design changes in an EPR system (such changes can of course be provided also through other instruments, see below). IPR entails the idea that each producer finances the waste from his/her own

³⁵³ See e.g. Van Rossem, C. Individual producer responsibility in the WEEE Directive. From theory to practice? IIIIEE Dissertation 2008:3. Lund University.

³⁵⁴ Lifset, R., Lindhqvist, T. (2008). Producer Responsibility at a Turning Point? *Journal of Industrial Ecology*, vol. 12, pp. 144–147.

³⁵⁵ Huisman, J., Magalini, F., Kuehr, R., Maurer, C., Oglivie, S., Polk, J., Delgado, C., Artim, E., Szlezak, J., & Stevels, A. (2008). *2008 Review of Directive 2002/96 on waste electrical and electronic equipment*. NV.G.4/ETU/2006/0032. Bonn: United Nations University.

³⁵⁶ The latter argument is misplaced because the court of justice has established a “centre of gravity” approach when it comes to the proper legal basis. This means that it’s the main purpose of a legal act that shall be the decider of the legal basis, see Jans, J. and Vedder, H. (2012). *European environmental law after Lisbon*. 4th Ed. Europa Law Publishing. Today, there are also several examples of directives based on a dual legal basis, e.g. the Batteries Directive.

products, in order to provide incentives for design for reduced life cycle impacts (design for recycling etc.).

There are many misconceptions about IPR in literature.³⁵⁷ Research shows that producers have different conceptions about what IPR is, how it could be implemented and how it relates to company competitiveness.³⁵⁸ The most important of the misconceptions is that IPR implies that individual producers would have to set up their own collection and recycling infrastructure. However, this is not true and there are real world examples of IPR implementation within collectively organized systems. In relation to this, it is interesting to note how some EU member states have made it virtually impossible to promote IPR within current EPR systems as they have mandated the set-up of individual collection schemes etc.

When it comes to other objections against IPR, for instance that it will significantly increase waste handling costs, van Rossem has found little evidence that this is the case.³⁵⁹

It is important to stress that it would be hard to design a “perfect IPR” system where each producer pays the exact costs associated with the handling of his/her products. This does however not imply that no differentiation can take place, but simply that it cannot be exact. Kieran Meyers and other authors have discussed how IPR can be promoted. Different options are possible.³⁶⁰

The case for IPR

There are a number of motives that support IPR. These include:

Ecodesign – if EPR schemes are to provide incentives for ecodesign, measures must be taken that enforces cost internalization among producers, which means some kind of differentiation is necessary. There is evidence that some EPR schemes have indeed lead to design changes.³⁶¹

Polluter pays principle (PPP) – PPP is a main principle of EU environmental policy and waste policy.³⁶² IPR supports the PPP, whereas a system where no differentiation between waste products is made does not.

³⁵⁷ See van Rossem, C, above.

³⁵⁸ Ibid.

³⁵⁹ Ibid.

³⁶⁰ See also e.g. Rotter, V.S. *et al.* (2011). Practicalities of individual producer responsibility under the WEEE directive: experiences in Germany. *Waste Manag Res* 2011 29: 931.

³⁶¹ van Rossem, C, Tojo, N, & Lindhqvist, T. (2006). *Lost in Transposition? A study of the implementation of individual producer responsibility in the WEEE Directive*. Lund: Report commissioned by Greenpeace International, Friends of the Earth Europe and European Environmental Bureau (EEB).

³⁶² See for instance the references to the PPP in the Waste Framework Directive (WFD).

Fairness – IPR is a way to make the polluter pay for his own costs, thus its “fairer” than a system where all producers pay the same regardless of costs (how easy/hard it is too establish the costs for different products is of course of relevance here. Also, fairness is a criterion that may have to be compromised in environmental policy due to other considerations).

Obligation vs. right – interviews with producers³⁶³ seems to indicate that most producers accept that they have to pay for collection treatment of their products and that many producers now has started to stress that they have a right to get their e-o-l products back. With expected increases in resource prices this discussion will probably continue. There are problematic issues. For instance, it is obviously easier to get the products back in a B2B scheme than in a B2C scheme).

Illegal waste export – several people in industry stress that IPR could be a mechanism that supports a stronger link between the producer and his/her products, and that it could therefore – at least in the long run – be helpful in better controlling illegal waste flows

Innovation – it is likely that IPR better promotes innovation among producers than a system where all producers pay the same regardless of costs, for several reasons. Clearly, functional sales and product-service-system solutions will be supported by IPR solutions.

The WEEE Directive, IPR and product design

While it is perfectly fine to state that the WEEE Directive should not be about product design, I believe it is wrong to state that ecodesign is not a big part of the WEEE Directive. This is due to several reasons:

- *There is certainly evidence that this has always been a big issue in the context of the negotiation and implementation of the directive, with different views among actors. The history of the WEEE directive shows the different opinions of the Parliament and the Council regarding IPR and individual financing, and the design of Art. 8(2) of the Directive. And the debate continues to this day. The text of the directive supports this, as will the (likely) text of the revised directive, as evidenced by the fact that Art. 4 will most likely continue to have a similar content, and a recital will probably state that: “The establishment, by this Directive, of producer responsibility is one of*

³⁶³ There is an ongoing master thesis work on this topic at Lund University. It however only includes interviews with a small number of large EEE producers, of which some are clearly pro-EPR, so it may not reflect the views of all producers.

the means of encouraging design and production of EEE which take into full account and facilitate its repair, possible upgrading, re-use, disassembly and recycling.”

- *Further support can be found in the Waste Framework Directive (WFD), e.g. in recital 27, which states that: “The introduction of extended producer responsibility in this Directive is one of the means to support the design and production of goods which take into full account and facilitate the efficient use of resources during their whole life-cycle including their repair, re-use, disassembly and recycling without compromising the free circulation of goods on the internal market.” In my view, Articles 8–9 on extended producer responsibility and waste prevention sets several links between product design and waste. Especially Art. 8.2 establish a link between product design and the waste phase. *It would be peculiar if the WEEE directive should be interpreted in a way that is not consistent with the WFD, which sets the framework for EU waste policy.**
- Finally, the Commission has in several of its waste publications stressed that EPR provides producers with incentives for design.

In this light it would be strange to state that design is not a major part of the WEEE Directive. Whether ecodesign *should be* a main objective of the WEEE Directive is however a relevant question. One general objection is that design considerations should be addressed through the Ecodesign and RoHS Directives, which are after all based on Art. 114 of the TFEU (previously Art. 95). There are however some problems with this view:

- We have reviewed a number of implementing measures under the Ecodesign Directive and they do not address standards for recyclability and similar issues, nor provide incentives for design for recyclability. Enacting such standards under the Directive might be a good idea but will most likely not happen in the near future.
- Setting binding standards for design for recyclability, or other waste-related standards, under the Ecodesign directive *as an alternative* to providing incentives under the WEEE Directive has at least one serious drawback: Binding standards would be a poor replacement for the economic incentives that will emerge from IPR; many producers believe it will not allow for competition amongst EEE-

producers on the basis of EOL performance.³⁶⁴ Thus, the potential to employ market mechanisms for improved design and EOL practices would be limited. Therefore, I believe it is better that the WEEE and Ecodesign directives complement/reinforce each other in providing incentives for design.

- The RoHS Directive has many benefits, but also numerous exemptions, and a limited scope. It is doubtful if the RoHS Directive without support from other Directives (including the WEEE directive, the Ecodesign Directive and the REACH Regulation) provides enough incentives for reducing toxics in EEE.
- There is a lack of common understanding within the Commission on what the different directives (mainly WEEE/RoHS/Ecodesign) should accomplish, and how they should interact. This is obvious when reading the various documents. For instance, there is much confusion on the role of the Ecodesign Directive which was originally intended to cover all relevant life cycle aspects but has – for good reasons, when looking at the implementing measures – come to be viewed as “an energy directive” by many actors. Further, the “passing the buck” syndrome is obvious when consultants propose implementing measures under the Ecodesign Directive: they refer to the RoHS and WEEE Directives as a reason not to deal with recycling and toxicity under the Ecodesign Directive.

The conclusion from the above is that design considerations should not be “transferred” from the WEEE Directive to the other directives as this would only mean that design for EOL will not happen at all.

My conclusion

In my view, IPR makes a lot of sense, and there are good reasons to strive for a more distinct application of the IPR concept in the implementation of the WEEE Directive. But of course there are practical issues and solutions must be pragmatic. There are of course also a number of other, pressing issues related to the implementation of the WEEE Directive. Further, there are different ways to promote IPR, and different actors promote different solutions. Thus, the criticism against the practical applications of IPR is not irrelevant. Still, it is hard to avoid the feeling that some of the criticism – both from industries and authorities – stems

³⁶⁴ See note above on the ongoing research project.

from the fact that solutions that support IPR require much more effort and analysis. Thus, it is simply harder to work towards IPR than to use more “convenient” solutions. The history of waste management has been full of such discussions. One obvious example concerns the discussion of whether all waste should be incinerated; it provided a very convenient solution to all waste related problems.

So, I propose we continue to support solutions where producers primarily pay for their own products’ life cycle environmental impacts, and try to use market mechanisms to support competition for improved product design. IPR can be part of this, and IPR can work also within the context of collective collections systems. But some deep thinking is required to move to better solutions.

Annex IV – Interview guide for industry

General questions on competitiveness and the system dimension:

1. What is your overall view of how the Ecodesign Directive currently influences the EU industry in terms of competitiveness?
2. In relation to the above, how could the current situation – in terms of the Directive and the implementation process – be improved?
3. The JRC reports are quite positive towards new types of requirements, promoting maximum disassembly times, more recycling, and so on. What is your general view on the issue?
4. The DEFRA report seems to indicate that from a socioeconomic point of view the benefits can exceed the costs associated with new requirements, e.g. for recycling requirements. What do you think?
5. Do you see any benefits for EU industries in terms of resource security and reduced costs, e.g. associated with recycling standards, requirements on design that reduces costs of recycling etc.?
6. If we were to set standards that promote resource efficiency, what are the potential implications for EU firms cf. to non-EU firms?
 - Specifically: requirements on recycled content that can not be guaranteed from product inspections but requires supplier declarations: can this be a problem for EU-based firms?
7. Are there any potential benefits for EU industries if we are early movers and set up European standards for measurement, compliance checks etc.?
 - Life cycle competencies?
 - EU businesses setting pioneering standards?
 - Supplier relations?
 - Standardization in general?
 - System orientation and new business models?

8. The systems view: EU industries seem to be a bit split on the issue of what kind of unit/system to regulate: some see benefits associated with taking a wider perspective than the “product”, and regulate “a system” [provide examples], others do not. What is your view?
9. Do you see any benefits in terms of regulations aiding the development of new business models?

The legality of such requirements:

1. Are there any legal issues in relation to the text of the Ecodesign Directive?
2. Do you see any potential WTO concerns?
3. How important is Art. 15 and the “significance” criteria in practice? Can we set requirements now that can aid recycling in the future or is this out of the question?

What is your view on the potential of a number of potential requirements, listed below?

- BOMs
- Material declarations / supplier declarations on recycled materials
- Maximum disassembly times
- Ban of chemicals that hinder recycling for the product group at hand
- Requirement to issue longer guarantees when required
- Prove that certain issues (design for longer life, design for multi-functionality, design for modularity and upgrading, and LC orientation in design, etc.) has been taken into account in the design process

What are the implications for SMEs in relation to larger firms, in relation to potential new requirements for resources and recycling? Which types of requirements are difficult for SMEs to handle?

It seems German ministries are keen to promote stricter standards for product energy efficiency, discussing changes to the least life cycle cost methodology and the case for a European Top Runner concept. Why do you think they are progressive in this respect?

Do you have any final ideas on the policy mix? What role should the Ecodesign Directive have in the policy mix?

Annex V – Interview guide for policymakers

Political framework

1. Do you get the impression that the Ecodesign Directive 2009/125/EC is a well-accepted framework directive amongst stakeholders, in particular industry and politicians?
 - Yes
 - No
 - If no, which aspects of it are less well accepted?
2. How do you perceive the current possibility for a wide selection of stakeholders to participate in the process attached to obtaining binding eco-design product regulations?

The Ecodesign Directive

3. Against the background of several instruments, such as the EU Energy label or GPP, addressing a specific phase in a product life cycle only: What is your view regarding the Ecodesign Directive pursuing product-specific eco-design regulation which fosters a life-cycle perspective?
4. Do you think the Ecodesign Directive 2009/125/EC is an efficient policy instrument for achieving higher resource efficiency in energy-related products ?
 - Yes
 - No
5. What is your perception regarding the ability of the Directive to foster product innovations?
6. What is your impression of the implementing measures adopted so far?
7. How do you perceive the stringency in adopted eco-design requirements of the product-specific regulations in view of attaining higher resource efficiency?

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Addressing resource efficiency through the Ecodesign Directive

The European Union has initiated a number of initiatives to improve resource efficiency in Europe. The Ecodesign Directive is one of the policy instruments that could aid the transition towards a more resource efficient economy. So far, the Directive has mainly been applied to set requirements related to energy efficiency, but there is potential for setting legal standards that increase product durability and promote the future re-use and recycling of components and materials. This paper examines the potential benefits and disadvantages in applying the Directive for this purpose, and analyzes the potential to apply certain types of legal standards. There is a need for continuous development of indicators and methods in order to allow for a broader range of legal standards in the future. The study provides some short and long term recommendations on the way forward.

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