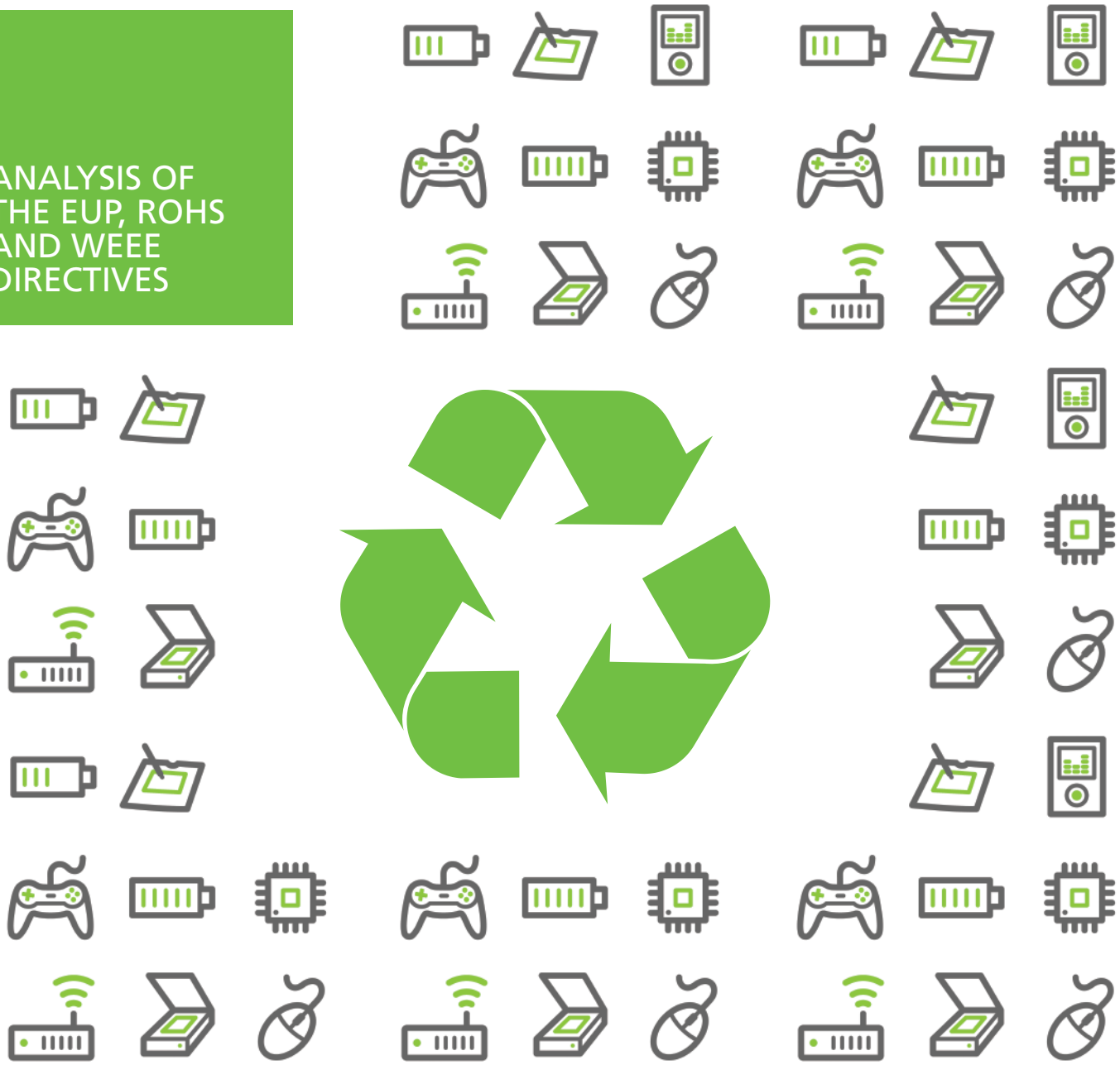
ANALYSIS OF THE EUP, ROHS AND WEEE DIRECTIVES



DESIGNING GREENER ELECTRONIC PRODUCTS:

BUILDING SYNERGIES BETWEEN EU PRODUCT POLICY INSTRUMENTS OR SIMPLY PASSING THE BUCK?

INTERNATIONAL INSTITUTE FOR INDUSTRIAL ENVIRONMENTAL ECONOMICS (IIIEE) AT LUND UNIVERSITY

REPORT FOR EUROPEAN ENVIRONMENT BUREAU (EEB)

EUROPEAN ENVIRONMENTAL BUREAU

The **European Environmental Bureau (EEB)** is a federation of over 140 environmental citizens' organisations based in EU Member States, and surrounding countries. These organisations range from local and national, to European and international. Created in 1974, EEB aims to provide a focal point for our members to monitor and respond to the EU's environmental policy and other policies having an impact on the environment.

EEB is the environmental voice of European citizens, standing for environmental justice, sustainable development and participatory democracy. We want the EU to ensure all people a healthy environment and rich biodiversity.

Edited by: Doreen Fedrigo and Nathalie Cliquot, and with special thanks to Edouard Toulouse from the European Environmental Citizens' Organisation for Standardisation (ECOS) for his technical contribution.

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Both EEB and ECOS are members of the Coolproducts for a Cool Planet campaign, activities undertaken by a group of environmental organisations working to ensure that the European Union pushes for ambitious environmental improvements to electrical and electronic products through legislation. More information can be found on the campaign website (www.coolproducts.eu), which aims to inform people in an engaging and non-technical way about what is going on behind the scenes. This is important because the on-going EU's Ecodesign of Energy-Using Products Directive implementation has the potential to green many of the products we use and change our lives for the better.

(For Ecodesign and NGO experts willing to enter the full details of the policy process of the Ecodesign directive, a more comprehensive website is also available at www.env-ngo.eup-network.eu)

coolproducts
for a cool planet

This report was commissioned by the European Environmental Bureau as part of its work on EU product policy. The research was performed at the International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden. The main authors are Chris van Rossem and Carl Dalhammar. Additional reviewing and editing from Edouard Toulouse (ECOS) has been included to ensure the information is fully up-to-date at the publication date and to provide recommendations based on in-depth involvement in the implementation of the EuP Directive. The authors would like to thank the interviewees, and everyone who provided input to the research process.

FOREWORD

The current multiple crises in the economic, social and environmental spheres are evidence of financial and market systems that do not truly reflect the cost of the environmental and social impacts of our behaviour, or even the reality of living on a finite planet. In other words, we have designed societal structures that ignore environmental and social limits and do not show when we have overstepped these limits.

The environmental issue receiving the most media and political attention in the West is climate change and related CO_2 emissions, but the stark reality is that similar crises also exist or are largely looming on other fundamentally important issues, such as water and biodiversity, and on availability of some limited natural resources. Windows of opportunity for avoiding worsening, and ultimately irreversible, crises are closing on many more fronts than just climate change.

EEB has long been working to establish European policies to avoid these crises and it is in the context of this work that this particular study was commissioned. Through our product policy work, we have tried to ensure that the full life cycle impacts of a product are considered when it comes to identifying the key impacts to be improved through ecodesign processes. For this reason, we campaign for the recognition that the energy and CO_2 related aspects are not, by default, the only impacts to be focused on, and for better linkages to be made between legislation which focuses on different aspects of a product's life cycle. Current European legislation exists individually and separately to potentially reduce the energy impacts of electronic products, to reduce their toxicity, and to ensure that these products are recycled rather than simply thrown away for disposal. But the integration of these policies into a consistent, overarching approach to ecodesign has not been achieved.

One way to describe the improvements of the life cycle of a product is to use the term 'ecodesign'. This demands that a designer or producer understand all the impacts of a product's life cycle from cradle to grave, and their interconnections, to reduce or avoid these impacts in a consistent manner. In the 1990s, European Union policy started from a focus on the end-of-life phase, setting objectives on recycling, reuse and recovery, and more recently has tried to expand to the concept of ecodesign. As with any new processes which require new ways of thinking, people need to pass through a learning phase, to understand how to address the issues and whether the approach is really applied in its genuine sense.

We commissioned this study as a means of assessing this shift from an end-of-life only focus to a broader ecodesign approach, and to see what improvements could be made to the legislative mechanisms supporting these activities and to their implementation. The study comes at a time when the European Union is preparing its economic strategy until 2020 and when an eco-efficient economy and eco-innovation are being increasingly seen as a means of achieving more economic stability and environmental and social sustainability.

What we see is that more can be done in the implementation of ecodesign-related legislation. There are clear needs for strengthening and clarifying the key Directives – this is particularly the case for better implementation of the life cycle approach. Implementing ecodesign and a life cycle approach through legislative mechanisms is not an easy thing, but we are lucky to have existing legislation to improve on with some effort. Our hope is that those who matter – the product designers and manufacturers, the retailers and those deciding on how the approach to greening products should now evolve – will recognise the improvements needing to be made to the legislative mechanisms so that they can be used more effectively in trying to find solutions to the multiple crises we have created.

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Background

'Life cycle thinking' has become an increasingly important concept in EU policy-making. The core building block of life cycle thinking is that relevant actors, most notably producers and consumers, should be aware of environmental (and social) problems throughout the product life cycle, and take measures to reduce these problems and their impacts.

Electrical and electronic equipment (EEE) have a number of environmental impacts throughout their life cycle. Relevant life cycle stages include the extraction of raw materials and refinement, production of intermediates and finished goods, sales, transportation, storage, use/consumption and final disposal. Additional phases can be attached to the product life cycle, although not necessarily in a physical sense, such as the product design stage and product marketing. The design stage is crucial, as most of the environmental impacts - calculated at 80% - in the different life cycle stages are determined by the product design.

The European Union (EU) has adopted three main regulatory instruments in order to improve the environmental life cycle performance of electrical and electronic equipment (EEE): the EuP, RoHS and WEEE Directives*. While the WEEE and RoHS Directives deal mainly with waste and hazardous substances, the EuP Directive is wider in scope and has the potential to regulate a number of life cycle-related impacts and provide producers with incentives for ecodesign.

These three directives should, in the best case, be complementary; they should be used in synergy in order to promote life cycle thinking in a clear and consistent manner. However, **there are worrying signs that current policy approaches may create confusion, and make actors adopt a "passing the buck" strategy: rather than dealing with an issue within the context of one Directive, it may be more convenient to state that it should be dealt with through an alternative one**. Given this, there is an evident danger of designing sub-optimal and fragmented policies. Due to the above considerations, this study was undertaken to assess the achievements of the Directives, and the potential limitations in their current structure and application.

Objective

This study aimed to examine the current and potential effectiveness of the EuP, RoHS and WEEE Directives to stimulate improvements along the life cycle of EEE. More specifically, the study aimed to:

- Provide an understanding of how the EuP, RoHS and WEEE Directives are addressing life cycle impacts of EEE.
- Discuss the inherent weaknesses in the EuP Directive and its methodology, and identify some potential areas for improvement.
- Identify synergies, overlaps and gaps in addressing life cycle impacts of EEE through the implementation of these policy instruments.

The main focus of the study is on the EuP Directive and its associated MEEuP methodology, and the development of implementing measures for four product groups (lighting, televisions, refrigerators and freezers, and personal computers and monitors). The EuP Directive provides the framework - at least theoretically - to address all life cycle impacts of EEE, at least insofar as those impacts can be influenced by product design, and therefore implementing measures that are developed can be complimentary to the intended measures in the WEEE and RoHS Directives, especially when those measures do not achieve their expected outcome. It is therefore very relevant to examine whether proposed implementing measures actually do complement the WEEE and RoHS Directives.

Methodology

In order to meet the objectives of the study, three data collection strategies were employed:

- A review of relevant reports and academic literature. All relevant literature on the EuP, RoHS and WEEE Directives that could be found through database searches were examined.
- A qualitative review of the EuP Directive's MEEuP and EcoReport Tool, and the proposed implementing measures.
- Interviews with 3 anonymous experts in the field of life cycle assessment (LCA) knowledgeable about the MEEuP. The main purpose of the interviews was to collect views on the MEEuP methodology and its implications regarding the development of implementing measures.

* EuP stands for Ecodesign of Energy-using Products, RoHS for the Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment, and WEEE for Waste Electrical and Electronic Equipment.

Main findings

Implementation and Review of the WEEE & RoHS Directives

The implementation of the WEEE Directive to date has not provided the incentives for design for end-of-life as originally perceived by policy-makers. The main principle to achieve this, namely **individual financial responsibility through individual producer responsibility (IPR), has not been transposed properly by many Member States, neither have compliance schemes implemented the concept in actual financial fee structures for producers**. The Directive is currently under revision, through a "recast" process allowing narrower revision of targeted elements of existing legislation. In the recast proposal, the European Commission has put forward recommendations to improve the functioning of the Directive, especially in terms of reducing administrative burden for economic actors. **Unfortunately, although IPR remains in the Directive, there has been neither recognition by the Commission of the lack of IPR implementation in practice, nor proposals to implement it effectively. This recast process has also not be used to make stronger synergetic links to the EuP Directive, so is a wasted opportunity.**

While the RoHS Directive has been successful in restricting the use of six hazardous substances in EEE, during the review process (again, a recast) of the Directive, enforcement issues and the process for handling exemptions have been pointed out as areas for improvement. However, the recast proposal does not put forward any new substances to be restricted and instead calls on any new substances to be identified through REACH (the new EU legislation on chemical substances).

The EuP Directive: Critical Review of the MEEuP and EcoReport

In reviewing the environmental assessments through the application of the EcoReport tool for the preparatory studies on computers, televisions, domestic fridges and lighting, it appears that the importance of the energy in the use phase of the life cycle may be *overestimated to some degree*. This is especially relevant for computers, monitors and televisions.

An analysis of previous environmental impacts and comments made by consultants working directly on these preparatory studies highlight potential issues with the methodology employed. **For PCs and TVs with increased use of semi-conductor devices within them, evidence suggests that the *production phase* may be as much or even more environmentally relevant over the entire life cycle than the use phase.**

A key study[1] notes that the life cycle energy use of a computer is dominated by the *production phase* (83%) as opposed to the *use phase* (13%). In comparison the application of the EuP EcoReport tool found that 73-90% of the total life cycle energy use of computers and monitors is found in the *use phase*. A closer look at the EcoReport tool indicates that **many *speciality chemicals* (requiring high purity levels which in turn require substantial energy demand) and processes in semi-conductor manufacturing do not appear to be included in the assessment of the manufacturing phase of the product life cycle.** The choice of product life length in the study (6.5 years) as opposed to the Williams study (3 years) also greatly influences the relative importance of the use phase to overall environmental impacts.

Another concern with the EcoReport, although its impact has not been quantified in this report, centres around the chosen default scenarios for recycling rates (and the fact that they do not take into consideration overall collection rates) of materials as described in the MEEuP and EcoReport. It is likely that incorporating actual collection rates in the calculations would show environmental impacts from the end-of-life life cycle phase to be much more important than currently established.

What is clear from reviewing the process of developing EuP implementing measures - from the preparatory study stage to draft regulations - is that there seems to be ***a steady downgrading from considering a total and integrated life cycle methodology towards only setting minimum energy efficiency standards addressing a part of the use phase impacts, and remaining vague on how to deal with the other ecodesign aspects***. This trend was seen in all of the product groups reviewed in this study. Considering this, the EuP Directive may be helpful in making products somehow more energy efficient, but is unlikely to result in a real paradigm shift towards sustainability in product design in its current implementation style.

Discussion and conclusions

Given the early stage of implementation of the EuP Directive, and the patchwork approach to ecodesign and life cycle based legislation to date, a number of different factors are worth considering when drawing conclusions on the analysis of the EuP, RoHS and WEEE Directives.

Complementarity of the EuP, RoHS and WEEE Directives

Clearly there are many overlapping objectives of the EuP, RoHS and WEEE Directives. Given the historical context of the development of these Directives, this is not surprising. Early drafts of the WEEE Directive had both the hazardous substance restrictions articles and the remit to promote future ecodesign standard development under its mandate. It was only when the WEEE Directive was officially proposed that the RoHS and WEEE Directives were separated into two distinct Directives. At the same time, DG Enterprise of the European Commission also released a Draft EEE Directive which later became the EuP Directive.

This Directive assumed control over the development of ecodesign minimum requirements. This history still has an impact on the relationship between these instruments still today. The explanations provided by the Commission for the reasons for revisions to the RoHS and WEEE Directives show different understandings of the role of the EuP Directive. The impact assessment for the RoHS Directive notes that the EuP Directive "aims at improving the overall environmental performance of selected groups of EEE, while considering economic feasibility". The WEEE Directive impact assessment, however, notes that EuP aims for "improvement of the energy efficiency" but only where this is possible without detriment to other environmental impacts in the life cycle of the product and considering economic feasibility. *Given this, it is clear that a certain ambiguity remains over the roles and responsibilities of the EuP, RoHS and WEEE Directives, and this would need to be better addressed and resolved as soon as possible.*

On the effectiveness of EuP as a life cycle-based instrument

Addressing life cycle impacts of production

The EuP Directive has inherent weaknesses which reduce its capacity to truly address any significant life cycle impacts (beyond energy efficiency in use) and drive a radical paradigm shift in product design. In particular, **the MEEuP methodology may overestimate the significance of the use phase, because of the boundaries set and the product lifespan applied** (as in the case of personal computers).

Usually, when generic requirements related to non-energy aspects have been proposed so far, they have been dropped in the final version of the regulation detailing the implementing measures.

Embedding life cycle thinking

Generic requirements making it mandatory for designers to take the life cycle impacts into account in the design process were proposed in one EuP preparatory study, but have subsequently been dropped. This means that manufacturers are only obliged to work with those aspects addressed in the implementing measures. **This indicates that the EuP Directive will probably not be very effective at integrating life cycle thinking among manufacturers.** Some of the 'pedagogical' elements, which would have forced manufacturers to learn more about their life cycle impacts and ecodesign options, are not sufficiently developed and promoted through the Directive.

Standards on Reusability, Recyclability, Recoverability

During the review process of the WEEE Directive, one option put forth by the European Commission to stimulate ecodesign practices was to define targets for reusability, recyclability and recoverability of EEE. However, limited support was expressed by some stakeholders noting that *"to set such targets, much investigation would be needed to have appropriate measuring methods to calculate the targets"*. The Commission recognised that the number of EEE types would render such a measure non-proportionate and was therefore discarded as an option. This then stresses **the importance of quickly developing appropriate measurement standards, as well as implementing fully the incentive mechanisms associated with individual producer responsibility for the financing of WEEE as required in the WEEE Directive.**

Toxicity and chemicals

Some chemicals are not properly assessed in the EuP methodology. There is also a tendency for preparatory study consultants to systematically point to the RoHS Directive or REACH as more suitable instruments to deal with these issues. However, it seems reasonable that the EuP Directive be used to assess the relevant toxicity issues for each of the product groups covered, to elaborate a more serious discussion as to what will be genuinely implemented through RoHS/REACH, and where gaps need to be filled. There are good reasons to consider how the approach and methodology can be improved in this respect.

Addressing the life cycle impacts of products: A case of Passing the buck?

If life cycle thinking is to be one of the central principles on which product policy, and indeed sustainable industrial policy, is based, then the current triangle of legislation addressing energy-using products – the EuP, RoHS and WEEE Directives - offers a consistent and potentially effective starting point.

Implementation of the WEEE Directive to date has been problematic in a number of areas, most notably the slow process of the creation of compliance systems in many Member States and a high level of administrative burden being placed on producers required to register and report in all 27 MS with varying formats. There is a high degree of uncertainty over the fate of the majority of WEEE, and a small percentage of this is ending up in landfill or incineration facilities. 41% of the reported WEEE is being exported illegally or treated out of compliance with the Directive.

The RoHS Directive has had positive impacts, despite the high number of exemptions to date. However, it is clear that restricting additional substances of concern in electrical and electronic products under this Directive is complicated. The European Commission's proposal for the recast (revision) of the Directive includes a new methodology for approving exemptions, with time-limited exemptions and placing the burden of proof on manufacturers to provide evidence of the need for an exemption. Despite this, no new substances restrictions were proposed in the recast. The proposal also included the suggestion to shift the substance identification and restriction methodology to REACH, even though it is well recognised that it is unclear how REACH will address the restriction of identified substances in products.

Legislating ecodesign is a complex issue, and the triangle formed by the EuP, RoHS and WEEE Directives offers a good starting point for addressing the impacts of electrical and electronic products throughout their life cycle. However, it is clear that the European Commission's proposals for revising the RoHS and WEEE Directives show more emphasis on avoiding Internal Market difficulties and the effects of the Better Regulation initiative, and not on effective, synergistic improvements to strengthen the application of ecodesign. The synergistic implementation of the three Directives demands institutional support that is integrated and proactive in driving an improvement agenda and closing legislative gaps.

As we have seen from our analysis, the institutional structure appears to be more interested in the Internal Market impacts and on energy in use phase only. Political decisions have also tended to water down originally ambitious proposals. This means that the implementation of the three Directives will remain sub-optimal, thereby not creating the strong signal to producers to design greener products - until the political leadership at EU and national levels is found.

RECOMMENDATIONS

General comments

To say that the EuP Directive is implementing full "life cycle thinking" addressing all significant design and ecological issues can currently be considered a case of "false marketing". The Directive itself, the MEEuP methodology and the process of proposing and adopting implementing measures, very much restricts the life cycle scope. Further, as proposed generic requirements that would have mandated designers to look at a wider number of life cycle issues in the design process usually are not adopted in the end or vaguely channelled to other Directives, the EuP Directive will probably not be the tool to embed life cycle thinking and associated practices among manufacturing firms. Not unless its implementation changes so as to address full "life cycle thinking".

Unfortunately, it is developments beyond the EuP, RoHS and WEEE Directives which will likely force improvements in these Directives. Last year, the European Commission published the EU Sustainable Consumption and Production/Sustainable Industrial Policy Action Plan (SCP/SIP). Part of the aims of the Action Plan was to bring more synergy and coherence between current fragmented product policies – EuP, the European Ecolabel and green public procurement. It is still early days in changes to implementation, but there is much work to be done to improve the implementation of the EuP Directive so that it can meet its aim of improving the *environmental performance of products throughout their life cycle* through the systematic integration of environmental aspects at the earliest stage of their design.

Sustainable Industrial Policy is very thin on content on what sustainability means beyond creating a "low carbon, resource efficient economy". With increasing political interest in areas such as eco-efficiency and eco-innovation, the need to bring more detail and clarity to policy objectives will become stronger. As yet, there is no sign of work on the development of detail on key environmental impact areas, clearer objectives in the different areas, nor of the relationships between "trade-offs" (for example, how to decide what action to take when a reduction in toxicity requires an increase in energy consumption).

Coordinating the policy instrument mix

As a result of the findings of this research, it is recommended that the European Commission develops procedures to ensure that information gathering and results of studies conducted on behalf of the Commission are fed into the appropriate channels for the EuP, RoHS and WEEE Directives. For example, results from the preparatory studies identifying product characteristics which are environmentally significant and where no actual specific or generic ecodesign requirements are proposed, should be shared early enough by the appropriate desk officers handling the EuP, WEEE and RoHS Directives.

The consultants undertaking future EuP preparatory studies should take more time to review evidence of how effective the WEEE and RoHS Directives have achieved their overall objectives, rather than just pointing to the fact that these instruments address the environmental aspects identified. European Commission desk officers handling the WEEE and RoHS Directives should be active participants in the preparatory stakeholder meetings and Ecodesign Consultation Forum meetings, incorporating discussions and resulting actions into their implementation analysis.

The optimal policy

As always in policymaking, there is no "optimal" way to design policies, and to coordinate their interaction. Still, one question obviously needs to be answered: *What is the actual role of the EuP Directive and associated methodology?* Should it be used to assess and address all relevant environmental impacts for a given EuP product group? If so, the methodology must be improved. When implementing measures are set, one should not look too much into REACH, RoHS and WEEE as better instruments to address certain issues, because we do not know when/if they will materialise in these instruments.

The MEEuP methodology needs to be refined to take into better consideration full life cycle impacts and addressing non-energy issues better. Still, this will not be enough to deal with all the life cycle related impacts of EEE. Therefore, we will need new policy approaches for this purpose.

Given the recent partial extension to the EuP Directive (to address "energy-related" products), a revision before the one scheduled for 2012 is not realistic. However, work can start to be done now on possible changes that would strengthen the full life cycle and full ecodesign considerations to be taken.

The European Commission can already develop procedures to ensure that the preparatory studies and development of product-specific measures under the EuP, RoHS and WEEE Directives (as well as other product-related policies such as Energy Labelling, the European Ecolabel, etc.) are delivered in a more consistent and integrated process.

For the 2012 revision, the review should reconsider the life-cycle approach and tools used in EuP to ensure a more consistent and balanced approach to developing implementing measures. It would also help if the product-by-product approach used in the EuP Directive were complemented by a horizontal document enforcing a few systematic ecodesign practices, to make sure that the Directive sends a strong overall signal to manufacturers and to not lose the bigger picture while focusing on trying to deliver on case-by-case margins in specific measures.

For EuP to better address life cycle impacts beyond energy efficiency in the use phase, the methodology needs refinement in at least two key areas. First, an improvement needs to be made so that chemical substances and toxicity issues can be more appropriately assessed. Second is on the link between natural resources and end-of-life management, most notably where we have already seen the failure to differentiate between collection and recycling of WEEE in the existing EuP studies. This has led to flawed base case scenarios, which affected the importance given to these aspects.

One of the areas for immediate activity proposed within a *Blueprint on European Sustainable Consumption and Production* is the articulation of sustainable industrial policy, with clearer sustainability objectives. As one of the criticisms of the SCP/SIP Action Plan made by EEB was that it lacked overarching objectives, it is clear that the European Commission has not wanted to step up to this particular challenge. As is also articulated in the *Blueprint*, the steps to sustainability will need to be set out actively sooner rather than later if we are to make reasoned, anticipated steps in a transition process. To continue avoiding setting out the path will lead to less reasoned, chaotic responses and decisions being made in future. Policy-makers need to take these difficult decisions now, to avoid the need to take even more difficult decisions in future.

1) INTRODUCTION

Background to the study

In the last decade, the concept 'life cycle thinking' has become increasingly important in EU policymaking. While life cycle thinking is not defined in any EU policy document, the core building block is that relevant actors, most notably producers and consumers, should be aware of environmental (and social) problems throughout the product life cycle; and take measures to address these problems.

A significant number of policy instruments have been implemented to green the life cycle of products, including mandatory standards, taxes and charges, green public procurement, and eco-labels. Both the European Commission and several European governments have tried to develop more comprehensive policies for product life cycle improvements. There is however considerable disagreement regarding the need for government intervention. Some industries are concerned that too much or too ambitious intervention will stifle innovation, increase costs and act as barriers to trade. Therefore they often advocate that governments make use of market-based approaches, and primarily rely on economic and voluntary instruments, while legislation should play a more limited role. In this scenario the primary role of government is as facilitator, rather than regulator. This 'facilitative' approach – which was very much in line with ideas on "good governance" - was embraced by the Integrated Product Policy (IPP) strategy when it was launched at the European level, as the focus was on co-regulation and less on mandatory standard-setting. However, in later years there has been increasing concerns regarding the effectiveness of such "facilitative" approaches, and therefore we see increasing calls for regulatory standards.

In the ideal case, 'life cycle oriented' legislation should:[2]

- Promote ecodesign among producers, so products are developed that have as little environmental impacts as possible in various life cycle stages.
- Adopt an integrated approach: environmental problems should not be passed on from one part of the life cycle to another.
- Strive to avoid a situation where pollution is transferred from one media (e.g. air) to another.
- Stimulate cooperation among various actors in the supply chain in order to reduce life cycle impacts.
- Strive to involve various actors throughout the product chain in continuous improvement work.

There are different types of legal constructions that may be used for these purposes. They include regulatory standards for hazardous substances in products and the material composition of products, standards regulating the energy/water/resource efficiency of products, and standards affecting the recyclability of products. Relevant rules can also be laws that mandate producers to collect and disseminate information about the life cycle environmental impacts of their products.

Increasingly, waste-related policy and laws are adopting a life cycle perspective. The Thematic Strategies on Waste and Natural Resources promote life cycle thinking as a bearing concept, There are also examples of some concrete policy measures, such as the European Commission's proposal to revise the Road Transport Fuels Directive in order to reduce life cycle emissions of greenhouse gases from fuels.[3] There are also ongoing attempts to incorporate environmental aspects in New Approach directives which have traditionally been employed as means to promote the free movement of products on the Internal Market.

At the Member State level, there is also a stronger life cycle orientation in environmental law. There are ongoing discussions on the need to regulate chemicals in products, and how product and life cycle issues can be better incorporated into traditional environmental regulations, like environmental impact assessments (EIAs) and environmental permits.[4]

While there is an increased life cycle orientation in European environmental law, current efforts are quite 'patchy'. There is no master plan for the regulation of the life cycle impacts of products at the EU or national levels. Current laws have been of limited importance for ecodesign and life cycle considerations. They have stimulated the phase-out of hazardous chemicals from products (although on a rather modest level), and promoted higher recycling rates of discarded products. This has had some, but rather modest, influence on the product design. This means that there is probably a great, unexploited potential to further promote life cycle thinking and ecodesign through law-making. *This is especially pertinent for the electrical and electronic equipment (EEE) sector, which has been the focus of specific environmental legislation often targeting various life cycle phases.*

Several processes to review existing EU policies have been completed recently or are on-going, such as on the expansion of the scope of the Energy-using Products Directive[5] (EuP) to cover "energy-related" products; and the revisions of the WEEE[6], and RoHS[7] and Energy Labelling[8] Directives. Several industry and academic stakeholders have called for all measures intended to influence product design currently in the WEEE

Directive (through the application of Individual Producer Responsibility) to be more appropriately addressed through measures in the RoHS or EuP Directives[9],[10]. It is believed that the WEEE Directive should prioritise improving the management of WEEE only, including appropriate collection and recycling target levels as well as sound environmental and health and safety treatment of WEEE. However, the RoHS Directive will mainly influence the use of a few selected chemicals regulated in the Directive, and at the same time there is limited evidence to suggest that the practical application of the EuP Directive will go beyond setting specific ecodesign requirements for energy efficiency of EEE, and thus there is a risk that many other design-related issues will not be covered consistently.

The main concern is that, rather than building synergies between these three product policy instruments in order to promote life cycle thinking in a clear and consistent manner, current policy approaches may create confusion, and make actors adopt a "passing the buck" strategy. Rather than dealing with an issue within the context of one Directive, it may be more convenient to state that it should be dealt with through an alternative one. Given this, there is an evident danger of designing suboptimal policies. This is even more obvious when EuP implementing measures will take the form of voluntary initiatives by industry stakeholders. This has not happened yet, but there is evidence that some EEE product categories might escape mandatory ecodesign rules. What then about consistency aspects with the other policies mentioned?

Due to the above considerations there is a current need to assess the achievements of the EuP, RoHS and WEEE Directives and the potential limitations in their current structure and application.

Objective of the Study

This study aims to examine the current and potential effectiveness of the EuP, RoHS and WEEE Directives to stimulate improvements along the life cycle of EEE. More specifically, the study aims to:

- Provide an understanding of how the EuP, WEEE and RoHS Directives are addressing life cycle impacts of EEE.
- Discuss the inherent weaknesses in the EuP Directive and its methodology, and discuss some potential areas for improvement.
- Identify synergies, overlaps and gaps in addressing life cycle impacts of EEE through the implementation of these policy instruments.

The main focus of the study is on the EuP Directive and the associated MEEuP methodology, and the proposed implementing measures, for several key reasons:

- There is evidence to suggest that an evaluation of the MEEuP methodology, and the way it is used by various actors, is warranted. Such an investigation could aid in order to correct potential flaws in current practices.
- Given that the EuP Directive provides the framework - at least theoretically - to address all life cycle impacts of EEE, at least insofar as those impacts can be influenced by product design, implementing measures (IM) that are developed can be complimentary to the intended measures in the WEEE and RoHS Directives; especially when those measures do not achieve their expected outcome. *It is therefore very relevant to examine whether proposed implementing measures actually do complement the WEEE and RoHS Directives.*

Research Approach

In order to meet the objectives of the study, three data collection strategies were employed:

- A review of relevant reports and academic literature. All relevant literature on the WEEE, RoHS and EuP Directives that could be found through database searches were examined.
- A qualitative review of the MEEuP and EcoReport Tool, and the proposed implementing measures.
- Interviews with 3 anonymous experts in the field of life cycle assessment (LCA) knowledgeable about the MEEuP. The main purpose of the interviews was to collect views on the MEEuP methodology and its implications regarding the development of implementing measures (IM).

Report Outline

Section two discusses the context of the study (regulating the life cycle impacts of EEE) including a discussion over what the main problems are when addressing the life cycle environmental impacts of products through policymaking. Section three includes a general overview as well as a critical assessment of the EuP, RoHS and WEEE Directives. Section four reviews in more detail the MEEuP and EcoReport as the critical decision-making tools used in the process of developing implementing measures under the EuP. This is followed by a detailed review of four selected preparatory studies and their subsequent steps toward becoming implementing measures. Section five discusses the interaction of the three Directives, while section six presents the conclusions and recommendations of the study.

2) THE CONSTRAINTS OF REGULATING THE LIFE CYCLE IMPACTS OF PRODUCTS

Before embarking on an analysis of the Directives, it is useful to account for the relevant context by analysing some of the limitations for law-making as a tool to promote life cycle thinking and induce improvements in the product life cycle.

There is an increasing recognition of the environmental problems associated with the life cycle of products, and policy documents provide some support for a stronger life cycle orientation in EU environmental policy. However:

- It is not always easy to establish a link between the diffuse impacts from producing, using and disposing of products, and the impacts on health and the environment. The impacts can be hard to measure, there are problems of allocation[11], and the causal relationship[12] between activities and impacts can be hard to prove.
- EC environmental law does not, in theory or practice, aims for "the highest level" of environmental protection. This means that life cycle regulations can mainly be expected in cases where the life cycle impacts are well proven, and considered to be of some significant.
- When the life cycle impacts of products are hard to prove in a definite way, it is easy to raise economic arguments for why a certain legal measure should not be taken.

This suggests, rather unsurprisingly, that the economic aims of the EU take some precedence over the environmental aims. There is therefore reason to consider the balance between different policy objectives. Onida criticises the fact that most EC product regulations and policies are concerned with free movement, while the environmental impacts of products has not been properly addressed; environmental protection and the completion of the Internal Market are in principle equally important as EU policy objectives.[13] In practice, however, the Internal Market dimension of product policy takes preference over the environmental dimension. *The EC has a master plan to deal with the free movement of goods, but it has no master plan for how to deal with the environmental impacts from products: current regulations addressing the environmental impacts of products provide a patchwork, but there is not enough coherent strategy*. A typical example is chemicals in products: despite numerous legislative pieces, the EU still does not have a coherent strategy to deal with these or policy on their sustainable use.[14]

We will now discuss some other problems, before concluding what this means in the context of EU product legislation.

Trade law and Processing and Production Methods

One limiting factor for EU environmental product policy is the potential restrictions associated with the World Trade Organization (WTO) Agreements. The most problematic issue concerns PPMs. A rule or standard for processing and production methods (PPMs) sets criteria that relate to the production methods – how a good is produced – which can be very significant in the overall life cycle impact of a product. PPMs are often divided into two categories:[15]

- *Product-related PPMs* (PR-PPMs), also referred to as *incorporated PPMs*: PR-PPMs are PPMs that can affect the product so the product itself may pollute or degrade the environment when it is used, consumed or disposed of. For instance, when pesticides are used when growing apples, this may result in higher residues also in the apples. If so, the use of pesticides constitutes a product-related PPM.
- *Non-product-related PPMs* (NPR-PPMs), also referred to as unincorporated PPMs: NPR-PPMs do not affect the characteristics of the final product, although they highly influence the life cycle environmental performance of the product. An example concerns recycled paper and paper made by virgin materials; while the two kinds of paper may have very different environmental life cycle performance, they do not have a difference in qualities that makes it necessary to treat them differently in connection to use, handling or disposal.

The difference between these two categories is crucial. Countries are usually allowed to discriminate based on PR-PPMs, within the limits provided by the main WTO agreements[16], and relevant case law. Non-product related PPMs are much more problematic. Hereafter, the term PPMs refers to NPR-PPMs.

It makes a lot of sense from an environmental perspective to differentiate between products based on their environmental performance during the whole life cycle; after all life cycle thinking connects the consumption and the production phases, and makes consumers aware of the social and environmental consequences of their consumption, which are often geographically (and "culturally") distant. For many products, the PPMs account for a large part of the life cycle environmental impacts. This is typically the case with products from agriculture and forestry (where relevant PPMs are related to sustainable agriculture and forestry practices, such as re-planting of trees), and fishing (for instance by-catches of dolphins and sea turtles from trawling equipment). For many industrial products the PPMs (such as raw material extraction, chemicals use, and energy use during production) have a great influence over the environmental life cycle performance.

However, accepting that PPMs can be used to differentiate between products on the international level has been problematic. The main issue concerns the interpretations of the central parts of the WTO-administered GATT Treaty and most notably Art. II. It states that imported products should be treated no less favourably than "like products" of domestic origin. The main issue then is whether "likeness" should be based on the physical characteristics of products or whether other criteria may be applied, including environmental impacts during the life cycle. The reigning view has been that physical characteristics are the main criteria to be used.[17] This means that a product-related policy measure which blocks or restrains imports of a product because of the PPMs employed in its production is not allowed, because the two products are "like"; therefore policies based on PPMs are not allowed. A further problem is that an increased acceptance of PPMs, in order to pursue environmental protection, would also open the door to PPMs that relate to *social criteria* including workers' rights, use of child labour, and implementation of an appropriate minimum wage.

However, the GATT text does not expressively forbid PPMs. The main idea that PPMs are not allowed relates to the reasoning of the panels in the Tuna/Dolphin disputes, which were never adopted. The reasoning of the Appellate Body in the subsequent Tuna/Shrimp dispute seems to indicate that PPMs could be allowed under certain circumstances.[18] However, the reasoning is so vague that it provides little guidance on the matter.

Thus, the views on the potential to regulate PPMs differ.[19] However, despite the fact that neither the legal documents nor the case law prohibits PPMs, it has become the "conventional wisdom" that PPMs are not allowed. Some authors even point out that there is a large confusion among practitioners and researchers; they often believe that the WTO agreements specifically ban PPMs.[20]

We can notice that policymakers are quite unwilling to regulate PPMs. It is hardly a coincidence that most EC (EU) laws relating to products regulate product characteristics (for instance chemical content), or relate mainly to the downstream (after use) handling of products (for instance standards for waste treatment). Thus, standards relating to upstream (before use), non-product related PPMs (NPR-PPMs) regulating the extraction of raw materials or production processes, are avoided. Some EC standards, for instance regarding chemicals in products, may have further implications for PPMs in the product chain but the standards are still related to the product characteristics (PR-PPMs).

However, we have now seen that the EU intends to take measures to regulate PPMs for biofuels and other bioliquids, through the setting of sustainability criteria.[21] This came after the revelation that the production of biofuels and bioliquids, such as palm oil, is connected to bio-diversity loss, land disputes and significant releases of greenhouse gases. *Unlike consumer products, biofuels and bioliquids are not within the scope of GATT, which means that the setting of these PPM-related standards should be lawful. But when it comes to finished products, for instance electronics, the issue is much more sensitive.*

Responsibility in international product chains

One of the main underpinnings of Commission's IPP strategy is that of 'shared responsibility'. This concept suggests that all actors along the product life cycle have a responsibility to reduce environmental impacts. These include raw material extractors, producers of intermediates, transporters, manufacturers, importers, retailers, consumers, and waste operators. Although an appealing idea from a fairness perspective[22], experience in policymaking has taught us one important lesson: *making everyone responsible usually means that no one takes responsibility*.[23] Indeed, stressing the need for shared responsibility seems to be one of the strategies employed by industrial lobbyists to avoid regulation targeting the producers.[24] The concept of shared responsibility may therefore provide poor guidance for policymaking. In worst case it strengthens the '*organised irresponsibility*' which is often noticed in connection to environmental risks. The concept of organised irresponsibility refers to the fact that it is hard to find out who is responsible for many environmental problems:

Risks are no longer attributable to external agency… Society becomes a laboratory, but there is no one responsible for its outcomes.[25]

Heiskanen has argued that in the modern world – where buyers and users of products are more and more distanced from the conditions under which they are produced – life cycle thinking may aid in connecting the production and use/consumption phases:[26]

Life cycle thinking can, in an optimistic light, be seen as part of a counter-tendency to this anonymity and 'organised irresponsibility', along with a variety of other current movements for traceable and accountable production chains…

Yet, as Heiskanen acknowledges, this is an optimistic view. At worst, producers collect life cycle environmental information but little happens in terms of improvement. Additionally, there is a risk that the concept of life cycle thinking may be used in many various ways and for several purposes - including deregulation.

Therefore, while policies should be designed to encourage all actors to shoulder some responsibility and 'do their bit', effective policies may require that the most important actors are targeted and given clearer responsibilities. Most environmental instruments in the product field are directed towards producers, although an increasing number of instruments have been developed to harness the purchasing power of consumers and professional purchasers as well.

Among the actors in the product chain, it is usually the producers who have the highest capacity to prevent problems at the source as they have influence over the design of their products/product systems. Furthermore, producers usually have a strong power position in the product chain and can therefore influence suppliers to adopt more sustainable practices.

Increasingly, policymakers put demands on producers and ask them to act as "regulatory surrogates": in order to comply with legal criteria on products and materials, producers need to push demands through their supply chain. This is not an easy task. Problems include costs for certification procedures and inspections of suppliers, additional costs for investments in more environmentally or socially friendly production practices, and supplier resistance, and not least an unwillingness from many suppliers to share sensitive information. It may appear unreasonable to expect producers to control the practices of other actors in the product chain as they often have limited potential to control their operations. On the other hand, producers tend to have significant economic power, and should in most cases be able to persuade other actors to adopt more sustainable practices if they are prepared to pay for it. The question regarding how much producers can be expected to control in a product chain is far from settled. Legal, political, and economic factors should be considered when establishing a reasonable level of responsibility.

The application of Extended Producer Responsibility (EPR) as a policy principle in the WEEE Directive, including the underlying incentives for producers to improve the life cycle impacts of their products, has not materialised as originally intended.[27] Through the extension of responsibilities for the physical and financial management of the product along its life cycle and especially its end-of-life management, EPR aims to create economic incentives for producers to innovate product design to avoid environmental impacts and end-of-life costs. In fact, there are few policies to make producers supply life cycle information, which will be discussed in the next section.

Insufficient incentives to supply life cycle information

The flow of information about the life cycle impacts of products to various actors in the product chain is an important prerequisite for improvement. Environmental information has several functions:[28]

- *It is a prerequisite for improvement.* Information is necessary in order for producers to improve the product. Several actors – including private consumers, professional purchasers, NGOs – can use the information to evaluate the environmental performance of various products, and create pressure on producers to develop less impacting products.
- *Enable a safe/less impacting use and final disposal of a product.* Consumers may need information that can help them to use and dispose of the product appropriately. Companies that treat/recycle waste products may need information about materials, where toxic parts can be found etc., to ensure a safe and cost-effective treatment, which will in the long run be a prerequisite for more closed material loops. It is often product manufacturers that develop the most successful systems for re-use and recycling of products and their components.[29] This indicates that good knowledge about product properties is crucial for waste treatment operations.
- *Contribute to the wider uptake of life cycle thinking.* Product-related environmental information about life cycle impacts will contribute to a better understanding of the diffuse life cycle emissions of products among actors in society, and thereby promote life cycle thinking as a concept.
- *Improve statistics.* A better flow of information is also important in order to provide better statistics, for instance regarding mass flows and chemicals in products. Reliable information is a prerequisite for effective policy.

Product-related environmental information can be of different types, and include:[30] product declarations, for instance on materials and chemicals; information about the life cycle environmental impacts of the product, its energy need, etc.; and information on how the product should be used and disposed of in order to reduce environmental impacts.

Voluntary schemes for product-related environmental information are usually divided into three categories:

1) ISO Type I claims (the relevant standard is ISO 14024). This is what is usually referred to as (positive) eco-labels, including schemes such as the Nordic Swan and the German Blue Angel. These are declarations that meet criteria set by a third party, and the conformance of the product to the criteria is controlled by the third party.

2) ISO Type II claims (the relevant standard is ISO 14021). This includes manufacturers' or retailers' own declarations, sometimes referred to as 'green claims'.

3) ISO Type III claims (the relevant ISO standard is ISO 14025). These claims contain quantified information about the life cycle impacts of the product. These are often referred to as environmental product declarations (EPDs).

Except from these categories, there are also several other product declaration schemes, for instance schemes relating to chemicals in building materials, textiles and electronic products.[31]

Environmental information is a prerequisite both for effective policy measures and for market players (like retailers, consumers and professional purchasers) who wish to contribute to green product development. Mandating producers to provide relevant information about the life cycle environmental impacts of products could be a very important instrument for reaching the objectives of environmental products policy. However, despite the large potential, there are few mandatory schemes in place that oblige producers to provide information about the life cycle impacts of products. Instead, most schemes for product-related environmental information have been voluntary. However, the current voluntary information schemes for product-related environmental information, such as Environmental Product Declaration (EPD) schemes, cover few product groups, attract few producers, and often only address a limited number of environmental aspects.[32] Thus, the IPP Working Group on Product Information has concluded:[33]

…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.

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 some 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 a very effective way to stimulate pollution cuts, as several interest groups will put pressure on producers to improve their practices.[34]

It thus appears as if there could be good reason to investigate the potential for EU regulations mandating producers to supply more information about the life cycle impacts of products (this work was already done in the Integrated Product Policy context, with a working group on product information[35]). The EuP Directive, for instance, may be used in this context. However, so far, implementation focuses mostly on information relating to the use phase characteristics of products (energy consumption, water consumption, etc.) and not to broader life cycle aspects (e.g. production methods, recycled content, recyclability, reparability, etc.). A relevant question concerns whether the time is ripe to mandate that specific life cycle information be provided for specific product groups. This means that certain criteria has to be applied for selection of product groups, for instance choosing products that have high environmental impacts, or products where there are probably great potential for improvements. Further, the life cycle information included should be the most relevant one, for instance because it relates to high environmental impacts. Relevant questions include:

- What product groups should be included?
- What life cycle phases are associated with high environmental impacts?
- What information is useful for various actors (chemical content, recyclability, impacts from raw materials extraction and production, transport-related impacts, and so on)?
- Who is to use the information (private consumers, professional purchasers, NGOs, authorities)?
- How shall the information be presented to the relevant actors (data sheets, product labelling, etc.)?
- What are the costs for collecting and spreading relevant information? How can these costs be lowered, for instance by developing sector-wide solutions?

One common argument in the debate is that it is costly to collect the information. It is also costly for producers to control that information given from various actors in a product chain is credible. Therefore, any requirements put on producers should weigh benefits and costs. There are however some concerns that significantly affect the potential to mandate producers to supply life cycle information about products, related to the effects on trade and competition:

- A first question concerns the legality under the WTO Agreements; it is questionable if the inclusion of NPR-PPMs in a mandatory product information scheme would be allowed under WTO provisions.
- An additional problem is that a scheme would probably – even if not intentionally – disfavour manufacturers in developing countries, and SMEs more generally, as these have less resources to devote to collecting relevant information.

For these reasons, we can expect that proposals for a mandatory scheme would be strongly opposed by many governments and industries. This is probably the reason why so little attention has been given to the issue of mandatory product information in EU policy documents, and not least in the IPP discussions. There is a clear preference towards voluntary information tools, despite their limitations.

The potential to set mandatory requirements

Mandatory requirements can be set with the intent to force the market to develop products with a better environmental performance than currently available (often referred to as 'technology forcing'). This will clearly be indispensable, for the EU to reach its environmental objectives and keep its leadership stance[36].

This is difficult as such laws are sometimes heavily resisted by industries. However it is to be noted that more and more manufacturers have changed their opinion on this and now consider that a regulatory approach is in their best interest to ensure a common level playing field and avoid 'free riders' on the market. Mandatory requirements are sometimes opposed by policy-makers, in the name of liberalism and freedom of choice or just because policy-makers cannot be sure of future technological developments and are afraid to make a mistake. It is indeed a challenge to know in advance how many companies or products will be able to reach a quantified target, and governments sometimes drop standards which enterprises are not on track to deliver. However, this does not mean that such policies are a failure, as they often lead to new investments in research and development.

A key aspect is how to set mandatory targets that all products put on the market will have to comply with. The Japanese 'Top Runner Programme' is an example of a mix of a benchmark approach and fleet average target. The performance levels of top-performing products at a given time are set as the mandatory level to be achieved some years later (usually between 4-8 years). Despite its reknown, this scheme is not necessarily a perfect model[37]. In particular, the scheme seems better suited to achieving steady improvements rather than radical ecodesign innovations, because of the (too?) long timeframes for compliance. Industry has claimed that the Programme's success in inducing innovation has been overrated, and that the success varies depending on product group and consumer awareness.

The EuP Directive leaves the door open to several options for its implementing measures. They can take the form of a mandatory regulation, a voluntary industry initiative, legislation, a label or a combination thereof. So far, the ten measures adopted under the EuP use regulations. As they are a central aspect in this policy, they will be further discussed in the rest of the study.

3) EUP, ROHS AND WEEE DIRECTIVES: OVERVIEW AND EXPERIENCES TO DATE

This section briefly introduces the three main EC Directives that are addressing various life cycle impacts of EEE products. Excluded from the description here are the Energy Labelling and the Energy Performance of Buildings Directives, and REACH. The aim of this section is to describe the Directives and their intended objectives, including a brief analysis of the effectiveness of their implementation to date. For EuP, this assessment is limited to the application of the MEEuP and EcoReport and the progress towards developing implementing measures for 4 product groups.

The WEEE Directive

Background and Main Provisions

The WEEE Directive was adopted by the European Parliament and the Council on 27 January 2003 and came into force on 13 August 2005. The main stated objectives are principally to prevent the generation of electrical and electronic waste and to promote re-use, recycling and other forms of recovery so as to reduce the quantity of such waste to be eliminated, while also improving the environmental performance of economic operators involved in its treatment. Recitals (12) of the WEEE Directive clearly states that the directive aims to encourage design changes to reach these goals.[38]

Scope

The WEEE Directive covers a diverse scope of electrical and electronic equipment (EEE). EEE is defined as any equipment which is dependent on electric currents or electromagnetic fields to work properly and includes equipment for the generation, transfer and measurement of such currents and designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current. In total, there are ten broad categories of EEE included in the table below. Compared with other EPR legislation for electronics around the world, the scope of the WEEE Directive is incredibly broad.

Figure 1: Categories of EEE Equipment in the WEEE Directive

WEEE Directive 2002/96/EC - Product Categories	
1	Large household appliances
2	Small household appliances
3	IT and telecommunications equipment
4	Consumer equipment
5	Lighting equipment
6	Electrical and electronic tools
7	Toys, leisure and sports equipment
8	Medical devices
9	Monitoring and control instruments
10	Automatic dispensers

Collection

For WEEE from households, Article 5 obliges Member States (MS) to ensure that by 13 August 2005, systems are set up for consumers and retailers to return, at least free-of-charge, their end-of-life EEE. The Directive does not explicitly identify either producers or municipalities as the responsible party to set up this infrastructure and the legal text leaves MS the interpretation/discretion to make this decision. It also puts the onus on retailers to accept WEEE from consumers on a 1:1 basis when selling new products, although MS can deviate from this requirement if they can show that an alternative procedure is just as convenient for consumers.

For non-household WEEE, MS must ensure that producers or those acting on their behalf provide for the collection and finance of this waste stream. For WEEE from households there is a collection target of 4 kg/ inhabitant/year, while for non-household WEEE (e.g. business to business) there is no such target.

Treatment & Recycling, Reuse and Recovery

Article 6 outlines the requirement for producers to develop systems to treat WEEE using the best available treatment, recovery and recycling techniques in accordance with Community legislation. More specifically, Annex II outlines certain requirements for selective treatment of WEEE. Many of these requirements have a potentially significant impact on the treatment paths employed by the national WEEE schemes operating before Directive 2002/96/EC was transposed and subsequently brought into force in MS.

Specifically, these include the selective treatment requirement to remove circuit boards greater than 10 cm^2, mercury-containing components such as switches or backlighting lamps, and plastic containing brominated flame retardants. If the 'have to be removed' wording in Annex II is interpreted as the requirement to remove these components *prior to shredding*, manual disassembly would be necessary, significantly increasing the cost of treating WEEE in certain categories.

In terms of recovery, Table 1 below outlines the *weight-based*[39] recovery, recycling and component re-use targets for the various categories of WEEE as found in the WEEE Directive. The difference between recovery required and component, material and substance re-use/recycling required is the amount that can be incinerated with energy recovery or treated through another recovery operation. This amount is, for instance, 5% for large household appliances.

Table 1: Recovery, Recycling and Reuse Targets in the WEEE Directive

WEEE Category	Recovery by weight required	Component material and substance reuse and recycling by weight required
Large household appliances (1) Automatic dispensers (10)	80%	75%
Information & Communication Technology (3) Consumer equipment: (4)	75%	65%
Small household appliances (2) Lighting equipment (5) Electrical and electronic tools (6) Toys, leisure and sports equipment (7) Monitoring and control instruments (9)	70%	50%
Gas discharge lamps	80%	80%

Financial Responsibility (WEEE from private households)

Producers are required to finance at least the collection (collection from collection sites onwards), treatment, recovery and environmentally-sound disposal of WEEE from households deposited at collection sites. The significance of the term 'at least' is that it also allows MS to place the financial burden on producers to set up and operate the collection sites.

Recital (20) of the WEEE Directive clearly shows that, in order to allow for the maximum effect of the producer responsibility principle, each producer of electrical and electronic equipment (EEE) should be financially responsible for managing waste from his/her own products. This is meant to provide the necessary financial feedback mechanism to producers to design their products for better end-of-life management that results in lower treatment costs and environmental improvements. In other words, it is not the intention to have a collectively financed end-of-life management system where all costs are divided equally based on current market share. In this scenario, producers with better-designed products are not financially rewarded, as the cost savings attributed to their products are shared by all producers.

However, as it is not possible for producers to influence the design of their products that were already on the market before the Directive came into force (historical waste), in terms of allocation of financial responsibility for WEEE from households, Directive 2002/96/EC distinguishes between historical and new WEEE. This is found in Article 8:

For products placed on the market after 13 August 2005 (new WEEE), Article 8(2) states that:

> *Each producer shall be responsible for financing the operations referred to in paragraph 1 relating to the waste from his own products. The producer can choose to fulfil this obligation either individually or by joining a collective scheme.*
>
> *Member States shall ensure that each producer provides a guarantee when placing a product on the market showing that the management of all WEEE will be financed and that producers clearly mark their products in accordance with Article 11(2). This guarantee shall ensure that the operations referred to in paragraph 1 relating to this product will be financed. The guarantee may take the form of participation by the producer in appropriate schemes for the financing of the management of WEEE, a recycling insurance or a blocked bank account.*

For products placed on the market before 13 August 2005 (historical WEEE) Article 8(3) stipulates the responsibility as follows:

The responsibility for financing of the costs of the management of WEEE from products put on the market before the date referred to in paragraph 1 [13 August 2005] (historical waste) shall be provided by one or more systems to which all producers, existing on the market when the respective costs occur, contribute proportionately, e.g. in proportion to their respective share of the market by type of equipment.

Article 8(2) clearly allocates individual financial responsibility to producers for their own products put on the market after 13 August 2005. Since this Article ensures that producers are only required to pay for the management of their *own* new WEEE *and not* of others that go out of business (orphan products) or producers that might try to avoid their obligations (free riders), a financial guarantee is necessary for individual financial responsibility to work in practice. Thus, producers must, when placing a product on the market (after 13 August 2005) show that the management of all future WEEE will be financed. The guarantee can take the form of one of three options (as specified in Article 8(2) second paragraph); (1) participation by the producer in appropriate schemes for financing the management of WEEE, (2) recycling insurance or (3) a blocked bank account.

Given that Article 8(3) requires that all players in the market pay a proportion of the costs to manage historical waste based on, for instance, their market share when those costs are incurred, systems must be developed to record all new products placed on the market by each producer today as well as all the historical WEEE collected by all compliance schemes. MS are required to set up *national registers* to provide the market share calculation that will determine the relative share of historical waste financed by each producer. Additionally, the register needs to confirm that for products placed on the market after August 13, 2005, there is a suitable financial guarantee covering the future costs of WEEE management.

Financial Responsibility (Non-household WEEE)

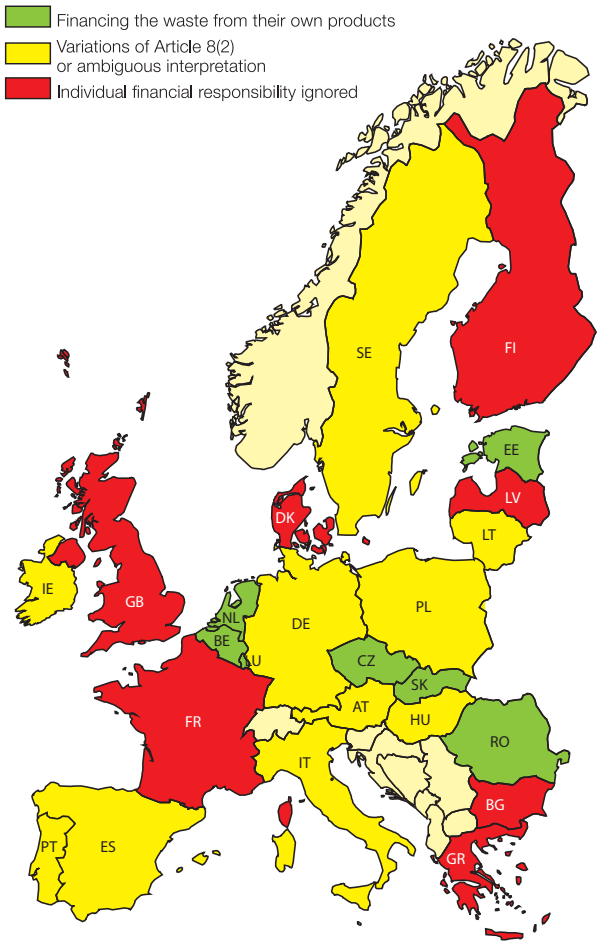
Directive 2003/108/EC amends 2003/96/EC with regards to financing WEEE from users other than households. The Commission acknowledged industry concern over the impact of retroactive financial responsibility for historical non–household WEEE, due to changing market share structure over time. For historical non–household WEEE, producers are only responsible when they supply new products on an old-for-new basis. The amendment does not change the obligations with respect to individual responsibility for new waste.

Implementation

The implementation of the WEEE Directive in Member States can be characterised as being somewhat difficult on a number of levels. Firstly, many Member States missed the deadline of 13 August 2004 to transpose the Directive into national law, although by April 2007 all but one had done so.

In terms of the transposition process, there have been a number of problems with how MS have interpreted the WEEE Directive requirements. Although MS do have the freedom to go beyond the minimum requirements laid down in the Directive, they are required to at least be in line with the minimum requirements. However, on the key mechanism to encourage the improved design of products, namely Article 8(2), many MS have not transposed the Directive to allow for a definitive individual financial responsibility for each producer's own products[40].

Figure 2: Transposition of Financial Responsibility for New WEEE under Article 8(2) by Member States



Therefore it is not surprising to see compliance systems set up that are based on collective financial responsibility for both historical and new WEEE. The financial mechanism that proportions the cost of each producer's obligation based on market share will not provide any financial incentive for producers to improve the environmental performance of their products.[41] *This improper transposition of Article 8 jeopardises the original intent of the WEEE Directive to provide financial incentives for improved design of products resulting in improved environmental performance and reduced costs. Therefore the incentives for ecodesign as originally envisioned when the Directive was drafted are not very strong.*

Review and Recast Proposal

The main justification to revise the Directive is to enforce its implementation, and to avoid the known leakages of collected WEEE outside the official collection and treatment routes. The main proposed changes in the Recast include:

- To improve effectiveness
  - Set minimum collection targets equivalent to 65% in weight of what was placed on the market in the preceding 2 year average
  - Set minimum requirements for inspection and enforcement by Member States to be decided in Comitology
  - Encourage Member States to assign the financial responsibility for collection to producers instead of municipalities
- To improve efficiency
  - Define the scope of the Directive in RoHS (based on Article 95) and require Member States to publish list of products within their national scope
  - Require interoperability and data-transfer between MS producer registers
  - Include reuse of whole appliance in the target for recycling combined with reuse
  - Set targets for medical equipment (Cat. 8) to the level of those for monitoring equipment

If the better registration, permitting and reporting by all WEEE actors seems to be accepted, the ongoing discussion tends to show that the collection targets under producer responsibility are very controversial, as the producers claim they do not have the enforcement power to achieve such results.

While the recast does not affect article on Ecodesign (Art 4 recast), nor the Individual producer responsibility principle (art 12 recast), the new Proposal does not address the issue of improper implementation of individual producer responsibility and the limited incentives for ecodesign currently provided by the Directive.

The RoHS Directive

Background and Main Provisions

Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronics equipment (RoHS) was adopted on 27 January 2003 by the European Parliament and the Council, and came into force July 1, 2006. The RoHS Directive applies to 8 of the 10 categories in the WEEE Directive: large and small household appliances, information technology and telecommunication equipment, consumer equipment, lighting equipment, electrical tools, toys, leisure and sports equipment and automatic dispensers.

The purpose of RoHS is to approximate the laws of the Member States on the restrictions of the use of hazardous substances in electrical and electronic equipment and to contribute to the protection of human health and the environmentally sound recovery and disposal of waste electrical and electronic equipment.

The RoHS Directive restricts the use of six hazardous substances in EEE: cadmium, lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ether (PBDE).

The RoHS Directive exempts certain application of the use of the restricted substances and these are listed in Annex 1 of the Directive. There are a total of 32 separate exemptions listed in Annex 1 of the consolidated version of the legal text. Exemptions are reviewed at least every 4 years and if suitable alternatives exist the exemption can be considered for deletion. Decision 2005/618/EC specifies that the maximum concentrations permitted are 0.1% (except for cadmium which is limited to 0 .01%) by weight in homogenous materials.

Implementation

According to the Commission the RoHS Directive has reduced the quantities of the restricted substances being disposed of and potentially released into the environment by 89,800 tonnes of lead, 4,300 tonnes of cadmium, 537 tonnes of hexavalent chromium, 22 tonnes of mercury and 12,600 tonnes of Octa-BDE.[42]

A number of problems associated with the operation of the Directive have been identified by stakeholders and documented in the studies supporting the review of the RoHS Directive. The Commission asserts that these problems fall into the following main categories:

- Implementation-related problems
  - Products outside the Directive's scope harming the environment
  - Differences in scope between Member States
  - Increased administration costs because of diverging requirements between Member States
- Enforcement-related problems
  - Potentially high proportion of non compliant EEE (up to 44%)
  - Problems related to perceived inconsistency with other Community legislation
  - RoHS process for granting exemptions has proven too cumbersome and too lengthy to keep pace with innovation, in particular to products with lead times which can be shorter than the exemption procedure.

Review and Recast proposal

As required in Article 6, a review of the RoHS Directive is currently underway. This shall review measures provided for in the directive in particular with regard to the inclusion of two additional categories of equipment in the scope (categories 8 & 9 medical devices and monitoring and control instruments) and the adaptation of the list of restricted substances. To support the review several stakeholder consultations have been undertaken and a number of studies commissioned.

In the explanatory text of the RoHS recast, the Commission recommends introducing clarifications and enforcement-related clauses, to align provisions where possible with other pieces of Community legislation such as REACH, to adapt the exemption mechanism and to include two new categories of equipment. The expected benefits are environmental (reduction of quantities of hazardous substances released in the environment from medical devices and control and monitoring instruments, reduction of number of non-compliant products in the market) and economic (reduction of administrative burden, avoidance of duplication of procedures, and increase of legal certainty).

The main changes proposed in the recast proposal include:

- Article 2: Scope – 2 new Annexes added (WEEE Directive Product Categories now listed in RoHS Directive) medical devices and monitoring and control instruments added
- New exemptions added for product categories of medical devices and monitoring and control instruments in a new Annex
- A new mechanism to add new restrictions of substances in line with the REACH methodology which places the burden on manufacturers
- New 4 year maximum exemption period to stimulate innovation to find alternatives
- A mandate is given to the Commission for establishing detailed rules for the applicants to apply when requesting an exemption for facilitation and speeding up the scrutiny process
- Introduction of product conformity assessment requirements and market surveillance mechanisms in line with the "marketing of products" package.

Important to note is that the Commission is not recommending any new substances be added to the list of restricted substances due primarily to a lack of scientific and market information to justify this. Even though there does seem to be substitutes in many applications, the Commission views them as neither sufficiently investigated as to their potential environmental and health effects, or too expensive to apply in all EEE covered by the RoHS scope, or both. However, the Commission will continue to monitor developments in this area and may recommend adding new substances at the occasion of the next review of the Directive.

The REACH Directive may over time be a useful complement to the RoHS Directive as it contains relevant provisions to address chemicals in articles. However, the early signs are that the process of incorporating new substances will be considerably time consuming and lengthy.

The EuP Directive

Background and Main Provisions

This Directive aims at improving the *environmental performance of products throughout their life* cycle through the systematic integration of environmental aspects at the earliest stage of their design.

By introducing EU-wide rules for ecodesign, the EU wants to make sure that national regulations do not become obstacles to intra-EU trade. The Directive itself does not introduce directly binding requirements for specific products but defines some general conditions and criteria for setting requirements on a product-by-product basis.

The European Commission then sets these product-specific requirements under the EU Comitology process, provided that the product group:

- Has a significant impact on the environment
- Has a high volume of trade in the EU
- Has clear and significant potential for improving its environmental performance

A number of EuP implementing measures have already been adopted, some are under discussion, and others are under the initial phase of preparatory study[43]. For the purpose of deciding on ecodesign measures, the Commission is assisted by a Consultation Forum of stakeholders and a Regulatory Committee composed of EU Member State representatives ("experts"). The European Parliament has a right of scrutiny on the implementing measures, which can take various forms - mandatory regulation, voluntary initiative by the industry, etc.

The list of the product groups currently covered includes a set of initial priorities already mentioned in the Directive text, complemented by several new groups as discussed further in the *EuP Working Plan*[44].

Political Process for Adopting Implementing Measures

The process of developing and eventually adopting implementing measures has been described as a 4-step process as presented in Table 1 below.

Table 2: EuP Process of Implementing Measure Development

STEP 1: Preparatory study to determine whether and which ecodesign requirements should be set: 11-21 months (with one to three stakeholder meetings to discuss the draft chapters)
STEP 2: Submission of a first Working Document to the Consultation Forum
STEP 3: Submission of a refined draft measure to the Regulatory Committee (including an impact assessment and European Commission inter service consultation,): usually 3 to 6 months after the Consultation Forum meeting
STEP 4: Final adoption by the Commission after European Parliament and Council scrutiny and WTO notification: 6 to 12 months

Inherent limitations of the EuP Directive as a tool for life cycle thinking

While the EuP Directive has been promoted as built on life cycle thinking, and sometimes as an example of the IPP approach, it is important to realise some of the inherent limitations. Some of these are discussed below.

Life cycle scope

Some observers believe that EuP requirements may force manufacturers to keep track of all types of environmental impacts throughout the product life cycle. However, the WTO rules and the PPMs discussion, as outlined in the Introduction section, have influenced the EuP Directive significantly. The definition of 'life cycle' given in the Directive, as well as the wording in the Annexes, limits the scope of the Directive. Life cycle is defined as: 'the consecutive and interlinked stages of an EuP from raw material use to final disposal'. The other terms build upon the definition of life cycle. For instance: 'Ecodesign' means the integration of environmental aspects into product design with the aim of improving the environmental performance of the EuP throughout its whole life cycle'. The implications are obvious: the earlier phases of the product life cycle, for instance raw materials extraction and processing

cannot be regulated through implementing measures, at least not directly. Furthermore, while production processes and transport are not necessarily excluded from implementing measures with the definitions given, it is now increasingly clear that the production of components and the transport and delivery of the products are in the end not covered in the implementing measures adopted (so far).

The Explanatory Memorandum for the initial EuP proposal stated that (p. 10):

> *It will be possible to address energy consumption throughout the life cycle of the product and not only during its use phase, as is currently the case.*

Indeed, this is what is challenged today by the current implementation of the Directive. In actual practice, the life cycle is "cut in half", and the MEEuP methodology and the boundaries set when assessing the life cycle impacts of product groups will further skew the picture. So far, the focus has been systematically steered towards the use phase of products, and nearly always only the energy-use has been addressed in a serious and thorough way (both in the preparatory studies and subsequent policy discussions).

Stringency of ecodesign requirements

An important matter is to what extent the implementing measures will provide strong incentives for ecodesign, or rather weak ones. This of course depends on several factors, most notably the comprehensiveness and stringency of ecodesign requirements.

Some of the first adopted EuP measures are introducing some interesting requirements (for example a horizontal limit on standby modes of 1W), and are expected to have some influence on energy efficiency against business-as-usual trends. However, the measures usually never go as far as the most ambitious scenarios proposed in the preparatory studies (which would be technically feasible), and never call for the reinforcement of other instruments such as WEEE or RoHS. This means the EuP measures will help to implement the simplest, most cost-effective low-hanging fruits in terms of product optimisation, but will not necessarily have radical influences on design approaches[45]. They also sometimes rely on long implementation periods, meaning the provisions might already be outdated before they enter into force. It is questionable whether these measures will be able to not only slow down but actually reverse the environmental impacts due to the increasing stocks and longer use of electric products in Europe.

Further, during the drafting of the Directive and the related policy discussions, the main focus have gradually gone from stressing environmental benefits towards stressing the Internal Market dimension. The same tendency can be observed also in connection to other EU environmental policies, for instance, REACH. Moreover, the EuP Directive is based solely on Article 95 of the EC Treaty, while arguments in favour of Article 175 or a dual legal basis were rejected. Article 15 of the EuP Directive presents many hurdles which implementing measures must pass, and it makes it hard for them to enact important changes to industry practices. The rejection of an approach similar to the Japanese Top Runner programme in the EuP Directive is also an indication that the ambitions are not set very high: In the current text, there is no obligation to base standards on top performers.

While we should await the developments of more EuP measures, especially on key products such as boilers, water heaters and air-conditioners before making a final assessment, it is hard to see how the current limitations could be overcome without going through a thorough revision of some of the criteria and methodology used in the policy process.

4) RESULTS AND MAIN FINDINGS: MEEUP & DEVELOPMENT OF IMPLEMENTING MEASURES

The next section begins with a presentation of the main results of our qualitative review of the MEEuP (Methodology Study Ecodesign of Energy-using Products) and presents the EcoReport tool in some detail. This is followed by a review of the application of the MEEuP and EcoReport Tool on four product groups (Study Lots): personal computers, televisions, domestic refrigerators and freezers, and domestic lighting. For each of the product groups we review the findings of the preparatory study conducted by consultants in collaboration with the European Commission and industry input, particularly with respect to significant environmental impacts along the product life cycle. Depending on the stage of development of implementing measures, we compare the outcome of the preparatory study to the current stage of IM development, on criteria such as: which environmental aspects and life cycle phases are identified as important when attempting to influence the environmental performance of EuPs, including the actual generic and specific eco design requirements proposed or adopted.

MEEuP & EcoReport: Qualitative Review

Overview

MEEuP is the methodology that should be applied by the Commission when evaluating whether and to which extent energy-using products fulfil certain criteria enabling them to be eligible for implementing measures (IM) under Article 15 of Directive 2005/32/EC.

The MEEuP includes the following chapter headings that each preparatory study is to use when presenting the preparatory study report: Product Definition; Economic and Market Analysis; Consumer Behaviour and Local Infrastructure; Technical Analysis – Existing Products: Definition of Base Case; Technical Analysis; BAT Improvement Potential; and Scenario, Policy, Impact and Sensitivity Analysis.

MEEuP EcoReport

VHK, the consultants that developed the MEEuP, included a MS Excel tool called EuP EcoReport that is to be used in preparatory studies to conduct the environmental impact analysis that the Commission assisted by the Regulatory Committee developing implementing measures must undertake. The EuP EcoReport essentially assists regulators (contracted out to consultants) to conduct the necessary calculations to translate product-specific characteristics into environmental impact indicators per product. The intended audience of the tool includes policy makers, consultants and stakeholder experts involved in the preparatory stages as well as the final decisions with respect to implementing measures. The consultants note that the tool may also be used by manufacturers for a *preliminary analysis of the environmental performance resulting from the implementation of various design options.* In addition to the environmental impact per product group, the EuP EcoReport also contains tools to make an assessment of EU totals and the assessment of monetary Life Cycle Costs (LCC).

MEEuP and EcoReport: Critical Review

It is clear that VHK's task to develop the methodology to be used by all preparatory studies has been an enormous undertaking by the consultants who should be commended on their detailed work. With that however, there are a number of concerns regarding the methodology that have been raised by stakeholders that also need to be considered. This is especially relevant as the outcome of the EcoReport tool will steer consultants conducting the preparatory studies towards proposing specific and generic ecodesign requirements in line with the EcoReport result, which in turn influences the work of the Commission, the Consultation Forum and the Regulatory Committee in developing implementing measures.

In reviewing the environmental assessments through the application of the EcoReport tool for the preparatory studies, it appears that the importance of the energy in the use phase of the life cycle may be overestimated to some degree. This is especially relevant for personal computers and monitors and televisions. Although we do not claim to have conducted a detailed review of the EcoReport tool ourselves, we have relied on previous environmental impact analyses as well as comments made by consultants working directly on the preparatory studies to highlight potential issues with the methodology.

For example, in all preparatory studies reviewed, energy use in the use phase has been flagged out as the most significant environmental aspect to be addressed which leads to a focus on improving the energy efficiency of products. However, for personal computers and potentially televisions with increased use of semi-conductor devices within them, the production phase may be as much or even more environmentally relevant over the entire life cycle than the use phase.

Using a hybrid assessment that combines process and economic input-output methods, Williams (2004) asserts that the total energy used in producing a desktop computer with a 17 inch CRT monitor is estimated at 7,320 MJ.[46] He notes that in contrast to many home appliances, the life cycle energy use of a computer is dominated by the *production phase* (83%) as opposed to the *use phase* (13%).[47] In comparison, 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* (See Table 6, page 29). The variances between these studies are considerable and the results of each would suggest a completely different approach when determining design requirements. While energy efficiency measures targeting minimum efficiency standards would emerge as the most feasible and sufficient intervention in the case of the EcoReport outcome, the focus for the assessment made by Williams (2004) would be to also put substantial efforts in encouraging reuse of the whole product or its energy intensive components as well as a focus on improving the efficiency of manufacturing processes.

A closer look at the EcoReport tool indicates that many speciality chemicals (requiring high purity levels which in turn require substantial energy demand) and processes in semi-conductor manufacturing do not appear to be included in the manufacturing phase of the product life cycle. As noted by Williams (2004), the processes associated with producing microchips account for 27% of the total energy needed to manufacture a computer. This may explain part of the differences in the numbers discussed in the previous section, but not all of it. Another major influence in the result is the choice of expected product life that is used to calculate use phase energy demand. For example, Williams (2004) uses a three-year lifespan, while the consultants used a lifespan of 6.6 years. This obviously influences the importance of the use phase in the overall life cycle impacts. This is discussed in more detail in the Chapter 4 on the analysis of personal computers and monitors (page 26).

This view is also supported by the Fraunhofer Institute, the contractor responsible for conducting the preparatory study on televisions. Besides the fact that data received from industry partners as input for the assessment are not fully transparent, the consultants note that there have been problems in allocating components to the input categories of the VHK EcoReport input table, especially for displays and electronic boards of LCD TVs. The consultants note that LCD panel manufacturing process (based on the VHK EcoReport figures) "does not put forth a high impact as we would have expected from our experiences in assessing manufacturing processes".[48] The consultants also assert that they would have expected the processes to be more energy intensive than actually reported and explicitly point out that "VHK does not include the up-stream processes for raw material refinery of steel, plastics, electronics etc., except for glass (which is highly processed glass) and is therefore also underestimated".[49]

Fraunhofer Institute notes that there is a factor 3.6 between the VHK EcoReport and the environmental product declaration of Philips. When this factor is applied to the total energy consumption of the 32" LCD TV display manufacturing, the consultants add approximately 3000 MJ to the original VHK EcoReport result. This added energy use would make the total to be more like 6000 MJ, a doubling from the original EcoReport assessment.[50] In fact, regarding LCD panel manufacturing, in terms of total energy consumption (1200 MJ) and global warming potential (52 kg/CO_2 eq.), the consultants note that the resulting environmental impact from LCD Panel manufacturing using the EcoReport seems on average underestimated.[51]

The above uncertainties of the EcoReport tool regarding the inclusion of energy use in the production phase were also recognised by VHK during the developmental phases of the MEEuP and EcoReport. In the Project Report under the heading 'Relative data gaps on Unit Processes' it is noted that "semi-conductors in all their forms (LCDs, LED, ICs) and other electronic components are relatively new materials produced by a sector that is highly competitive and changing rapidly. For these materials it was very hard to find publicly available, complete, well-documented Life Cycle Inventory data. Average values are mentioned, but never in a detailed, well-defined format. In those cases we had to combine data sources to make an estimate and then feed back the information to the component industry to obtain information on which there was some form of consensus".[52] Given this approach taken, it is questionable if VHK could have ensured that all upstream supplier activities were included in the estimate made.

Our concern over the exclusion of certain hazardous substances in the EcoReport tool was shared by the consultants when conducting the preparatory study on personal computers and monitors. They note 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".[53] While the significance of the excluding flame retardants in the assessment is not quantified, the limitations of the EcoReport tool for addressing these substances are further highlighted.

Unclear End-of-life Assumptions: Another concern, although its impact has not been quantified in this report, centres around the 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. *However, these WEEE Directive targets only represent the targets that separately collected WEEE must achieve. For example, if only 1 tonne of WEEE is collected then 750 kg must be recovered and of that 700 kg should be reused or recycled. 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 for each product the recycling targets will be achieved.* Collection rates in Europe range from approximately 25%-60% of expected total WEEE arisings.[54] Therefore, between 40-75% of these products are either being disposed of in landfill or incineration facilities, exported for recycling or reuse outside of the European Union, recycled in proper treatment facilities in the EU but unaccounted for or treated in substandard treatment facilities. To accommodate this phenomenon, an estimation of the average European collection rate could be used for this purpose. This is important especially when extrapolating impacts to form the base case.

The effect of this unclear treatment of end-of-life scenarios needs to be further assessed to determine the overall impact on the life cycle impacts of EuPs under implementing measures. However, 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. This will highlight that the WEEE Directive, although meeting its collection objective of 4kg/person/year does not divert more than 50% of expected WEEE arisings and therefore the stated recycling percentages in the MEEuP might be re-evaluated and change to reflect the current collection rate reality.

MEEuP Applied: From Preparatory Study to Implementing Measures – Status

This section examines four product groups – personal computers and monitors, televisions, domestic refrigerators and freezers, and domestic lighting (non-directional) - from the preparatory study stage through to the working document development and Consultation Forum Review, the Regulatory Committee Endorsement of the Draft Regulation, to the adoption by the Commission with Parliament scrutiny where applicable. For each of the product groups reviewed, the stage of development of the implementing measures is presented including an assessment of changes from those presented as policy options in the preparatory study for each stage in the process.

Personal Computers and Computer Monitors

As shown in Table 3 below, only the preparatory study has been completed and first Working documents discussed in October 2009 in the Ecodesign Consultation Forum. This section presents a description of the preparatory study outcome only.

Table 3: Personal Computers and Monitors - Status of implementing measure development

Step in the process of developing IMs	Status
Preparatory Study	Completed
Consultation Forum review of Working Document	Completed
Regulatory Committee Endorsement	Not started
Adoption by Commission	Not started

Review of the Preparatory Study

Table 4:[55] outlines the recommendations put forward by the consultants regarding specific and generic ecodesign requirements, information requirements, and benchmarks for best performing products, the conformity assessment procedure to be applied and the proposed review date.

As can be seen from Table 4, the consultants propose specific ecodesign requirements addressing energy efficiency measures for specific products falling under the product group. These are in the form of product-specific energy efficiency minimum standards for sleep mode, off /standby mode and idle on mode. No other specific or generic ecodesign requirements are proposed targeting other environmental aspects, except information about restricted substances such as mercury and lead. Regarding flame retardants and possibly also the chemical content of the batteries for laptops, the study simply shifts the issue over to RoHS and REACH in one short sentence. Embodied energy in the product, design for recycling, reparability, extension of lifetime, etc. are not included in the final recommendations.

Table 4: Personal Computers and Monitors - Preparatory Study details

Criterion	Preparatory Study
Specific Ecodesign Requirements	**Use phase: Desktops and Laptops** **Sleep:** 4W/4.7 W (desktops), 1.7W/2.4 W (laptops) Off/Standby: 2W/2.7W (desktops), 1W/1.7W (notebooks) **Idle-on mode** Desktops Category A: ≤ 50.0 W Category B ≤ 65.0 W Category C ≤ 95.0 W Notebooks (with screen shut off) Category A: ≤ 14.0 W Category B ≤ 22.0 W **Use Phase: Monitors** **Active/on mode:** Based on the data available, an indicative recommendation is to place the threshold limit at Y= 10+410*A, where Y is the active/on power in Watts and A is a "true" value in m^2 for the area of the screen surface. Almost all the products from the Energy Star database - products that fulfil the Energy Star Tier 2 criteria according to the Energy Star measurement method – is below the indicative Y= 10+410*A level. **Sleep and off mode: Monitors** In line with Energy Star, tier 2 **Sleep mode:** ≤ 2W **Off Mode**: ≤ 1 W **Power supply units:** • For Internal power supply (desktops and monitors): 80% minimum efficiency at 20%, 50%, 80% and 100% of rated output and Power Factor > 0.9 of rated output • For external power supply (laptops): 85% minimum efficiency **Mandatory enabling of Power management at system level** - 15 min to screen off (display sleep) - 30 min to computer sleep (System Level S3, suspended to RAM)
Generic Ecodesign Requirements	Information to be given for personal computers (desktops and laptops), according to measurement methods, described in Energy Star Program Requirements for Computers (version 4.0) is
Information & Data Requirements	• Power use in idle mode (or power per performance when the ECMA benchmarking tool is available) • Power use in sleep mode • Power use in off mode • Content of restricted substances such as mercury (e.g. in the lamps) • Web page address for information on Energy, Environment and End of life treatment. Information to be given for computer monitors, according to measurement methods, described in Energy Star program Requirements for Computer Monitors (Version 4.1). • Power use in active mode per product and per area (m^2) • Power use in sleep mode per product • Power use in off mode per product • Content of restricted substances such as mercury and lead • Web page address for information on Energy, Environment and End of life treatment Publication of a neutral website where all manufacturers must report information so that consumers can compare products: • Power consumption in different modes (described above) • Instructions (or a link to instructions) for the customer on what to do when it is time for End of life treatment. Information for all the countries where the product is sold • Information about the power management system available in the product. Information on restricted substances (mercury and lead) suggested (at the end of the study)
Benchmarks	Yes (see Table 5)
Conformity Assessment Procedure	None
Date for evaluation and possible revision	None

Table 5: Personal Computers and Monitors - Suggested Benchmarks (Best Available Products)

Mode	Desktop Computer	Laptop Computer	LCD Monitor	CRT Monitor
Off/Standby mode	1.10 W	0.38 W	0.67 W	3.8 W
Sleep mode	2.6 W	0.82 W	0.67 W	3.8 W
Idle Mode	23 W	6.8 W	17.1 W	51.7 W

A critical part of the *preparatory study* is the base case environmental impact assessment. It is in this part of the preparatory study where significant environmental impacts are identified and presented from the results of the EcoReport, which subsequently determines which specific and/or generic ecodesign requirements are selected in accordance with Article 15(6).

The results of the environmental impact of the base case scenario for all products included in this product group – Desktop PC, Laptop PC, CRT Monitor and LCD Monitor clearly point to energy use in the use phase as the most significant environmental aspect. Although the MEEuP does not weigh impact categories the consultants note that energy use determines a large component of the overall impacts of EuP and is therefore used as a factor in determining the most significant impact.

Table 6 below shows the results of life cycle energy demand in the various life cycle stages of this product group. Clearly, it is energy in the use phase that dominates total energy use.

Table 6: Personal Computers and Monitors - Total Life Cycle Energy Demand (GER) MJ

	Production Total Energy (GER) MJ	% of Total	Distribution Total Energy (GER) MJ	% of Total	Use Total Energy (GER) MJ	% of Total	% of Total
Office PC (desktop)	2259	14%	368	2,28%	13571	84%	-0,20%
Home PC (desktop)	2259	18%	368	2,94%	9936	79%	-0,26%
Laptop Office	1266	18%	122	1,69%	5832	81%	-0,28%
Laptop Home	1266	25%	122	2,44%	3627	73%	-0,40%
LCD Office	985	14%	192	2,66%	6006	83%	0,66%
LCD Home	985	22%	192	4,29%	3247	73%	1,07%
CRT Office	956	7%	404	2,78%	13106	90%	0,34%
CRT Home	956	11%	404	4,81%	6994	83%	0,59%

Source: Adapted from TCO Development, IVL, & IVF. (2007).

However, as discussed in Section 4 on the critical review of the MEEuP and EcoReport (page NUMBER) there is evidence to suggest that the overall importance of the use phase may be overstated through the application of the EcoReport tool in this product group. Using a hybrid assessment that combines process and economic input-output methods, Williams (2004) asserts that the total energy used in producing a desktop computer with a 17-inch CRT monitor is estimated at 7,320 MJ.[56] The author reports that the life cycle energy use of a computer is dominated by the *production phase* (83%) as opposed to the *use phase* (13%). In comparison the application of the EcoReport tool in computers and monitors found that 73-90% of the total life cycle energy use of computers and monitors is found in the *use phase* (See Table 6, page 29).

Base Case Assumptions used

Part of the explanation of why energy use in the use phase is proportionally so high compared with other life cycle phases - namely the production phase – can be attributed to the choice of time that the product is in operation in the use phase. Williams (2004) study mentioned above uses a lifespan of 3 years compared with a lifespan of over 6 years used in the preparatory study. Essentially, choosing a 6-year life span instead of a 3-year life span doubles the importance of the use phase.

Table 7: Personal Computers and Monitors - Comparison of average lifespan

EuP	Average economic lifetime (yrs) including second use	EPIC ICT[57]	Wesnaes, M. et al, 2008	Willams, E. 2004
Desktop	6,6	4	4	3
Laptop	5,6	-	4	-
CRT	6,6	-	4	3
LCD	6,6	4	4	-

The extended lifetime of these products obviously influences the total life cycle impacts of the product placing more influence in the use phase. This has repercussions on the project team when selecting specific or generic ecodesign requirements for future consideration by policy makers and other stakeholders. On the one hand a *higher product lifetime will increase the relative impacts in the use phase, focussing attention on use phase for improvement potential (energy reduction in the use phase) at the expense of eco design measures at other life cycle phases such as production.*

Assumptions made on end-of-life behaviour: The preparatory study uses a default scenario of 95% recycling rate, however the study disregards actual current collection rates of end-of-life products. Although recycling rates of collected products will most likely be high, collection rates for laptops, desktops and CRTs and LCDs are never 100% and are in the range of 40%-60% of expected WEEE arisings for these product cases. *As a result recycling credits assigned for the various materials found in these products may be higher than warranted, which will appear to reduce the impacts associated with raw material extractions and production.*

Base case environmental impact assessment: Despite that the consultants only put forward recommendations for specific eco design requirements in the form of minimum energy efficiency standards, they do identify other focus areas where ecodesign requirements could be envisaged.

Table 8: Personal Computers and Monitors - Main Focus Areas Identified for Improvement

EuP	Main Focus Areas Identified
Desktop	**Production phase:** Motherboard including the processor, power supply and steel casing **Use phase:** Energy use
Laptop	**Production phase:** Motherboard including the processor, and the battery **Use phase:** Energy use
CRT	Production phase: integrated circuit, CRT screen and plastics **Use phase:** Energy use
LCD	Production phase: integrated circuits, plastics and galvanized steel **Use phase:** Energy use

Despite identifying the use phase as the most significant life cycle phase, in *Chapter 6: Technical Analysis and Improvement*, the consultants point out the following production phase improvement potential technologies including:

Mercury-free LED Monitors and Laptops are listed as a technology that is now available on the market that could potentially replace mercury backlights as a technology that is less impacting and more energy efficient.

Reducing the environmental impact from board assembly is highlighted and low impact 3D packaging is mentioned as leading technology as well as halogen flame retardant free alternatives for epoxy used in electronics components and the epoxy for printed circuit boards. *Removable mercury containing back lamps* are highlighted as a possible design requirement that would improve the capture of Hg at the end-of-life treatment facility, but at the same time would entail costs.

Minimising the content of flame retardants in plastics is listed as a possible measure as flame retardants are not included in the EcoReport tool. They mention the possibility to replace plastics with hardwood as a potential substitution for flame retardant plastics. Other suggestions which include both advantages and disadvantages outlined include: *substituting non-renewable for renewable plastics in the target products*, including preference for lithium polymer batteries over lithium ion. The requirement to make *batteries easily* removable and *minimise battery aging*, through removal when connected to the mains are also discussed.

In Chapter 8: Scenario, Policy Impact, and Sensitivity, the consultants note that besides energy consumption, the further major environmental issues to deal with for the products under review include: content of *flame retardants in plastics and electronics, content of mercury in the lamps for LCD screens and laptops, and content of chemicals in the batteries for laptops.* However, they recommend only including information provision requirements regarding these issues. *Regarding the flame retardants, and possibly the chemical content of batteries for laptops, it is recommended that these requirements be handled under the RoHS Directive on a substance by substance basis. New chemicals should be handled by the Reach Directive.*[58]

Televisions

The EuP measure on televisions was discussed in 2008 and adopted in 2009.

Table 9: Televisions – Status of implementing measure development

Step in the process of developing IMs	Status
Preparatory Study	Completed
Consultation Forum review of Working Document	Completed
Regulatory Committee Endorsement	Completed
Adoption by Commission (with Parliament scrutiny	Completed

Table 10 on the following page summarises the main recommendations put forth for specific and generic ecodesign requirements from the preparatory study, the requirements proposed in the working document of 2008 and the requirements in the resulting adopted regulation.

Table 10: Televisions - Overview of Ecodesign Requirements proposed in the Preparatory Study & Working Document

Criterion	Preparatory Study	Working Document	Final Regulation
Specific Ecodesign Requirements	**Production:** none **Distribution:** none **Use Phase:** - Minimum requirement for **on-mode power consumption** (0.275 W/in2 +40W)	**Production:** none **Distribution:** none **Use Phase:** Minimum requirements **On-mode power consumption**	**Production:** none **Distribution:** none **Use Phase:** Minimum requirements **On-mode power consumption**
	* the study recommends using a factor b =1.4 (whereas c remains 1) as calculation basis for determining the minimum requirement for average on-mode power consumption of full HD TVs - Minimum Requirements for passive and active standby and off-mode power consumption **Off-mode** 1st tier with compliance in 2010: ≤ 0.5 W 2nd tier with compliance in 2012: ≤ 0.2 W Passive standby: 1st tier with compliance in 2010: ≤ 1 W 2nd tier with compliance in 2012: ≤ 0.5 W **Active standby:** 1st tier with compliance in 2010: ≤ 3 W 2nd tier with compliance in 2012: ≤ 2 W 3rd tier with compliance in 2015: ≤ 1 W - Mandatory energy efficiency label: all technologies **End-of-Life:** none	**1st Tier (1 year after entry into force)** **Full HD: with visible screen are A (dm²)** P_{basic} +A * 1.12* 4.3224 W/dm² All other: P_{basic} +A * 4.3224 W/dm² Where Pbasic = 20W for TV sets Pbasic =5 W for TV monitors **2nd tier: (from 1 January 2013 onwards) On Mode power consumption** with a visible screen size (dm²): 0.8 * (P_{basic} +A * 4.3224 W/dm²) [no differentiated requirement for Full HD] Off-mode and standby modes according to the horizontal EuP regulation on standby **End-of-life:** none Energy Labelling of TVs to be proposed under the Energy Labelling Directive	**1st Tier (20 August 2010)** **Full HD: with visible screen are A (dm²)** P_{basic} +A * 1.12* 4.3224 W/dm² **All other:** P_{basic} +A * 4.3224 W/dm² Where P_{basic} = 20W for TV sets P_{basic} = 15 W for TV monitors **2nd tier: (from 1 April 2012 onwards)** **On Mode power consumption** with a visible screen size (dm²): 0.8 * (Pbasic +A * 4.3224 W/dm²) [no differentiated requirement for Full HD] More ambitious requirements on standby and Off modes: 2W/1W level on 7 January 2010, 1W/0.5 W level on 20 August 2011 **End-of-life:** none
Generic Ecodesign Requirements	- Mandatory use of ECMA 341 or IEC 62430 as the base for generic ecodesign requirements • - Marking the backlight unit in LCD when containing mercury so that recyclers are made aware that the LCD contains mercury. - Lead content in displays: Similar to above the presence of lead in Plasma Displays and CRTs should be declared.	None	Mandatory auto-power down feature, set as default, which switches the TV to standby after 4 hours of no user interaction TVs with a forced menu on activation shall propose "home mode" as the default option
Information & Data Requirements	The following power consumption data should be provided to consumers: • On mode • Active Standby low • Passive standby • Off-mode The following information requirements are recommended: • Mandatory energy efficiency labelling • Mode-specific power consumption data provided to customers • Rated power consumption in the user manual • Explanations of power modes and energy savings modes in the operating manual • Warning of mercury content in backlights (information to the recycling industry on the backside of the BLU	Mandates the use of the Energy label in 3 stages of efficiency ranking Information on the label • Suppliers name • Model identifier • Energy efficiency class • Can add a copy of the eco-label award • On mode power consumption in W • Annual on mode energy consumption • Visible screen diagonal in inch and centimetres • Number of the applicable stage On other printed communications: • Energy efficiency class • On mode power consumption • Annual energy consumption • Visible screen size	*Similar*
Benchmarks		On mode power consumption 0.41 * (20W + A [dm²] * 4.3224 W/dm²)	
Date for evaluation and possible revision		No later than 4 years after entry into force	No later than 3 years after entry into force

Comments on the Preparatory Study

Environmental impact assessments were made on 3 base case products in the preparatory study. These included 1) 32 inch LCD-TV, 2) 42 inch PDP-TV and 3) 29 inch CRT-TV.

LCD-TV

For the 32" LCD TV with a 10 year expected lifespan, it was determined that the use phase contributes most significantly to the overall environmental impact followed by production when considering total energy consumption as the primary reference for environmental impacts. The proportion of energy use in the use phase compared with that of the production phase is 7:1. All other phases have only a minor impact.[59]

In addition to presenting the life cycle energy consumption, the contractors also review each of the life cycle phases individually. For the production phase, the display panel, the PWB (printed wire board), PSU (power supply unit), and the chassis are identified as having the greatest impacts. The LCD panel has the single most important environmental impact in the production phase. However, the consultants note that LCD panel manufacturing process (based on the VHK EcoReport figures) "does not put forth a high impact as we would have expected from our experiences in assessing manufacturing processes". The consultants also assert that they would have expected the processes to be more energy intensive than actually reported and explicitly point out that: "This means that VHK does not include the up-stream processes for raw material refinery of steel, plastics, electronics etc., except for glass (which is highly processed glass) and is therefore also underestimated".[60]

In fact the Fraunhofer Institute notes that there is a factor 3.6 difference between the VHK EcoReport and the environmental product declaration of Philips. When this factor is applied to the total energy consumption of the 32" LCD TV display manufacturing the consultants add approximately 3,000 MJ to the original VHK EcoReport result. This added energy use would make the total to be more like 6,000 MJ, a doubling from the original EcoReport assessment.

Interestingly, despite that the EcoReport environmental impact results for the end-of-life phase are negligible, the contractors point out that in their view this is insufficient due to the growing material value of LCD-TVs, expected shorter life times, and the growing volumes of sales that will result in high disposal volumes in the coming decades. To address these future challenges it is suggested to investigate environmentally sound and cost efficient technologies for LCD-TV recycling. This is put into the context of the WEEE Directive where currently there are only limited incentives for producers to improve material composition and product design with the goal of improved recycling.

PDP-TV

The results of the environmental impact assessment for the PDP-TV are similar to that of the LCD-TV presented above where from the perspective of total energy consumption the use phase has the highest contribution. A similar proportion of the use phase in comparison to the production phase is also found. In terms of the production phase the VHK EcoReport did not contain an input category for PDP-TV manufacturing and the consultants needed to obtain data from manufacturers directly. Besides the display panel itself, the most important components identified included the PSU and PWB assemblies. However, it is important to note that the consultants are cautious regarding the validity of the results where they note that "Consequently, all assessments taken for PDP TVs with the averaged data set have to be interpreted with caution when it comes to the manufacturing phase".[61]

Proposed Ecodesign Requirements in the Preparatory Study

Minimum requirements On Mode power consumption:
With the exception of Full High Definition (HD) TVs, the study recommends that for all TV technologies minimum energy efficiency standards for off mode, passive stand-by and active standby operation modes. There are three tiers of energy efficiency minimum standards starting in 2010 and increasing in 2012 and 2015 respectively. An exception is made for Full HD TVs as it is noted that this technology is in early phase of development. Energy labelling is suggested for all technology types.

In terms of the impact on the current market, the consultants point out that for full HD TVs the correction factor that is recommended will be difficult for full HD PDP-TVs and would require significant improvements compared to current products on the market. While at the same time full HD LCD TVs this target is less ambitious. However, with respect to the effectiveness of the proposed minimum efficiency targets the consultants note the following: "In conclusion there are strong indications that the ongoing product development towards better picture quality and full HD will increase power consumption of TVs again." The technical improvement potential that has been discussed in the task 6 and task 7 reports may compensate the power demand of current developments. In consequence it is questionable if the application of such energy efficient technologies even leads to an overall reduction or just maintains the current power consumption level".[62]

Generic Ecodesign Requirements

Interestingly, the consultants recommend that TV manufacturers should conduct an assessment of their products based on the ECMA 341 or IEC 62430 standards which are essentially checklists for general design practices that designers need to consider when designing new products. *This requirement, they say, would force TV design teams to consider relevant environmental aspects which cannot be addressed by specific ecodesign requirements.*

Comparison of the study recommendations with the Working Document and Regulation

There are several changes that appear in the working document compared with the preparatory study recommendations. In terms of minimum energy efficiency requirements, the dates for achieving the targets in the respective tiers have been pushed back approximately 2 years and limited to two tiers instead of three. The correction factor for Full HD TVs has been limited to the first tier. This means that all TV sets need to meet the same efficiency requirement for the second tier. The generic ecodesign requirements proposed in the study have been completely removed in the working document, meaning that manufacturers are not obliged to follow the ECMA or IEC standards for incorporating ecodesign into the general design process.

After discussions in the Ecodesign Consultation Forum, the European Commission's Impact Assessment Board and the Regulatory Committee of Member States, the final regulation has been adopted with a few significant changes: the date of the 2nd tier has been advanced by 9 months, some tougher requirements have been decided for the standby and off modes, a mandatory auto-power down feature has been included and the date for revision of the measure has been advanced by a year.

These ultimate modifications should bring some additional energy savings, which is good news, but they will not change the statement that the EuP implementing measure is solely focused on one aspect (electricity consumption during the use-phase) and fails to give any guidance on a broader ecodesign approach to televisions and displays which could tackle the current major issues with this product group (increasing sizes and absolute environmental impacts, toxic content, poor recycling records for flat screens, lack of upgradeability, etc.).

Domestic Refrigerators and Freezers

The implementing measure had been discussed in end 2008 and voted and adopted in 2009.

Table 11: Domestic Refrigerators and Freezers – Status of implementing measure development

Step in the process of developing IMs	Status
Preparatory Study	Completed
Consultation Forum review of Working Document	Completed
Regulatory Committee Endorsement	Completed
Adoption by Commission (with Parliament scrutiny	Completed

Table 12: Domestic Refrigerators and Freezers - Overview of Ecodesign Requirements proposed in the Working Document and Final Regulation

Criterion	Working Document (based on the least ambitious scenario of the Preparatory Study)	Final Regulation
Specific Ecodesign Requirements	Requirements on the use-phase energy efficiency: (EEI: Energy Efficiency Index) **Phase 1: one yr after entry into force (2010)** Compression: EEI <55 Absorption: EEI <150 **Phase 2: three yrs after entry into force (2012)** Compression: EEI <55 Absorption: EEI <125 **Phase 3: six yrs after entry into force (2015)** Compression: EEI <44 Absorption: EEI <110	Requirements on the use-phase energy efficiency: (EEI: Energy Efficiency Index) **Phase 1: one yr after entry into force (2010)** Compression: EEI <55 Absorption: EEI <150 **Phase 2: three yrs after entry into force (2012)** Compression: EEI <44 Absorption: EEI <125 **Phase 3: five years after entry into force (2014)** Compression: EEI <42 Absorption: EEI <110 (one year after)
Generic Ecodesign Requirements	**Info requirements** now fall under generic ecodesign requirements **1 yr after entry into force:** - Wine storage appliances must note that their use is intended for storing wines only - Info on how to combine drawers, shelves for best energy efficiency **3 yrs after entry into force** - auto revert of fast freeze setting to normal after 72 hrs - auto setting towards ambient temperature - Refrigerators < 10L. 0 W when empty	*Similar*
Benchmarks	**Refrigerators, compressor-type:** • EEI = 29,7 and an annual consumption of 115 kWh/year **Refrigerators, absorption-type:** • EEI = 97,2 and an annual consumption of 245 kWh/year **Refrigerator-freezers, compressor-type:** • EEI = 28,0 and an annual consumption of 157 kWh/year **Upright freezers, compressor-type:** • EEI = 29,3 and an annual consumption of 172 kWh/year **Chest freezers, compressor-type:** • EEI = 27,4 and an annual consumption of 153 kWh/year	*Similar*
Date for evaluation and possible revision	7 years after entry into force	5 years after entry into force

Comments on Preparatory Study[63]

Base case environmental impact assessments are made on 4 product groups within the category of refrigerators and freezers including the following:

- Cold 1: Household refrigerators without low temperature compartments
- Cold 7: Household refrigerators with low temperate compartments
- Cold 8: Household food freezers (upright)
- Cold 9: Household food freezers (chest)

Given the long lifespan of products in this study lot, it is not surprising that energy in the use phase has been identified as the most significant environmental aspect for all product types. At the same time the consultants note that not all of the materials listed within the BOM have corresponding entries in the EcoReport tool. Given this, between 10.5% and 34.8% of the materials do not have a direct correspondence in the EuP EcoReport database and the results of impact assessment should consider this.

Although the results of the EcoReport do point to higher waste in the production phase for all product categories, no further explanation is provided to the respective sources. Also observed emissions to air are highest in the production phase for persistent organic pollutants, heavy metals and polyaromatic hydrocarbons. Emissions to water are also highest in the production phase for heavy metals. Despite this, no ecodesign requirements are proposed that would address these impacts in the production phase.

In terms of the end-of-life phase, the preparatory study does not adequately address the potential environmental impacts associated with end-of-life household cooling appliances in either *Consumer Behaviour and Local Infrastructure or Technical Analysis Existing Products* chapters of the MEEuP. This is somewhat surprising given that cooling appliances if improperly transported or stored at the end-of-life stage can release refrigerants to air. Although, refrigerants in products placed on the market after 2005 are mostly hydrocarbons, their release can lead to the formation of ground level ozone as well as greenhouse gas emissions. Again similar to other product groups discussed above, no mention is made of how the system is operating in practice for the management of end-of-life cooling and freezing appliances regarding the level of overall collection, and whether products are being properly de-polluted.

The preparatory study presented several possible sets of specific requirements and corresponding scenarios, but based on data as old as 2005. Discussing ambition of a measure voted in 2009 on a market situation as old as 2005 is a clear flaw in terms of accuracy. Most of the models sold in 2005 are no longer on the shelves, and cannot be used as a reference for future models. The so-called 'realistic' scenario was suggesting to phase-out compression fridges of EEI>44 only in 5 years (2014). The so-called 'ambitious' scenario was only slightly tougher on this 2014 step (EEI>42), meaning that in both scenarios practically no action would have been required from manufacturers in the next 5 years.

Comments on the final regulation

The first working document, based on the preparatory study, was clearly not ambitious enough in terms of energy efficiency levels. These were less ambitious than what the white good manufacturers were claiming to be able to do on a voluntary basis. This explains why the timeline has been substantially advanced in the final regulation. Most of the current A class (of the Energy Label) models (EEI>44) will be phased out already in 2012. This also highlights the lack of proper updating of the Energy Label for fridges, since the A class does not correspond anymore to energy efficient models. Even if the final regulation is more ambitious, it can still be argued that in comparison with the benchmarks, the requirements are still far below what is technically achievable today.

This implementing measure also illustrates again the narrow focus of the EuP Directive at the end of the political process: the final regulation does not contain any ecodesign requirement on other aspects than the electricity use (such as refrigerant fluids, resource efficiency, recyclability, reparability, etc.).

Domestic Lighting (non-directional)

The implementing measure has been discussed and adopted in 2009, and an amendment has also been added recently to correct a provision on the UV levels.

Table 13 below illustrates this stage in the developmental process.

Table 13: Domestic Lighting - Status of implementing measure development

Step in the process of developing IMs	Status
Preparatory Study	Completed
Consultation Forum review of Working Document	Completed
Regulatory Committee Endorsement	Completed
Adoption by Commission (with Parliament scrutiny	Completed

Table 14: Domestic Lighting - Overview of the main Ecodesign Requirements proposed in the Preparatory Study, Working Document and Final Regulation

Criterion	Preparatory Study[64]	Working Document	Final Regulation
Specific Ecodesign Requirements	*All formulas are not replicated here.* The Preparatory study suggested several possible options: • Scenario 'BAT": only CFLs allowed from 2009 onwards • Scenario 'Option 1 Fast': 3 stages in 2009, 2011 & 2013 ending up with only CFLs • Scenario 'Option 2 Clear B fast' & 'Option 2 Clear C fast': with same timeline but leaving (improved) B or C halogens on the market in 2013 • Scenario 'Option 2 Clear B slow' & 'Option 3 slow', with 5 stages from 2009 to 2017 and leaving halogens on the market Additional quality requirements suggested on lamps (especially CFLs)	*All formulas are not replicated here.* 3 possible options were suggested: • Only leave CFLs/LEDs on the market (A class) • Also leave improved halogen clear lamps • Also leave average halogen lamps of class C Two possible timelines were suggested: • 'Ambitious': 3 stages in 5 years • 'Cautious': 5 stages in 9 years Specific requirements on lamp performance parameters are presented for the various stages (improving over time) for: minimum rated lamp life, lumen maintenance, number of switching cycles, starting time, lamp power factor, maximum premature lamp failure rate, maximum UVA + UVB. These are differentiated by CFL and all other types of lamps	*All formulas are not replicated here.* A timeline of 6 stages from 2009 to 2016: • Frosted lamps below A class are phased-out in 2009 • Clear incandescent lamps (classes E,F,G) are phased-out from 2009 to 2012 • Average halogen lamps of class C and D are tentatively phased out in 2016 (but the measure will be discussed again and revised before) Quality requirements applying in two stages (2009 and 2013), similar to those described in the middle column.
Information & Data Requirements	Informational requirements: Lamp wattage in Watt [W] rounded off to 1W, Luminous flux, Nominal lamp lifetime in hours, Energy label rating, Colour rendering if not level '+', colour temperature starting time (seconds), Warm up time up to 80% of the full light output, Lumen maintenance factor at end of life, Where to dispose of the lamp, Warning if lamps can only be dimmed on dimmers able to dim fluorescent lamps, Note if not designed for standard conditions, Lamp dimensions	Lamp wattage in Watt [W] rounded off to 1W, Luminous flux, Nominal lamp lifetime in hours, Energy label rating, Colour rendering if not level '+', colour temperature starting time (seconds), Warm up time up to 80% of the full light output, Lumen maintenance factor at end of life, Where to dispose of the lamp, Warning if lamps can only be dimmed on dimmers able to dim fluorescent lamps, Note if not designed for standard conditions, Power factor	Main change: The mercury content in lamps (in mg) shall be indicated on the packaging. Further information on recycling and how to dispose of the lamp at its end of life to be indicated on public website.
Date for evaluation and possible revision		5 years after entry into force	5 years after entry into force

Comments on the Preparatory Study

The results of the impact assessment for household lamps which illustrate that energy in the use phase is the most significant environmental aspect are not surprising given the nature of the product group. Despite this, we have a number of comments regarding assumptions made about the end-of-life scenario used. The preparatory study takes into account the relatively low average European collection rate for lamps under the scope of the WEEE Directive. It reports that 27.9% of lamps are recycled (more accurate to call this collected) from data provided by the UNU Study for the Review of the WEEE Directive.

However, in Chapter 5 of the preparatory study regarding the definition of the base case for CFL lamps, it is assumed that 5% of the materials go to landfill and 95% of the metals and glass is recycled. Although at the same time for mercury contained in the compact fluorescent lamp 80% is assumed to be emitted to air during end-of-life processing. It is uncertain why on the one hand the consultants acknowledge the low collection rates of lamps, but still assign a recycling rate of 95% for the metal and glass, while at the same time it is recognised that 80% of mercury is assumed to be emitted to air during end-of-life processing. It is important to note, however, that the impact of including the metal and glass recycling is unlikely to change the significant environmental impact of energy use in the use phase.

Comments on Working Document and Final Regulation

In the working document, the significant environmental aspects identified were: energy in the use phase, mercury content of lamps, and waste. Of the working documents reviewed in this study, the domestic lamps document is the only one to highlight so clearly significant aspects other than the energy in the use phase.

It also proposed generic ecodesign requirements to address the non-energy in use phase environmental aspects. The working document noted that (with respect to identifying relevant ecodesign parameters) lamps, luminaires and wall-mounted lamp dimmers for general lighting should be *manufactured* in such a way that the impact on the environment[65] is minimised taking into account technical progress and the specific legislation on waste such as the WEEE Directive. Accordingly, the EuP Directive lists parameters to be used, as appropriate, and supplemented by others, where necessary, for evaluating the potential for improvement.

It is interesting to note that these requirements were not proposed in the preparatory study but added after the Consultation Forum provided input into the process. At the same time, however, despite identifying the relevant ecodesign parameter of end-of-life life cycle phase, and parameters to be used for evaluating the potential improvements of the end-of-life life cycle phase (waste), no requirements of the sort were left in at the end of the political process. The only significant non-energy requirement in the final regulation is the mandatory indication of the mercury content (in mg) on the packaging of lamps. However, as there is no obligation in terms of font size, this information will probably be quasi-inaccessible to consumers and the impact can be questioned.

The limitation of the mercury content in lamps is mostly channelled to the RoHS Directive, currently under revision. It is unfortunate to see that the two parallel discussions on this aspect (under the Ecodesign and the RoHS processes) were not well connected and required from stakeholders to duplicate arguments and contributions. The same remark seems to apply to the revision of the Ecolabel for lamps.

The Regulation also notes that the WEEE Directive article on information for users should be fully implemented to ensure minimising the potential risks for the environment and human health in case of accidental breakage of CFLs or at their end of life.

Comments on the 4 Product Groups Reviewed

Common trends

What is clear from reviewing the process of developing implementing measures - from the preparatory study stage to final Regulations - is that there is a steady *succession from considering total life cycle impacts of the products in question towards setting minimum energy efficiency requirements addressing mostly only the use phase impacts.* This trend was seen in all of the study lots reviewed. For example, even though in all cases the EcoReport environmental impact assessment identified energy use in the use phase as the most significant aspect influencing the environmental performance, a detailed assessment of the contribution of key components in the production phase was also presented. *In many cases, although the EcoReport did not highlight the end-of-life phase of the product life cycle as significant, the consultants pointed to the need for improvements in design to address recyclability and recovery of materials contained in EuP.* In most of the preparatory studies (excluding on Refrigerators and Freezers), *the consultants described a number of options that could improve the environmental performance of the targeted products in other life cycle phases than the use phase only.*

The use of Generic Ecodesign Requirements

Much confusion exists over how generic ecodesign requirements (Annex 1) would be set in the EuP. Article 15(6) notes that implementing measures shall lay down ecodesign requirements in accordance with Annex 1 and/or Annex 2.

Annex 1 states that ecodesign requirements aim at improving the environmental performance of energy-using products, focusing on significant environmental aspects without setting limit values. When preparing implementing measures laying down generic ecodesign requirements, the European Commission is required to identify relevant ecodesign parameters (listed in Part 1), the information supply requirements (Part 2) and manufacturer requirements (Part 3). In other words, the Directive sets out generic ecodesign requirements, yet how this is actually done is confusing.

The confusing part about setting generic ecodesign requirements is that when the Commission chooses a particular life cycle phase, environmental aspects and environmental parameters from Annex 1 Part 1, it is unclear what the producer obligations would be once the generic ecodesign requirements are set. Although it is stated in Annex 1 that in the implementing measures, the requirements of the manufacturers will be laid down, this has not yet translated into any significant content in the EuP measures adopted.

This confusion is not surprising, given the historical background and development of the EuP Directive. In the early drafts, the main vision as outlined in the text was that manufacturers should make a (simplified) LCA, create an eco-profile, and use this for prioritisation of design solutions. The text made it possible for the European Commission to implement mandatory measures, but the impression given was that this would be the exception rather than the rule. In other words, the Directive would be effective in forcing manufacturers to collect life cycle data and show that they actively pursued ecodesign measures, while it would probably not force manufacturers to reach certain standards. This means that the proposed draft Directive was, potentially, a good instrument for integrating life cycle thinking in companies, while the effectiveness, in terms of concrete environmental improvements, could not be guaranteed.

With the subsequent introduction of the EuP Directive, and all the changes that were made, the situation is rather the opposite. It is the role of the European Commission to make use of LCA methodologies and identify the most significant impacts and to draft implementing measures that may address those significant impacts. As implied by the wording of the EuP Directive, the manufacturers are only obliged to work with those aspects addressed in the implementing measures. Thus, the manufacturers will not be asked to make their own assessment for the full spectrum of life cycle impacts, and make their own prioritisation. *This explains why the EuP Directive may have an effect on some aspects and products on a case-by-case basis, but will probably not be as effective at horizontally integrating life cycle thinking among manufacturers as the draft Directive – if enacted – would have been. It will most likely promote less life cycle thinking, but attract the attention of manufacturers on some specific and targeted limit values to meet (whatever the way to comply). Therefore, some of the 'pedagogical' elements, which would have forced manufacturers to learn more about their life cycle impacts and ecodesign options, have been lost.*

For example, for televisions, the consultants recommended that the European Commission consider the application of the ECMA 341 Standard "Environmental Design Considerations for ICT & CE Products", as a generic ecodesign requirement. This standard lays down the procedures designers shall follow and document to demonstrate that the designer has systematically considered the life cycle environmental impacts of the product designed and has taken steps to improve the environmental performance over successive product releases. Industry stakeholders have commented that while there is support of the use of such standards, there are uncertainties regarding how a manufacturer would document and demonstrate compliance with such a standard, including test results. However, as discussed above, this generic ecodesign requirement was finally removed when the Working Document text was presented.

At the same time, in the working document for domestic lighting, an attempt was made to include generic ecodesign requirements to be carried out. Designers would have been obliged to undertake an assessment of the manufacturing stage of lamps, luminaires and wall-mounted dimmers on aspects such as amounts of waste and hazardous waste generated, emissions to water, and emissions to soil with the aim of evaluating the options for improvement (the environmental parameters listed in Annex I of the Directive). *Again, this generic ecodesign requirement was dropped when the Regulation was adopted.*

WEEE and RoHS Directive Overlap with EuP

In reviewing the preparatory studies, it was quite clear that *when environmental impacts from end-of-life or the use of hazardous substances were identified as important from the product design perspective, the consultants simply referred to the WEEE and RoHS Directives as the instrument(s) that would appropriately address the impact.* This was done without necessarily reviewing how well or poorly the Directive(s) performed in addressing that particular impact. *This is a lost opportunity in terms of the EuP Directive's role in complimenting the WEEE and RoHS Directives objectives where they are not being met.*

Possible normative references for life cycle impacts other than from energy use in the product use phase

Energy use in the product use phase has theoretically the least uncertainty in terms of measurement and testing protocols for product performance assessment. There are existing standards developed by international and European standardisation bodies that can be used by consultants performing the preparatory studies and the European Commission to develop minimum requirements. Sometimes, these standards need to be revised or updated, but on the whole minimum requirements on the energy usage of appliances are a well-known topic. The same can often not be said for aspects other than energy efficiency, such as measuring the level of recyclability or reparability of a product for example.

Despite this, the IEEE 1680 - EPEAT is a standard (for personal computers and monitors) or soon to be family of standards (other electronic products to be considered) that includes a measurement standard for determining whether a product meets the design for disassembly or design for shredding criteria in the EPEAT criteria list. Although a voluntary standard, a number of environmental performance criteria explicitly address environmental impacts from products in other life cycle stages than in use. These include the following:

- Reduction/elimination of environmentally sensitive materials (copies RoHS requirements)
- Materials Selection
- Design for end-of-life
- Life cycle extension
- End-of-life management
- Packaging

For most of the criteria addressing the above environmental performance areas, the manufacturer needs to declare that the requirements are met, although no explicit harmonised testing standards have been developed. In order to develop generic and specific requirements under the EuP Directive that can be enforced and monitored, such measurement standards would need to be developed by European standardisation bodies. Depending on the issue, standards development processes can be lengthy and controversial, as experience has shown in the development of packaging standards. However, despite the difficulty and slowness of some of the standardisation work on such issues, there are positive examples showing a way forward to quickly improve the unbalanced situation in the Ecodesign process. For instance, the recent decision by the European Commission to require mobile phone manufacturers to develop and use a common universal battery charger by 2011 (to reduce electronic waste and give freedom to consumers to buy greener chargers); a standard to implement such a decision is under development and should be delivered in a maximum of a year.

Specific performance criteria that have existing testing standards having the potential to be used for EuP include existing EPEAT standard details on design for end-of-life, design for recovery through recycling systems that utilise shredding, elimination of paints or coatings not compatible with recycling or reuse, and requirements on plastic parts. To verify these, the EPEAT standard includes details on a declaration from manufacturer, documentation showing manufacturer test, and supplier verifications if paints or coatings are used on plastic parts (IEEE, 2006)[66].

5) DISCUSSION

Given the shortcomings and the effects of EuP implementation to date, as identified in the previous Section, some discussion is needed on areas where immediate improvements can be made and where future modifications will be needed. Immediate improvements relate to the behaviour of institutions in current implementation, whereas future modifications focus more on changes needed to legislation. It is no surprise that the relationship between EuP, RoHS and WEEE features strongly in the discussion.

On the complementarity of EuP, RoHS and WEEE Directives

Clearly there are many overlapping objectives of the EuP, RoHS and WEEE Directives. Given the historical context of the development of these Directives, this is not surprising. Early drafts of the WEEE Directive included both the hazardous substance restrictions articles and the remit to promote future ecodesign minimum requirements. It was only when the WEEE Directive was officially proposed that the RoHS and WEEE Directives were separated into two distinct Directives. At the same time, DG Enterprise of the European Commission also released a draft EEE Directive (later to become the EuP), which assumed control over the development of ecodesign minimum requirements.

Obviously, this history still affects the relationship between these instruments today. **Recent iterations on how the Commission views the coherence between the EuP, RoHS and WEEE Directives can be found in both Impact Assessments (IA) of the recast proposals for the revisions of the WEEE and RoHS Directives currently underway.** ***Interestingly, the views differ with respect to the role of EuP.*** For example, in the IA for the RoHS Directive it is noted that the EuP Directive *"aims at improving the overall environmental performance of selected groups of EEE, while considering economic feasibility"*. Therefore, reducing toxicity of the product can be considered under EuP, but restricting the use of substances is not the aim of the Directive. EuP was not meant to substitute specific legislation, but to ensure that sectoral/specific legislation be applied in a coherent and efficient way, for the benefit of the environment and the internal market.

While the impact assessment for the recast of the WEEE Directive notes, in reference to the development of implementing measures under EuP, that although the Commission could select products also covered under WEEE and RoHS there is a difference in approach between the WEEE, RoHS and EuP Directives. The EuP Directive aims for *"improvement of the energy efficiency but only where this is possible without detriment to other environmental impacts in the life cycle of the product and considering economic feasibility"*.

Given this, and the fragmentation between the Directives in the implementing measures proposed to date in the EuP, ***it is clear that a certain ambiguity remains over the roles and responsibilities of the EuP, RoHS and WEEE Directives, and this would need to be better addressed and resolved as soon as possible.*** The current recasts of the RoHS and WEEE Directives would have offered the ideal opportunity to make legal improvements (clarification) as soon as possible, but the Commission proposals for each Directive recast and discussion so far has focused on other issues other than better complementarity. Notwithstanding this, implementation improvement can be made more immediately. The three Directives are implemented through different decision-making processes, involving different European Commission staff and in different political contexts. More proactive institutional harmonisation is needed, not least in the proposals made by the Commission in the different implementation processes.

On the effectiveness of EuP as a life cycle-based instrument

Addressing life cycle impacts of production

As discussed in Section three, the EuP Directive has inherent weaknesses which reduces its capacity to truly address any significant life cycle impacts (beyond energy efficiency in use) and drive a radical paradigm shift in product design. In particular, **the MEEuP methodology may overestimate the significance of the use phase, because of the boundaries set and the product lifespan applied** (as in the case of personal computers).

Usually, when generic requirements related to non-energy aspects have been proposed so far, they have been dropped in the final version of the regulation detailing the implementing measures.

Embedding life cycle thinking

Generic requirements making it mandatory for designers to take the life cycle impacts into account in the design process were proposed in one EuP preparatory study, but have subsequently been dropped. This means that manufacturers are only obliged to work with those aspects addressed in the implementing measures. **This indicates that the EuP Directive will probably not be very effective at integrating life cycle thinking among manufacturers.** *Some of the 'pedagogical' elements, which would have forced manufacturers to learn more about their life cycle impacts and ecodesign options, are not sufficiently developed and promoted through the Directive.*

Standards on Reusability, Recyclability, Recoverability

In a stakeholder consultation during the review of the WEEE Directive, one option put forth by the European Commission to stimulate ecodesign practices was to define targets for reusability, recyclability and recoverability of EEE. However, limited support was expressed by some stakeholders on this option with the Commission noting that *"to set such targets, much investigation would be needed to have appropriate measuring methods to calculate the targets"*. The Commission also notes that while this was possible for vehicles in the type approval Directive, the number of EEE types would render the measure non- proportionate and was therefore discarded as an option (Commission of the European Communities, 2008). This then stresses **the importance of quickly developing appropriate measurement standards, as well as implementing fully the incentive mechanisms associated with individual producer responsibility for the financing of WEEE as required in the WEEE Directive.**

Toxicity and chemicals

As was noted, **some chemicals are not properly assessed in the EuP methodology. There is also a tendency that preparatory study consultants systematically point to the RoHS Directive or REACH as more suitable instruments to deal with these issues.** However, it seems reasonable that the EuP Directive be used to assess the relevant toxicity issues for each of the product groups covered, to elaborate a more serious discussion as to what will be genuinely implemented through RoHS/REACH, and where gaps need to be filled. There are good reasons to consider how the approach and methodology can be improved in this respect.

Improving the life cycle impacts of products: A case of passing the buck?

If life cycle thinking is to be one of the central principles on which product policy, and indeed sustainable industrial policy, is based then the current triangle of legislation addressing energy-using products – the EuP, RoHS and WEEE Directives - offers a consistent and potentially effective starting point.

In Section three, a description of the three main Directives regulating the environmental impacts of electronic products was presented. Implementation of the WEEE Directive to date has been problematic in a number of areas. Compliance systems in many Member States have been slow to set up and a high level of administrative burden has been placed on producers required to register and report in all 27 MS with varying formats. The United Nations University study[67] supporting the Directive review process identified that only 2.7 million tonnes of the expected 8.3 million tonnes of WEEE arisings were reported as being collected and properly treated. There is a high degree of uncertainty over the fate of the remaining 5.6 million tonnes of WEEE, and the European Commission estimates that only a small percentage (1.1 million tonnes) of this is ending up in landfill or incineration facilities. It is estimated that approximately 4.5 million tonnes is being separately collected but not being reported. Of this, 2% is supposedly being reused, 11% is treated in compliance with the Directive, 41% being exported illegally or treated out of compliance with the Directive.

Despite these issues, the critical mechanism to influence product design - individual financial responsibility - has not been implemented in any Member State to date. Therefore there is no incentive for producers to improve the design of their products, as they are collectively responsible for the financing of all WEEE. During the WEEE review process repeated calls were made to remove any reference in the Directive regarding product design and that the focus should be placed on waste management. *Several stakeholders had indicated that the EuP is better suited to influence design of EEE for end-of-life improvements. While the European Commission has not proposed to remove these measures (Article 8.2), there has been no attempt to clarify the situation in order to address a lack of implementation by Member States. Considering the experience to date with the ecodesign requirements in the context of the EuP Directive, end-of-life parameters will probably not be adequately addressed.* This calls for a renewed focus on the incentive mechanisms as they were originally envisioned, namely IPR, to be strengthened in the new WEEE Directive.

The RoHS Directive has had positive impacts, despite the high number of exemptions to date (33). However, it is clear that restricting additional substances of concern in electrical and electronic products under this Directive is complicated. The European Commission's proposal for the recast (revision) of the Directive includes a new methodology for approving exemptions, with time-limited exemptions and placing the burden of proof on manufacturers to provide evidence of the need for an exemption. Despite this, no new substances restrictions were proposed in the recast. In fact, many stakeholders have advocated that REACH should address any new substance restrictions in EEE. Industry association, Orgalime, favours the use of REACH instead of RoHS to address restrictions, and questions the need to expand the list of substances restricted under RoHS. NGOs on the other hand point out that although they are supporters of REACH as the overarching chemical regulation, RoHS is the appropriate legal instrument to address hazardous substances in electronics, as REACH will be a very slow roll out of chemicals policy for all sectors, not just the electronics industry. NGOs claim that it is not a matter of double regulation: REACH regulation for these particular applications is not yet in place, while RoHS is.

Clearly, the European Commission agrees with the strategy of addressing further restrictions through REACH, even though it is well recognised that it is unclear how REACH will address the restriction of identified substances in products. What is clear is that the European Commission's approach ensures that the process will be time consuming without any measures coming forth on chemical restrictions in products for quite some time.

The use of alternative incentives to discourage the use of hazardous substances could also be harnessed more clearly. Additionally, any future decisions to restrict further substances is influenced by pioneering companies that have already phased out substances proving that it is technically possible and cost-effective, as has already been seen with the current recast of the RoHS Directive. While not restricting the use of substances of concern in products when they are put on the market through legal standards, better monitored treatment standards in the WEEE Directive concerning the maximum concentration of hazardous substances in material output flows or in emissions to air, water and soil from treatment and recycling facilities would allow for greater flexibility in reaching the same goal. By internalising the social costs associated with hazardous waste treatment, requirements in downstream processing would drive the cost to manage products containing these substances and encourage their substitution by less hazardous substances. In this sense the WEEE Directive and the RoHS Directive could complement each other, but come at the problem from different angles.

It is obvious that legislating ecodesign is a complex issue, yet, as said before, the triangle formed by the EuP, RoHS and WEEE Directives offer a good starting point for addressing the impacts of electrical and electronic products throughout their life cycle. Their synergistic implementation, however, demands institutional support that is integrated and proactive in driving an improvement agenda and closing legislative gaps. As we have seen from our analysis, the institutional structure appears to be more interested in the Internal Market impacts and on energy in use phase only. Political decisions also have tended to water down originally ambitious proposals. This reality means that the implementation of the 3 Directives will remain sub-optimal, thereby not creating the strong signal to producers to design greener products, until the political leadership at EU and national levels is found.

6) RECOMMENDATIONS

General comments

To say that the EuP Directive is implementing full "life cycle thinking" addressing all significant design and ecological issues can currently be considered as a case of "false marketing". The Directive itself, the MEEuP methodology and the process of proposing and adopting implementing measures, very much restrict the life cycle scope. Further, as proposed generic requirements that would have mandated designers to look at a wider number of life cycle issues in the design process usually are not adopted in the end or vaguely channelled to other Directives, the EuP Directive will probably not be the tool to embed life cycle thinking and associated practices among manufacturing firms. Not unless its implementation changes so as to address full "life cycle thinking".

Unfortunately, it is developments beyond the EuP, RoHS and WEEE Directives which will likely force improvements in these Directives, unless the revisions of RoHS and WEEE currently underway can be harnessed to bring more coherence and complementarity. Last year saw the publication of the EU Sustainable Consumption and Production/Sustainable Industrial Policy Action Plan (SCP/SIP), produced by the European Commission. Part of the aims of the Action Plan was to bring more synergy and coherence between current fragmented product policies – EuP, the European Ecolabel and green public procurement. It is still early days in changes to implementation, but there is much work to be done to improve the implementation of the EuP Directive so that it can meet its aim of improving the *environmental performance of products throughout their life cycle* through the systematic integration of environmental aspects at the earliest stage of their design.

Taking a moment to consider Sustainable Industrial Policy within the Action Plan, there is very little content on what sustainability means beyond creating a "low carbon, resource efficient economy". With increasing political interest in areas such as eco-efficiency and eco-innovation, the need to bring more detail and clarity to policy objectives will become stronger. As yet, there is no sign of work on the development of detail on key environmental impact areas, clearer objectives in the different areas, nor of the relationships between "trade-offs" (for example, how to decide what action to take when a reduction in toxicity requires an increase in energy consumption).

In reality, the policy direction from the EU seems very much to be to continue keeping the product policies such as EuP, WEEE, RoHS, Ecolabel, etc. as separate policy instruments, with their own dynamics, scope and revision processes. This could be an acceptable approach if an overarching framework was in place to give guidance and coherence, and if these policies were implemented and revised accordingly. This is precisely what is missing today, and explains why this policy mix is not delivering enough to meet the challenge of sustainability.

Earlier this year, a group of environmental and social NGOs and the research community (particularly those working on product policy and on sustainable consumption) launched the *"Blueprint for European Sustainable Consumption and Production"*[68]. The Blueprint was prepared in response to the narrow political agenda on SCP/SIP as was being shaped by the European Commission. The document gives additional ideas as to how to better integrate life-cycle thinking into product approaches, via sustainability minimum requirements.

Coordinating the policy instrument mix

As a result of the findings of this research, it is recommended that the European Commission develops procedures to ensure that information gathering and results of studies conducted on behalf of the Commission are fed into the appropriate channels for the EuP, RoHS and WEEE Directives. For example, where appropriate, results from the preparatory studies identifying product characteristics which are environmentally significant and where no actual specific or generic ecodesign requirements are proposed, should be shared early enough by the appropriate desk officers handling the EuP, WEEE and RoHS Directives.

In terms of future preparatory studies that are to be conducted under EuP, it is recommended that consultants take more time to review evidence of how effective the WEEE and RoHS directives have achieved their overall objectives, rather than just pointing to the fact that these instruments address the environmental aspects identified. If possible, Commission desk officers handling the WEEE and RoHS should be participants in the preparatory stakeholder meetings and Ecodesign Consultation Forum meetings.

The optimal policy

As always in policymaking there is no "optimal" way to design policies and to coordinate their interaction. Still, one question obviously needs to be answered: *What is the actual role of the EuP Directive and associated methodology?*

Should it be used to assess and address all relevant environmental impacts for a given EuP product group? If so, the methodology must be improved, and when implementing measures are set, one should not look too much into REACH, RoHS and WEEE as better instruments to address certain issues, because we do not know when/if they will materialise in these instruments.

There are good reasons to refine the MEEuP methodology and the way it is applied. Still, this will not be enough to deal with all the life cycle related impacts of EEE. Therefore, we will need new policy approaches for this purpose.

Given the recent partial extension to the EuP Directive (to address "energy-related" products), a revision before the one scheduled for 2012 is not realistic. However, work can start to be done now on possible changes that would strengthen the full life cycle and full ecodesign considerations to be taken.

The European Commission can already develop procedures to ensure that the preparatory studies and development of product-level measures under the EuP, RoHS, WEEE Directives (as well as other product-related policies such as Energy labelling, Eco-labelling…) are delivered in a more consistent and integrated process. As an example, in terms of future EuP preparatory studies, we recommend that consultants be required to assess the appropriateness of "shifting" responsibility for improvements to the WEEE and RoHS Directives based on their effectiveness to date in achieving their overall objectives. This work would overcome the automatic reaction to point to these instruments since they are meant to address some of the environmental aspects identified in the preparatory study. Also, the Commission desk officers handling the WEEE and RoHS should be more active participants in the Ecodesign Consultation Forum in charge of discussing EuP implementing measures.

For the 2012 revision, the review should reconsider the life-cycle approach and tools used in EuP to ensure a more consistent and balanced approach to developing implementing measures. It would also help if the product-by-product approach used in the EuP Directive were complemented by a horizontal document enforcing a few systematic ecodesign practises, to make sure that the Directive sends a strong overall signal to manufacturers and to not lose the bigger picture while focusing on trying to deliver on case-by-case margins in specific measures.

For EuP to better address life cycle impacts beyond energy efficiency in the use phase, the methodology needs refinement in at least two key areas. First, an improvement needs to be made so that chemical substances and toxicity issues can be more appropriately assessed. Second is on the link between natural resources and end-of-life management, most notably where we have already seen the failure to differentiate between collection and recycling of WEEE in the existing EuP studies. This has led to flawed base case scenarios, which affected the importance given to these aspects.

One of the areas for immediate activity proposed within the Blueprint on *European Sustainable Consumption and Production* is the articulation of sustainable industrial policy, with clearer sustainability objectives. One of the criticisms of the SCP/SIP Action Plan made by EEB was that it lacked overarching objectives and it is clear that the European Commission has not wanted to step up to this particular challenge. As also noted in the *Blueprint*, the steps to sustainability will need to be actively set out sooner rather than later if we are to make reasoned, anticipated steps in a transition process. failing to do so will lead to less reasoned, chaotic responses and decisions being made in future. Policy-makers need to take these difficult decisions now in order to avoid the need to take even more difficult decisions in future.

REFERENCES

Ashford, N. (2000). An innovation-based strategy for a sustainable development. In: Hemmelskamp, J. et al. Innovation-oriented environmental regulation: Theoretical approach and empirical analysis. Springer Verlag, Heidelberg.

Beck, U. (1998). Politics of Risk Society. In: Franklin, J. (Ed). The Politics of Risk Society. Cambridge: Polity Press.

Bhagwati, J. and Mavroidis, C. (2007). Is action against US exports for failure to sign Kyoto Protocol WTO-legal? World Trade Review, 6:299-310

Boardman, B. (2004). Achieving energy efficiency through product policy: the UK experience. Environmental Science and Policy 7(3), 165-76.

Charnovitz, S. (2002). Solving the production and processing methods (PPMs) puzzle. In: Gallagher, K. and J. Werksman (Eds). *The Earthscan reader on international trade and sustainable development.* Earthscan Publications.

Commission of the European Communities. (2008). *Commission Staff Working Paper accompanying the Proposal for a Directive of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE) (recast) Impact Assessment.*

Commission of the European Communities. (2008). *Commission Staff Working Paper accompanying the Proposal for a Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast) Impact Assessment. COM (2008) 809.*

Dalhammar, C. (2004). *Lagstiftningens roll i den integrerade produktpolitiken.* Rapport 5412. Naturvårdsverket [Swedish EPA Press], Stockholm.

Dalhammar, C. (2007). An emerging product approach in environmental law: Incorporating the life cycle perspective. Doctoral Dissertation, IIIEE, Lund University.

Dalhammar, C. (2007). Product and life cycle issues in European environmental law: A review of recent developments. *Yearbook of European Environmental Law Vol. 7.* Oxford University Press.

Dalhammar, C. and Nilsson, A. (2005). Chemicals in articles – A look at current policy and law and recent trends. Presented at the 7th Nordic *Environmental Social Science Research Conference (NESS), Gothenburg, June 15-17, 2005.*

Egelund Olsen, B., Steinicke, M. and Engsig Sörensen, K. (eds). (2006). *WTO – from a European perspective.* Thomson, Copenhagen.

Environmental Resources Management (ERM). (2002). *Evaluation of environmental product declaration schemes.* Report to DG Environment, September 2002.

Heiskanen, E. (2002).The institutional logic of life cycle thinking. *Journal of Cleaner Production* 10(5), 427-437.

Howse, R. and Regan, D. (2000). The product/process distinction – an illusory basis for disciplining 'unilateralism' in trade policy. European *Journal of International Law* 11(2), 249-289.

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* . ENV.G.4/ETU/2006/0032. Bonn: United Nations University.

IEEE. (2006). IEEE *Std 1680 - Standard for Environmental Assessment of Personal Computer Products, Including Laptop Personal Computers, Desktop Personal Computers and Personal Computer Monitors.* New York: IIIEE Computer Society.

IISD/UNEP. (2006). *Environment and trade. A handbook.* 2nd ed, UNEP.

IPP Working Group on Product Information. (2006). Making Product Information Work for the Environment.

ISIS (2008). Preparatory Studies for Ecodesign Requirements of EuPs. Lot 13: Domestic Refrigerators and Freezers, Italy. DG TREN. Tender TREN/D1/40-2005.

Kemp, R. (2005). Zero Emission Vehicle Mandate in California: misguided policy or example of enlightened leadership? In Sartorius, C. and S. Zundel. (eds.). Time Strategies, Innovation and Environmental Policy. Edward Elgar, Cheltenham.

Krämer, L. (2003). EC Environmental Law. 5th ed, Sweet & Maxwell, London.

Lindhqvist, T. (2000). Extended Producer Responsibility in Cleaner Production. IIIEE Dissertations 2000:2. The International Institute for Industrial Environmental Economics, Lund University, Sweden

Lindhqvist, T. & Lifset, R. (1997). What's in a Name: Producer or Product Responsibility? Journal of Industrial Ecology, 1(2), 6-7;

Naturvårdsverket [Swedish EPA]. (1999). Producenters ansvar för varors miljöpåverkan. Rapport 5043, Swedish EPA report series, Stockholm.

OECD. (1997). PPMs: Conceptual framework and considerations of use of PPM-based trade measures.

Orgalime (2008) Orgalime position paper on WEEE Review Policy Options, Brussels, June 4, 2008.

Onida, M. (2006). Products and the environment. In Macrory, R. (Ed). Reflections on 30 years of EU Environmental law. A high level of protection? Europa Law Publishing, Groningen.

Sander, K, Schilling, S, Tojo, N, van Rossem, C, Verrnon, J, & George, C. (2007). *The Producer Responsibility Principle of the WEEE Directive.* Hamburg, Germany: DG ENV. Study Contract No. 07010401/2006/449269/MAR/G4

Stobe, L. (2007). EuP Preparatory Studies "Televisions" (Lot 5) Final Report on Task 5 "Definition of Base Cases". Berlin, Germany. DG TREN/D1. Tender No.40 lot 5-2005.

Svensson, P. (2004). *Regulating for better environmental performance: Effects of the draft EuP directive on ecodesign.* Report, Linköping University.

Tojo, N. (2005). The Top Runner Program in Japan - its effectiveness and implications for the EU. Report 5515. Swedish EPA, Stockholm.

TCO Development, IVL, & IVF. (2007). Lot 3 Personal Computers (desktops and laptops) and Computer Monitors: Final Report (Contract TREN/D/140-2005/Lot 3/S07.56313. In ECD TREN (Ed.). Brussels.

Tufet-Opi, E. (2002). Life after end of life: The replacement of end of life product legislation by an European integrated product policy in the EC. *Journal of Environmental Law* 14(1), 33-60.

van Rossem, C. (2001). *Environmental Product Information Flow. Communication of environmental data to facilitate product improvements in the ICT sector.*

van Rossem, C. and Dalhammar, C. (2005). OEM outsourcing trends: an opportunity or threat for life cycle management in the electronics product chain. *In Proceedings from LCM2005, Barcelona, pp. 348-52.*

van Rossem, C. (2008). *Implementing IPR in the WEEE Directive – From Theory to Practice? Doctoral Dissertation IIIEE Dissertations 2008:3, Lund.*

Webb, B., Chilvers, J. and Keeble, J. (2006). *Improving Business Environmental Performance: Corporate Incentives and Drivers in Decision-making.* A report to the Department for Environment, Food and Rural Affairs by Arthur D Little Ltd. Defra, London.

Wesnaes, M, Thestrup, J, & Remmen, A. (2008). *Memorandum on Environmental Screening and Evaluation of Energy-using Products (EuP) Final Report:* Danish Environmental Agency.

Williams, E. (2004). Energy Intensity of Computer Manufacturing: Hybrid Assessment Combining Process and Economic Input/Output Methods. *Environmental science and technology.,* 38(22), 6166-6174.

Williams, E, & Hatanaka, T. (2005). Residential computer usage patterns in Japan and associated life cycle energy use. *Electronics and the Environment, 2005. Proceedings of the 2005 IEEE International Symposium on,* 177-182.

Williams, ED. (2004). Revisiting energy used to manufacture a desktop computer: hybrid analysis combining process and economic input-output methods. *Electronics and the Environment, 2004. Conference Record. 2004 IEEE International Symposium on*, 80-85.

NUMBERED REFERENCES

1 Williams, ED. (2004). Revisiting energy used to manufacture a desktop computer: hybrid analysis combining process and economic input-output methods. Electronics and the Environment, 2004. Conference Record. 2004 IEEE International Symposium on, 80-85.

2 Dalhammar, C. (2007). Product and life cycle issues in European environmental law: A review of recent developments. Yearbook of European Environmental Law Vol. 7. Oxford University Press.

3 Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and the introduction of a mechanism to monitor and reduce greenhouse gas emissions from the use of road transport fuels and amending Council Directive 1999/32/EC, as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC, COM (2007)18.

4 Dalhammar, C. (2007). Product and life cycle issues in European environmental law: A review of recent developments. Yearbook of European Environmental Law Vol. 7. Oxford University Press.

5 Directive 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC.

6 Directive 2002/96/EC on waste electrical and electronic equipment.

7 Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

8 Directive 92/75/EEC on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances

9 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. ENV.G.4/ETU/2006/0032. Bonn: United Nations University.

10 Orgalime position paper on WEEE Review Policy Options, Brussels, June 4, 2008.

11 To give an example: How do we allocate a certain part of the environmental impacts from goods (and service) transport to a certain product group? This can often be very difficult in practice.

12 An example concerns chemicals: It is often difficult to establish how certain chemicals affect human health and the environment, and the issue gets even more complicated when there are suspicions that several chemicals interact.

13 Onida, M. (2006). Products and the environment. See also the discussion in Krämer, L. 2003. EC environmental law, Ch. 6.

14 See Dalhammar, C. and Nilsson, A. (2005). Chemicals in articles – A look at current policy and law and recent trends.

15 OECD. (1997). PPMs: Conceptual framework and considerations of use of PPM-based trade measures.

16 General Agreement on Tariffs and Trade (GATT), Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), and Agreement on Technical Barriers to Trade (TBT Agreement).

17 Most notably because of the reasoning of the WTO panels in the Tuna/Dolphin disputes: United States – Restrictions on imports of tuna, 30 ILM (1991) 1594; United States – Restrictions on imports of tuna, 33 ILM (1994) 936.

18 See United States – Import prohibitions of certain shrimp and shrimp products. Report of the Appellate Body, 12 October 1998, WT/DS58/AB/R.

19 For a more detailed discussion see Howse, R. and Regan, D. (2000). The product/process distinction – an illusory basis for disciplining 'unilateralism' in trade policy; Bhagwati, J. and Mavroidis, C. (2007). Is action against US exports for failure to sign Kyoto Protocol WTO-legal? World Trade Review , 6:299-310; IISD/UNEP. (2006). Environment and trade. A handbook; Charnovitz, S. (2002). Solving the production and processing methods (PPMs) puzzle. A further problem with PPMs concerns their "extraterritorial" effects. A fundamental principle of international law is that nations have the sovereign right to govern themselves and to exploit their own resources as they wish. An 'extraterritorial' application of domestic environmental (or other) law, means that it somehow affects activities taking place either beyond its national jurisdiction, or in areas situated within the jurisdiction of another country. Such extraterritorial application of national law may compromise the sovereignty of other countries. A further problem is that is may restrain countries from making their own priorities when it comes to issues are economic development and resource use. The extraterritoriality issue has been central in some WTO case law, for instance in the Tuna/Dolphin and Shrimp/Turtle disputes. Some authors argue that the extraterritorial effect of policies in developed countries is positive, as it brings about improvements in developing countries which have limited institutional capacity to deal with environmental issues.

20 Egelund Olsen, B. et al. (2006). WTO law – from a European perspective, p. 269.

21 See Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources. COM(2008) 19 final, Brussels, 23.1.2008..

22 See Tufet-Opi, E. (2002). Life after end of life: The replacement of end of life product legislation by an European integrated product policy in the EC.

23 This is discussed in Lindhqvist, T. & Lifset, R. (1997). What's in a Name: Producer or Product Responsibility? Journal of Industrial Ecology, 1(2), 6-7; Dalhammar, C. Product and life cycle issues in European environmental law: A review of recent developments. For a defence of the notion of 'shared responsibility', and a critique of producer responsibility laws, see Tufet-Opi, E. (2002). Life after end of life: The replacement of end of life product legislation by an European integrated product policy in the EC.

24 An example of this is when American industries preferred the concept 'extended product responsibility' to 'extended producer responsibility', as the former concept is more in line with a shared idea of responsibility. See Lindhqvist, T. & Lifset, R. (1997). What's in a Name: Producer or Product Responsibility?

25 Beck, U. (1998). Politics of Risk Society. In: Franklin, J. (Ed). The Politics of Risk Society. Cambridge: Polity Press, p. 14.

26 Heiskanen, E. (2002). The institutional logic of life cycle thinking, p. 435.

27 See Lindhqvist (2000).

28 Dalhammar, C. (2004). Lagstiftningens roll i den integrerade produktpolitiken, pp. 35-37.

29 See for instance van Rossem, Christopher. (2001). Environmental Product Information Flow. Communication of environmental data to facilitate product improvements in the ICT sector.

30 Naturvårdsverket. [Swedish EPA]. (1999). Producenters ansvar för varors miljöpåverkan.

31 These are often referred to as environmental product declarations (EPDs) in the literature, although they do not always comply with the criteria for EPDs as given in ISO 14025.

32 For more information see for instance Environmental Resources Management (ERM). (2002). Evaluation of environmental product declaration schemes. Report to DG Environment, September 2002.

33 IPP Working Group on Product Information. (2006). Making Product Information Work for the Environment, p. 4.

34 Webb, B. et al. (2006). Improving Business Environmental Performance: Corporate Incentives and Drivers in Decision-making.

35 See http://ec.europa.eu/environment/ipp/pdf/20070115_report.pdf for the final report of the working group.

36 See Ashford, N. (2000). An innovation-based strategy for a sustainable development. In: Hemmelskamp, J. et al. Innovation-oriented environmental regulation: Theoretical approach and empirical analysis. Springer Verlag, Heidelberg.

37 Tojo, N. (2005). The Top Runner Program in Japan – its effectiveness and implications for the EU.

38 Article 4 of the Directive requires MS to "encourage the design and production of electrical and electronic equipment which take into account and facilitate dismantling and recovery, in particular the re-use and recycling of WEEE, their components and materials …".

39 Weight-based reuse, recycling and recovery targets are calculated by stipulating that an overall percentage of the product by weight is to be achieved, without stipulating which materials within the product are to be recovered. Weighted-based targets have been criticised by some actors for treating all material equally, despite that certain materials from a life cycle perspective are more relevant to recover than others.

40 Sander, K, Schilling, S, Tojo, N, van Rossem, C, Verrnon, J, & George, C. (2007). The Producer Responsibility Principle of the WEEE Directive. Hamburg, Germany: DG ENV. Study Contract No. 07010401/2006/449269/MAR/G4

41 van Rossem, C. (2008). Implementing IPR in the WEEE Directive – From Theory to Practice? Doctoral Dissertation IIIEE Dissertations 2008:3. Lund.

42 Commission of the European Communities (2008). Commission Staff Working Paper accompanying the Proposal for a Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast) Impact Assessment. COM (2008) 809.

43 See for instance www.env-ngo.eup-network.eu and ec.europa.eu/energy/efficiency/ecodesign/eco_design_en.htm for an overview of the policy process product by product.

44 COM(2008) 660 final. European Commission Communication on the establishment of the working plan for 2009-2011 under the Ecodesign Directive

45 With maybe the exception of the measure on domestic lighting, phasing-out incandescent lightbulbs (but still leaving a large number of halogen alternatives on the market).

46 Williams, ED. (2004). Revisiting energy used to manufacture a desktop computer: hybrid analysis combining process and economic input-output methods. Electronics and the Environment, 2004. Conference Record. 2004 IEEE International Symposium on, 80-85.

47 Ibid, p. 80.

48 Stobe, L. (2007). EuP Preparatory Studies "Televisions" (Lot 5) Final Report on Task 5 "Definition of Base Cases". Berlin, Germany. DG TREN/D1. Tender No.40 lot 5-2005. Task 5, p. 7.

49 Ibid, Task 5, p. 13.

50 Ibid, Task 5, p. 14.

51 Ibid, Task 5, p. 12.

52 Ibid, Task 5, p. 20.

53TCO Development, IVL, & IVF. (2007). Lot 3 Personal Computers (desktops and laptops) and Computer Monitors: Final Report (Contract TREN/D/140-2005/Lot 3/S07.56313. In ECD TREN (Ed.). Brussels. p. 200.

54 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 . ENV.G.4/ETU/2006/0032. Bonn: United Nations University.

55 TCO Development, IVL, & IVF. (2007). Lot 3 Personal Computers (desktops and laptops) and Computer Monitors: Final Report (Contract TREN/D/140-2005/Lot 3/S07.56313. In ECD TREN (Ed.). Brussels.

56 Williams, ED. (2004). Revisiting energy used to manufacture a desktop computer: hybrid analysis combining process and economic input-output methods. Electronics and the Environment, 2004. Conference Record. 2004 IEEE International Symposium on, 80-85.

57 EPIC ICT (2004). Development of Environmental Performance Indicators for ICT Products on the example of Personal Computers. Publishable final activity report. Project no. 513673 (SSPI).

58 TCO Development, IVL, & IVF. (2007). Lot 3 Personal Computers (desktops and laptops) and Computer Monitors: Final Report (Contract TREN/D/140-2005/Lot 3/S07.56313. In ECD TREN (Ed.). Brussels. p. 263.

59 Stobe, L. (2007). EuP Preparatory Studies "Televisions" (Lot 5) Final Report on Task 5 "Definition of Base Cases". Berlin, Germany. DG TREN/D1. Tender No.40 lot 5-2005. Task 5, p. 8.

60 Ibid, Task 5, p. 13.

61 Ibid, Task 5, p. 9.

62 Stobe, L. (2007). EuP Preparatory Studies "Televisions" (Lot 5) Final Report on Task 5 "Definition of Base Cases". Berlin, Germany. DG TREN/D1. Tender No.40 lot 5-2005. Task 8, p. 11.

63 ISIS (2008). Preparatory Studies for Ecodesign Requirements of EuPs. Lot 13: Domestic Refrigerators and Freezers, Italy. DG TREN. Tender TREN/D1/40-2005.

64 VITO et al. (2008). Preparatory Studies for Ecodesign Requirements of EuPs.: Lot 19 Domestic lighting. DG TREN. Contract. TREN/07/D3/390-2006/S07.72702.

65 Annex I, Part 1.3 of the EuP Directive lists parameters such as amounts of waste generated and amounts of hazardous waste generated; emissions to water (heavy metals, substances with an adverse effect on the oxygen balance, persistent organic pollutants); and emissions to soil (especially leakage and spills of dangerous substances during the use phase of the product, and the potential for leaching upon its disposal as waste).

66 EPEAT defines compatible in this context as the following: Paints and coatings on plastic parts are proven to be compatible with recycling processes if they do not significantly impact the physical/mechanical properties of the recycled resin. Significant impact is defined as >25% reduction in notched Izod impact at room temperature as measured using ASTM D256.

67 The study is available at : http://ec.europa.eu/environment/waste/weee/pdf/final_rep_unu.pdf

68 "Blueprint for European Sustainable Consumption and Production: Finding the path of transition to a sustainable society", EEB and SCORE! (May 2009), http://www.eeb.org/publication/2009/0905_SCPBlueprint_FINAL.pdf

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