Policy Options to Foster Eco-Design of Electronics Products Beyond Energy Efficiency

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Abstract
Consumer electronics have yet to reap the full potential of green technologies and ecodesign. The European policy framework is supposed to foster the implementation of environmentally benign product design, but largely addresses substance restrictions and energy efficiency in the use phase only. Resource consumption, usage of recycled plastics, bio-based materials and fewer substances of health and environmental concern, lifetime extension and design to facilitate recycling are only some of the design options, which enable additional significant environmental improvement potential. The paper explores the possibilities to incentivise these design features through policy measures based on a project conducted for the UK Department of the Environment, Food and Rural Affairs (Defra).

Keywords: ecodesign, recyclability, bio-based material, fluorinated greenhouse gas emissions, life-cycle, televisions, lighting, computers, imaging equipment, commercial refrigeration

1. Introduction

The European Framework Directive Ecodesign of Energy Related Products (ERP) is highly relevant for driving environmental improvements in household equipment, information and communication technology, consumer electronics and other energy-using products. Since 2005 the European Commission has developed this legislation for numerous product groups. While the ERP legal framework allows for a broad implementation of ecodesign requirements to reduce multiple environmental impacts across the product life cycle (from material acquisition to end of life (EOL)), only energy consumption in use and energy efficiency requirements have been adopted for most products. This is despite the fact that comprehensive Preparatory Studies for each of the product groups have been undertaken which incorporate wider ecodesign opportunities. The UK Department for Environment, Food and Rural Affairs (Defra) contracted Global View Sustainability Services Ltd. (GVSS) and partners to explore opportunities for ecodesign options beyond energy-in-use and to propose and assess the feasibility of measures to incorporate these in future ERP

and wider instruments [1]. The background to this project is that since the Ecodesign of Energy Using Products (EuP) Framework Directive [2] has been recast as the Ecodesign of Energy Related Products (ERP) Directive [3], there is an opportunity to revisit the environmental improvement potential of the ERP ecodesign legislative framework beyond "energy in use" impacts alone. This is important as it can be a powerful driver for significant environmental improvements across product supply chains.

2. Objectives and Method

The objectives of this project were as follows:

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

- Develop evidence based recommendations for incorporating non energy-in-use improvement targets in the IMs or other instruments going forward. This takes into account the role of other legal and market instruments impacting energy-related products e.g. Directive on Waste Electrical and Electronics Equipment (WEEE), Directive on Restriction of certain Hazardous Substances (RoHS) and voluntary initiatives.

To meet the project objectives, the method used was to analyse the existing evidence using EuP Preparatory Studies, wider literature and stakeholder views from a representative group that could offer insight on the existing status and opportunities going forward. Over 20 stakeholder organisations provided their views. The analysis incorporated a high level screening of Preparatory Studies and a detailed analysis of five ERPs with significant non energy impacts.

3. Project Findings

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3.1. Environmental and economic opportunities for ecodesign

The ERP product groups with significant non energy in use impacts based on the Preparatory Study screening analysis and wider evidence are in Table 1.

Table 1. ERP product groups with significant non energy in use impacts

Washing Machines and Dishwashers	Air Conditioners & Ventilation
Boilers and Small Combustion Units	Refrigerators (Domestic & Commercial)
Water Heaters	Motors
PCs	Laundry Driers
Imaging Equipment	Vacuum Cleaners
TVs	Simple & Complex STB
Battery Chargers & External power Supplies	DVD, Video, Games Consoles
Office/ Street / Domestic Lighting	Air Conditioners & Ventilation

Those identified as offering clear non energy in use environmental improvement opportunities are TVs, PCs, Imaging Equipment, Commercial Refrigeration, Lighting, Air Conditioners, Ventilation, Simple and Complex Set Top Boxes (STB). As some of these are still the subject of future IMs under the current ERP Working Plan they offer an opportunity for consideration of new approaches. Of these, the following five ERPs - TVs, PCs, Imaging Equipment, Commercial Refrigeration, and Lighting - were chosen by Defra for detailed analysis of the ERP IM / other instruments possible to achieve these environmental improvements and the economic rationale. The main opportunities identified for environmental improvement beyond energy in use for these ERPs are summarised below.

- For *Washing Machines and Dishwashers, TVs, PCs, Imaging Equipment, Lighting, Motors, Laundry Driers, Vacuum Cleaners, Simple and Complex STB, DVDs/Video/Games Consoles* - Because of their significant materials and EOL impacts, these ERPs would benefit from consideration of materials, EOL ecodesign strategies and tradeoffs e.g. substitution (for hazardous/limited substance avoidance), lifetime extension, miniaturisation, durable modular designs to minimise resource use/waste, reuse and recycling. At present, existing mandatory instruments do not provide the platform for enabling these improvements.

- Environmental benefits can also be realised for *printers* where associated consumables have a significant impact e.g. paper for printers.

- For *air conditioning and refrigerating and freezing equipmen*t, refrigerants with global warming potential / ozone depleting impacts are significant and while aspects of these are being considered under separate instruments already, there are still opportunities for material substitution to green refrigerants that eliminate or considerably reduce these impacts. Further, improved EOL management for fixed installation refrigerators and resource efficiency benefits for Refrigerated Display Cabinets, in particular are opportunities.

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

processes, with related costs likely to fall in line with this uptake.

3.2. Reasons Implementing Measures on Ecodesign have not focussed on non-energy in use impacts

The reasons that non energy in use impacts are not incorporated in the IMs proposed in the Preparatory Studies are summarised below:

- Policy focus – The product groups prioritised to date were chosen because they have significant energy in use impacts and greenhouse gas emissions improvement potential. The recent Washing Machine and Dishwasher IMs are the first to include specific requirements for a non energy in use impact – water use. While this is not ambitious in comparison to the water saving possible, it sets a precedent in the policy approach widening somewhat, albeit still only for an "in use" impact".

- Other instruments – Wider instruments (mandatory and voluntary) that cover non energy in use impacts include REACH, WEEE, RoHS and other specific regulations for Global Warming Potential and ozone depletion impacts of refrigerants (e.g. A/C and refrigerating equipment) and for air emissions (NOx, SOx, PM etc) (e.g. for boilers). Most ERP under consideration by the European Commission are covered in WEEE (for end-of-life) and RoHS (for Mercury, Lead, Cadmium and two types of Brominated Flame Retardants - subject to some exceptions). As such, WEEE and RoHS compliance is largely assumed when considering environmental improvement scenarios in Preparatory Studies and IMs, and there is some political resistance to implement additional or more stringent substance restrictions beyond RoHS requirements in any ERP IM. Where existing instruments are in place, the IMs in the main refer to compliance with these, as would be expected.

- Enforcement concerns – Some stakeholders, including the European Commission (EC), noted that a credible method has not yet been recognised that can support enforcement of a lifecycle ecodesign approach and in particular benchmark improvement targets e.g. for materials. There are particular concerns with enforcement and market surveillance regarding improvements to lifecycle stages operating outside the EU, especially relating to WTO requirements. However, given WEEE and RoHS already successfully operate enforcement at materials and EOL stages by putting the legal onus on the producer for compliance as well as EU Member State enforcement, parts of this method do already exist. Yet, in practice the EC preference for enforcement of ERP has been focused on the final product going onto the EU market so this can be tested for compliance using national market surveillance systems. With a large proportion of ERPs sold in the EU being manufactured outside and especially in the Far East, requirements and enforcement for materials and production would need to be part of a coordinated international effort. This has informed the recommended options proposed for future ERP instruments.

3.3. Including non energy in use in future policy instruments

Building on a screening analysis of the Preparatory Studies conducted to date and a detailed analysis of five product groups (TVs, PCs, Imaging Equipment, Commercial Refrigeration and Lighting), it is feasible to implement a multi environmental impact lifecycle approach for ERPs that enables the key ecodesign opportunities identified to be realised, but there are enforcement challenges for some options where development of supporting standards and certification schemes are required. To ensure a workable approach, the options proposed utilise existing legal frameworks, precedent and enforcement systems. These are summarized in 4 below.

4. Conclusions

The environmental improvement opportunities, instruments, enforcement measures and economic implications identified are summarised here. Full details are in the project report with a ranking indicating the level of difficulty in implementing the recommendations based on the feasibility of the instruments, enforcement and cost implications [1].

At a **generic** level, a range of mandatory and voluntary instrument options can be used separately or in combination. Mandatory instruments e.g. ERP IMs can be used for the most significant impacts and also supported by voluntary instruments to drive continuous improvements over an agreed phased basis. Examples are Voluntary Agreements (VAs), industry standards e.g. IEC *62430 Environmentally conscious design for electrical and electronics products* [4] and *IEEE 1680 Environmental Assessment Standard for Electronics Products* [5], labelling schemes with strong market uptake e.g. *Blue Angel* (for printers) [6], *EU Eco label* (for washers, dishwashers, PCs, TVs or light bulbs) [7] or *EPEAT* (monitors) [4], existing industry measures e.g. extended warranties and Technology Roadmaps as well as Green Public Procurement (GPP) as a market driver. Further, beyond energy in use, embedded energy impacts across the life cycle (i.e. the Carbon Footprint (CF)) are also missing from ERP IMs. For ERP e.g. TVs where production GHG impacts are arguably as significant as in use, this may be a way to capture the full energy impacts vs. trying to prioritise one stage over the other.

At the big picture idealistic level, an integrated ERP instrument run through DG Environment at the EC is also proposed as it would better enable ecodesign to be prioritised

in ERP and streamline compliance/enforcement frameworks that are currently spread over several instruments. However, this is not likely to be feasible for the time being, so more pragmatic instruments utilising the existing structures are the main recommendations to regulate life cycle improvements.

At the **specific** level, the environmental improvement options can be most feasibly implemented by the following instruments.

- **ERP Horizontal IM with a declaration of fluorinated greenhouse gas emissions (GHG) / abatement rates**- For reducing GHG emissions of fluorinated process gas at LCD production stage in display products e.g. TVs, laptops and PC monitors.
- **RoHS extension** - For restricting mercury in display products, and of liquid mercury in lighting.
- **WEEE extension** - For commercial refrigeration EOL recycling (currently excluded).
- **ERP VAs** - For incorporating design for recycling related ecodesign requirements. Given these opportunities are relevant for complex STBs, Imaging Equipment, TVs, monitors and PCs, VAs for consumer electronics in general could require mandatory ecodesign requirements among VA signatories. In the VA, generic eco-design requirements using the IEC 62430 standard as a baseline could be made mandatory and customised to suit specific ERPs using the more detailed IEEE 1680.1 (PCs) and developing IEEE 1680.2 (Imaging Equipment) & IEEE 1680.3 (TV) [5]. The EC recently recommended the importance of using IEC62430 to address materials and waste aspects when signaling agreement to the VA for complex STBs, which provides a precedent.

A key **enforcement** feature of all of these instruments is the requirement for robust compliance testing standards and procedures both for the producers to check internal compliance as well as for market surveillance authorities. In several of the improvement options identified these testing standards are not yet available. The instruments and enforcement proposed aims to most efficiently utilise the existing legal precedents and systems e.g. extensions to WEEE and RoHS where relevant to facilitate addition of ecodesign requirements. However, outside of this, much development work will be required where testing standards/procedures are not already available. Irrespective of this, the approach for incorporating the ecodesign improvements recommended for the five ERPs analysed in detail are possible. The most challenging from an enforcement perspective and ways to overcome them are as follows.

- Improvement options that address the impacts of component production e.g. LCD production in TVs that occurs outside the EU are a difficulty for the CE Conformity Assessment market surveillance approach ERP uses. However, the Biofuels Directive provides a precedent for making requirements on non EU based production but

requires a standardised declaration scheme for fluorinated GHG emissions / abatement rates to be developed.

- VAs could more easily implement generic design for recycling or related requirements, which face market surveillance problems when specified as a legal requirement. VAs already incorporate the role of an independent inspector, who at their own discretion audit compliance with industry and could give a compliance / non-compliance statement with respect to generic requirements, based on a product check. Therefore, making the application of a generic eco-design standard such as IEC 62430 a mandatory requirement for all signatories of a VA shifts the market surveillance responsibility to the independent inspector, instead of making it a legal act.

Going forward, a pilot to trial the most promising approaches is proposed. PCs, TVs and Printers are suited to such a trial in particular as the IEEE 1680 ecodesign standards are developing (with the PC draft available). Key stakeholders e.g. DG ENTR/ENER, DG Environment, EEB, Digital Europe could participate in pilots/trials. The development of the 2012-14 ERP Working Plan launched in January 2011 and current revision of the Method for Evaluating EuP (MEEuP), due for completion at the end of 2011, also provide timely opportunities to incorporate the recommendations and evidence base for them that are proposed in this project. The issue of enforceability and legality should be incorporated in these trials with the Ecodesign AdCo Committee of Member States, recently convened by the EC to coordinate market surveillance activities under ERP, being a key stakeholder to include.

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