

**Project: Review of EuP Preparatory Study Evidence: Does it support
development of non-energy related implementing measures?**

SPMT10_013

FINAL REPORT - EXECUTIVE SUMMARY

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1. ACRONYMS

Acronyms used in the report are below.

ABS	Acrylonitrile Butadiene Styrene
B2B	Business to Business
B2C	Business to Consumer
BAT	Best Available Technology
BNAT	Best Not Available Technology
BaU	Business as Usual
BFR	Brominated Flame Retardants
BOM	Bill of Materials
CFL	Compact Fluorescent Lamp
Defra	Department of the Environment, Food and Rural Affairs
DfR	Design for Recycling
EC	European Commission
ELV	Emission Limit Value
EOL	End of Life
EPEAT	Electronic Product Environmental Assessment Tool
GHG	Greenhouse Gas
GPP	Green Public Procurement
IEEE	Institute of Electrical and Electronics Engineers
IM	Implementing Measure (under ERP Ecodesign Directive)
LLCC	Least Lifecycle Cost
MEPS	Minimum Efficiency Performance Standards
MS	Member State
OEM	Original Equipment Manufacturer
OLED/LED	(Organic) Light Emitting Diode
PAH	Poly Aromatic Hydrocarbons
PM	Particulate Matter
POP	Persistent Organic Pollutants
PP	Polypropylene
STB	Settop Box
VA	Voluntary Agreement
VOC	Volatile Organic Compounds
WEEE	Waste Electrical and Electronic Equipment Directive
RoHS	Restriction of Hazardous Substances Directive

2. EXECUTIVE SUMMARY

2.1 PROJECT OBJECTIVES

This is the final report for the *Review of EuP Preparatory Study Evidence: Does it support development of non-energy related implementing measures?* The background to this project is that now that the Ecodesign of Energy Using Products (EuP) Framework Directive¹ has been recast as the Ecodesign of Energy Related Products (ERP) Directive², there is an opportunity to revisit the environmental improvement potential of the ERP eco-design legislative framework beyond “energy in use” impacts alone as it can be a powerful driver for environmental improvements across product supply chains. For these reasons, the objectives of this project were as follows:-

1. Review the existing evidence base (EuP Preparatory Studies included in the EC’s 2009-11 Working Plan and wider evidence sources) to determine ERP with significant non energy in use impacts opportune for consideration in future instruments.
2. Determine whether the evidence in the Preparatory Studies is robust enough to inform ERP Implementing Measures (IM) for non energy related IMs.
3. Provide clarity on the reasons that the ERP IMs have not focused on non energy in use impacts to date.
4. Develop evidence based recommendations for incorporating non energy in use improvement
5. targets in the ERP IMs or other instruments going forward. This takes into account the role of other legal and market instruments impacting ERPs e.g. WEEE, RoHS and voluntary initiatives.

For simplicity ERP is used going forward to refer to both EuP and ERP.

To meet the project objectives, the agreed approach was to analyse the existing evidence using EuP Preparatory Studies, wider literature and stakeholder views from a small representative group that could offer insight on the existing status and opportunities going forward. The analysis incorporated a high level screening of Preparatory Studies, finished and ongoing (where impacts data was available) (see section 5.0) and a detailed analysis of five ERPs with significant non energy impacts (see section 7.0). Stakeholder engagement involved outreach to 62 stakeholder organisations. From these, 23 responses were received. The list of respondents, questions and generic responses are included in **Annex A-C**. The general response from stakeholders was enthusiastic that the project was being done, was timely, the right questions being asked with some offering to do trials/other suitable follow up based on the project outcomes. The key project findings are outlined in 2.2 below with signposting to report sections containing the details.

2.2 PROJECT FINDINGS

2.2.1 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 include the following.

¹ Directive 2005/32/EC establishing a framework for setting eco-design requirements for Energy Using Products (EuP) and amending Council Directives 92/42/EEC, 95/57/EC and 2000/32/EC

² Directive 2009/125/EC Of 21 October 2009 Establishing A Framework For The Setting of Ecodesign Requirements For Energy-Related Products (Recast) of Original Directive EC Ecodesign Requirements For Energy-Using Products

Washing Machines and Dishwashers
Boilers and Small Combustion Units
Water Heaters
PCs
Imaging Equipment
TVs
Battery Chargers & External power Supplies
Office/ Street / Domestic Lighting

Air Conditioners & Ventilation
Refrigerators (Domestic & Commercial)
Motors
Laundry Driers
Vacuum Cleaners
Simple & Complex STB
DVD, Video, Games Consoles

These are detailed in section 5.0 with supporting narrative per ERP providing further detail in Annex D. Of these, those highlighted in green offer clear non energy in use environmental improvement opportunities and some are still the subject of future IMs under the current ERP Working Plan. Hence they offer an opportunity for consideration of new approaches. Of these, 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 detailed environmental and economic rationales for the improvements identified are detailed in 5.0 for all the ERPs assessed and in 7.0 for the five ERP subject to detailed analysis. The main opportunities for environmental improvement beyond energy in use 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 **AC and refrigerating and freezing equipment**, refrigerants with Global Warming Potential (GWP) / 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 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 there is good potential to realise environmental improvement without incurring significant long-term economic costs, and in many cases net lifecycle benefits are considered possible. In some cases measures to achieve overall lifecycle benefits may 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 ERP 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.

2.2.2 REASONS ERP IMS HAVE NOT FOCUSED ON NON ENERGY IN USE IMPACTS

Based on an assessment of whether the Method for Evaluating EuP (MEEuP) was complied with and its robustness, it is clear that while the MEEuP does have some limitations, it did not prevent the non energy in use impacts being identified. In general it was found to be suitable for the purpose of identifying lifecycle environmental impacts. However limitations and improvements were identified (see 6.0) that can be incorporated in the upcoming planned MEEuP review. The reasons that non energy in use impacts are not incorporated in the IMs proposed in the Preparatory Studies are summarised below. These are detailed in 6.0.

- **Policy focus** – The ERPs prioritised to date were chosen because they have significant energy in use impacts and GHG improvement potential. Ecodesign of ERP is under the jurisdiction of DG ENTR/ENER and the priority for IMs is explicitly on energy in use impacts. 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 ERP 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 are detailed in 5.3. Of these from a mandatory perspective key instruments are REACH, WEEE, RoHS and other specific regulations for GWP and ozone depletion impacts of refrigerants (e.g. A/C and refrigerating equipment) and for air emissions (NO_x, SO_x, PM etc) (e.g. for boilers). Most ERP on the current Working Plan are covered in WEEE³ (for EOL) 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 ERP 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 EC, noted that a credible method has not yet been recognised that can support enforcement of a lifecycle eco-design 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. 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 Member State enforcement, parts of this method do already exist. However, practically 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 Excluding motors, machine tools, industrial furnaces and fixed installations.

2.2.3 INCLUDING NON ENERGY IN USE IN FUTURE ERP INSTRUMENTS

Building on the screening analysis of the ERP Preparatory Studies and the detailed analysis of the five ERPs (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. The environmental improvement opportunities, instruments, enforcement measures and economic implications were assessed and detailed findings are presented in 8.4. They are summarised below.

At a **generic** level, a range of mandatory and voluntary instrument options are proposed that 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* and IEEE 1680 *Environmental Assessment Standard for Electronics Products*, labelling schemes with strong market uptake e.g. *Blue Angel* (for printers), *EU Eco label* (for PCs, TVs or light bulbs) or *EPEAT* (monitors), existing industry measures e.g. extended warranties and Technology Roadmaps as well as 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 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). 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 5 ERPs 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.

To highlight the feasibility of moving forward with these, the **Matrix 2.1** below provides an ad hoc ranking to prioritise the recommended ways for incorporating the significant environmental impacts associated with the 5 ERPs. All environmental improvement options identified in this Matrix are seen as significant and result from the detailed screening analysis carried out in this study. Red, Amber and Green are used to indicate the level of difficulty in implementing the recommendations based on the feasibility of the instruments, enforcement and cost implications. For example, for the measures proposed, if standards, testing and compliance structures need to be developed or pose particular challenges this is red. If existing ones can be used, e.g. in WEEE & RoHS with minimal adjustments, this is green.

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 noted their interest to participate in pilots/trials. The development of the 2012-14 ERP Working Plan launched in January 2011 and current revision of MEEuP due for completion at the end of 2011 also provide timely opportunities to incorporate the recommendations and evidence base for them 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.

MATRIX 2.1: RANKED ENVIRONMENTAL IMPROVEMENT RECOMMENDATIONS: 5 ERPs (TVs, PCs/Monitors, Imaging Equipment, Lighting & Commercial Refrigeration)

ENVIRONMENTAL IMPROVEMENT OPTION	RELEVANT ERPS	INSTRUMENT FEASIBILITY	ENFORCEMENT FEASIBILITY	ECONOMIC IMPACTS	
				Manufacturers	Life-cycle
Hazardous Substances restrictions (organohalogens)	TVs, PCs, Monitors, Imaging Equipment	RoHS extension	Enforcement provisions would fall within existing RoHS compliance	Short-term cost to manufacturers in changes to product / process	Reduced EOL costs & Risk (e.g. health) reduction
Reduction target for GHG emissions of fluorinated process gas at LCD production stage	TVs, Laptops, Monitors	New horizontal IM requiring a declaration of fluorinated GHG emissions / abatement rates for display products. Alternatively self-declaration from producers based on a VA.	Enforcement system beyond conformity assessment /market surveillance required as production is outside EU. International certification system to be established. WTO conflicts TBD. If viable compliance testing & enforcement to be developed	Production site monitoring / certification (i.e. for self declaration) could result in costs for manufacturers	Limited costs associated with extension of legislation and enforcement framework
Mercury restriction (all forms) in backlights (CCFL) & shift to LED	TVs, Laptops, Monitors	RoHS extension & technically feasible	Enforcement provisions would fall within existing RoHS compliance	Technology already being placed on market – any costs likely to fall quickly	Reduced EOL costs & Risk (e.g. health) reduction
Design for Disassembly, reuse & recycling	TVs, PCs, Laptops, Monitors	VA using criteria based on/compliance obligation to meet IEEE 1680.3 TVs IEEE 1680.1 PCs	Use of existing VA Independent inspector and compliance / non-compliance statement, based on a product check	Short-term cost to manufacturers in changes to product / process. Potential need for new equipment / training	Significant EOL benefits expected. Will be some cost in extension of legislation and enforcement framework
EOL disassembly to enable easy removal of Mercury backlight (until RoHS Mercury restriction is in place)	TVs	VA	As above	As above	As above
Use of recycled plastics	TVs, PCs, Monitors	VA using criteria based on/compliance obligation to meet IEEE 1680.3 TVs IEEE 1680.1 PCs	Requires proof of recycled content on materials through certified labelling schemes. Barriers are that market surveillance cannot be checked on final product and plastic sources might change over production cycles	As above. Preparatory study for TVs indicates cost ‘trade-offs’ possible	As above, but also requiring certification

ENVIRONMENTAL IMPROVEMENT OPTION	RELEVANT ERPS	INSTRUMENT FEASIBILITY	ENFORCEMENT FEASIBILITY	ECONOMIC IMPACTS	
				Manufacturers	Life-cycle
Use of bio based plastics	TVs, PCs, Monitors, Imaging Equipment	Voluntary self-declaration based on harmonised standard	Presumption of conformity to the standard unless proven otherwise	Short-term costs possible. Long-term costs likely to fall especially if viable bio-plastics market develops	Limited commercial value at EOL
Lifetime extension reduces production stage impacts per “use year”	TVs, PCs, Monitors	Voluntary market use of extended warranties coupled with consumer awareness campaigns	Presumption of conformity to the standard unless proven otherwise	Short-term cost to manufacturers in changes to product / process	‘Per year of usage’ costs should fall. Benefits will depend on other factors (e.g. consumer behaviour)
Waste reduction (obsolete power supplies)	Laptops & Monitors	Mandatory standardisation of external power supplies to be added to ERP VA. Precedent in mobile phone VA	Can be included in market surveillance of ERP.	No significant costs predicted	Potentially significant life cycle benefits – e.g. reduced likelihood of premature disposal
Duplexing as default in B2B	Imaging Equipment	Mandatory requirement in ERP VA (already negotiated)	Can be included in market surveillance	No significant costs predicted	Potentially significant life cycle benefits esp. for reduced paper use
Toner & Ink cartridge remanufacture & reuse	Imaging Equipment	VA. Requires an industry agreed certification scheme for cartridge remft & reuse quality. UK Cartridge Remft Association provides a baseline; Conflict with printer OEM business model will mean resistance.	Use of existing VA Independent inspector and compliance / non-compliance statement, based on a product check	Some costs expected in introducing / meeting / certification of standards	Cost of extension of legislation
Design for Disassembly, reuse & recycling	Imaging Equipment	VA using criteria based on/compliance obligation to meet IEEE 1680.2 & Blue Angel rqts.	As above	Short-term cost to manufacturers in changes to product / process. Costs relatively higher in consumer than B2B sectors	Cost of extension of legislation and enforcement framework

ENVIRONMENTAL IMPROVEMENT OPTION	RELEVANT ERPS	INSTRUMENT FEASIBILITY	ENFORCEMENT FEASIBILITY	ECONOMIC IMPACTS	
				Manufacturers	Life-cycle
Liquid mercury restriction & shift to solid mercury amalgam	Lighting	RoHS extension (amendment to exemption list to only allow for solid mercury amalgam) & technically feasible	Enforcement provisions would fall within existing RoHS compliance	Technology already being placed on market. Any initial costs likely to fall rapidly	Commercially feasible and potentially significant EOL benefits
Non Household Lamps EOL recovery	Lighting	Current WEEE exception to be amended to include recovery targets and sound EOL Mgt requirement.	Requires WEEE enforcement extension	Potential costs associated with take-back scheme / infrastructure	EOL benefits likely, however take-back may result in increased transportation: benefits uncertain
Design for Disassembly, reuse & recycling	Commercial Refrigeration (CR) & Refrigerated Display Cabinets (RDC)	Current WEEE exceptions to be amended to include recovery targets and sound EOL Mgt requirement for fixed installation RDC; Industry std to be agreed for materials, disassembly, remanufacturing criteria based on IMPRESS ⁴ (or add to CR standard ISO 23953 as it has certification/verification already included)	Requires WEEE enforcement extension.	Costs likely in remanufacturing processes and training staff / engineers	EOL benefits possible, however cost associated with extension of legislation and enforcement framework
Material substitution to green refrigerants	Commercial Refrigeration (RDC)	Include voluntary requirement in ERP VA based on UNEP Guidelines for green refrigerants and, when completed, IEA 4E guidance on to optimise energy efficiency in use/refrigerant trade off ⁵ .	Presumption of conformity unless proven otherwise.	Costs associated with product redesign / new material use, as well as training of engineers	Life cycle costs/benefits uncertain. There may be refrigerant and energy use trade-offs.

⁴ IMProving Refrigeration System Sustainability study (IMPRESS, 2010)

⁵ IEA Efficient Electrical End Use Equipment (4E) Mapping & Benchmarking Annex (IEA 4E, 2010)