Summary: Intervention & Options

Department /Agency:	**Title:** **Impact Assessment of EuP Implementing Measures for Standby and Off-Mode Losses**	
Stage:	**Version:** 1.0	**Date**: 30 **June 2006**
Related Publications:		

Available to view or download at:

http://www.

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What is the problem under consideration? Why is government intervention necessary?

The level of carbon emissions and energy usage in the UK and globally remain a concern to the UK as a result of global warming and the threat to the country's energy security. The increasing availability and use of electrical and electronic equipment in recent years and the power consumed in standby and off-modes has further exacerbated the problem. Technical solutions are available to produce quality products which are in demand by consumers and which could use significantly less power during off-mode and standby states. The market itself has not moved sufficiently quickly to sufficiently low levels of power consumption in standby and off-modes and as a result, it is felt necessary to introduce legislation.

What are the policy objectives and the intended effects?

The objective of implementing restrictions on power consumption of electrical and electronic products whilst in off-mode and standby states is to reduce the amount of energy used in the UK and to reduce carbon emissions as a result of the lower requirement for electricity generation. Adoption of the Implementing Measure will contribute to easing pressures on global warming via the reduction in CO_2 emissions and will also save resources for households.

What policy options have been considered? Please justify any preferred option.

The UK, as a Member of the European Union, has implemented Framework Directive 2005/32/EC of 6 July 2005 establishing a framework for the setting of Ecodesign requirements for energy-using products. This draft Implementing Measure issued by the Commission sets out requirements for standby and off mode losses and the UK is required to take a position on the measure at an upcoming Regulatory Committee meeting in July 2008. This impact assessment sets out the potential costs and benefits of implementing the measure with its currently drafted requirements and explores two options:

- Moving to the requirements suggested for implementation in 2010 and in 2013
- Only moving to the requirements suggested for 2010

Option 1 best reflects the proposal as now tabled by the Commission. We are therefore expecting only to be asked to vote yes or no on Option 1. Option 2 was developed following initial discontent among manufacturers about the perceived difficulties of achieving the tighter limits in 2013. It is unlikely that the vote at the Regulatory Committee will include Option 2 but prudent to include the analysis in case of this event.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

The IM will be subject to review not later than 6 years after it enters into force.

Ministerial Sign-off For SELECT STAGE Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

.... Date:

Summary: Analysis & Evidence

Policy Option: 1	Description: Restrictions on limits for standy and off-mode power consumption in 2010 and more stringent limits in 2013

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'	
One-off (Transition)	**Yrs**	Cost borne between manufacturers and consumers of making products compliant will be approximately £ 53.5 million per year	
£ N/A	11		
Average Annual Cost (excluding one-off)			
£ 53.5m		**Total Cost** (PV)	**£ 450m**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'	
One-off	**Yrs**	Energy cost savings to consumers: £1.56bn - £1.96bn Savings from lower carbon emissions: £290m - £362m Savings from air quality damages avoided: £60m - £75m	
£ N/A	11		
Average Annual Benefit (excluding one-off)			
£ 230m – 289m		**Total Benefit** (PV)	**£ 1.9bn – 2.4bn**

Other **key non-monetised benefits** by 'main affected groups'

Increased security of energy supply

Key Assumptions/Sensitivities/Risks

The range of total benefits has been based on differing assumptions for (i) the number of products covered and (ii) the extent to which any perverse incentives to stop producing a standby function materialise.

Price Base Year 2008	Time Period Years 11	**Net Benefit Range** (NPV) **£ 1.45bn - £1.95bn**	**NET BENEFIT** (NPV Best estimate) **£ 1.45bn (conservative**

What is the geographic coverage of the policy/option?	UK(but same in EU)
On what date will the policy be implemented?	1 year after publication in Official Journal - c2010
Which organisation(s) will enforce the policy?	Under review but currently UK Trading Standards
What is the total annual cost of enforcement for these organisations?	£ unknown but of the order of £250k pa
Does enforcement comply with Hampton principles?	Yes
Will implementation go beyond minimum EU requirements?	No
What is the value of the proposed offsetting measure per year?	£ N/A
What is the value of changes in greenhouse gas emissions?	£ 290m - 362m
Will the proposal have a significant impact on competition?	No

Annual cost (£-£) per organisation (excluding one-off)	Micro **Unknown**	Small **Unknown**	Medium **Unknown**	Large **Unknown**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)					(Increase - Decrease)
Increase of	£ Unknown	Decrease of	£ Unknown	**Net Impact**	**£** Unknown

Key: **Annual costs and benefits: Constant Prices** **(Net) Present Value**

Summary: Analysis & Evidence

Policy Option: 2	**Description: Restrictions on limits for standy and off-mode power consumption in 2010 only and no more stringent limits in 2013**

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	Cost borne between manufacturers and consumers of making products compliant will be approximately £ 46 million per year
£ N/A	11	
Average Annual Cost (excluding one-off)		
£ 46.0m		**Total Cost** (PV) **£ 380m**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'
One-off	**Yrs**	Energy cost savings to consumers: £1.3bn - £1.7bn Savings from lower carbon emissions: £242m - £304m Savings from air quality damages avoided: £50m - £64m
£ N/A	11	
Average Annual Benefit (excluding one-off)		
£ 194m - 245m		**Total Benefit** (PV) **£ 1.6bn – 2.0bn**

Other **key non-monetised benefits** by 'main affected groups'

Increased security of energy supply

Key Assumptions/Sensitivities/Risks

The range of total benefits has been based on differing the assumptions for (i) the number of products covered and (ii) the extent to which any perverse incentives to stop producing a standby function materialise.

Price Base Year 2008	Time Period Years 11	**Net Benefit Range** (NPV) **£ 1.15bn - £1.55bn**	**NET BENEFIT** (NPV Best estimate) **£ 1.15bn (conservative**

What is the geographic coverage of the policy/option?			UK(but same in EU)	
On what date will the policy be implemented?			1 year after publication in Official Journal – c 2010	
Which organisation(s) will enforce the policy?			Under review but currently UK Trading Standards	
What is the total annual cost of enforcement for these organisations?			Unknown but c £250k	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			No	
What is the value of the proposed offsetting measure per year?			£ N/A	
What is the value of changes in greenhouse gas emissions?			£ 242m - £304m	
Will the proposal have a significant impact on competition?			No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **Unknown**	Small **Unknown**	Medium **Unknown**	Large Unknown

Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of	£ Unknown	Decrease of	£ Unknown	**Net Impact**	**£** Unknown

Key: **Annual costs and benefits:** **(Net) Present**

Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

1. Introduction/Purpose

The Framework Directive for the Eco-design of Energy Using Products (EuP) was adopted in July 2005 and implemented in the UK and other Member States (MS) in August 2007. EuP establishes a framework by which the Commission and MS can bring forward measures to establish minimum standards relating to the environmental impacts of products (e.g. their energy consumption). The legal basis is Article 95 – Single Market.

The ability to establish minimum standards in this way is a key plank of our approach to reducing the carbon impacts of products in the UK. As a member of the EU, the UK is bound to implement the Framework Directive and any implementing measures made under it. Therefore, it can be argued that the UK has effectively ceded its legislative competence in this policy area and so cannot take unilateral measures to take regulatory/legislative action in this area.

This particular measure relates to the energy used by a wide range of products while they remain switched on but not in use – i.e. stand-by. This Impact Assessment will enable the UK to assess the costs and benefits to the UK of the measure as proposed by the European Commission and help inform our negotiating and voting position during the forthcoming Regulatory Committee meeting and at any subsequent meetings.

The UK has fully participated in all EU discussions on this measure to date, using evidence developed by the UK Market Transformation Programme (MTP) to inform our discussions and to influence the development of the proposal.

The Commission proposal has now been formally tabled for a vote of the relevant EU regulatory committee on 7 July where the UK will need to be in a position to either support or oppose the measure.

Option 1 best reflects the proposal as now tabled by the Commission. However, Option 2 was developed following initial discontent among manufacturers about the perceived difficulties of achieving tier 2 of the proposal (i.e. reducing from 1 Watt to 0.5 Watts after 4 years) in order to enable us to properly assess the *additional* value added of not adding tier 2 requirements. We are therefore expecting only to be asked to vote on Option 1.

Voting at the Committee is under the Qualified Majority Voting Procedure. If approved the measure will go to the European Parliament for Scrutiny; if it is not then it will be passed to the Council to resolve. If approved this measure will be subject to review no later than 6 years after entry into force (possibly early c2010).

2. Rationale for Intervention

Market failures occur, for instance, where negative externalities (carbon emissions, rapid energy supply depletion) affecting the wider general public are not compensated for in market transactions in terms of the price paid for electrical goods. As a result, the level of pollution via carbon emissions is higher than might be the case if the cost of pollution were fully incorporated into product prices. To respond to this, policy tools exist to correct for negative externalities. Across the EU, the EU Emissions Trading Scheme internalises the carbon externality back into market transactions and its coverage includes large electricity producers. In total it captures approximately 50% of all EU CO_2 emissions.

However, policy tools such as the EU Emissions Trading Scheme do not correct for all market failures, e.g. where barriers to behaviour change still persist (due to another form of market failure – lack of, or inequality in information). For instance, consumers are not always aware of the availability of the most efficient products (and of the difference in costs of running them versus other less efficient equipment).

Even where consumers do have access to all information required to make informed decisions on the purchase of energy efficient products, the fact that there are such a wide range of factors to consider (price, colour, maintenance facility, easy access, brand name etc.) can often mean that energy efficiency is not considered as a major determining factor in the decision to buy one product over another.

As a result of either of these factors, consumers may not take-up seemingly beneficial options where any additional upfront cost is traded off against relatively larger energy savings benefits over time. Cost-effectiveness analysis confirms this in showing that significant volumes of cost-effective potential still remains. This leads to insufficient signals coming from consumers and incentives for manufacturers to push the market into the production and usage of electrical and electronic equipment which operate at appropriate levels of energy efficiency.

This analysis is consistent with the "third leg" of the Stern Report (the need to develop policies to remove barriers to behaviour change such as a lack of reliable information, transaction costs, and organisational and individual inertia) and provides the rationale for the Implementing Measure which complements the EU ETS as described above.

3. Content of the proposed Implementing Measure and options

The proposed Implementing Measure for standby and off-mode losses sets out a number of eco-design requirements that set limits on the power consumption of electrical and electronic equipment in these modes. The requirements can be summarised as:

To be implemented by 2010:

- Power consumption in any off-mode condition shall not exceed 1.0W,
- Power consumption of equipment in any condition providing only a reactivation function or providing only a reactivation function and a mere indication of enabled reactivation function, shall not exceed 1.0W,
- The power consumption of equipment in any condition providing only information or status display, or providing only a combination of reactivation function and information or status display, shall not exceed 2.0W.

For 2013, the following corresponding limits shall be in force:

- 0.5W for off-mode,
- 0.5W for standby with only reactivation or reactivation and indication of reactivation,
- 1.0W for providing information or status display or providing a combination of reactivation and information or status display.

The implementing measure also requires that, unless inappropriate for the intended use, equipment will be required to offer a power management function (or similar) that switches equipment after the shortest possible time automatically into standby or off-mode when the equipment is not providing its main function or when other equipment is not dependent on its functions.

It further requires manufacturers to supply information on the product's performance in these areas in technical documentation that accompanies the product.

Two Options for the implementation of the requirements of the Implementing Measures will be considered in this Impact Assessment – applying the restrictions on power consumption for standby and off-mode losses as they are proposed, with a limit being introduced in 2010 and further more stringent limit being imposed in 2013 as the first option, and alternatively, implementing the restrictions for 2010 alone as a second option. This will enable an assessment to be made of the potential additional costs/benefits that might accrue from the extra reductions in power consumption that the second option requires.

The Impact Assessment concludes that although both options are clearly net beneficial, option 1 has higher net benefits than option 2 due to the *additional* value added of the tighter limits in 2013.

4. Identification of Potential Impacts

The Implementing Measure, in setting the requirements identified in section 3 above, seeks to improve the environmental performance of electronic and electrical products in standby and off-modes.

Environmental performance of products must be considered throughout their life cycle, at the component/product manufacturing, usage and end-of-life phases. Changes will need to be made to products that are currently not in compliance with the proposed measure and consequently it is necessary to consider the impacts of those changes on all relevant stakeholders at each stage of the products' life cycles. Table 4.1 below sets out the relevant environmental, economic and social impacts at each of the like-cycle phases that will be examined (including their costs and benefits) in subsequent sections.

Table 4.1: Areas of Potential Impacts

Life cycle stage	**Impact Category**		
	Environmental	**Economic**	**Social**
Component/Product Manufacture	Material and energy use requirements during manufacturing process	Costs of production for manufacturers and subsequent consumer prices. Availability of technology and need for R&D. Other compliance issues e.g. labelling, supply chain management, competitive position. Market surveillance and compliance systems and processes.	Possibility of firms leaving the market and any effects on employment
Usage	Changes in electricity consumption across UK due to less power consumed in standby and off-mode. Changes in CO_2 emissions across UK due to less power consumed in standby and off-mode. Changes in air quality as result of less electricity being generated.	Changes in energy costs for consumers resulting from any changes in electricity consumption.	Changes in functionality of products as result of compliance with requirements or due to decisions of manufacturers when faced with decisions on product adaptation.
End of life	Ease of recycling and any requirements to	Changes in recycling and waste	

Table 4.1: Areas of Potential Impacts			
Life cycle stage	Impact Category		
	Environmental	Economic	Social
	deal with different materials used in order to ensure compliance.	management costs.	

4.1 Component/Product Manufacture

Currently, a number of products in each of the product categories covered by the Implementing Measure are already compliant with the requirements set for availability, power consumption and power management for off- and standby modes in products. For such products, no action will be required. For those products which are not currently compliant, a range of technical solutions exist in order to bring them into compliance. Examples of possible solutions (provided by the Electronics Transfer Network, ETN) are set out in table A6 in the Annex. The Electronics Transfer Network then proceeds to identify products for which these solutions might be applicable and these are identified in Table A7 in the Annex).

What is clear is that there are a number of potential solutions to making products compliant with the proposed requirements of the Implementing Measure that are readily available for each product type.

4.1.1 Component/Product Manufacture – Environmental

Expert opinion from the Market Transformation Programme (the body established to support the development and implementation of UK Government policy on sustainable products) suggests that most product designs not currently in compliance with the proposed standby requirements will simply need to add an auxiliary power supply/microprocessor or “ PIC” and that the material requirements of this added device are likely to be insignificant. Environmental costs and benefits from moving to compliance with the proposed standards in terms of materials involved and energy usage in the manufacturing phase are therefore likely to be negligible in this case.

4.1.2 Component/Product Manufacture – Economic

4.1.2.1 Making Products Compliant

The various solutions indicated in Table A.6 in the Annex below will require some manufacturers to make different technical and physical adjustments to their products in order to bring them into compliance with the proposed requirements; as a result, they will incur some additional costs in making such adjustments. Limited information on these costs is currently available, as is information on the number of products that are currently not meeting the proposed requirements. The European Commission preparatory study on standby and off-mode losses (EuP Preparatory Study Lot 6 – “Standby and Off-mode Losses”, Final Report, Compiled by Fraunhofer IZM) made a number of assumptions as to the likely magnitude of these costs, taking into account the wide range of products covered by standby and off-mode requirements.

Examples of the estimates resulting from this work are set out in Table 4.2 below.

Table 4.2: Estimates of costs to make products compliant

Solution	Assumed Cost
Hard-off switch	€1 (range from €0 to a few Euros depending on whether replacing a soft-switch or catering for a larger construction for the hard off switch)
Power supplies with minimised off-mode losses	€0.2 (as an average of the different variants which can be neutral in many cases and neglecting redesign efforts due to very high production volumes)
Standby-efficient PSU	€0.2 (power supply changes are considered equal in complexity to those required for off-mode losses)
Complex buffering (using electronic "primary side" switches)	€10 (unlikely to be applied to low-cost products unless a mass produced customisation significantly lowers the price)
Auto-transitions (faster to lower power modes, to lower power modes, short transition times as default, limiting possibilities for user to deactivate defaults)	€2 (if different hardware is needed or €0 if only setup changes are made)

The Lot 6 study also identified some broad cost figures emanating from an industry-sponsored study in Germany which estimated costs for LCD TVs, TFT monitors and electric shavers as part of an impact assessment for the EuP (Biebler, Hendrik, Mahammadzadeh, Mahammad: Gesetzesfolgenabschätzung und Integrierte Produktpolitik; Forschungsberichte aus dem Institut der deutschen Wirtschaft Köln, Heft Nr 17, Köln, 2006). The study identified one-time redesign costs of between €4,000 and €100,000 and additional per-product costs of between €0.2 and €5.

The Market Transformation Programme has estimated costs associated with making the required adjustments (with the limited information available) for this impact assessment. These are reproduced below:

- Cost of a PIC device: €0.47 (resulting in an increased price paid by the consumer of €0.96)
- Installation of additional memory for display data to indicate transitional phase which will increase as a result of reduced power in standby mode: €3 (resulting in an increased price to the consumer of €6).

However, MTP notes that due to increasing economies of scale as the majority of product designs move to such approaches for 2010, these additional costs are likely to decrease over time from those currently predicted.

In conclusion, the wide range of products that will be subject to the requirements set out in the draft Implementing Measure coupled with the lack of information available on the precise costs of implementing a range of solutions makes it difficult at this time to assess the overall costs to industry and consumers of implementing the measure. This is further exacerbated by the similarly lacking information on the number of different manufacturers' products currently on the market which are or are not already compliant with the requirements set out in the Implementing Measure.

Consequently, a simple approach is used here to set out some basic scenarios for potential costs to manufacturers for making the required adjustments to their products in order to make them compliant.

Projected sales figures for 50 products over the period 2010 to 2020 have been provided by MTP, along with predicted information on the percentage which are likely to have standby functions in those years. Expert opinion from the MTP has also been used to estimate the percentage of products that do have standby/off-mode functions and that are already compliant with the proposed restrictions on power consumption in standby and off-modes to provide an estimate of the volume of products placed on the market in each year from 2010 to 2020 which will need to be adapted. MTP have also provided an estimate of the costs that manufacturers will likely incur in order to make their products compliant. These are based on the figures above and on estimates to make products compliant which merely need to improve energy efficiency from the selection of more efficient but readily available components. The base costs used are as follows:

Table 4.3: Per product costs for making products compliant	
Action	**Per product cost/£**
Utilisation of more efficient, readily available components to produce more efficient power supplies	0.20
Adding an auxiliary power supply / microprocessor or "PIC"	0.37
Adding additional memory to the product	2.38

A number of assumptions have been made in order to generate projected costs to manufacturers, given the limited data available on costs and number of products which will require adaptation in order to meet with the Implementing Measure's requirements, and these are as follows:

- Projected sales figures for products are those utilised in the MTP models for predicting future savings in carbon emissions and energy consumption. These have been revised downwards for products in the domestic wet and domestic cooking product categories where data on the % of products having and likely to have standby functions is available. All other products are assumed to have standby capabilities
- The base costs used (from Table 4.3) are an average of costs to be incurred by manufacturers in order to make them compliant with the Implementing Measure's requirements at both 2010 and 2013 for Option 1 and for 2010 only for Option 2
- Any negative impacts that occur (and that have been modelled for predicting savings in carbon emissions and energy consumption) as a result of manufacturers' opting to remove or not to include standby functions are assumed not to have any costs to manufacturers
- Applying the identified solution in Table 4.3 involves the same cost irrespective of the product being considered
- Product costs are assumed to cover any necessary R&D costs required to implement the identified solutions in order to make products compliant. Given the economies of scale that exist within the electrical products market and the fact that the solutions identified are readily available from a number of sources, the amount of R&D expenditure necessary will likely be relatively small and spread over a large number of products.

Figures relating to the % of products assumed to require adaptation and the nature of the adaptation required for each product modelled are attached in Annex (Table A5). The figures have been applied to the MTP projected sales data to produce the following results for costs to manufacturers.

Table 4.4: Costs to Manufacturers /£, discounted at 3.5%, 2008 prices		
Year	**Option 1**	**Option 2**
2010	52,208,469	45,995,852
2011	43,966,601	37,848,522
2012	41,562,813	35,574,864
2013	39,829,910	33,973,930
2014	39,278,045	33,521,011

2015	39,058,101	33,384,317
2016	38,511,849	32,927,950
2017	38,863,189	33,385,670
2018	38,381,437	33,020,182
2019	37,487,622	32,235,639
2020	36,460,831	31,305,175
Total	**445,608,866**	**383,173,112**

It should be noted that uncertainties in the data for the number of products requiring adaptation along with similar uncertainties over the exact costs that will be incurred by different manufacturers of different products, meaning that actual costs may vary significantly. However, as later sections focussing on benefits demonstrate, the benefits of this policy measure are likely to far outweigh the costs involved and as a result, no sensitivity analysis is performed here.

4.1.2.2 Information Requirements

In addition to the costs associated with actually making products compliant, the Implementing Measure requires manufacturers to “declare in the technical documentation file a test report” and provides a format for this report:

- Off mode: 0W – 0.3W with hard-off switch on the primary side (depending inter alia, on the characteristics related to electromagnetic compatibility pursuant to Directive 2004/108/EC;
- Standby – reactivation function: 0.1W; and
- Standby display: simple displays and lower power LEDs 0.1W (larger displays (e.g. for clocks) require more power).

This requirement will necessitate that manufacturers make minor changes to their product documentation with associated costs. Whilst no specific information is available on the costs for producing documentation for these particular products, Table 4.5 provides figures for changing labelling information for products in other sectors (based on data for the cleaning products and toy sectors).

Table 4.5: Summary of Potential Manufacturer Costs Due to Changes in Labelling

Product Change / Regulatory Requirement	Cost per Product (£)	Cost per Unit (£)	Source
Change to the artwork/ design of label (one-off cost)	£120-1,500 per new label	Not available	AISE (2007): Assessing the Business Impacts of the EU GHS Regulation Proposal on the Detergents and Cleaning Products Sector, by RPA for the International Association for Soaps, Detergents and Maintenance Products (AISE), Oct 2007
Change of label on a product	£37 per 1,000 units	£0.04 per unit	

Altering one plastic mould (one-off cost due to timing of regulation)	£400-£750 per mould	Not available	EC (2004): Impact assessment of proposed modifications to the Toy Safety Directive, by RPA for the European Commission DG Enterprise
Production of new plastic mould (one-off cost due to timing of regulation)	£3,500-£120,000 per mould	Not available	

Whilst the figures for labelling indicated above are not directly comparable with those for changes to documentation, they are indicative of the scale of costs that might be associated with documentation changes required under the Implementing Measure. The proposed changes are very minor and associated costs will likely be lower or be at the lower end of the scales above. Given the volumes and economies of scale associated with the products in the electronic and electrical equipment sector, the costs on a per product basis will be negligible.

4.1.2.3 Supply Chain Management and Competitive Position

Despite differences in the function, value, specification, and brand of each electrical product encompassed by the proposed Implementing Measure, the production process, manufacturing characteristics and market structure of each product group can be described as relatively similar. In a globalised economy, this means that components are supplied and products assembled in any part of the world to benefit from scale economies in costs as well as offering the manufacturer the flexibility to pick and choose from the world's best or cheapest producers in terms of quality, price, or ethical/environmental concerns.

Supply chains for electrical and electronic equipment are characterised by the inclusion of various tiers of equipment suppliers, producing components and products under contract to, independently of, or owned by a particular final product manufacturer. In some cases, manufacturers have little involvement in the design, innovation or marketing of a product (Original Equipment Manufacturers or OEMs). In other cases, a manufacturer may design its own product, set its own specifications to suppliers, and market its own array of brands (Original Design Manufacturers or ODMs). Other manufacturers (Electronic Manufacturing Services or EMS) produce devices, components, or complete products under contract to OEM or ODM manufacturers. Consequently, individual manufacture supply chains can vary in terms of the amount of production undertaken in-house or outsourced at each stage, as well as in the complexity and extent of the supply chain in terms of the number of tiers and suppliers involved. Impacts on the ability and costs of manufacturer to produce a specific product can therefore be passed upstream to suppliers or downstream to retailers and end consumers.

Greater context for the UK electronic products industry is provided in Table 4.6 below which, although providing information on a greater number of products than modelled in assessing the potential costs to industry, provides an overview of the size of the sector in the UK.

Table 4.6: Key Indicators of UK Electrical Product Manufacturing 2005

Product Category	Production Value (£bn)	Import Value (£bn)	Export Value (£bn)	Apparent Consumption (£bn)
Domestic Wet	0.15	0.56	0.15	0.56
Domestic Cooking	0.16	0.40	0.14	0.42
Other Domestic Appliance	0.20	0.77	0.14	0.83

Table 4.6: Key Indicators of UK Electrical Product Manufacturing 2005				
Product Category	**Production Value (£bn)**	**Import Value (£bn)**	**Export Value (£bn)**	**Apparent Consumption (£bn)**
ICT Equipment (Home and Office)	2.17	13.13	7.81	7.49
Electrical Toys, Musical Instruments & Clocks	.002	0.15	0.04	0.11
Radio, Audio Listening and Recording Equipment	.001	0.12	0.03	0.09
Televisions, Monitors and Displays	0.32	1.50	0.56	1.26
Video Recording Equipment	0.70	2.10	0.78	2.02
Telephone and Communication Equipment	0.21	1.82	0.61	1.42
Total	***£3.9 Billion***	***£20.6 Billion***	***£10.3 Billion***	***£14.2 Billion***
Based on £1 = €1.3. Source: Eurostat (2005): PRODCOM database, available at http://ec.europa.eu/eurostat				

Table 4.6 indicates that the UK is involved in the manufacture of all categories of electrical products identified in the draft regulation. The largest manufacturing segments of the market in terms of value includes ICT equipment (over £2 billion), video recording equipment (nearly £1 billion), and televisions, monitors and displays (£0.3 billion) produced in the UK. These segments include the manufacture of LCD, TFT, and plasma screens, in addition to DVD recorders and various computer related equipment with high technology characteristics and often of high value. The data indicates that the UK is significantly involved in segments where highly skilled labour and leading edge innovation are important. In other sectors where labour costs are more important due to competitive pressures on costs and prices, some manufacturers have chosen to locate their European regional hubs outside the UK. Therefore, the UK remains a significant importer of many products such as domestic appliances, electrical toys and clocks, as highlighted in Table 4.6.

The supply chain described above and the market structure leads to a number of characteristics of the electronics manufacturing industry, namely:

- Competitors – Companies often purchase components and even complete products from one another. Several products placed on the market can therefore be produced by the same manufacturer, or contain some common components (e.g. Intel computer chips are found in the majority of the world’s personal computers, regardless of manufacturer).
- Joint Ventures – The huge costs and risks of investing in a large production facility for the next generation of products in a highly competitive market, often draws manufacturers together in order to share risk and cost burdens. Joint ventures allow the creation of larger production facilities and thus all parties to benefit from greater economies of scale. Examples include Samsung/Sony and Philips/LG joint owned production plants for LCD displays for computer monitors and televisions.
- Regional Focus – large and expensive production facilities, plus competitive pressures on price, can result in production taking place in only a few global locations per manufacturer.

For items which can be transported at low cost due to size and weight, such as video cameras, small kitchen appliances and shavers, a significant proportion of the supply chain can therefore be located in a low labour cost country and a handful of manufacturing plants to supply the world. The UK, therefore, imports many such goods, rather than produce them domestically. In cases where the product is heavy and costly to transport, or significant regional differences in product design exist, the final assembly and manufacturer of the product (e.g. large white goods and cookers) can often take place in a regional hub. Consequently, a manufacturer located in the EU is likely to supply the complete European market from a single location. However, this does not stop many components being traded and produced globally.

In the case of standby and off-mode losses, the potential solutions for ensuring compliance with the Implementing Measure's requirements identified in section 4.1 are likely to involve a range of the supply chain situations set out above. Expert opinion from the Market Transformation programme suggests that there is widespread availability of suppliers of the hardware and software required to make components compliant and in a competitive market, suggesting that there is unlikely to be a shortage of required parts and that individual suppliers will not be able to impose significantly increased prices due to higher demand. There are therefore unlikely to be any major competition issues associated with adoption of the Implementing Measure.

The range of supply chain solutions and the number of companies able to provide the required solutions also suggest that it will be relatively straightforward for manufacturers to adapt their supply chains to the requirements of the Implementing Measures at minimal cost.

With respect to UK manufacturers' competitive position in relation to manufacturers in other EU Member States, the proposed Implementing Measure and its associated requirements would be implemented across the EU; manufacturers in all EU Member States would be required to make their products compliant to the same standards. This would mean that all products previously non-compliant and being sold on the UK market (whether manufactured in the EU or externally) would be required to undergo the same adaptation process and incur the same costs in order to do so. Therefore, UK manufacturers would not be in a less competitive position than their EU and worldwide competitors when it comes to the UK and EU markets.

There might be a possible negative impact for UK manufacturers placing products in overseas markets which are not subject to the same requirements for standby power consumption and off-mode losses if cheaper "non-compliant" products are being made available by competitors. However, there are other global, national and regional initiatives to reduce standby and off-mode losses which are comparable with the requirements of the Implementing Measure. Examples include:

- The IEA 1W initiative that seeks to reduce power consumption in standby to 1W by 2010, adopted by the G8 Summit in 2006;
- Australia's Standby Power Strategy 2002 – 2012, which has a voluntary 1W target for standby for 2007, becoming mandatory in 2012;
- US Executive Order 13221, which requires every Federal Agency to only purchase IT devices that consume less than 1W on standby; and
- Korea's policy "Standby Korea 2010", which has a voluntary 1W policy for 2005-7, preparation for a mandatory 1W policy for 2008-9 and implementation of the mandatory 1W from 2010.

These initiatives and others indicate a global convergence in policy and requirements for standby and off-mode losses which should lead to a level playing field across the word for UK manufacturers, removing any competitive advantage that might be either perceived or real.

4.1.2.4 Costs to Consumers

In terms of the prices paid for electronic products, Table 4.7 below shows the price index from 2000-2006 for electric domestic appliances in the UK. From the year 2000 (index = 100), the table shows that prices have generally increased at a rate well below inflation, due to economies of scale, outsourcing of supplies and production moving to low cost regions such as Eastern Europe and Asia, particularly China (BERR (2006): Electronics 2015 – Making a Visible difference, publication for BERR, available at: http://www.berr.gsi.gov.uk/).

Table 4.7: UK Price Index for Electric Domestic Appliances (2002-2006)					
Year	**2002**	**2003**	**2004**	**2005**	**2006**
Index (2000=100)	99.9	100.1	99.8	101.8	103.5
Source: EC (2007): Electronics Industry Statistics – NACE Rev.1 29.71, last updated 17/10/2007					

There are no indications that this situation is likely to change as a result of increased costs to manufacturers associated with the requirements of the Implementing Measure, given the competitive nature of the electrical product sector. Manufacturers would ideally pass on increased costs to consumers and the extent to which this is possible will depend on the competitiveness within the product sectors. The rate of increase in prices in the electrical domestic appliance sector has been consistently below the rate of inflation, suggesting that the increase in price to consumers might not be as great as suggested by the MTP figures (confirming MTP's view that with economies of scale as the majority of product designs move to compliance approaches for 2010, that additional costs to may be lower than currently predicted). It is likely that the increase in costs identified above will be borne by both consumers and manufacturers to a degree, but with the information available, it is not possible to accurately apportion the amounts.

The issue of the split of costs between consumers and manufacturers is also complicated by the fact that the Implementing Measure for standby and off mode losses will sit alongside other vertical implementing measures, potentially requiring other adjustments to products and other costs. In this sense, as products will be redesigned for a number of different compliance reasons, the compliance costs relating to this horizontal measure are likely to be spread across a number of measures, thereby reducing any additional burden from this particular measure.

If the overall amount of costs are passed on to consumers, the costs per product are likely to be low (a few pounds or less). Over the lifetime of the product they are likely to be outweighed by the savings due to reduced electricity bills. Consequently, consumers will benefit, (although the savings from each product will be small and therefore not noticeable to the consumer). The small increase in capital costs due to the measure (actual and as a percentage of appliance capital cost) mean that the measure is unlikely to present a cash flow issue to the fuel poor.

4.1.2.5 Market Surveillance and Compliance Systems and Processes

The draft Implementing Measure for standby and off-mode losses sets out a number of requirements for compliance verification procedures.

However, the Implementing Measure for standby and off-mode losses will be one of a number of implementing measures which will ultimately apply to energy using products under Directive 2005/32/EC. Since other implementing measures are yet to be developed, it is not yet known what the verification procedures will be for different product groups and since standby and off-mode losses constitute a horizontal measure applicable across a wide range of product groups and products, it is important that verification procedures are streamlined and consistent with each other.

As yet, the UK has not decided upon the precise nature of the verification process to be adopted for standby and off-mode losses and consequently the costs of this impact have not been calculated for this measure.

4.1.3 Component/Product Manufacture – Social

Table 4.1 identifies potential impact areas from the Implementing Measure and raises the question as to whether or not manufacturers in the UK will opt to leave the market rather than incur the extra costs associated with making their products compliant, or whether they will be forced to leave the market as a result of competition from other manufacturers, with the possibility that there is a negative effect on employment.

Table 4.8 below provides an indication of the number of enterprises involved in the various electronics sub-sectors in the UK and the number of people employed in each sector.

Table 4.8: Number of Enterprises and Total Employment in UK Electronics Manufacturing 2006

SIC Code	Description	Number of Enterprises	Total Employment
30.01	Manufacture of office machinery and computers	133	9,000
30.02	Manufacture of computers and other information processing equipment	1,473	16,000
32.3	Manufacture of television and radio receiver, sound or video recording or reproduction apparatus and associated goods	1,075	16,000
33.5	Manufacture of watches and clocks	100	1,000
29.71	Manufacture of electric domestic appliances	383	17,000
Total		**3,164**	**59,000**

Source: ONS (2007): Annual Business Inquiry 2007, available at: http://www.statistics.gov.uk/abi

The previous sub-section indicates that UK companies will not likely be negatively affected in their competitive position vis-à-vis other EU and international competitors, and given the relatively straightforward solutions available for making products compliant and their limited costs, it is unlikely that manufacturers would simply elect to leave the market. There is consequently unlikely to be any significant effect on employment levels as a result of adopting the Implementing Measure.

4.2 Product Usage

As with impacts associated with the component/product manufacturing phase, Table 4.1 sets out the potential areas of impacts for the Implementing Measure under the three categories of impacts: environmental, economic and social. The likely costs and benefits under each of these three categories are set out in the following sub-sections.

4.2.1 Product Usage – Environmental

Three areas of environmental impact associated with reduced power consumption in standby and off-mode losses have been identified as environmental benefits resulting from the implementation of the proposed Implementing Measure. These are:

- Reductions in electricity consumption across UK due to less power being consumed;
- Reductions in CO2 emissions across UK due to less power being consumed;
- Improvements in air quality as a result of less electricity being generated at power stations due to less power being required.

At the product usage stage, the only potentially significant environmental cost identified that might arise from requiring improved power management and reduced power consumption in standby and off-mode is from the removal (or reduced or non-incorporation) of these functions from electrical products. The draft Implementing Measure itself attempts to avoid such actions by stipulating that "Equipment shall, unless inappropriate for the intended use, provide off mode and/or standby mode" in Annex II of the measure, Ecodesign Requirements.

These costs have been accounted for in the scenarios presented below for the benefits of the measure by making assumptions for certain products involving negative impacts and using these to produce overall net benefits under the different scenarios.

In order to calculate benefits for each of the three impact types, 50 products have been modelled by the Market Transformation Programme with respect to likely reductions in electricity consumption and CO2 emissions and resulting improvements in air quality subsequent to lower levels of electricity generation. The products modelled are shown in Table 4.9 below and the results are presented in the following paragraphs.

Table 4.9: Products Modelled

Category	Product
Domestic Wet	Washing machines, Washer Dryers, Tumble Dryers, Dishwashers
Domestic Cooking	Electric Hob. Microwave Oven, Electric Oven
Domestic ICT	Monitors (CRT, LCD, Plasma), Printers (Inkjet, LaserJet, MFD Inkjet, MFD Laser, Photo), desktop PC, laptop PC
Non-Domestic ICT	Monitors (CRT, LCD, Plasma), Printers (Inkjet, LaserJet, MFD Inkjet, MFD Laser, Photo), desktop PC, laptop PC
Consumer Electronics	Analogue DVD Recorders, DVD Players, Mobile PSUs, Other PSUs, TVs (CRT, and LCD, (primary and secondary), plasma, projection, FED and OLED)), terrestrial digital adaptors (set top box)
Other	Clock Radio, Compact Hi-Fi, Small kitchen appliance, Video Games, DTR, Coffee Makers, Handheld Vacuums, Domestic amplifier

The Implementing Measure sets limits for power consumption in standby and off-mode as follows.

<u>To be implemented by 2010:</u>

- Power consumption in any off-mode condition shall not exceed 1.0W,

- Power consumption of equipment in any condition providing only a reactivation function or providing only a reactivation function and a mere indication of enabled reactivation function, shall not exceed 1.0W,
- The power consumption of equipment in any condition providing only information or status display, or providing only a combination of reactivation function and information or status display, shall not exceed 2.0W.

For 2013, the following corresponding limits shall be in force:

- 0.5W for off-mode,
- 0.5W for standby with only reactivation or reactivation and indication of reactivation,
- 1.0W for providing information or status display or providing a combination of reactivation and information or status display.

The implementing measure also requires that, unless inappropriate for the intended use, equipment will be required to offer a power management function (or similar) that switches equipment after the shortest possible time automatically into standby or off-mode when the equipment is not providing its main function or when other equipment is not dependent on its functions.

The calculations of the benefits of the products modelled in terms of reduced electricity consumption, reduced CO2 emissions and air quality improvements already account for the baseline situation and have taken the following into account:

- the increase in household numbers
- the decrease in household size
- the increased number of consumer electronic products in each household and the number of hours they are on

The models also take into account the lifetime of each product (with a random distribution around the average) and calculate the number needed to replace those disposed of, plus or minus any increases or decreases in sales needed to meet the overall expected stock numbers.

The modelling accounts for the ‘business as usual’ references scenario and takes into account improvements in product performance that are due to normal processes (such as improved technology, the need for cost savings and competition) and to adopted policy relating to electrical and electronic equipment. The impacts are therefore assessed as being in addition to what the market and existing policies are expected to deliver. The majority (estimated at >98%) of these savings arise from this policy alone – there are only very minimal possible overlaps with other policies – CERT being the only policy that could contribute very slightly to these impacts. Consequently, the benefits stated are considered to be net of the baseline.

The modelling assumes a constant value for CO2 emissions from electricity. Similarly the air quality assumptions assume a constant generation mix between different sources (in accordance with IPPC standards). Emission factors (taken from the NAEI) and damage costs (from IGCB central values) have been provided by DEFRA to carry out the air quality related calculations.

In order to accommodate uncertainties in the scope of the Implementing Measure (this issue has been raised by a number of stakeholders including the Market Transformation Programme), scenarios have been developed which cover wider and narrower scopes. Further scenarios have been developed which cater for the possibility that negative impacts might arise due to the fact that manufacturers might reduce or not incorporate standby functionality as a way to avoid having to comply with the measure, resulting in increased energy consumption and CO2 emissions instead of reductions for certain products. The products modelled in this way are domestic and non-domestic laptops and desktop PCs.

Two sets of these scenarios have been applied to two different options for introducing the Implementing Measure, the first imposing the limits for both 2010 and 2013 set out above and the second only considering implementing the limits for 2010.

The options and scenarios are described in Table 4.10.

Table 4.10: Options and Scenario Definitions	
Option	**Scenario Description**
Option 1 – Implementing requirements for both 2010 and 2013	Scenario 1: All possible products are included within scope.
	Scenario 2: A more limited set of products are included within the scope.
	Scenario 3: All possible products are included within the scope and potential negative impacts on energy consumption from avoiding compliance through non or reduced incorporation of standby functionality are accounted for.
	Scenario 4: A more limited set of products are included within the scope and potential negative impacts on energy consumption from avoiding compliance through non or reduced incorporation of standby functionality are accounted for.
Option 2 – Implementing requirements for 2010 only	Scenario 5: All possible products are included within scope.
	Scenario 6: A more limited set of products are included within the scope.
	Scenario 7: All possible products are included within the scope and potential negative impacts on energy consumption from avoiding compliance through non or reduced incorporation of standby functionality are accounted for.
	Scenario 8: A more limited set of products are included within the scope and potential negative impacts on energy consumption from avoiding compliance through non or reduced incorporation of standby functionality are accounted for.

Following application of the modelling to the selected products, predicted savings in energy consumption and CO2 emissions for the various scenarios have been calculated. The total estimated savings under each option and scenario are presented in Table 4.11 (with figures by year for energy savings given in table A1 the Annex).

Table 4.11: Total Savings Energy Consumption and Carbon Emissions 2010 – 2020			
		Gross Savings in energy consumption/GWh	Net* Savings in CO2 emissions/ktCO2
Option 1	Scenario 1	56,969	16,557
	Scenario 2	52,144	15,125
	Scenario 3	50,279	14,650
	Scenario 4	45,454	13,218
Option 2	Scenario 5	48,166	13,931
	Scenario 6	44,294	12,820
	Scenario 7	42,024	12,217
	Scenario 8	38,152	11,069

*savings are net of the Heat Replacement Effect (HRE) see

http://www.mtprog.com/ApprovedBriefingNotes/pdf.aspx?intBriefingNoteID=151 for details.

4.2.1.1 Reduced damages from climate change as a result of reduced carbon emissions

In accordance with government guidance, the valuation of the decrease in emissions that will result from products using less power in standby and off-modes is calculated using the projected EU Allowance price under the EU Emissions Trading Scheme i.e. the revenue gained from selling permits for emissions.

The values for the EU Allowance used for the period 2010 to 2020 are as follows:

£/tCO_2	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2008 Prices	16.8	17.3	18.0	28.5							

Assumptions: All prices expressed in £2008, Exchange rate of €1 = £0.7, 2010 -2012 uses prices from the forward market (averaged across August 2007-May 2008), and 2013-2020 is based upon the European Commission's price forecast of €39 (2005 prices) from their Impact Assessment for measures to meet the Climate and Energy Package, adjusted to 2008 prices.

Applying these allowance prices to the carbon savings identified (discounted at 3.5% and in 2008 prices), table 4.12 below provides the value of the benefits from reducing carbon emissions which would result. Detailed annual figures for options 1 and 2 are provided in Tables A10 and A11.

Table 4.12: Value of Reduction in Carbon Emissions in 2008 prices/£million				
	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Option 1	362.4	331.0	321.4	290.0
Option 2	304.3	280.0	267.6	242.4

4.2.1.2 Value of reduced damage costs due to air quality improvements

The reduction in energy usage that will result from restricting power consumption in standby and off-mode losses will have additional benefits in terms of air quality since less pollution will be generated from power stations. The value of air quality impacts can be assessed by measuring the marginal external costs caused by each tonne of pollutant emitted. In this case, in the absence of detailed data on air pollution from power stations, damage costs approximating the value of air quality changes by applying average values for the benefit of reducing a pollutant emitted by one tonne have been used (see Table A4 in the Annex for the per annum values).

Applying these costs to the gross amount of energy savings resulting from the reduction in power consumption in standby and off-modes provides the following benefits in terms of damages avoided for the period from 2010 – 2020 (discounted at 3.5% at 2008 prices) for the different scenarios under each option (see Table A12 and A13 in Annex for detailed annual figures).

Table 4.13: : Value of Air Quality Damage Avoided in 2008 prices/£ Millions				
	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Option 1	75.0	68.7	66.1	59.8
Option 2	63.7	58.5	55.5	50.4

4.2.2 Product Usage – Economic

The major economic impact as a result of placing restrictions on power consumption in standby and off-modes as being benefits to consumers in terms of savings from lower electricity bills from reduced power consumption of electrical equipment.

Benefits to consumers from reduced energy consumption have been calculated by taking the savings in energy use (in GWh) identified above and multiplying these by average long run marginal (resource) costs (as advised by BERR and used in a recent impact assessment on Smart Metering) for electricity for both domestic and commercial use in each of the respective years from 2010 to 2020. The Electricity prices (per kWh) applied to the energy savings are given in Table A2 in the Annex.

The resulting savings to consumers and businesses have then been adapted for the fact that lower power consumption in standby and off-modes will result in less beneficial heat being generated from electrical products. Heat replacement factors have been used to scale down the savings from the proposed Implementing Measure under the assumption that additional energy will be required to generate the "lost" heat.

Different HRE factors have been used for different product groups and years between 2010 and 2020. The factors used are given in the Annex (Table A3).

The following table shows the savings to consumers, for each option and scenario, discounted at 3.5% and at 2008 prices (More detailed annual breakdowns of these figures are provided in Tables A8 and A9 in the Annex.)

Table 4.14: Cost Savings to Consumers from Energy Savings at 2008 prices/£ Millions				
	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Option 1	1,964.4	1,791.6	1,735.8	1,562.9
Option 2	1,668.0	1,528.1	1,456.9	1,317.0

4.2.3 Summary of Monetised Benefits

Table 4.15 summarises the benefits predicted to arise for all of the scenarios under the two different options in terms of the benefits to consumers of energy savings, the value of reduced damages from climate change due to lower emissions and the value of air quality damages avoided.

Table 4.15: Total Economic Benefits from Options 1 and 2 (£ Millions, discounted at 3.5% over period from 2010 to 2020 (2008 prices))				
	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Option 1				
Total Value Energy Savings	1,964.4	1,791.6	1,735.8	1,562.9
Total Value Carbon savings	362.4	331.0	321.4	290.0
Total Value Air Quality Damages Avoided	75.0	68.7	66.1	59.8
Total	**2,401.9**	**2,191.3**	**2,123.3**	**1,912.7**
Option 2				
	Scenario 5	**Scenario 6**	**Scenario 7**	**Scenario 8**
Total Value Energy Savings	1,668.0	1,528.1	1,456.9	1,317.0
Total Value Carbon savings	304.3	280.0	267.6	242.4
Total Value Air Quality Damages Avoided	63.7	58.5	55.5	50.4
Total	**2,035.9**	**1,866.6**	**1,779.9**	**1,609.8**

4.2.4 Product Usage – Social

In a general sense, since equipment in standby or off-modes is not providing its main function, the issue of functionality is not likely to be a major issue in most cases. However, there are instances where a reduced power usage in standby and off-mode will hinder the speed with which a product returns to a state where it can perform its main function. Again, this may not be an issue in many cases and manufacturers might be able to introduce product changes without any fear of losing their market share. Where a consumer has to wait a significant amount of time for a product to return to an active state, the possibility exists that the use will become impatient and press other buttons (potentially causing the item to crash), or may believe the product to be defective. In theses cases, manufacturers might need to install extra memory to be able to display information to the user on its reactivating state in order to prevent such problems arising. This becomes a cost issue for manufacturers and such costs have been borne into consideration in identifying the economic cost to manufacturers.

4.3 End of Life Phase

The materials used in implementing solutions to enable products to comply with the proposed implementing measure are already used in many applications by a wide range of products. Expert opinion suggests that there will be negligible changes in the waste stream generated from products which are to be made compliant with the requirement of the legislation. In the majority of cases, the difference will be a PIC microprocessor or will involve using more efficient versions of components which are already incorporated into products.

Similarly, as people purchase newer energy efficient products which are in compliance with the requirements of the draft implementing measure, there might be some who simply throw away their old equipment, thereby increasing the waste stream. However, this does not seem to be the case as often people hang onto their older products as “second items” (e.g. TV in the bedroom).

Consequently no major environmental or economic effects are expected in the end-of life phase as a result of implementing the requirements for off-mode and standby.

4.4 Sensitivities

It should be noted that although sensitivity analysis has been carried out for scenarios 1-4 and 5-8 above, no sensitivities have been carried out for the following: (i) changes in EU Allowance prices when calculating the benefits in terms of carbon emission reductions; and (ii) variations in electricity prices for the calculation of consumer benefits.

Also note that the “rebound effect” (which analyses where money saved from energy efficiencies may lead to subsequent emissions elsewhere) is not accounted for but that it would apply to the CO2 and local air quality impacts only which are small relative to energy savings benefits.

Due to the scale of the difference between predicted costs and benefits, inclusion of either of these factors would not affect the overall conclusion of this IA.

5. Climate Change Policy Cost-Effectiveness Indicator

All Impact Assessments that estimate changes in CO2 emissions in excess of either (i) 0.1MtCO2e average per year for appraisal of less than 20 years, or (ii) 2.0MtCO2e over the lifetime of appraisal of more than 20 years, are required by PSA Delivery Agreement 27, Indicator 6 to undergo a Climate Change Policy Cost-Effectiveness analysis. This involves measuring the proportion of tonnes of CO2 abated, for which the cost falls below the Shadow Price of Carbon. This Impact Assessment falls into that category with average per year CO2 emissions reduced in excess of 0.1MtCO2. The analysis applying to the options under consideration is as follows:

- Option 1, Scenario 1 (i.e. the maximum benefit scenario)

Cost effectiveness = (Present value of costs - present value of non-CO2 benefits) / lifetime tones of CO2 saved = (£445 million - £2,035 million)/ 16.6 million tCO2 = -£95.7, or £95.7 saved for every tonne of CO2 reduced.

The current weighted average discounted shadow price of carbon for scenario 1 is +£23.50

- Option 2, Scenario 8 (i.e. the least benefit scenario)

Cost effectiveness = (Present value of costs - present value of non-CO2 benefits) / lifetime tones of CO2 saved = (£383 million - £1,350 million)/ 11.1 million tCO2 = -£87.1 or £87.3 saved for every tonne of CO2 reduced.

The current weighted average discounted shadow price of carbon for scenario 1 is +£23.60

Therefore 100% of the CO2 emissions that the Implementing Measure is aiming to reduce in both the highest and lowest case scenarios fall below the Shadow Price of Carbon and are therefore deemed to be cost-effective reductions.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	***Results in Evidence Base?***	***Results annexed?***
Competition Assessment	Yes	No
Small Firms Impact Test	No	No
Legal Aid	No	No
Sustainable Development	No	No
Carbon Assessment	Yes	No
Other Environment	Yes	No
Health Impact Assessment	No	No
Race Equality	No	No
Disability Equality	No	No
Gender Equality	No	No
Human Rights	No	No
Rural Proofing	No	No

Annexes

Table A1: Savings in Energy Consumption (Annual figures)			
Year	**Option**	**Scenario**	**Savings in Energy consumption/GWh**
2010	1	1	1,221
		2	1,127
		3	790
		4	696
	2	5	1,225
		6	1,131
		7	794
		8	700
2011	1	1	2,364
		2	2,176
		3	1,900
		4	1,711
	2	5	2,373
		6	2,184
		7	1,908
		8	1,719
2012	1	1	3,399
		2	3,122
		3	2,901
		4	2,625
	2	5	3,412
		6	3,136
		7	2,915
		8	2,639
2013	1	1	4,476
		2	4,097
		3	3,917
		4	3,538
	2	5	4,188
		6	3,844
		7	3,653
		8	3,309
2014	1	1	5,268
		2	4,811
		3	4,655
		4	4,198
	2	5	4,681

Table A1: Savings in Energy Consumption (Annual figures)			
Year	Option	Scenario	Savings in Energy consumption/GWh
		6	4,292
		7	4,115
		8	3,726
2015	1	1	5,867
		2	5,353
		3	5,213
		4	4,699
	2	5	4,988
		6	4,575
		7	4,399
		8	3,986
2016	1	1	6,308
		2	5,757
		3	5,629
		4	5,078
	2	5	5,186
		6	4,762
		7	4,583
		8	4,159
2017	1	1	6,659
		2	6,084
		3	5,967
		4	5,393
	2	5	5,342
		6	4,912
		7	4,731
		8	4,302
2018	1	1	6,940
		2	6,351
		3	6,242
		4	5,652
	2	5	5,480
		6	5,046
		7	4,866
		8	4,433
2019	1	1	7,154
		2	6,556
		3	6,453
		4	5,855
	2	5	5,598

Table A1: Savings in Energy Consumption (Annual figures)			
Year	**Option**	**Scenario**	**Savings in Energy consumption/GWh**
		6	5,160
		7	4,983
		8	4,544
2020	1	1	7,312
		2	6,708
		3	6,612
		4	6,008
	2	5	5,692
		6	5,250
		7	5,077
		8	4,634

Table A2: Electricity Prices per kWh											
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Domestic	5.29	5.30	5.31	5.32	5.33	5.34	5.35	5.36	5.36	5.37	5.38
Commercial	4.65	4.67	4.69	4.72	4.74	4.73	4.75	4.77	4.78	4.80	4.82

Table A3: HRE Factors Used to Adjust Energy Savings				
	Domestic Wet	Cooking (Electric)	Consumer Electronics (including ICT)	Office Equipment
2010	99%	78%	78%	74%
2011	99%	79%	79%	74%
2012	99%	79%	79%	75%
2013	99%	80%	80%	75%
2014	99%	80%	80%	75%
2015	99%	81%	81%	76%
2016	99%	81%	81%	76%
2017	99%	81%	81%	76%
2018	99%	81%	81%	76%
2019	99%	81%	81%	76%
2020	99%	81%	81%	77%

Table A4: Air quality Damage Costs per GWh in £2008										
2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
1,440	1,469	1,498	1,528	1,559	1,590	1,622	1,654	1,687	1,721	1,755

Table A5: Cost of adapting for compliance and % of products

	Domestic Wet				Domestic Cooking			Domestic Monitors		
	Washing Machines	Washer Driers	Tumble driers	Dishwashers	Electric hob	Microwave oven	Electric oven	CRT	LCD	Plasma
Compliance cost	£0.37	£0.37	£0.37	£0.37	£0.37	£0.20	£0.20	£0.37	£0.37	£0.37
% of products	50%	50%	0%	50%	25%	75%	75%	75%	25%	100%
	Domestic Printers					Non-Domestic Monitors			Non-domestic Printers	
	Inkjet	LaserJet	MFD Inkjet	MFD Laser	Photo	CRT	LCD	Plasma	Inkjet	LaserJet
Compliance cost	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37
% of products	75%	100%	50%	100%	25%	75%	25%	100%	75%	100%
	Non-domestic Printers			Consumer Electronics				Other Products		
	MFD Inkjet	MFD Laser	Photocopier	Analogue DVD Recorders	DVD Players	Mobile PSU's	Other PSU's	Clock Radio	Compact hi-fi	Home theatre system
Compliance cost	£0.37	£0.37	£0.37	£2.38	£2.38	£0.20	£0.20	£0.20	£0.37	£0.37
% of products	75%	100%	75%	100%	75%	75%	50%	75%	100%	100%
	Other Products									
	Small kitchen appliance	Video games	DTR	D. Laptop	ND. Laptop	Terr DA	Coffee makers	Hand-held vacuums	D. Desktop PC	ND. Desktop PC
Compliance cost	£0.20	£2.38	£2.38	£0.20	£0.20	£2.38	£0.20	£0.20	£0.37	£0.37
% of products	100%	100%	100%	25%	25%	100%	0%	100%	100%	75%
	Other Products									
	D. Amplifier	D TV-1-CRT Pri	D TV-2-CRT Sec	D TV-3-FED-Pri	D TV-4-LCD-Pri	D TV-5-LCD-Sec	D TV-6-Oled-Pri	D TV-7-OLED-Sec	D TV-8-Plassma-Pri	D TV-9-Proj-Pri
Compliance cost	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37	£0.37
% of products	100%	75%	50%	75%	25%	50%	0%	0%	50%	25%

Table A6: Design Options to Reduce Off-mode Losses and Improve Standby Energy Efficiency

Option	Design Option	Comments and Guidance
	Reducing off-mode losses	
O1	Hard-off switch on the primary side	Many products do not have hard-off switches, for example so that they can keep some functions available all of the time. However, a primary side hard-off switch can be installed in almost every product to eliminate off-mode losses. Of course, this relies on the user to switch off the equipment when not in use. To reduce losses when using switches, they should be situated on the primary side of the input transformer and in front of any primary circuit protection such as filters or transient suppression devices that will also give rise to losses if left connected.
O2	External or internal power supply with minimized off-load losses	If a hard-off switch can not be used, then off-mode energy losses will arise from the power supply and secondary side electronic soft-off switch, which requires a continuous power supply for operating the switch. This can be reduced by choosing a power supply with minimized off-mode losses. New developments in power supply topology and controller

Table A6: Design Options to Reduce Off-mode Losses and Improve Standby Energy Efficiency		
Option	**Design Option**	**Comments and Guidance**
		Ics allow losses below 200mW. This is also beneficial where the user chooses not to use the hard-off option.
O3	Automated transitioning to standby or off-mode when function not required	The draft Implementing Measure requires that all equipment shall, without prejudice to good engineering practice and unless inappropriate for the intended use, offer a power management function (or similar function) that automatically switches equipment to a condition with reduced energy consumption (i.e. standby or off-mode) when the equipment is not providing the main function, or when other energy-using product(s) are not dependant on its functions. Auto-standby or auto-off functions are particularly applicable to job-based products.
O4	Use of external switch (power strips, master/slave outlets)	To avoid off-mode losses or to switch off a device which normally does not have an off-mode, power strips with switches can be used. This option is equivalent to the user unplugging the device but is more practicable for the user and therefore likely to be used more often. Alternatively, a form of power strip called a master/slave outlet can be used. This will detect the change in current for the master outlet and will automatically cut off the power supply for all outlets when the current of the master outlet drops below a certain level.
	Improving standby energy efficiency	
S1	External or internal power supply with minimized power consumption in standby	Choosing a power supply with minimized power consumption in standby mode. This is also beneficial where the user chooses not to use the hard-off option.
S2	Provide power for standby mode using a secondary power supply which has high efficiency in the low power range needed for standby functions	In this option the secondary power supply provides power to the standby circuit without keeping the main power supply activated. This approach is particularly beneficial where the main power supply has poor energy efficiency in the low power ranges, and where a hard-off option is not available.
S3	Using batteries or super capacitors as a secondary power supply for standby functions	The batteries or super capacitors (also known as super caps) will charge during on-mode and discharge during standby and off-mode. It is important check whether these options really do lead to reduced energy consumption, or whether the energy consumption is only shifted from one mode to another or, in the worst case, the energy consumption actually increases due to additional losses.
S4	Using an autarkic secondary power supply for standby mode	Autarkic (self-sufficient) supplies harvest energy from their environments. Photovoltaic cells can be used to harvest solar energy. Thermoelectric converters can generate electricity from temperature gradients. Piezoelectric generators can generate electricity from vibrations. Other forms of static autarkic energy generation include turbines for wind and hydro power.
S5	Automated transitioning to	The draft Implementing Measure requires that all

Table A6: Design Options to Reduce Off-mode Losses and Improve Standby Energy Efficiency		
Option	**Design Option**	**Comments and Guidance**
	standby or off-mode when function not required	equipment shall, without prejudice to good engineering practice and unless inappropriate for the intended use, offer a power management function (or similar function) that automatically switches equipment to a condition with reduced energy consumption (i.e. standby or off-mode) when the equipment is not providing the main function, or when other energy-using product(s) are not dependant on its functions. Auto-standby or auto-off functions are particularly applicable to job-based products.
S6	Improved circuit design of the standby function, possibly with more integrated Ics or dedicated microcontrollers	New and optimised microcontrollers with integrated power save functions can lead to less components and therefore to less “side losses” and a reduced energy consumption. By installing additional microcontrollers which are more dedicated to the standby functions, the standby energy consumption can be reduced, because only the microcontrollers need to be powered.
S7	Reduced number of circuits powered during standby conditions (e.g. by using electronic switches or relays)	Installing electronic switches or relays that isolate non-standby circuits from the power source leads to a reduced standby energy consumption.
S8	Providing users with options to switch off circuit blocks which are not needed during standby	If a user does not require a function to be available in standby mode, it should be possible for the user to permanently disable the function during standby.
S9	Not allowing the user to disable auto-standby or auto-off functions	In some applications this may not be desirable for the user or network administrator.
S10	Use of very low power (or no power) display technologies to indicate equipment status	For example, zenithal bistable displays (ZBDs). These displays use a grating structure to hold the liquid crystal molecules at the surface in one of two stable orientations, one of which is black and the other white. Molecules can only be switched from one orientation to another by a voltage pulse of appropriate polarity. This ‘bistability’ is not affected by thermal or mechanical effects, so that once a pixel is switched from ‘black’ to ‘white’, or vice versa, it remains in that state, even when the power is switched off. ZBDs only require power when the image is updated, which results in enormous power savings. By comparison, most conventional LCDs require continual application of a voltage to each pixel to maintain the required liquid crystal orientation – even if the displayed image is static.
S11	Use of more efficient signal lamps	LEDs are more energy efficient and durable than incandescent bulb signal lamps (including halogen and Krypton lamps). An incandescent bulb uses about 100 W to produce the same amount of light as an LED lamp that uses about 12 W – an energy saving of 88%. LEDs emit coloured light which eliminates the

Table A6: Design Options to Reduce Off-mode Losses and Improve Standby Energy Efficiency		
Option	**Design Option**	**Comments and Guidance**
		need for coloured lenses.
S12	Avoiding continuous preheating (not necessary for modern CRTs/printers etc.)	Old CRT displays preheat continuously to enable a fast reactivation. This is not necessary today due to new optimised components and a different circuit design.
S13	Use of non-volatile memory	This would eliminate the need for power to be supplied continuously to the memory e.g. to maintain settings.
S14	Minimize the power level requirement for necessary safety functions	A review of safety functions in standby may identify opportunities to reduce power requirements to meet necessary safety levels.

Table A7: Applicability of design options to different products	
Products	**Generally Applicable Design Options**
On/off products	
Power supply for a mobile phone	O1, O4, Primary side regulation IC
Lighting (e.g. low voltage halogen lamp)	O1, O4, Improved transformer efficiency
Radio	O1, O2, O4, S1
Electric toothbrush	S1, S5
On/standby products	
Electric oven	O1, S2, S10, S11
Cordless phone	O1, O2, O4, S1, S10, S11
TV, set top box	O1, O3, O4, S2, S7, S8, S9, S10,S11
Job-based products	
Washing machine	O1, O3, O4, S2, S5, S10, S11
DVD	O1, O3, O4, S2, S5, S9, S10, S11
Audio mini system	O1, O3, O4, S2, S5, S10, S11
Fax machine	O1, O3, S5, S7,S8, S9, S10, S11, S12
PC	O1, O3, O4, S2, S3, S5, S7,S8, S9, S10, S11
Laptop	O1, O3, O4, S2, S3, S5, S7,S8, S9, S11
CRT monitor	O1, O3, O4, S5, S7, S9, S10, S11
LCD monitor	O1, O3,
Laser printer	O1, O3, O4, S2, S5, S7, S8, S9, S10, S11, S12
Inkjet printer	O1, O3, O4, S2, S5, S7, S8, S9, S10, S11, S12

(Source: Electronics Transfer Network,

http://www.electronics-ktn.com/pub/sites/erg/EuP/environ/standbyOffmode)

Table A8: Cost Savings to Consumers from Energy Savings at 2008 prices/£				
Option 1	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
2010	49,234,082	45,228,296	32,333,806	28,328,020
2011	92,938,239	85,119,328	75,099,848	67,280,937
2012	130,284,587	119,138,755	111,605,658	100,459,826
2013	167,751,511	152,886,450	147,255,500	132,390,439
2014	193,001,296	175,524,851	171,061,805	153,585,360
2015	209,561,363	190,438,927	186,831,248	167,708,812

Table A8: Cost Savings to Consumers from Energy Savings at 2008 prices/£				
2016	218,857,263	199,008,768	195,973,564	176,125,069
2017	224,308,739	204,269,470	201,680,657	181,641,388
2018	226,863,933	206,970,324	204,712,437	184,818,828
2019	226,835,923	207,301,568	205,285,171	185,750,816
2020	224,769,365	205,667,128	203,913,007	184,810,770
Total	**1,964,406,301**	**1,791,553,866**	**1,735,752,702**	**1,562,900,267**

Table A9: Cost Savings to Consumers from Energy Savings at 2008 prices/£				
Option 2	**Scenario 5**	**Scenario 6**	**Scenario 7**	**Scenario 8**
2010	49,402,429	45,396,643	32,502,153	28,496,367
2011	93,282,812	85,463,901	75,444,421	67,625,510
2012	130,826,274	119,680,441	112,147,345	101,001,512
2013	156,781,460	143,261,222	137,142,375	123,622,137
2014	171,163,919	156,307,363	150,868,183	136,011,627
2015	177,731,143	162,364,577	157,195,021	141,828,455
2016	179,435,029	164,173,967	159,036,737	143,775,675
2017	179,381,080	164,416,726	159,379,113	144,414,759
2018	178,571,699	163,930,742	159,069,404	144,428,448
2019	176,945,778	162,627,199	157,984,726	143,666,147
2020	174,463,737	160,464,728	156,096,044	142,097,034
Total	**1,667,985,360**	**1,528,087,509**	**1,456,865,521**	**1,316,967,670**

Table A10: Value of Reduction in Carbon Emissions in 2008 prices/£				
Option 1	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
2010	5,778,233	5,319,261	3,771,924	3,312,952
2011	11,194,554	10,275,148	9,025,736	8,106,330
2012	16,237,759	14,881,224	13,891,523	12,534,988
2013	32,965,033	30,106,847	28,903,507	26,045,320
2014	37,726,680	34,377,409	33,396,504	30,047,233
2015	40,813,374	37,161,471	36,333,863	32,681,960
2016	42,579,592	38,785,210	38,073,203	34,278,820
2017	43,593,918	39,760,128	39,141,278	35,307,488
2018	44,039,910	40,232,078	39,684,884	35,877,052
2019	43,981,246	40,241,287	39,748,866	36,008,907
2020	43,525,869	39,868,560	39,435,208	35,777,899
Total	**362,436,167**	**331,008,622**	**321,406,495**	**289,978,951**

Table A11: Value of Reduction in Carbon Emissions in 2008 prices/£				
Option 2	**Scenario 5**	**Scenario 6**	**Scenario 7**	**Scenario 8**
2010	5,784,850	5,338,576	3,791,238	3,332,267

2011	11,209,068	10,315,705	9,066,293	8,146,887
2012	16,264,258	14,947,184	13,957,484	12,600,949
2013	30,749,382	28,229,225	26,939,788	24,340,295
2014	33,398,228	30,643,275	29,490,103	26,643,014
2015	34,561,028	31,724,597	30,618,816	27,684,288
2016	34,862,058	32,042,697	30,948,495	28,031,359
2017	34,820,060	32,052,816	30,983,657	28,121,322
2018	34,626,111	31,916,524	30,887,684	28,085,997
2019	34,269,604	31,618,179	30,638,302	27,897,730
2020	33,744,453	31,151,274	30,231,366	27,551,930
Total	**304,289,100**	**279,980,053**	**267,553,227**	**242,436,039**

Table A12: Value of Air Quality Damage Avoided in 2008 prices/£				
Option 1	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
2010	1,758,733	1,623,051	1,137,817	1,002,136
2011	3,355,025	3,087,175	2,695,651	2,427,801
2012	4,752,857	4,366,538	4,057,356	3,671,038
2013	6,168,244	5,646,767	5,398,095	4,876,617
2014	7,155,341	6,534,617	6,321,922	5,701,199
2015	7,853,592	7,165,736	6,977,921	6,290,065
2016	8,320,823	7,594,116	7,425,677	6,698,970
2017	8,656,780	7,909,869	7,757,464	7,010,553
2018	8,891,578	8,136,606	7,996,706	7,241,733
2019	9,033,128	8,278,169	8,147,926	7,392,967
2020	9,098,518	8,346,559	8,227,323	7,475,364
Total	**75,044,619**	**68,689,203**	**66,143,859**	**59,788,443**

Table A13: Value of Air Quality Damage Avoided in 2008 prices/£				
Option 2	**Scenario 5**	**Scenario 6**	**Scenario 7**	**Scenario 8**
2010	1,764,435	1,628,753	1,143,520	1,007,838
2011	3,366,829	3,098,979	2,707,455	2,439,605
2012	4,771,632	4,385,313	4,076,132	3,689,813
2013	5,772,072	5,297,766	5,035,161	4,560,854
2014	6,357,649	5,829,966	5,588,735	5,061,052
2015	6,676,836	6,124,066	5,888,189	5,335,420
2016	6,840,916	6,282,146	6,045,110	5,486,340
2017	6,943,991	6,386,209	6,150,757	5,592,975
2018	7,021,015	6,465,352	6,234,639	5,678,977
2019	7,068,412	6,514,994	6,290,976	5,737,559
2020	7,083,140	6,532,028	6,317,291	5,766,178
Total	**63,666,927**	**58,545,573**	**55,477,965**	**50,356,610**