Summary: Intervention & Options

Department /Agency:	Title: Impact Assessment of EuP Implementing Measures of Domestic Lighting	
Stage:	Version: 2.4	Date: 1st December 2008
Related Publications:		

Available to view or download at:

http://www.

Contact for enquiries: **Telephone:**

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, the emissions reduction targets the UK has set itself and the threat to the country's energy security. Climate change means that the UK must reduce emissions quickly and **the carbon emission caps established with the EU Emissions Trading Scheme need to be met in the most cost effective manner**. The continuing availability and sales of less efficient non-directional household lamps has meant that whilst there has been progress in terms of the market for efficient lighting products, the level of installation and use of more energy efficient products has not been as great as desired. Energy efficient solutions are widely available and could use significantly less power. However, **behavioural barriers and information failures, and consumer perceptions of the functionality of newer technologies, mean that some of the more energy efficient products are not being taken up quickly enough**. The market itself has not moved sufficiently quickly to higher use of more energy efficient lighting in response to the price signal provided through the ETS on energy use and, as a result, it is felt that **government intervention (at the EU level due to the Single Market) in the form of regulation to set minimum energy standards for domestic lighting products should be introduced to achieve the desired cost-effective abatement**.

What are the policy objectives and the intended effects?

The new Energy White Paper, issued on the 23 May 2007 announced a renewed commitment from the government to improve the performance of energy using products over the next 10–20 years, with this including proposals for product standards and targets to phase out the least efficient products. **The objective of implementing restrictions for non-directional household lamps is to contribute to realising CO2 savings required to achieve the EU ETS cap in the most cost-effective way, by mitigating for the effects resulting from barriers to behaviour change.** Product policy is considered as a necessary complement to the EU ETS for the overall ambition to reduce CO2 in the most cost-effective manner possible. Lower energy usage as a result of the lower power consumption and longer life of efficient domestic lighting products (and therefore lower energy demand) will also contribute to energy security of the UK.

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 (EuP). A draft Implementing Measure (IM) has been issued by the Commission setting out requirements for non-directional household lamps. **This impact assessment (IA) sets out the potential costs and benefits of implementing the measure on non-directional household lamps according to currently drafted requirements.** This IA does not consider alternative requirements and/or propose different standards for non-directional household lamps other than those proposed by the IM due to the limited time available for detailed technical appraisal of such alternative standards and for modelling the potential impacts. It does, however, present three different scenarios (higher energy savings, lower energy savings and most likely energy savings) relating to anticipated consumer behaviour regarding replacement of non-compliant lamps. **The costs and benefits presented here are considered against the counterfactual of no implementation of the measure.**

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 5 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

Description: Setting of lamp efficacy and functionality requirements for non-directional household lamps through a European Commission Regulation implementing Directive 2005/32/EC

COSTS

ANNUAL COSTS		
One-off (Transition)	**Yrs**	
£ n/a		
Average Annual Cost (excluding one-off)		
£29m - £59m	11	

Description and scale of **key monetised costs** by 'main affected groups'

Most likely scenario:

Costs to manufacturers = £negligible

Costs to consumers of switching lamps = -£ 120,490,000 [i.e. a net saving to consumers]

Costs to consumers of replacing luminaires = £92,990,000

Increased CO2 emissions from HRE = £ 83,700,000

Cost of additional air quality damage due to HRE = £18,690,000

Increased heating costs to consumers from HRE = £226,370,000

TOTAL COSTS: £301,260,000

The cost to consumers of switching lamps is negative, due to the increased longevity of the lamps purchased under the IM. This means that for the same period, few higher efficiency lamps will be bought, than would be the case if less efficient lamps remained on the market.

Due to uncertainty over consumer responses to the phase out of inefficient light bulbs, two other scenarios were developed which suggest that the costs will fall in the range of £254,760,000 to £511,740,000

NOTE: Figures above are presented after accounting for the impacts of CERT and the UK Voluntary Lighting Initiative

Total Cost (PV)	**£255m – 512m**

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

Potential environmental costs associated with dealing with quantities of mercury pollution from CFLs not entering the hazardous waste stream:

- increased capacity requirement for recycling/waste management of CFLs
- costs of information dissemination activities
- potential future clean-up costs at landfill sites.

There will also be some small cost associated with dealing with waste luminaires that are incompatible with more energy efficient lamps

Potential adverse health impacts on those with pre-existing photo-sensitive conditions

Potential for negative impacts on competition

There will be a cost for meeting renewables targets (due to HRE); this has not been quantified in this Impact Assessment

BENEFITS	ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'	
	One-off	**Yrs**	**Most likely scenario** Total Value Energy Savings = £1,010,120,000 Total Value EU ETS allowance savings (from CO2 emissions savings) £195,970,000 Total value air quality damages avoided = £ 26,730,000 Total value of absolute reduction in required delivery of renewable energy £297,680,000 TOTAL BENEFITS: £1,530,500,000 Due to uncertainty over consumer responses to the phase out of inefficient lamps, two other scenarios were developed which suggest that the benefits will fall in the range of £1,214,860,000 to £2,026,210,000 NOTE: Figures above are presented after accounting for the impacts of CERT and the UK Voluntary Lighting Initiative	
	£ n/a			
	Average Annual Benefit (excluding one-off)			
	£ 140m - 233m	11	**Total Benefit** (PV)	**£1,215m - £2,026m**

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

Benefits to end-users from information on the product due to information requirements for manufacturers.

Potential extra benefits may arise from the fact that LEDs are likely to be encouraged in the future as a result of this measure, although it has not been possible to model these benefits in this IA.

The option will also produce potentially significant wider benefits on a global scale, in particular in areas where there are no "caps" on carbon emissions. Non-directional household lamps produced in the EU and sold in these areas, as well as those produced locally to EU standards for the UK and EU markets and also used locally, will use less energy and produce lower carbon emissions than would have otherwise been the case.

Adopting the IM will also assist in enabling a longer-run agenda shift towards tighter emission "caps" in the future.

The measure will result in lower mercury emissions from power stations, which more than offsets any potential risk of waste mercury from CFLs not entering the hazardous waste stream.

Potential for positive impacts on competition

Key Assumptions/Sensitivities/Risks
The MTP model developed to generate costs and benefits from the EuP Implementing Measure has accounted for the impacts from other policies/initiatives also focusing on energy efficiency of lighting. The figures presented are therefore considered to be net of the impacts of these other policies. The model only considers household use of lamps and does not cater for the fact that energy efficient lamps will also be used in office settings. Consequently, the costs and benefits calculated do not include these.

Price Base Year 2008	Time Period Years 11	**Net Benefit Range** (NPV)[1] **£ 703m - £1,771m** (NPV Alternative 2– NPV Alternative 1)	**NET BENEFIT** (NPV Best estimate) **£ 1,229m (Most likely scenario)**

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 2009
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 share of c. £250k. Note this amount is indicative for ALL products being considered under EuP Implementing Measures
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?				£ 89m – 141m
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	No	No

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**

[1] NPV range is calculated as lowest net present value of a single scenario to highest net present value of a single scenario. So in this case it is "NPV of Alternative 2 scenario to NPV of Alternative 1 scenario".
Alternative 1 scenario (to 2020): NPV Benefits = £2,026m; NPV Costs = £255m; NPV benefit-costs = £1771m
Alternative 2 scenario (to 2020): NPV Benefits = £1,215m; NPV Costs = £512m; NPV benefit-costs = £703m
Most-likely scenario (to 2020): NPV Benefits = £1531m; NPV Costs = £301m; NPV benefit-costs = £1,229m

Evidence Base (for summary sheets)

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 energy performance standards in this way is a key foundation of the UK 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.

The Implementing Measure sets out lamp efficacy and functionality requirements for non-directional household lamps in its Annex II at different implementation stages from 2009 to 2016. 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 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 8th December 2008, where the UK will need to be in a position to either support or oppose the measure.

Voting at the Committee is under the Qualified Majority Voting Procedure. If approved the measure will go to the European Parliament for Scrutiny; if not approved it will then be passed to the Council to resolve. If approved this measure will be subject to review no later than 5 years after entry into force (around 2010).

2. Rationale for Intervention

Efficient non-directional household lamps have been available on the UK market for some years now but the sales of less energy efficient products (e.g. General Lighting Service lamps - commonly referred to as GLS or standard incandescent lamps) are still significant, pointing to the fact that purchasers are likely to be unaware of the benefits of using a more energy efficient product, or are not aware of their availability or their applicability to existing lighting systems. The continued use and sales of inefficient and high energy using non-directional household lamps represent a market failure in the sense that whilst negative externalities such as carbon emissions are compensated for in market transactions, via the EU ETS, this mechanism does not correct for all market failures e.g. where barriers to behaviour change still persist (for example, those due to a lack of, or inequality in, information). The EuP preparatory study on domestic lighting states that “optimal use of domestic lighting starts with adequate information on existing products”. Proposals for changes in product information and documentation would appear to support this analysis.

The 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.

Moreover, the new Energy White Paper, issued on the 23 May 2007 announced a renewed commitment from the government to improve the performance of energy using products over the next 10–20 years, with this including proposals for product standards and targets to phase out the least efficient products. The White Paper highlights lighting as one of the key sectors to press for adoption and implementation of new EU minimum energy performance standards by the end of 2008 and to "develop coherent product policy measures...which are effective in providing reliable consumer information and in driving up efficiency standards", including for energy efficient lighting.

3. Content of the proposed Implementing Measure

3.1 Efficacy and Functionality Requirements

The Implementing Measure sets out lamp efficacy and functionality requirements for non-directional household lamps in its Annex II at different implementation stages from 2009 to 2016. In practice, the implications of these requirements are that some low efficiency lamps will be phased out by the regulations at different stages whilst others will be allowed to remain on the market. The potential impacts from the phase out of the different types of lamps are described in section 4.

The implication of the requirements of the Implementing Measure are set out for the different lamp types of different power ratings (in Watts) in Table 3.1 below.

Note that the scenario dates in Table 3.1 do not directly tally with those in the Implementing Measure. This is because they account for the fact that there will be a 3-4 month lag in stock at each stage.

Table 3.1: Implications of the requirements of the Implementing Measure (IM)

Scenario	2010	2011	2012	2013	2014	2017	Lamps remaining under IM
Implementing Measure	100W ND GLS & halogen D 100W equivalent phased out. All frosted lamps must be class A	75W ND GLS & halogen D 75W equiv. phased out	60W ND GLS & halogen D 60W equiv. phased out	≤40W ND GLS & halogen D 40W equiv. phased out	Functionality requirements increased	Retrofit class C halogen phased out	**Clear**: class B & C for Rx7 or G9 halogen sockets **Frosted**: CFL class A or B+[1]

Note: ND = Non-directional

[1] B+ CFLs with 2nd envelope that reach 0.95 * efficacy of class A'

The intention of the measure is to phase out less efficient lamps in favour of products with greater energy efficiency. A brief description of the lamps affected by the measure follows below along with a summary of main characteristics in Table 3.2.

A. Incandescent lamps (General Lighting Service (GLS))

These lamps are the traditional filament lamps which have been in domestic use for decades and provide a bright light source when made with transparent glass. They are very low efficiency lamps compared with other lamps (CFLs in particular) but are generally available in good quality, and provide good performance.

B. Conventional halogen lamps (Halo conv)

Standard halogen lamps consume at best, 15% less energy than GLS lamps for the same light output. Many of these lamps are low voltage lamps which are more efficient that mains voltage ones but which require a transformer either in the luminaire or in the lamp itself. They provide good quality light.

C. Halogen lamps with xenon filling (C-class)

These are recent technology lamps with xenon filling and will use approximately 25% less energy for the same light output as GLS lamps. These lamps come in two types, one which is placed in glass bulbs, shaped like incandescent lamps, which are compatible with existing luminaries (retro C), and halogen socket c type lamps which can only be used in special halogen sockets (halosocket C). Lamps provide good quality light and performance.

D. Halogen lamps with infrared coating (B-class)

These lamps are new technology, with an application of infrared coating to the wall of the halogen lamp capsule making the lamp considerably more efficient. However, this is only possible with low voltage lamps and therefore a transformer is required. Currently only one manufacturer produces these lamps with a fitting so that they can fit traditional sockets. Due to heat issues, these are only available up to the equivalent of 60W GLS bulbs. They provide a bright light source and good performance and are estimated to provide 45% energy savings over GLS lamps

E. Compact fluorescent lamps (CFLs)

These include an integrated ballast, fit into existing GLS sockets, and are produced with both bare tubes and also with a traditional bulb-shaped cover. They have a long lifetime and vary in their energy efficiency, being estimated to use between 20-35% of energy of that needed for GLS lamps. CFLs are sometimes criticised by consumers resulting from lingering perceptions over poor light quality and it is recognised that long periods of close-up use can have adverse effects on those with pre-existing photo-sensitive conditions.

Table 3.2: Summary of Types of Lamp affected by IM

Lamp type	Energy class (proposed levels)	Clear / Frosted	Specific luminaire?	Notes
CFL A	A	F	N	‘Stick’ and 2nd envelope CFLs with high efficacy > 0.24Ø+ 0.013Ø – efficacy class A
CFL B+	B+	F	N	2nd envelope CFLs with efficacy > (0.95 x efficacy class A) < A
Halogen B	B	C	N	Energy efficient halogens
Halogen socket C	C	C & F	Y	Average energy efficiency halogens
Halogen retro C	C	C & F	N	Average energy efficiency halogens
Halogen D	D	C	Y	Poor energy efficiency halogens
GLS	E-G	C & F	N	100W, 60W & 40W

Note: “Energy class” classifications based on proposed levels for possible revision of energy class labelling for lamps (EC document May 2008).These are provided for indicative purposes only and do not represent any decisions taken with respect to labelling schemes.

Current stock levels indicate around 75% of lamps are non-directional i.e. will be affected by the IM. The remaining 25% are predominantly directional halogen lamps, with a small percentage (around 10% of total stock) of directional GLS lamps. Only halogen C lamps and GLS lamps are available in both clear and frosted forms

The Implementing Measure seeks to replace older, inefficient technologies with newer more energy efficient ones and a summary of the estimated relative efficiencies(along with their assumed lifetime as used in the MTP modelling) of the different lamp types is provided (against incandescent GLS lamps) in Table 3.3.

Table 3.3: Relative energy efficiencies of different lamp types			
Lamp technology	**Energy savings**	**Lifetime assumed in stock model (Hours)**	**Energy class**
I. Incandescent lamps	-	1,000	E, F, G
II. Halogen D (conventional halogens (mains voltage 220 V)	0 – 15 %	2,000	D, E, F
II. Halogen socket C (conventional halogens (low voltage 12 V)	25%	2,000	C
II. Halogen retro C (Halogens with xenon gas filling (mains voltage 220 V)	25%	2,000	C
II. Halogen B (Halogens with infrared coating)	45%	5,000	B (lower end)
III. CFL class B+ (CFLs with bulb-shaped cover and low light output)	65%	10,000	B (higher end)
III. CFL class A (CFLs with bare tubes or high light output)	80%	10,000	A
Note: Energy class refers to current energy efficiency lamp labelling categories where G is low and A is high efficiency CFL B +: Some have shorter lifetime than A class – around 6000hr Halogen B tend to have higher lifetime than other halogens, approx. 5,000 hrs Source: "Discussion Paper on the Options for a draft Ecodesign Measure on Domestic Lighting Products, October 13th 2008"			

3.2 Product Information Requirements on Lamps

Under the Implementing Measure, manufacturers will be obliged to provide specific information on the product, both at the time of purchase and on free access websites. Certain information must also be included in the product's technical documentation file, drawn up for the purposes of conformity assessment pursuant to Article 8 of Directive 2005/32/EC. Details of these requirements are provided in the Annex A1 to this Impact Assessment.

4. Identification of Potential Impacts

The Implementing Measure, in setting the requirements identified in section 3.1 above, seeks to improve the environmental performance of non-directional household lamps. Environmental performance of products must be considered throughout their life cycle, at the component/product manufacturing, usage and end-of-life phases. Table 4.1 below sets out the potential environmental, economic and social impacts at each of the life-cycle phases examined 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 (e.g. increased use of mercury in CFL lamps).	Costs of production for manufacturers. Producers of non-compliant lamps potentially going out of business. 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. Purchase cost of lamps and luminaries to consumers	Possibility of firms leaving the market (e.g. producers of GLS lamps) and any effects on employment. Possible increases in employment in manufacturers of energy efficient lamps. Potential for supply shortages of compliant products resulting in shortages for consumers. Effects on workers health from increased use of mercury.
Usage	Changes in electricity consumption across UK due to less power consumed. Changes in CO2 emissions across UK. Changes in air quality as result of less electricity being generated. Potential reduction in mercury discharged to air from power stations	Changes in energy costs for domestic lighting users (consumers) resulting from any changes in electricity consumption. Changes in the required delivery of renewable energy as a result of changes in electricity demands	Changes in functionality of products as result of compliance with requirements. Potential negative health effects.
End of life	Ease of recycling and any requirements to deal with different materials used in order to ensure compliance (e.g. mercury in CFL lamps). Negative environmental impacts from replacing existing lamp stocks early[1] and replacing existing luminaires if people choose to replace luminaires rather than to use lamp alternatives. Negative impact of household CFLs being disposed of in non-hazardous waste streams and subsequent aquatic and terrestrial environmental damage.	Changes in recycling and waste management costs e.g. costs for improving recycling capacity to absorb the increasing numbers of CFLs sold. Costs of introducing a free of charge take-back system for lamps at the point of sale (attributed to WEEE Directive)	Employment in recycling industry sector. Awareness of consumers on how to deal with CFLs at the end of their life.

[1] Some people, as they become aware of the forthcoming implementation of legislation which will make GLS lamps unavailable may decide to switch to more efficient lamps quicker by actually replacing even those lamps which have not expired. Whilst this might happen to a limited extent and is not quantifiable (and therefore has not been modelled), it might be attributable to the measure since awareness of and attention on energy efficiency of alternative lamps will likely be increased the closer the measure comes to being in force.

The extent of impact under each of the categories below will be strongly influenced by the decisions taken by consumers when choosing which lamps they will purchase and use to replace those lamps that become unavailable when the requirements of the Implementing Measure come into force.

A set of assumptions have been made to predict consumer behaviour with regards to the lamps they will switch to once the IM requirements phase out different types of lamps. Average lamp lifetimes have been used along with these assumptions in order to predict the quantities of lamps that would be purchased and used. These assumptions, which are similar to those made in the EU EuP preparatory study on domestic lighting but adapted for the specific market situation in the UK, are set out in Tables 4.2 and 4.3 below for the following 3 scenarios:

Most likely scenario

The most likely scenario is based on what people are most likely to do, with some variation in service depending on cost & consumer preferences i.e. some people will choose replacement lamps of a different light quality (e.g. switch from a clear GLS to a frosted CFL) because it is cheaper, even though this represents a change in the quality of light. These assumptions are based on evidence about past and current sales patterns, possible lamp switching options presented by the IM, consumer behaviour surveys, and evidence about the uptake of new lamps types in recent years.

Alternative 1 scenario
Maximum savings possible with minimal cost to consumers whilst still maintaining the equivalent level of service i.e. replacement lamps are always of the same light quality (clear/frosted) and no additional luminaires are required.

Alternative 2 scenario
Minimum savings likely, maintaining level of service, costs depend on consumer preference i.e. some people will choose replacement lamps of a different light quality (e.g. switch from frosted GLS to clear halogen) because they prefer the quality of light, even if this represents a more expensive option.

Reference scenario
All costs and benefits of the 3 scenarios above are measured relative to a reference scenario. The reference scenario takes account of underlying trends in markets and technologies, and accounts for the estimated impacts of historical and current policy measures. It indicates what would happen in the market – e.g. predictions of changing consumer preferences, and switches to different technologies - if no further measures were to come into place. It thereby provides a baseline from which to measure the expected impacts of the IM.
(Note in the calculation of the reference scenario, the effects of CERT and VI prior to the Implementing Measure coming into effect have been accounted for post-hoc. Methodology details can be found in Section 5).

It should be noted that the Alternative scenarios do not describe the extremes (e.g. higher savings would be achieved if everyone switched to CFLs), but are intended to set more realistic boundaries in terms of what people will actually do.

Table 4.2: Summary of three IM scenarios modelled

Lamp type	Most likely scenario	Alternative 1 scenario	Alternative 2 scenario
GLS frosted	Some frosted GLS lamps are replaced with CFL (cheaper) but some consumers choose to replace with clear GLS (up to 2013) and halogens (even though more expensive)	All frosted GLS lamps are replaced with CFL. No switch from frosted GLS to clear GLS (whilst still available) or halogen (any type)	Some frosted GLS lamps are replaced with CFL (cheaper) but some consumers choose to replace with clear GLS (up to 2013) and halogens (even though more expensive)
GLS clear	Some clear GLS are replaced by halogen (mix of halosocket C, retrofit C and halogen B) and some by CFL	All clear GLS are replaced by halogen – mainly to retrofit C initially since cheaper than Hal B (no switch to halosocket C), but will then switch to Hal B when retro C phased out in 2017. No switch from clear	All clear GLS are replaced by halogen (mix of halosocket C, retrofit C and halogen B). No switch from clear GLS to CFL

Table 4.2: Summary of three IM scenarios modelled			
Lamp type	**Most likely scenario**	**Alternative 1 scenario**	**Alternative 2 scenario**
		GLS to CFL	
Halogen D	Halogen D are replaced by more efficient halogens (mix of halosocket C, retrofit C and halogen B)	Halogen D are replaced by more efficient halogens (mix of retrofit C and halogen B)	Halogen D are replaced by more efficient halogens (mix of halosocket C, retrofit C and halogen B)
Halogen retro C	Consumers shift mainly to retro C lamps initially, whilst still available, with some consumers choosing halosocket C. Once retro C are phased out, consumers change to a mix of halogen B and CFL	Consumers shift mainly to retro C lamps initially, whilst still available. Once retro C are phased out, consumers change to halogen B (same quality of light)	Consumers shift mainly to retro C lamps initially, whilst still available. Once retro C are phased out, consumers change to halogen B (same quality of light)
Halogen socket C	Halosocket C increases to 8% of ND stock by 2017 (assuming a 50% increase in current stock levels) since people choose to incur the cost of additional halosocket C luminaires due to preference for the quality of light	Halosocket C stays constant (no one incurs the cost of buying a GLS luminaire to replace these with CFLs and no-one buys additional halosocket C luminaires)	Halosocket C increases to 20% of ND stock by 2017 (as proposed by VITO scenario) since people choose to incur the cost of additional halosocket C luminaires due to preference for the quality of light
Halogen B	Some consumers choose halogen B as a replacement for frosted lamps (rather than CFLs) due to consumer preference for the quality of light over CFLs	Consumers only choose halogen B as a replacement for clear lamps	Some consumers choose halogen B as a replacement for frosted lamps (rather than CFLs) due to consumer preference for the quality of light over CFLs
CFL	Some consumers choose to replace clear lamps with CFLs due to the lower cost even where this means a change in the quality of light whereas others choose to replace frosted lamps with more expensive halogens	Consumers replace all frosted lamps with CFLs. No clear lamps are replaced by CFLs	Some consumers choose to replace frosted lamps with halogens. No clear lamps are replaced by CFLs

Table 4.3 sets out the specific assumptions made in the MTP model relating to the percentages of the lamps being phased out that will be replaced by one type of lamp or another.

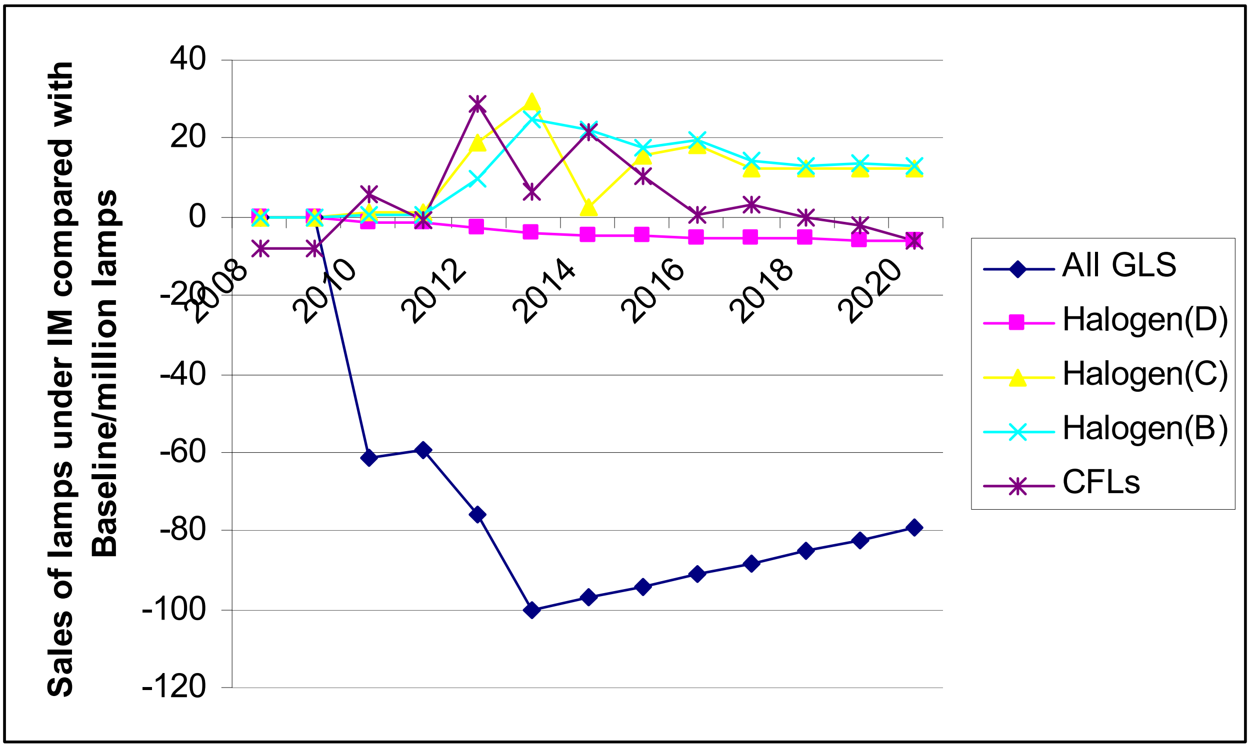
Table 4.3: Lamp replacement assumptions			
Original lamp type	**Most likely scenario**	**Alternative 1 scenario**	**Alternative 2 scenario**
FROM	**TO**	**TO**	**TO**
GLS (85% frosted, 15% clear)	All 100W lamps become CFL 60W and 40W lamps are split 67% to class A; 11% to class B; 22% to class C	All 100W lamps become CFL 60W and 40W lamps are split 85% to class A; 5% to class B; 10% to class C	All 100W lamps become CFL 60W and 40W lamps are split 50% to class A; 17% to class B; 33% to class C
Halogen D	33% to class B 67% to class C	33% to class B 67% to class C	33% to class B 67% to class C
Retrofit halogen C	Increase in retro C from GLS & Hal D. 2017 phase out: 50% to class A 50% to class B	Increase in retro C from GLS & Hal D. 2017 phase out: 100% to class B	Increase in retro C from GLS & Hal D. 2017 phase out: 100% to class B

Halosocket C	Increases at 0.5% pa as luminaires are bought to replace GLS/Hal D where people do not like CFLs.	remains constant – no replacement of GLS i.e. no halosocket luminaires purchased	increases at 2.0% pa as luminaires are bought to replace GLS/Hal D where people do not like CFLs.
Luminaire costs	- Hal D replaced by B & retro C - GLS replaced by halosocket C	- Hal D replaced by B & retro C	- Hal D replaced by B & retro C - GLS replaced by halosocket C
Notes	Up to 2017, % lamps changed to class C are split between retro C and halosocket C in the ratio 4:1 All CFLs assumed to be A class (no B+ class)	Up to 2017, % lamps changed to class C are retro C All CFLs assumed to be A class (no B+ class)	Up to 2017, % lamps changed to class C are split between retro C and halosocket C in the ratio 1:2 All CFLs assumed to be A class (no B+ class)
Note: All figures relate to non-directional lamps only			

The assumptions in the previous tables have been used to predict the quantities of lamps that would be purchased and used under the terms of the EuP Implementing Measure as consumers are required to switch from one type of lamp to another. They have then been used to model the scale of the potential impacts set out in Table 4.1 (above) and these are described in detail in the following sections.

The estimated sales resulting from the measure (which will ultimately influence the total stock of each type of lamp in use and therefore overall levels of energy consumption) will be influenced by the average lifetime of the different lamps that people switch from and to (i.e. if people switch to lamps which last longer, they will buy them less often). These lamp lifetimes have been used to model the various costs and benefits associated with the measure. There is evidence that Halogen class B lamps last over twice as long as other halogen lamps – this difference in lifetimes has been adjusted for in the cost calculations. Figure 4.1 below illustrates the effect of the IM (most likely scenario) on sales of different types of lamps, in comparison with what would have been the case under the reference scenario.

Figure 4.1 Projected change in sales of different lamp types under EuP IM compared with reference scenario



Note(1) - Halogen C category includes all Halogen C-class lamps, including Halosocket C, as it is not possible to separate out the different C-type lamps due to the way in which the MTP model is constructed.

The remaining sub-sections in this section set out the potential costs and benefits to each stakeholder group as they relate to the potential impacts identified in Table 4.1 above.

4.1 Component/Product Manufacture

4.1.1 Component/Product Manufacture – Environmental

The main implication of the Implementing Measure will be to phase out different types of lamps which do not meet specified efficacy and functionality requirements. This will require consumers to switch to an alternative type of lamp instead.

Different lamps are manufactured using different processes, types, and quantities of materials. Table 4.4 below illustrates the differences in the composition of different types of lamps affected by the measure, breaking down each type of lamp into its main component parts.

Table 4.4: Lamp composition

Lamp Group	Example	Weight (g)					
		Total	Glass	Metals	Electronics	Plastics	Balance
GLS	60W	33	30	3	-	-	0.01
Halogen	35W	2.5	2	0.5	-	-	0.01
CFL-integral	11W	120	65	4	25	25	1

Note: Balance includes lamp envelope additives including electrodes, capping paste and ceramic parts
Source: European Lamp Companies Federation http://www.elcfed.org/2_lighting_composition.html, 2008
CFL-Integral means CFLs with integrated ballasts

Under the proposed measure, consumers will be required to switch away from GLS lamps, as they are phased out at different stages, to alternatives. This could potentially require an increase or decrease in the amount of materials required to manufacture the overall number of lamps required. Using the examples illustrated above, estimated sales of the different lamp groups under the Implementing Measure have been used in Table 4.5 below to predict the overall net changes in materials required to produce the different types of lamps required in the period 2010 to 2020.

Table 4.5: Lamp composition

Lamp Group		Net change in materials required/Weight (kg)					
		Sales	Glass	Metals	Electronics	Plastics	Balance
GLS		-914,076,898	-27,420,000	-2,740,000	-	-	-10,000
Halogen		237,457,248	470,000	120,000	-	-	0
CFL-integral		52,902,393	3,440,000	210,000	1,320,000	1,320,000	50,000
Net change			-23,510,000	-2,410,000	1,320,000	1,320,000	40,000

Notes:
1. All figures rounded to nearest '000 kg
2. Balance includes lamp envelope additives including electrodes, capping paste and ceramic parts.
3. Figures calculated using predictions of sales attributable to the EuP Implementing Measure from MTP model

Table 4.5 above suggests that there will be net savings overall from the IM (based on figures developed for the most likely scenario and where a positive figure in the table represents an increase in materials used and a negative figure a reduction in the amount of materials required) in terms of glass and metals used, but net losses in terms of electronics, plastics and other materials.

The phase out of GLS lamps that will occur under the Implementing Measure, and the predicted replacement of these lamps with energy efficient CFLs will involve the use of greater quantities of mercury in lamp manufacture. Mercury (and its compounds) is persistent, bio accumulative and toxic and has no known function in human biochemistry or physiology; nor does it occur naturally in living organisms. It is recognised as a hazardous substance and its use in the manufacturing phase will be increased following the implementation of the measure.

However, quantities of mercury permitted in lamps are already restricted by the EC Directive 2002/95/EC of The European Parliament and of The Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive). It restricts mercury in compact fluorescent lamps to a maximum of 5 mg per lamp. The amount of mercury used in CFLs varies between lamp size and manufacturer, but assuming an average level of 3mg per lamp, Table 4.6 below predicts the level of increase in mercury use in CFL lamps as a result of the EuP Implementing Measure.

Table 4.6: Predicted increase in use of mercury in CFL lamp manufacture due to IM/kg

	Predicted net sales of CFLs (most likely scenario)	**Increase in quantity of mercury**
2008	- 7,902,134	-24
2009	- 7,902,134	-24
2010	6,075,101	18
2011	- 864,964	-3
2012	28,857,428	87
2013	6,708,555	20
2014	21,866,087	66
2015	10,456,439	31
2016	815,841	2
2017	2,808,511	8
2018	- 9,334	0
2019	- 2,217,255	-7
2020	- 5,789,748	-17
Total	**52,902,393**	**159**

Note – in 2008/09, the extra CFLs which would have been introduced by the Voluntary Initiative, were not included in the baseline used by the modelling. The impacts of these sales need to be taken away from the costs attributed to the Implementing Measure. Hence these appear as negative sales in 2008/09 in order that the overall analysis sums correctly. The reader should not infer anything intuitive from these entries. See Section 5 for further details.

Whilst Table 4.6 above shows an overall increase in the quantities of mercury being used in lamp manufacture, this does not represent an overall net increase in mercury levels due to the Implementing Measure. Section 4.2.1.3 describes the overall reduced levels of mercury emissions. This results from lower mercury emission levels resulting from reduced electricity generation requirements for CFL lamps, due to their greater energy efficiency.

The unsteady pattern observed in CFL sales can be accounted for through a combination of two factors. Firstly the phase in of the IM will not have a uniform effect across each year of implementation, due to the uneven spread of GLS lamps of different wattages in the UK. For example, there are very few 75W GLS lamps sold in the UK, so their removal through the measure in 2011 will have little impact on CFL sales. Secondly, CFL lamps have long lifetimes. Once stock has built up, as a result of the measure, sales will then drop off as fewer replacement lamps are needed. Once lamps come to the end of their lifetime, sales will increase as replacements are bought.

4.1.2 Component/Product Manufacture – Economic

4.1.2.1 Making Products Compliant

The intention of the Implementing Measure is to phase out inefficient products in favour of more efficient ones already in existence. Expert judgement suggests that the phasing of different requirements allows for manufacturers to switch production to more efficient products by the time the requirements become mandatory.

In the time available for completing this Impact Assessment, it has been very difficult to obtain any clear information on the potential costs to manufacturers of implementing the requirements of the Implementing Measure. Technical experts contracted under the Market Transformation Programme (MTP) have attempted to obtain information from industry contacts but very little data has been obtained.

The general impression is that there will be negligible effects on manufacturers' profitability due to minimal R&D costs, higher prices paid for compliant products, economies of scale and the fact that the market has already begun transition to producing compliant products. A brief analysis of this is provided below.

Costs to Manufacturers

The widespread availability of energy efficient alternatives for non-directional household lamps which meet with the requirements of the Implementing Measure means that the technological solutions for manufacturers to comply with the measure are already available. Further, there are no significant patenting issues in the market. Therefore, there will be no need for manufacturers to incur extra costs on R&D to develop solutions.

The analysis presented above in Table 4.5 does suggest that there will be an increase in materials required by manufacturers producing compliant CFL lamps due to the extra glass, electronics etc. that are involved. This will undoubtedly incur extra costs for manufacturers producing CFLs instead of GLS lamps. However, expert opinion suggests that due to the higher price of these compliant products achieved in the market (halogens as well as CFLs), manufacturers' profitability will not be affected negatively. In fact, due to the higher profit margins associated with the sales of CFL and halogen lamps, it is quite likely that profitability will be increased due to the extra volume of sales of these more expensive products. In the medium to long term, economies of scale will likely lead to reductions in prices of halogen lamps but with corresponding reductions in production costs. The longer lifetimes of halogens and CFLs relative to GLS lamps will mean that replacements will be purchased less frequently, but it is expected that overall increases in economies of scale will ensure that any negative impact on profitability will be minimised[2].

The increased demand for these more efficient products will ultimately require companies to expand production capacity (existing and new companies) and this will involve increased costs initially in terms of building extra plants. However, these costs would be more than matched by the extra sales.

There is, however, likely to be some effect on companies producing and supplying non-compliant lamps as their products will effectively be banned under the requirements of the Implementing Measure. This will not affect the larger companies (Philips, Osram etc.) to the same degree since they are also suppliers of more energy efficient products and will inevitably switch their production processes to these compliant products. The "Discussion Paper on the Options for a draft Ecodesign Measure on Domestic Lighting Products, October 13th 2008" points out that most GLS lamps sold in the EU are produced in Member State countries with the

[2] Ecos Consulting, November 2008

majority of CFL lamps being produced in countries outside the EU, where there are lower costs of production, and halogen lamps being manufactured in approximately equal proportions between the two. Therefore, the paper asserts, “a shift towards lamps with integrated electronics is likely to cause a shift of production away from the EU”.

However, the paper points to the fact that the natural market development towards more energy efficient products, which has taken place in recent years, means that this shift has largely taken place already and points to the fact that EU manufacturers have recently abandoned the claim that Member States should continue to impose excise duties on imported CFL lamps.

The fact that halogen class C lamps “can be made on the production lines of incandescent lamps” (according to the October 13th Discussion Paper), is also a reason why the Implementing Measure would not result in the complete closure of EU businesses producing only GLS lamps.

There are no manufacturers making GLS lamps in the UK but an earlier consultation carried out by MTP identified at least one manufacturer that makes constituent parts for these lamps. It is not possible to determine if the effects of the Implementing Measure would put such a company out of business, though it might remove one of their current lines of income. This was the only response to the consultation or to the announcement about the UK Voluntary initiative on lighting that mentioned impacts on manufacturers.

Costs to Consumers

The main costs to consumers associated with the Implementing Measure will be related to the difference in purchase costs of those lamps which are to be phased out and those that they select to replace them.

Table 4.7 below sets out the prices used to predict the effects on purchase costs for consumers’

Tale 4.7: Lamp Costs used in impact modelling for the IA

Lamp Type	Cost inc VAT, 2008 (£)	Cost reduction over time	Cost inc VAT, 2014 (£)	Rationale
CFL A	1.67	40 % reduction in 2009	1.00	Average price of stick and spiral CFLs
CFL B+	3.65	40 % reduction in 2009	2.19	Average price of 2nd envelope CFLs
Halogen B	3.20[1]	Phased 65% reduction from 2010 to 2014	2.80	Average price for retro halogen lamps with in-built transformer
Halogen C	3.17	Phased 50% reduction from 2010 to 2014	1.59	Average price for retro halogen lamps
Halogen D	2.02	Constant	2.02	Average price for linear halogen lamps
GLS class E	0.39	Constant	0.39	Average price for classic lightbulb
GLS class F	0.96	Constant	0.96	Average price for large globe or candle/small decorative lightbulb

[1]The current average market price of Halogen B lamps is approximately £8.00 but this has been divided by 2.5 in the modelling to account for the fact that Halogen B lamps last 2.5 times longer than other halogens.

For CFLs, the market is already well-developed and further price reductions due to higher sales volumes will be minimal. The price drop in 2009 is due to the removal of the 66% anti-dumping tax.

For Halogen B and C lamps, the price is assumed to fall over time due to higher sales volumes of these lamps, due to the IM and resulting economies of scale. This price drop begins in 2010 when the IM comes into force and the market for these lamps starts to develop. The price of Halogen B lamps is assumed to fall 65% to £2.80 (£1.12 in the model to account for the longer life of Halogen B lamps) by 2014. This projected price drop is supported by research[3,4] demonstrating that there is sufficient potential to reduce production costs for these lamps. The higher price of Halogen B lamps is partly due to the fact they are difficult to manufacture as the transformer is integral to the lamp itself. The price could be further reduced if the transformer was integrated into the luminaire. However, this would require replacement of the luminaire, resulting in an additional cost.

Despite the higher price of Halogen B lamps, it is assumed that some consumers will still buy them due to a preference for this type of light over CFLs. This will happen to a lesser extent whilst there are cheaper clear lamp alternatives available (i.e. retro C lamps), but some manufacturers are likely to be promoting Halogen B lamps (although the measure will prevent B-class lamps being marketed as 'energy saving' or anything that implies that they are).

Table 4.8 sets out predictions for net costs to consumers (as generated by the impact modelling underpinning this IA) resulting from the Implementing Measure under the three different scenarios.

Table 4.8: Costs to Consumers (excl. VAT) from lamp purchases resulting from the IM (£2008)

Year	Most likely scenario (Discounted @3.5%)	Alternative 1 scenario (discounted @3.5%)	Alternative 2 scenario (discounted @ 3.5%)
2008	-13,220,000	-13,220,000	-13,220,000
2009	-7,700,000	-7,700,000	-7,700,000
2010	-21,770,000	-11,130,000	-23,630,000
2011	-25,940,000	-18,010,000	-27,330,000
2012	26,620,000	15,530,000	34,350,000
2013	17,620,000	-7,270,000	29,480,000
2014	-10,620,000	-30,910,000	2,350,000
2015	-7,410,000	-29,350,000	6,780,000
2016	-8,700,000	-27,840,000	7,300,000
2017	-15,920,000	-31,130,000	1,840,000
2018	-17,560,000	-31,090,000	-630,000
2019	-17,380,000	-29,660,000	160,000
2020	-18,510,000	-29,080,000	-220,000
TOTALS	**-120,490,000**	**-250,860,000**	**9,530,000**

Note – in 2008/09, the extra CFLs which would have been introduced by the Voluntary Initiative, were not included in the baseline used by the modelling. Hence the impacts of these sales need to be taken away from the costs attributed to the Implementing Measure. Hence these reduced costs appear as negative costs in 2008/09 in order that the overall analysis sums correctly. The reader should not infer anything intuitive from these entries. See Section 5 for further details.

Consequently, even though the more efficient lamps that people will be required to switch to are more expensive, the negative costs arising in the above table under the "Most likely" and "Alternative 1" scenarios indicate that there will in fact be cost savings to consumers from purchasing lamps in these scenarios due to the fact that they will last longer than those that they replace, so that fewer lamp purchases are needed.

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[3] Ecos Consulting, November 2008

[4] Confidential industry sources

Cost of luminaires

Luminaire costs have been included where the replacement of one lamp type with another requires the purchase of a new luminaire. As identified in Table 3.1 above, Halogen D and Halosocket C lamps require specific luminaires since these lamps do not use the standard screw or bayonet sockets. Therefore luminaire costs have been included where:

- GLS lamps are replaced by Halogen socket C lamps
- Halogen D or Halosocket C lamps are replaced with Halogen C retro, Halogen B or CFLs

A Lighting Association survey identified a 'willingness to pay' of £27 per luminaire (for all types of luminaire), whilst the lowest possible cost is closer to £10 (for a complete lighting fixture e.g. a bedside lamp). An average cost of £16.50 per luminaire has been used in all luminaire cost calculations.

Although consumers are not forced into purchasing new luminaires under the IM, they are being forced to change some of their lamps and as a result of which some people will choose to change luminaires. Therefore, this extra cost is incurred as a result of the IM coming into force.

Estimates for the costs of luminaries that will be incurred by consumers based on the above assumptions are included in Table 4.9 below for the three different scenarios.

Table 4.9: Luminaire costs incurred by consumers under the IM (£2008)

	Most likely scenario (Discounted @3.5%)	Alternative 1 scenario (discounted @3.5%)	Alternative 2 scenario (discounted @ 3.5%)
2010	0	0	0
2011	9,210,000	10,620,000	5,900,000
2012	17,090,000	8,740,000	38,420,000
2013	28,920,000	13,670,000	121,540,000
2014	13,660,000	11,410,000	35,010,000
2015	9,300,000	8,260,000	22,250,000
2016	5,240,000	4,970,000	10,450,000
2017	2,910,000	3,140,000	3,330,000
2018	2,330,000	2,680,000	1,550,000
2019	2,210,000	2,550,000	1,420,000
2020	2,120,000	2,450,000	1,360,000

4.1.2.2 Information Requirements

The Implementing Measure sets out specific requirements regarding information on various characteristics aspects of lamp performance that manufacturers will be obliged to supply. These are set out in details in the annex A1 of this Impact Assessment . Information requirements are the same for all three scenarios. Some information is to be provided on the product itself, with other information to be made available on public access websites.

It is intended that the information provided should enable consumers to make informed decisions about their purchases as well as contributing to compliance and surveillance measures.

Manufacturers already provide certain information on products and websites, and will only incur costs in re-designing packaging and product information leaflets, as well as web re-design costs. However, the volume of sales of non-directional household lamps is very high and these one-off costs, for the limited number of UK manufacturers affected, are not deemed to be significant. .

4.1.2.3 Supply Chain Management and Competitive Position

Potential impacts on manufacturers of GLS lamps have been raised in section 4.1.3.1 below, and highlight the potential effects on manufacturers of non-compliant products following the measure. It has not been possible to quantify what this effect will be. However it is predicted that the effect will be mitigated to an extent since the major manufacturers (Philips, Osram etc.) are suppliers of both compliant and non-compliant lamps, so are expected simply to switch over and increase production of compliant lamps such as CFLs in the future.

Competition Assessment

The proposal as it stands does not directly limit the number or range of suppliers that would be able to exist on the market for lamps. Companies would be free to enter and exit the market at will, with the only restriction being that those placing products on the market ensure that they are compliant with the regulations.

There is a potential that the Implementing Measure might indirectly limit the number of suppliers due to an increase in the costs of production, thereby discouraging companies from entering the market. For example, incandescent lamps are cheaper to produce than equivalent CFLs which involve greater volumes of materials as well as electronics components. Halogen B lamps, in particular, are in their infancy in terms of the technology being used and prices are significantly higher (in terms of both sales and costs of production) than GLS lamps.

As a result, the initial fixed costs of setting up a business (and marginal costs of producing lamps resulting in higher product prices) is likely to be higher after the Implementing Measure comes into force and these costs will disproportionately affect smaller firms who will not be able to spread these costs over larger sales quantities than their larger competitors. Therefore, there may be a negative impact on competition resulting from the measure since fewer firms could be be expected to enter the market. However, currently there are more manufacturers for new technologies such as CFLs and LEDs than conventional technologies such as GLS – this would point towards a positive impact on competition from this Implementing Measure. It has not been possible, with the data available to quantify the overall effect in this Impact Assessment.

The measure will apply across the European Union in an equal manner and it is therefore unlikely that UK firms will be affected any more than their competitors in other Member States. Firms operating within the market would still be likely to compete vigorously since there is no indication that the measure will encourage firms to collude or share information regarding pricing.

4.1.2.5 Market Surveillance and Compliance Systems and Processes

Under the Implementing Measure, manufacturers are obliged to carry out a conformity assessment of any product which they place on the market in accordance with Article 8 of Directive/2005/32/EC. They can choose between the internal design and control system or the management system set out in Annexes IV and V of Directive 2005/32/EC in order to comply with this requirement.

The internal design and control system requires that a technical documentation file is compiled which contains specific information relating to the design and performance of the product against the standards set down in the Implementing Measure. The latter system involves generating and maintaining similar information and also establishing and documenting the management control and design process.

Participation in an eco-management and audit scheme (EMAS) which includes the design function within the scope of that registration will mean that the management system is considered to comply with the requirements of the Implementing Measure. Similarly, if products are designed under a management system "which includes the product design function and which is implemented in accordance with harmonised standards, the reference numbers of which have been published in the Official Journal of the European Union, that management system shall be presumed to comply with the corresponding requirements of the Implementing Measure.

Since the UK market is mostly dominated by a small number of large scale suppliers, dealing in very large volumes of sales, it is not expected that the Implementing Measure will incur any significant costs in terms of verification procedures for these companies. However, they may be implications for smaller companies and those entering the market, particularly where the larger suppliers require their suppliers to establish such systems.

The UK government will need to ensure compliance of products being placed in the market, and it has been estimated that approximately £250,000 is to be set aside for compliance monitoring of all products which are coming under EuP Implementing Measures.

4.1.3 Component/Product Manufacture – Social

4.1.3.1 Effects on producers leaving the market and on jobs

Table 4.1 above identifies potential effects of the Implementing Measure on jobs in companies producing both lamps, which will be phased out by the measure, and in companies producing compliant lamps.

MTP (July 2008: "Improving the energy performance of domestic lighting products") identifies that four main manufacturers represent 80% of the UK market for domestic lighting products and although there is a small amount of CFL production in the UK, approximately 99% originate from Asia. MTP (July 2008) points out that the majority of GLS lamps are produced in Eastern Europe and the discussion paper on the options for a draft Ecodesign Measure on domestic lighting products estimates that approximately 8,000 of the 50,000 people involved in producing lamps in the EU are involved in producing GLS lamps. The paper goes on to estimate that in the worst case scenario, approximately 2,000 - 3,000 of these jobs might be affected by the Implementing Measure.

MTP (July 2008) suggests that the main issue for UK business as a result of the changes in production of lamps would be around assuring that there is a sufficient supply of good quality CFL lamps to replace GLS ones, requiring a significant increase in production capacity worldwide to meet the additional demand for these products. Consequently, there is not expected to be any significant impact either way on UK manufacturers or jobs.

The potential for increased employment in companies manufacturing CFLs in the EU has been identified in Table 4.1, but there is little evidence to assert whether or not this is likely to happen in practice. A post-implementation impact assessment of the World Bank funded Poland Efficient Lighting Project (PEL) which was funded from the Global Environment Facility to promote the sale and use of CFLs in Poland (WORLD BANK GEF Post-Implementation Impact Assessment 2006) concluded that the project may have "contributed to opening up the market overall through expanded demand (and related supply opportunities), contributing to the wave of imports flooding the emerging market. With the cheaper products from abroad, local manufacturers faced serious challenges and competition". The assessment also concluded that the major players in the market, Philips and Osram, continued to dominate the market, with smaller players mostly only operating in the distribution of cheap, low quality products from Asia, with manufacturers maintaining that local production was too expensive in an increasingly competitive market.

4.1.3.2 Global CFL production capacity

The Discussion Paper on the options for a Draft Ecodesign Measure on Domestic Lighting Products identified the concerns of some stakeholders (especially within the European lamp industry) that there might be global production shortages if the phase out of GLS lamps were to be implemented too quickly and producers were not able to manufacture the required numbers of CFL replacements. The paper concludes that this is not a concern with respect to the slow implementation scenarios included in the EuP preparatory study, since the peaks in CFL requirements are relatively low and occur later in the implementation phases, thereby allowing manufacturers sufficient time to adjust capacity. With respect to more rapid implementation of requirements, the discussion paper points to a number of factors which might mitigate against there being a shortage in CFL production:

- Consumers may stockpile GLS lamps or use halogen lamps
- Reviews preceding the European anti-dumping regulations on CFLs have indicated that the Chinese market (which produces 80% of CFLs worldwide) is capable of expanding production of lamps which meet EU product quality requirements rapidly to cater for additional demand
- Whilst other countries might also introduce legislation phasing out GLS lamps, putting greater strain on global production capacities, similar introduction of legislation in countries such as Cuba and other Latin American countries have not created global shortages of CFL lamps, with industry being able to respond sufficiently to the increase in demand. However, it should be noted that the EU could be at risk of becoming a dumping ground for lamps surplus to requirements elsewhere if large countries elsewhere implement legislation faster than the EU to phase out GLS lamps

The overall conclusion appears to be that concerns over a shortage in global production capacity are not likely to materialise.

4.1.3.3 Effects on workers health

Another consideration identified in Table 4.1 is the potential negative effect of increased production of CFL lamps on workers' health due to their mercury content. No definitive sources of evidence have been located during information gathering for this Impact Assessment and it has therefore not been possible to quantify any such effects in the time available.

However, concerns over environmental health standards in factories in some parts of Asia have been raised on a number of occasions in the past. Due to the mercury content in CFLs, there may be concerns over mercury spillage during the manufacturing process and the availability of protective clothing, masks or other means of safeguarding workers' health.

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 benefits under each of these three categories are set out in the following sub-sections.

4.2.1 Product Usage – Environmental

Four areas of environmental impact are associated with reduced power consumption 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; and
- Effects on mercury levels due to reduced emissions from power stations.

A number of assumptions were made in order to generate estimates of changes in energy consumption, which were then used to estimate effects on the value of energy savings (in the following section), CO2 emissions and costs of air quality damage avoidance measures associated with the Implementing Measure. These assumptions, which attempt to predict the types of lamps that consumers will switch to as older inefficient lamps are phased out, are detailed above. Whilst the measure itself does not explicitly promote any specific lamp type over another, it is possible that manufacturers will also promote LED lamps (which are energy efficient) in the future which might also lead to additional benefits (which are not included in those modelled below).

4.2.1.1 Value of changes in CO2 emissions

In accordance with government guidance, the valuation of the decrease in emissions that will result from lighting products using less power 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 2008 to 2020 are as follows:

Table 4.10: EU allowance under emission trading (£2008)											
£/tCO2	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ETS Price	17.21	17.73	18.38	26.6	27.27	27.95	28.65	29.36	30.1	30.85	31.62

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 CO2 savings identified (discounted at 3.5% and in 2008 prices), Table 4.11 below provides the value of the benefits from reducing CO2 emissions which would result.

Table 4.11: Value of reduction in CO2 emissions (£2008)						
	Most likely scenario		**Alternative 1 scenario**		**Alternative 2 scenario**	
Year	**Carbon reduction (ktCO2)**	**Value CO2 reduction (£), DISCOUNTED**	**Carbon reduction (ktCO2)**	**Value CO2 reduction (£), DISCOUNTED**	**Carbon reduction (ktCO2)**	**Value CO2 reduction (£), DISCOUNTED**
2010	123	1,980,000	349	5,610,000	84	1,350,000
2011	313	5,010,000	730	11,670,000	241	3,850,000
2012	607	9,720,000	1,091	17,470,000	490	7,850,000
2013	823	18,420,000	1,244	27,860,000	652	14,610,000
2014	1,018	22,580,000	1,315	29,160,000	824	18,270,000
2015	1,104	24,260,000	1,328	29,180,000	910	19,990,000
2016	1,113	24,220,000	1,307	28,430,000	926	20,160,000
2017	1,103	23,760,000	1,274	27,440,000	893	19,230,000
2018	1,076	22,960,000	1,233	26,320,000	843	17,990,000
2019	1,044	22,070,000	1,190	25,150,000	791	16,720,000
2020	1,003	20,990,000	1,144	23,930,000	742	15,530,000

Table 4.11: Value of reduction in CO2 emissions (£2008)						
	Most likely scenario		Alternative 1 scenario		Alternative 2 scenario	
Year	Carbon reduction (ktCO2)	Value CO2 reduction (£), DISCOUNTED	Carbon reduction (ktCO2)	Value CO2 reduction (£), DISCOUNTED	Carbon reduction (ktCO2)	Value CO2 reduction (£), DISCOUNTED
TOTAL	9,328	**195,970,000**	12,204	**252,220,000**	7,397	**155,550,000**

Costs from HRE

Figures in Table 4.11 above represent the total value of CO2 reductions that would directly result from improvements in energy efficiency with consumers using more efficient lighting products. However, the energy used in lighting homes produces heat, and when these lamps are in a heated space they will contribute useful heat during the heating season (thereby lowering the amount of energy required by the heating system). Older inefficient lamps, which will be phased out as a result of the Implementing Measure, generate a greater amount of heat than the more efficient lamps being driven by the Implementing Measure. Consequently, the amount of heat generated in peoples' homes from lighting will be reduced under the measure, requiring people to use their heating systems more in order to maintain the same level of heat. This is referred to as the 'heat replacement effect' (HRE).

Increases in the use of heating systems to cater for HRE will result in an increase in CO2 emissions which will be an environmental cost of the Implementing Measure. An estimate of the costs involved is calculated in Table 4.12 below by applying factors which predict the amount by which overall energy savings will be reduced by the extra heating required in homes to the gross energy savings estimated to be achieved by the Implementing Measure in each of the three scenarios.

The factors applied allow for differences in fuel mix between electricity generation and heating as well as differing distribution efficiencies and are calculated using the shadow price of carbon in accordance with Defra issued guidance.

Table 4.12: Increased CO2 costs due to the Heat Replacement Effect			
Year	Most likely scenario (discounted @ 3.5%)	Alternative 1 scenario (discounted @ 3.5%)	Alternative 2 scenario (discounted @ 3.5%)
2010	1,270,000	3,600,000	870,000
2011	3,140,000	7,320,000	2,420,000
2012	5,940,000	10,680,000	4,800,000
2013	7,850,000	11,870,000	6,220,000
2014	9,500,000	12,260,000	7,680,000
2015	10,080,000	12,120,000	8,300,000
2016	9,940,000	11,670,000	8,270,000
2017	9,640,000	11,140,000	7,800,000
2018	9,240,000	10,600,000	7,240,000
2019	8,790,000	10,020,000	6,660,000
2020	8,310,000	9,470,000	6,140,000
TOTAL	**83,700,000**	**110,750,000**	**66,400,000**

4.2.1.2 Value of reduced damage costs due to air quality improvements

The reduction in energy usage that will result from the Implementing Measure 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 (which estimate the value of air quality changes) are calculated by applying average values for the benefit of reducing a pollutant emitted by one tonne, as provided by Defra.

Applying these costs to the gross amount of energy savings resulting from the reduction in power consumption provides the following benefits in terms of damages avoided for the period from 2010 – 2020 (discounted at 3.5% at 2008 prices).

Table 4.13: Value of Improvements in air quality (£2008)			
Year	**Most likely scenario (discounted @ 3.5%)**	**Alternative 1 scenario (discounted @ 3.5%)**	**Alternative 2 scenario (discounted @ 3.5%)**
2010	390,000	1,090,000	260,000
2011	970,000	2,250,000	740,000
2012	1,840,000	3,310,000	1,490,000
2013	2,460,000	3,720,000	1,950,000
2014	3,000,000	3,880,000	2,430,000
2015	3,210,000	3,860,000	2,640,000
2016	3,190,000	3,740,000	2,650,000
2017	3,110,000	3,590,000	2,520,000
2018	2,990,000	3,430,000	2,340,000
2019	2,860,000	3,260,000	2,170,000
2020	2,710,000	3,090,000	2,000,000
TOTALS	**26,730,000**	**35,220,000**	**21,190,000**

The increase in energy required to run heating systems as a result of the heat replacement effect described above will lead to an increase in overall emissions from power stations, thereby increasing the costs involved in avoiding air quality damages. HRE factors have been applied to overall energy savings from the Implementing Measure to calculate the additional costs in avoiding air quality damages that will result from additional use of heating systems. These are shown in Table 4.14 below.

Table 4.14: Cost of additional air quality damage due to HRE (£2008)			
Year	**Most likely scenario (discounted @ 3.5%)**	**Alternative 1 scenario (discounted @ 3.5%)**	**Alternative 2 scenario (discounted @ 3.5%)**
2010	280,000	800,000	190,000
2011	700,000	1,630,000	540,000
2012	1,330,000	2,380,000	1,070,000
2013	1,750,000	2,650,000	1,390,000
2014	2,120,000	2,740,000	1,720,000
2015	2,250,000	2,710,000	1,860,000
2016	2,220,000	2,610,000	1,850,000
2017	2,160,000	2,490,000	1,750,000
2018	2,060,000	2,360,000	1,620,000
2019	1,970,000	2,240,000	1,490,000
2020	1,850,000	2,110,000	1,370,000
TOTALS	**18,690,000**	**24,270,000**	**14,850,000**

4.2.1.3 Effects on Mercury Levels

Mercury is a heavy metal, an element that is persistent in the environment and that bioaccumulates up the food chain. It is released in an elemental gaseous form from the burning of fossil fuels (particularly some low grades of coal). It then precipitates rapidly out of the atmosphere, especially when it encounters cold conditions.

Section 4.1.1 above identified that the move towards phasing out of GLS lamps and replacing them with CFL lamps would have negative environmental impacts due to the use of mercury in the production of CFLs. Mercury emissions from electricity generation plants would be expected to decrease significantly due to the reduced requirement for electricity that would be required by using energy efficient lighting products. More detail on this topic can be found in Annex A2 of this Impact Assessment.

4.2.2 Product Usage – Economic

A major economic impact as a result of the requirements of the Implementing Measure are the benefits felt by consumers in terms of financial savings from lower electricity bills.

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 the domestic variable element electricity prices published in the guidance booklet produced by the Interdepartmental Analysts Group (IAG), to assist in evaluations and appraisals of greenhouse gas policies (for the respective years from 2010 to 2020). The electricity prices (per kWh) applied to the energy savings from 2010 to 2020 are given in Table 4.15 and used to calculate values for gross energy savings in Table 4.16

Table 4.15: Electricity prices per kWh (£2008)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Domestic Variable Element	6.34	5.95	5.95	5.98	6.02	6.06	6.13	6.17	6.2	6.24	6.21

Table 4.16: Total savings energy consumption 2010 – 2020 (£2008)						
	Most likely scenario		**Alternative 1 scenario (discounted @ 3.5%)**		**Alternative 2 scenario (discounted @ 3.5%)**	
	Energy savings (GWh)	**Value energy savings (discounted @ 3.5%)**	**Energy savings (GWh)**	**Value energy savings (discounted @ 3.5%)**	**Energy savings (GWh)**	**Value energy savings (discounted @ 3.5%)**
2010	287	16,970,000	812	48,050,000	196	11,590,000
2011	729	39,120,000	1,698	91,100,000	560	30,080,000
2012	1,411	73,160,000	2,537	131,540,000	1,139	59,080,000
2013	1,913	96,320,000	2,893	145,640,000	1,517	76,390,000
2014	2,367	115,930,000	3,057	149,720,000	1,915	93,790,000
2015	2,568	122,330,000	3,089	147,140,000	2,116	100,790,000
2016	2,588	120,500,000	3,039	141,460,000	2,154	100,290,000
2017	2,564	116,100,000	2,962	134,090,000	2,076	93,980,000
2018	2,502	109,990,000	2,868	126,070,000	1,960	86,170,000
2019	2,429	103,810,000	2,768	118,300,000	1,841	78,670,000
2020	2,333	95,890,000	2,660	109,300,000	1,726	70,920,000
TOTAL	**21,692**	**1,010,120,000**	**28,382**	**1,342,410,000**	**17,201**	**801,750,000**

As a result of the 'heat replacement effect' described above, consumers will be required to spend extra on heating and this will represent a cost of the Implementing Measure. An estimate of the amount that consumers will have to pay to generate this lost heat is provided in Table 4.17 below.

Table 4.17: Total costs of Heat Replacement Effect to consumers 2010 – 2020 (£2008)			
	Most likely scenario (discounted @ 3.5%)	**Alternative 1 scenario (discounted @ 3.5%)**	**Alternative 2 scenario (discounted @ 3.5%)**
2010	3,760,000	10,640,000	2,570,000
2011	9,070,000	21,130,000	6,980,000
2012	16,880,000	30,340,000	13,630,000
2013	22,020,000	33,290,000	17,460,000
2014	26,360,000	34,050,000	21,330,000
2015	27,570,000	33,160,000	22,720,000
2016	26,850,000	31,520,000	22,350,000
2017	25,700,000	29,680,000	20,810,000
2018	24,240,000	27,790,000	18,990,000
2019	22,770,000	25,950,000	17,250,000
2020	21,150,000	24,110,000	15,640,000
TOTAL	**226,370,000**	**301,660,000**	**179,730,000**

In addition to the economic costs and benefits associated with usage of more efficient lamps set out in the previous two tables, there will be an additional benefit to the UK from the contribution of the measure to meeting government targets for renewable energy. With a reduction in electricity requirements resulting from using more energy efficient products, the UK will be able to meet its targets for the contribution of renewable energy sources to overall energy at a reduced cost. Currently, renewable energy sources are more costly in financial terms than other sources of energy and reducing overall energy requirements will generate an additional benefit by reducing the need to make energy reductions through renewables. This benefit has been estimated at £18 per Mwh. The results, when applied to the energy savings predicted from the measure, are presented in Table 4.18 below.

Table 4.18: Savings energy consumption 2010 – 2020 (£2008) as a result of reduced need for renewables energy to meet targets

Year	Most likely scenario		Alternative 1 scenario		Alternative 2 scenario	
	Energy savings (GWh)	Value savings from reduction in need to reduce energy consumption through renewables, discounted @3.5% (£)	Energy savings (GWh)	Value savings from reduction in need to reduce energy consumption through renewables, discounted @3.5% (£)	Energy savings (GWh)	Value savings from reduction in need to reduce energy consumption through renewables, discounted @3.5% (£)
2010	287	4,820,000	812	13,640,000	196	3,290,000
2011	729	11,830,000	1,698	27,560,000	560	9,100,000
2012	1,411	22,130,000	2,537	39,790,000	1,139	17,870,000
2013	1,913	28,990,000	2,893	43,840,000	1,517	22,990,000
2014	2,367	34,660,000	3,057	44,770,000	1,915	28,040,000
2015	2,568	36,340,000	3,089	43,700,000	2,116	29,940,000
2016	2,588	35,380,000	3,039	41,540,000	2,154	29,450,000
2017	2,564	33,870,000	2,962	39,120,000	2,076	27,420,000
2018	2,502	31,930,000	2,868	36,600,000	1,960	25,020,000
2019	2,429	29,940,000	2,768	34,120,000	1,841	22,690,000
2020	2,333	27,790,000	2,660	31,680,000	1,726	20,560,000
TOTAL	**21,692**	**297,680,000**	**28,382**	**396,360,000**	**17,201**	**236,370,000**

Only the renewables benefit has been calculated for electricity and no calculations are included here for any resulting HRE effects.

It has not been possible to quantify the HRE renewables cost in the time available for this impact assessment but this would represent a cost to the UK due to the need to generate extra heating from renewables to compensate for the reduction in heat that would be produced from more efficient lamps. However this cost would be significantly smaller than the renewables benefits calculated above

4.2.4 Product Usage – Social

Potential social impacts identified from product usage in Table 4.1 above include reduced functionality of products and potential health impacts. These mostly relate to the switch from GLS lamps to CFLs. MTP (July 2008) recognises that “concerns about CFLs regarding light quality, run-up times, dimmability …pose a risk that may limit their universal acceptance as the lamp replacement of choice.” The requirements under the Implementing Measure provide for the availability of halogen B and C-class lamps which are considered adequate replacements for GLS lamps from the point of view of light quality etc. Also, CFL technology has improved significantly over recent years and it is expected to continue to do so. For example, some CFL lamps on the market are now dimmable.

Therefore, functionality is not considered to be a major issue under this scenario.

MTP (July 2008) recognises that there are potential negative health effects from the extended use of CFL lamps. These can potentially aggravate “certain light sensitive and neurological conditions” and faulty CFLs - along with mains frequency linear fluorescent lamps- “can cause a flicker that, in extreme cases, could trigger an epileptic seizure. The use of electronic CFLs or linear fluorescent control gear can eliminate this small risk to susceptible people.”

The European Commission has issued a Scientific Opinion on the issue and on 23rd September 2008, the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) adopted an opinion on the possible contribution of certain types of energy-saving lamps to the aggravation of symptoms of patients with certain diseases. SCENIHR did not find “suitable specific evidence” on the relationship between CFLs and symptoms in patients with specific conditions but investigated whether three lamp characteristics might have the potential to act as triggers in aggravating some symptoms:

- Flicker
- Electromagnetic fields
- UV and blue light radiation.

The committee only concluded that the third of these characteristics was a potential risk factor in the aggravation of existing light-sensitive symptoms in some patients with diseases such as chronic actinic dermatitis and solar urticaria, concluding that in the absence of relevant data, it was difficult to assess the number of patients who might be at risk. It did, however, provide a “preliminary rough estimation of the worst case scenario” of 250,000 or 0.05% of the EU population. This would represent approximately 30,750 people in the UK, assuming an even distribution across the EU[5]

In its opinion, the SCENIHR stated that “no evidence was found that would indicate that either EMF or flicker could be a significant contributor”.

The Health Protection Agency has conducted research that has also shown that “some energy saving compact fluorescent lights can emit ultraviolet radiation at levels that, under certain conditions of use, can result in exposures higher than guideline levels”. As a result of the research, the agency issued precautionary recommendations regarding the use of single envelope CFLs, advising against their prolonged use where people are in close proximity (<30cm).

A full assessment of the equality impacts is presented in Annex A6.

4.3 End of Life Phase

4.3.1 End of Life - Environmental

Table 4.1 above indicates that there are a number of potential impacts from the Implementing Measure relating to products in their end of life phase. These impacts relate to:

- An increased quantity of mercury in the environment resulting from a higher number of CFLs being sold and ultimately entering the waste stream. This may have impacts in both aquatic and terrestrial environments; and

[5] UK population is 12.3% of the EU population in 2008 according to Eurostat figures

- Potential negative impact from an increase in levels of waste as a result of people replacing existing lamp stocks earlier than otherwise would have been the case, and from changing luminaries to accommodate new halogen lamps replacing GLS.

The MTP model developed to estimate the impacts of the Implementing Measure estimated that approximately 178,700,000 extra CFL lamps will be sold above the baseline (in the 'most likely' scenario. Whilst CFLs are ostensibly controlled from entering the waste stream by the UK Waste Electrical and Electronic Equipment (WEEE) Regulations 2006, which encourage the separate collection of WEEE including household waste, there is currently no obligation upon households to dispose of expired or broken CFLs in the facilities set up for this purpose (provided at designated collection facilities, generally operated by local authorities).

In the UK, CFLs fall under Council Directive 91/689/EC (Hazardous Waste Directive -2005) and must legally be disposed of in hazardous waste streams by companies and industries. Before CFLs were classified as hazardous waste, many companies operated on-site crushing machines to deal with spent lamps. These crushing machines had a carbon filter to remove elemental mercury and the crushed glass was sent on to glass recycling plants, or to landfill sites. The main problem with this approach was that the mercury deposited as a residue on the phosphor powder and the lamp ends would then enter the non-hazardous waste stream as part of the crushed glass. From the implementation of the WEEE Regulations, (July 1st 2007), CFLs designated as hazardous waste must now only be treated through bona fide recycling and recovery operations. This means that companies which used to crush spent lamps on site would now require a Waste Management License, and would need approval from the Environment Agency to deal with hazardous waste. The technical arrangements and cost of licences for hazardous waste recycling have resulted in most producers of used lamp waste joining a WEEE Compliance Scheme, which collect spent lamps from two main sources:

- Civic Amenity Sites registered with the Distributor Take-back Scheme (DTS) and also known as Designated Collection Facilities (DCFs) and;
- Third party Commercial Collection Points - (CCPs) where the recycling companies provide special storage boxes for waste tubes and bulbs, and then arrange the collection and transportation to certified hazardous waste recycling facilities.

It is hard to determine the source of spent CFLs or the numbers being recycled from domestic sources, since recycling companies collect used CFL and tube lamps from both commercial and civic sites and rarely monitor the numbers of each type that are processed. However, it is likely that recycling rates for used CFLs in the UK are still relatively low, despite WEEE targets, which include fluorescent lamps, to increase component, material and substance re-use and recycling to a minimum of 80%. CFLs with integrated ballasts have particular recycling issues since a significant proportion of the waste is either electronics or engineering-grade plastics, making recycling a more complicated activity.

Information on the potential mercury emissions from end-of-life disposal can be found in Annex A3 of this Impact Assessment.

4.3.2 End of Life - Economic

The main potential economic impacts identified at the end of life stage relate to possible changes in recycling and waste management costs arising from the different materials used in the production of some energy efficient lamps.

Whilst there will be costs associated with setting up take-back systems for lamps, the main costs of these systems will be attributable to the WEEE Regulations which are already in force. Under this legislation, producers are required to finance the overall system for waste collection and so the overall costs would not be attributable to the Implementing Measure. However, there will be a larger number of CFLs containing mercury to recycle as a result of consumers purchasing larger numbers following the phase out of GLS lamps. This will require additional specialist facilities for their collection, recycling and treatment and whilst it is not possible to apportion exact amounts, it is arguable that at least some of these costs should be attributable to the Implementing Measure.

Information on indicative costs of setting up end of life disposal sites can be found in Annex A4 of this Impact Assessment.

4.3.3 End of Life Phase - Social

The social impacts associated with end-of-life phase relate primarily to the disposal of spent and broken CFLs. These impacts fall into fall into two areas, as follows:

- Awareness of consumers on how to deal with CFLs at the end of their life; and
- Potential effects on employment in the recycling industry

Consultation with officers at Greenpeace and the Environment Agency has stressed the importance of a public information campaign in order to advise people how to dispose of low-energy bulbs safely and that more information needs to be made available by retailers, local authorities and the government to alert people to the best way of dealing with these products when they become waste.

In the time available to conduct this Impact Assessment, it has not been possible to gather detailed information on the potential costs that might arise from running such information campaigns. However indicative costs of running public campaigns of a similar nature can be found in Annex A5 of this Impact Assessment.

With regard to potential effects on employment in the recycling industry, whilst there will be an increase in the number of CFLs and halogen lamps entering the waste stream, there will also be reduced numbers of GLS. It has not been possible to identify any research undertaken on the effects that the Implementing Measure might have on overall levels of employment in the waste/recycling industry, although due to the need to handle more CFLs which contain hazardous waste (mercury), it is predicted that some extra specialist employment to deal with this might be required.

5. Adjustments for Other Government Policies and Voluntary Initiatives

Two other policies/initiatives are targeting CO2 savings though energy efficiency of domestic lighting. These are:

- A UK Voluntary Initiative
- The Carbon Emissions Reduction Target (CERT)

Note that throughout this Impact Assessment, the Implementing Measure impact figures are presented taking into account the likely effects of the Voluntary Initiative and CERT programme.

UK Voluntary Initiative
The aim of the UK Voluntary Initiative (VI) is to reduce carbon dioxide emissions from UK electricity generation by 2012 through a move towards higher efficiency lamps being supplied to the UK households. The VI, which is being led by major retailers and energy suppliers, should

result in energy efficient lamps replacing their least efficient equivalents in shops in the period 2007-2011. There is thus a clear overlap between the aims of this voluntary initiative and the EuP Implementing Measure. Throughout this Impact Assessment, we have attributed all the costs and benefits to the Implementing Measure from September 2009. (Note, the underlying model used accounts for a 3-4 month lag in stock, so for the purposes of this Impact Assessment, all costs and benefits of the Implementing Measure are presented from the start of 2010).

Since the Voluntary Initiative pre-dates the Implementing Measure, any likely impact of the VI before September 2009 has been accounted for in this Impact Assessment. Previously MTP produced an unpublished scenario which included the likely impact from the VI which extended to 2020. The difference between this scenario and the baseline used for comparing against the impacts of the IM, (which does not include the likely impact of CERT or VI) is taken as the likely attributable energy savings impact of the Voluntary Initiative up to 2009. The IM energy baseline has been effectively adjusted through to 2020, by reducing the energy savings attributable to the IM going forward. The difference between the two scenarios was 276 GWh/year in 2009. These savings have been taken to persist to beyond 2020 (since the average lifetime of CFL is over 11 years). In addition to reducing the energy savings from the IM measure compared to the baseline, the purchase costs associated with the VI have also been reduced (conservatively attributed to 15.8 million CFLs over 2008 and 2009 in this analysis). These costs, extra CFLs which would have been introduced by the VI, are not included in the baseline. Thus, these costs (incurred in 2008 and 2009) need to be taken away from the costs in this assessment. This reduced cost will appear as a negative cost in 2008 and 2009, even though the IM will not have an impact until 2010 (when compared to a baseline that included the VI) – thus it is an artefact of not including the VI in the baseline. For this reason some of the tables (4.6 and 4.8) presented in the analysis above show data for 2008/2009 in order that the overall analysis totals up, though the reader should not infer anything intuitive from these entries.

The same approach was used to net off the benefits of the Voluntary Initiative and CERT; further details below.

Carbon Emissions Reduction Target (CERT)
CERT is the follow-on programme to the Energy Efficiency Commitment (EEC), which places a legal obligation on energy suppliers to install energy efficiency measures. It is scheduled to run between 2008 and 2011.

CERT is based on CO2 targets being met, rather than mandating specific products: energy suppliers have flexibility in terms of how they meet this obligation. It is therefore difficult to predict the actual numbers of CFLs that will be installed under this measure, and at what cost.

The published illustrative mix for CERT, which provides an indication, suggested that 55 million CFLs per annum could be introduced to British homes through direct sales and retailers during this period. MTP have based their modelling on the assumption on this illustrative mix, and additionally assumed that all of the 110m CFLs identified in the illustrative mix of the explanatory memorandum for CERT will be installed equally in 2010 and 2011. This is based on MTP technical expert's view that the lamps will be largely distributed in the final two years of the measure, as energy suppliers follow a distribution pattern similar to EEC. It was found that spreading the 110m CFLs over a longer time period did not significantly impact the costs & benefits attributable to the Implementing Measure, so for the purposes of this Impact Assessment, this assumption was deemed sufficient.

Assumptions listed in CERT Impact Assessment have been used to account for the likely CERT effect within this Impact Assessment, at the request of Defra Economists. The modelling has accounted for the 110 million CFLs predicted to be distributed through CERT and delivering energy savings of 8 kWh/year for each lamp, for 17 years, which is beyond 2020. These energy savings have then been netted off from savings predicted for the IM relative to the baseline presented in the previous sections. Costs have been similarly treated, where the purchase costs of these lamps have been removed from the costs in this analysis. Even thought CERT will run 2008-11, all the lamps costs have been include for the year 2010 and 2011 (55m lamps in each year), since experience under EEC showed that most lamps were installed at the end of the obligation period: in addition with discounting there cost reduction will be smaller so a more conservative effect on the impact assessment. The costs presented in the above sections are inclusive of CERT installations and are adjusted downwards accordingly.

CERT will be succeeded by The Supplier Obligation (SO). Indications from BERR suggest that suppliers might not be permitted to put energy efficiency improvements through the promotion of CFLs against Supplier Obligation targets since the IM would be in force then anyway. In its current form, CERT can only support products which offer a substantial carbon emissions reduction compared to the market average. If the IM is brought in, in its current form then all frosted lamps are required to be CFLs by the time the Supplier Obligation would come into force, so there would be no poorer average product with which to compare them. As a result, they would represent no carbon emission reduction. However other lighting products may benefit from the Supplier Obligation. For example, high efficacy LED technologies may be encouraged. These, however, are not covered by the measure under discussion and, in the absence of any concrete details of what the programme will look like, it is impossible to predict what would be included in this programme.

Consequently, a simplified approach has been adopted in this IA to estimating the effects of CERT (and nothing to the SO) that would need to be netted off from any benefits and costs attributable to the Implementing Measure.

In summary, it is difficult to predict with any confidence whether or not the full numbers of CFLs (110m) will be distributed under CERT if the Voluntary Initiative and/or IM were not in place. Any figures calculated for the IM net of CERT and the Voluntary Initiative are made under the assumption that the full likely benefits and costs of the measure are attributable to them.

Attribution of benefits and costs to any of the three policies (IM, Voluntary Initiative and CERT) is somewhat difficult, as all of these policies have been developed at the same time and the lighting industry has been anticipating and responding to all three. In order to illustrate the effects of the IM alone (i.e. attributing all the benefits and costs to just the IM), additional calculations on benefits and costs are presented in the Annex.

6. Summary of Monetised Benefits and Costs

6.1 Summary of Monetised Benefits

Table 6.1 summarises the monetised benefits predicted in terms of the benefits to users of energy savings, the value of reduced damages from climate change due to lower emissions, the value of air quality damages avoided and not having to meet energy targets through renewables.

Table 6.1: Total economic benefits (£, discounted at 3.5% over period from 2010 to 2020 (2008 prices)

	Most likely scenario	Alternative 1 scenario	Alternative 2 scenario
Total Value Energy Savings	**1,010,120,000**	**1,342,410,000**	**801,750,000**
Total Value CO2 savings	**195,970,000**	**252,220,000**	**155,550,000**
Total Value Air Quality Damages Avoided	**26,730,000**	**35,220,000**	**21,190,000**

Total value of absolute reduction in required delivery of renewable energy	**297,680,000**	**396,360,000**	**236,370,000**
Total	**1,530,500,000**	**2,026,210,000**	**1,214,860,000**
Note: These figures represent monetised costs calculated for the IM after accounting for the impact of CERT and the VI. Total figures for costs and benefits without netting off CERT and VI are presented in Table 6.3 below.			

6.2 Summary of Monetised costs

Table 6.2 summarises the monetised costs from the implementing measure as a result of increased costs of lamps, luminaries, HRE costs associated with CO2, air quality and electricity consumption,

Table 6.2: Total monetised costs from the Implementing Measure (£, discounted at 3.5% over period from 2010 to 2020 (2008 prices)			
	Most likely scenario	**Alternative 1 scenario**	**Alternative 2 scenario**
Total costs of lamps to consumers	**-120,490,000**	**-250,860,000**	**9,530,000**
Total cost of luminaries to consumers	92,990,000	68,490,000	241,230,000
Total increased CO2 costs due to HRE	83,700,000	110,750,000	66,400,000
Cost of additional air quality damage due to HRE	18,690,000	24,720,000	14,850,000
Total increased costs to consumers from HRE	226,370,000	301,660,000	179,730,000
Total	**301,260,000**	**254,760,000**	**511,740,000**
Note: These figures represent monetised costs calculated for the IM after accounting for the impact of CERT and the VI. Total figures for costs and benefits without netting off CERT and VI are presented in Table 6.3 below.			

6.3 Costs and benefits with/without netting off CERT and VI

Summary cost and benefit figures are presented in Table 6.3 below which compare the costs and benefits of the implementing measure both netting off the 55m sales of CFLs anticipated to be distributed through CERT annually in 2010 and 2011 as well as netting off the costs and benefits associated with the VI, and alternatively, identifying these costs and benefits as being attributable to the IM. The table also sets out the CO2 savings in both the traded & non-traded sectors.

Table 6.3: Total monetised costs from the Implementing Measure (£, discounted at 3.5% over period from 2010 to 2020 (2008 prices)			
	Most likely scenario	**Alternative 1 scenario**	**Alternative 2 scenario**
Total costs (including CERT and VI costs)	597,340,000	550,880,000	807,830,000
Total Costs (net of CERT and VI)	301,260,000	254,760,000	511,740,000

Total Benefits (including CERT and VI benefits)	2,413,830,000	2,909,520,000	2,098,220,000
Total Benefits (net of CERT and VI)	1,530,500,000	2,026,210,000	1,214,860,000
CO2 savings – traded sector (including CERT and VI savings)	302,870,000	359,080,000	262,430,000
CO2 costs – non-traded sector (including CERT and VI costs)	131,950,000	159,010,000	114,680,000
CO2 savings – traded sector (net of CERT and VI)	195,970,000	252,220,000	155,550,000
CO2 costs – non-traded sector (net of CERT and VI)	83,700,000	110,750,000	66,400,000

7. 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 current weighted average discounted EU ETS price of CO2 in the "Most likely" scenario is +£21.01 in the traded sector and £23.58 in the non-traded sector.

Thus the following applies for CO2 in the traded sector:

Cost effectiveness = Overall NPV minus PV of traded sector CO2/traded sector CO2

Cost effectiveness = ((£1,531m – £301m) – £196m)/9,328 ktonnes = - £110.77

In the non-traded sector,

Cost effectiveness = Overall NPV minus PV of non-traded sector CO2/non-traded sector CO2

Cost effectiveness = ((£1,531m – £301m) – £84m)/3,549 ktonnes = £322.77

The CEI figures for the traded sector represent savings of approximately £111 per tonne of CO2 saved and, since it is a benefit (i.e. a negative cost), is clearly well below the weighted average discounted EU ETS Allowance price for the traded sector.

Although there is an increase in carbon emissions in the non-traded sector, the non-traded sector CEI indicates that for each extra tonne emitted there is an overall benefit of approximately £323 per tonne of CO2 through the value of reduced energy use and reduced costs of air quality damages. As this is clearly greater than the WAD Shadow Price of Carbon (£23.37), the increase in non-traded carbon emissions is therefore considered cost-effective as part of this policy.

Consequently, the cost of the CO2 savings are deemed to be cost effective for this scenario.

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

A1. PRODUCT INFORMATION REQUIREMENTS ON LAMPS

For non-directional household lamps, the following information shall be provided as from Stage 1, except where otherwise stipulated.

3.1. Information to be visibly displayed prior to purchase to end-users on the packaging and on free access websites

The information does not need to be specified using the exact wording of the list below. It may be displayed using graphs, figures or symbols rather than text.
These information requirements do not apply to filament lamps not fulfilling the efficacy requirements of Stages 1-4.

(a) When the nominal lamp power is displayed outside the energy label in accordance with Directive 98/11/EC, the nominal luminous flux of the lamp shall also be separately displayed in a font at least twice as large as the nominal lamp power display outside the label;
(b) Nominal life time of the lamp in hours (not higher than the rated life time).
(c) Number of switching cycles before premature lamp failure;
(d) Colour temperature (also expressed as a value);
(e) Warm-up time up to 60% of the full light output (may be indicated as "instant full light" if less than 1 second);
(f) A warning if the lamp cannot be dimmed or can be dimmed only on specific dimmers;
(g) If designed for optimal use in non-standard conditions (such as ambient temperature Ta ≠ 25 °C), information on those conditions;
(h) Lamp dimensions in millimetres (length and diameter);
(i) If equivalence with an incandescent lamp is claimed on the packaging, the claimed equivalent incandescent lamp power (rounded to 1W) shall be that corresponding in Table 5 to the luminous flux of the lamp contained in the packaging.

The intermediate values of both the luminous flux and the claimed incandescent lamp power (rounded to 1W) shall be calculated by linear interpolation between the two adjacent values.

Table 6

Rated lamp luminous flux Φ [lm]			Claimed equivalent incandescent lamp power
CFL	**Halogen**	**LED and other lamps**	**[W]**
125	119	136	15
229	217	249	25
432	410	470	40
741	702	806	60

Rated lamp luminous flux Φ [lm]			Claimed equivalent incandescent lamp power
CFL	Halogen	LED and other lamps	[W]
970	920	1055	75
1398	1326	1521	100
2253	2137	2452	150
3172	3009	3452	200

(j) The term "energy saving lamp" or any similar product related promotional statement about lamp efficacy may only be used if the rated power of the lamp is not higher than $0.24\sqrt{\Phi}+0.0103\Phi$.

3.2. Information to be made publicly available on free-access websites

As a minimum, the following information shall be expressed at least as values.

(a) The information specified in point 3.1;
(b) Rated wattage (0.1 W precision);
(c) Rated luminous flux;
(d) Rated lamp life time (from Stage 2 if lifetime > 2000 h);
(e) Lamp power factor;
(f) Lumen maintenance factor at the end of the nominal life (from Stage 2 if lifetime > 2000 h)
(g) Starting time (as X.X seconds);
(h) Colour rendering.

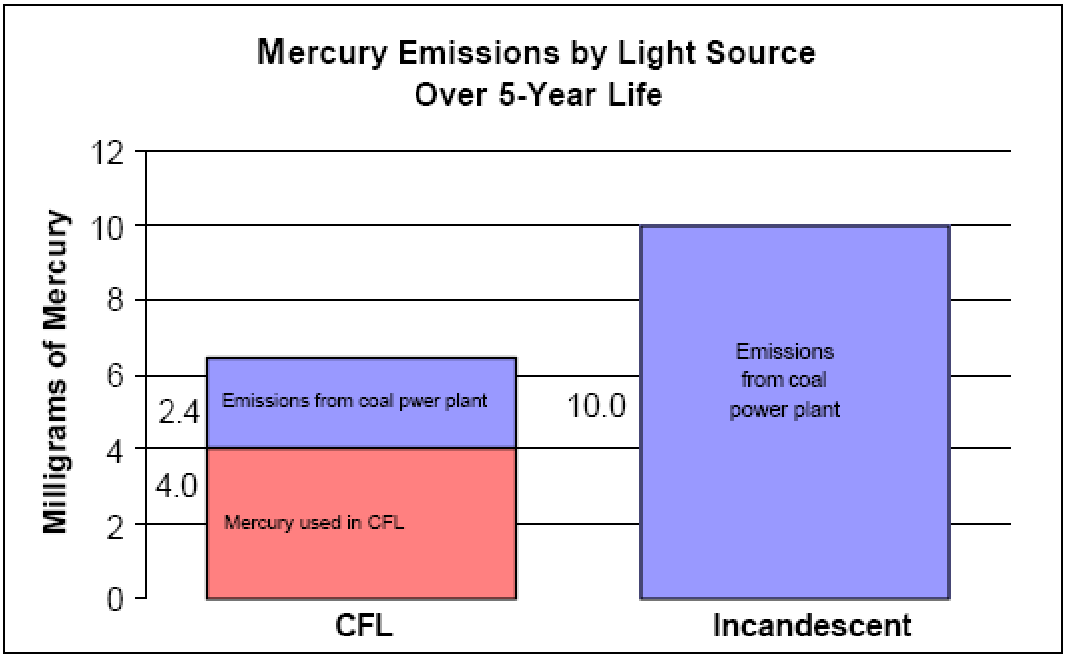
If the lamp contains mercury:

(i) Lamp mercury content as X.X mg;
(j) Instructions on how to clean up the lamp debris in case of accidental lamp breakage;
(k) Recommendations on how to dispose of the lamp at its end of life.

A2. BACKGROUND INFORMATION ON MERCURY EMISSIONS AND PHASE OUT OF INCANDESCENT LAMPS

Research conducted for the US Environmental Protection Agency suggests that there would be a significant reduction in mercury emissions from electricity generation if GLS lamps were phased out in favour of CFLs. Figure A1 below illustrates the relative mercury emissions from GLS and CFL lamps over a five year period as calculated by the US EPA.

Figure A1



Source: US EPA, June 2002

However, this analysis will vary according to the mix of fuels used to generate electricity; a higher concentration fossil fuels used in electricity generation will result in higher mercury emissions. The precise fuel mix used by the EPA in producing the results in Figure A1 above is not stated. Comparisons on the fuel mix used to generate electricity in the EU and in the US are made in Table A2.1 below.

Table A2.1: Electricity generation fuel mix for UK, US and EU25

	Coal	Oil	Gas	Nuclear	Renewables	Other
UK	38%	-	35%	20%	2%	5%
US	48.60%	1.60%	21.40%	19.40%	9.00%	-
EU25	29.50%	4.50%	19.90%	31.00%	13.70%	1.40%

Sources:
Select Committee on European Union: Minutes of Evidence, House of Lords, 23rd April 2008
U.S. Department of Energy, Energy Information Administration (EIA).Chart reflects fuel mix in 2006
European Environment Agency 2004

The savings in mercury emissions from lower electricity generation as a result of lower electricity use due to the phase out of GLS lamps might therefore be expected to be lower in the EU as a whole than in the US due to the lower use of fossil fuels used in generating electricity (71.6% in the US as opposed to 53.9% in EU25).

However, the UK fuel mix includes 73% fossil fuels, which is similar to the US, but the greater use of coal (the burning of which leads to greater mercury emissions) in the US would suggest that mercury emissions due to incandescent lamp use might be somewhat higher in the US than in the UK. MTP (July 2008) “Improving the energy performance of domestic lighting products”, concludes that the government estimates that phasing out inefficient GLS lamps will save over 260kg of mercury from entering the environment either via the air or landfill between now and 2020. It is not clear whether or not the MTP figures are compatible with those produced by US EPA since the fuel mix used to calculate the emissions from CFLs and GLS lamps is not known, nor is the grade of coal used for the analysis. Differences in emissions controls (between the US and UK, and between 2002 and now) also make applying the US figures to the situation in the UK difficult.

A3. MERCURY IMPACTS FROM END OF LIFE DISPOSAL

MTP (July 2008) recognises the challenges that increased volumes of CFLs in the lighting stock and, ultimately, entering the waste stream at their end of life will bring. It states “As large extra volumes of CFLs (following GLS phase-out) impact the waste stream there is a potential, from 2019 onwards, for more mercury to reach the environment (other than that emitted from power stations to the atmosphere) than would have done from continued use of GLS lamps (the Reference scenario). This risk highlights the need to build up effective domestic CFL collection and recycling schemes.”

It has not been possible to identify the source of CFLs entering the waste stream. However, using simplified assumptions on the split in CFLs between commercial and domestic use, and making further assumptions on the general rates of recycling of waste CFLs from household use, it is possible to estimate approximately the number of CFLs which might enter the non-hazardous waste sites (e.g. landfill sites). Table A3.1 below provides an illustration.

Table A3.1: Estimates of extra mercury potentially entering the non-hazardous waste stream (2010 – 2020)

Extra CFLs sold in UK due to EuP measure	Assume 60% recycled	Balance to non-hazardous waste sites	Assume 3mg mercury per lamp	kg mercury
52,902,393	31,741,436	21,160,957	63,482,871	63

Where CFLs end up in the non-hazardous waste stream, in particular in landfill sites as a result of consumers putting them in with general household waste, it is not possible to determine which sites they are going to, nor in which specific quantities.

Hylander and Goodsite examined the clean-up costs of mercury contaminated land and water at a number of different locations in Sweden. Most of the sites were closed industrial sites with extremely high levels of mercury contamination but the research shows that clean-up costs for mercury contamination can be expensive.

Table A3.2: Indicative clean-up costs when dealing with mercury (Hg) contamination

Country	Hg secured	Total cost (million US$)	Cost (US$ kg^{-1} Hg secured)	Year of Costs
Rolfstain	100	11-13	105,000-135,000	1995
Svartsjoama	15-150	15-16	98,000-110,000	2004
Turingen	350	9	25,000	2004
Orserumsviken	750	15	20,000	2002

Source: Environmental costs of mercury pollution. Lars D. Hylander & Michael E. Goodsite. Science of the Total Environment 368 (2006) 352–370

It is noted above that mercury is persistent, bio accumulative and toxic and the repeated dumping of CFLs in household waste in larger quantities at single sites may, in some cases, have the potential to cause dangerous build up. Whilst it is not possible to predict with any accuracy if, where and when this might occur, should monitoring of sites and further research require that a site is treated to deal with mercury contamination, research carried out on contaminated sites in Japan and Sweden provide some information on mercury clean-up costs. These figures are only intended to be indicative and cannot be directly translated to the costs of any clean-up activities that might be required as a result of mercury accumulation from CFLs in the future since the examples they refer to are based on clean up costs for disused industrial sites.

A4. INDICATIVE COSTS OF DEALING WITH END OF LIFE RECYCLING

Consultations with industry did not reveal many concrete figures, given the competitive and expanding nature of the recycling business. The National Household Hazardous Waste Forum (NHHWF) estimates that the cost of recycling one fluorescent tube (inclusive of compliance, transport, collection and treatment) is between £0.30p and £1.65 per lamp. In addition, they provide some costs for setting up and running collections for chemicals and WEEE products. Table A4.1 provides their estimated figures for the set-up and running costs of one hazardous waste collection facility dealing with fluorescent bulbs.

Table A4.1: Indicative costs for set up and running of a hazardous waste collection facility	
Set-up Costs	**£**
Fees to the EA for modification of Environmental Permit	2,300
Publicity (leaflets and signs)	350
Lockable container for fluorescent bulbs	450
Container for fluorescent bulbs	150
Spillage kit and PPE	700
Total per site	**3,950.00**
Running Costs (annual costs/site)	
Fluorescent bulbs/tubes (6 containers emptied at £150 each)	900
Note figures do not include staff costs	

These estimates, however, do not give insights into the geographical coverage of hazardous sites, nor the extra numbers (or at least extra capacity in most cases) that might be required due to the increase in number of CFLs needing to be recycled as a result of the Implementing Measure.

Information on the final recycling of mercury to the commodities (or other) markets is scarce. Whilst improving the take-up of recycled mercury would prevent it from being dumped into any class of landfill, recent figures show that there is a larger volume of mercury being recycled than can be reused by industry, due to its phasing out in many sectors (Source: RPA email correspondence with Environ, 2008).

A5. INDICATIVE COSTS OF RUNNING PUBLIC CAMPAIGNS.

Examples have been sourced which might provide indicative costs, but which are not directly related to the situation of waste CFLs.

To encourage householders to decrease the amount of waste that is disposed of in landfills, the London Borough of Ealing ran two recycling campaigns: one promoting green boxes and the other a food waste campaign, making 138,000 visits over a five month period (including repeat visits to areas of low recycling participation to maximise contact). Three waste education officers were also employed to target door-stepping on recycling and refuse collection days to inform or remind non-participating residents about the recycling services, monitor both the recycling crew performance and household recycling performance and develop sustained, targeted campaigns for one year at a cost of £90,000. These figures and details from another recycling scheme in Bristol are summarized in Table A5.1, below.

Table A5.1: Examples of costs associated with recycling campaigns

Campaign	Activities	Costs per Annum
Ealing Recycling Campaign[6]	16 'door-steppers' making 138,000 visits over five months Supply of Green boxes, composters and 'no junk mail ' stickers	£320,000/ five months
	Three waste Education Officers	£90,000/annum
	Total	**£410,000**
Bristol Battery Recycling Campaign[7]	Collection costs	£10,000
	Tonnage Fee	£9,800
	Promotional Work	£46,230
	Education programme	£7,053
	Retail promotion	£2,260
	Recycling Costs	£6,153
	Total	**£81,496**

Further examples of information campaign costs (not related to waste but which can provide useful indicative costs) are provided in Table A5.2 below. The travel awareness campaign was a national campaign which aimed to reach all households (as a lamp recycling scheme would).

Table A5.2: Further examples of information campaign costs

Campaign	Budget	Target audience	Implied cost per head
National Campaigns			
Annual road safety TV/radio adverts	£3000,000 - £6000,000	3 year bands of children nationally	15-30 p per child
Are you doing	£2 million	One year national campaign reaching 25 million households	8p per household

6 London Borough of Ealing BCLF Door Stepping Campaign Final Report (Waste Watch, September 2007)

7 Battery recycling campaign in Bristol: Report on pilot campaign in preparation for forthcoming European Directive Bristol City Council (September 2003)

your bit?		through national women's press and consumer interest magazines	
Regional campaigns			
Hertfordshire travelwise	£70,000	420,000 households (805,000 people)	17 p per household or 9p per person
Nottingham's Big Wheel	£250,000	650,000 residents	38p per resident
York	£88,000	181,094 residents	49p per resident
Source: Cairns S, Sloman L, Newson C, Anable J, Kirkbride A & Goodwin P (2004) ***Travel awareness*** *'Smarter Choices – Changing the Way We Travel'* UCL, Transport for Quality of Life Final report to the Department for Transport, The Robert Gordon University and Eco-Logica London, UK			

A6 Equality Impact Assessment

Which equality target groups are identified as being affected by the policy:

Age ☐
Disability ■
Faith or Religion ☐
Gender / Transgender ☐
Race ☐
Sexual Orientation ☐
Working Patterns ☐

Summary of negative impacts for each group:

There have been concerns raised with regard to potential impacts of the use of some forms of energy-efficient lighting, in particular Compact Florescent Lamps (CFLs) and halogen lamps, on those with pre-existing photo-sensitive conditions.

There is little evidence to suggest directly that these lamps when used in non-directional domestic lighting situations present a health issue for the public at large. However the Health Protection Agency (HPA) found that some open type CFLs emitted ultraviolet light radiation and has issued advice to the general public on using open type CFLs in certain close working situations[1]. For these situations the HPA issued precautionary advice that the doubly encapsulated type of CFL should be used.

However some support groups have expressed concern that the following conditions can be affected by the use of low-energy bulbs on the market even with normal usage: xeroderma pigmentosum, lupus, migraine, epilepsy, myalgic encephalomyelitis, Irlen-Meares syndrome, fibromyalgia, electrosensitivity, AIDS/HIV, dyspraxia, and autism.

After pressure from the UK and patient support groups, the European Commission's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) considered the health impact of low energy lighting, in particular CFLs, in its Opinion on Light sensitivity issued on 23 September 2008[2] in order to ensure that the proposed EU measures fully considered these issues. SCENIHR did not find suitable direct scientific data on the relationship between energy saving lamps and the symptoms in patients with various conditions. Of all compact fluorescent lamps properties, only UV/blue light radiation was identified as a potential risk factor for the aggravation of the light-sensitive symptoms in some patients with such diseases as chronic actinic dermatitis and solar urticaria. SCENIHR commented that, due to the lack of relevant data, the number of all light-sensitive patients in the European Union, who might be at risk from the increased levels of UV/blue light radiation generated by CFL is difficult to estimate. However, a preliminary rough estimation of the worst-case scenario yields a number of maximum 250,000 individuals (0.05% of the population) in the EU, which equates to a maximum 30,000 people in the UK.

The Department for Health (DoH) most recently conducted a search on Pubmed on 24November 2008 for published information on low energy light bulbs and whether there was any connection with age, disability, faith or religion, gender/transgender, race, sexual orientation or working patterns. The search did not reveal any direct relationship. Neither was there any relationship of these criteria with compact fluorescent light bulbs or halogen light bulbs specifically. Therefore we investigated each clinical condition mentioned by the support groups for information on equality criteria.

Lupus

Lupus UK[3] reports that there are around 50,000 people with lupus, a disease of the immune system, in the UK. The prevalence is around 1 in 1000 overall, however the prevalence in women is ten times that in men[4]. Lupus has also been reported to be more common in African-American, Afro-Caribbean, Native American, Asian Indian, Polynesian and Chinese populations compared with those of European descent[5]. We need to seek further information as to what extent light sensitivity plays a part in the condition experienced by the different ethnic groups. Clinicians[7, 42] informed us that a few thousand people with lupus in the UK could be affected by low energy lighting. Lupus UK informed us that, in their opinion, around 10,000 people with lupus in the UK could potentially be affected by low energy lighting, but the number is undetermined. Most lupus patients react to sunlight (60-80%) in some way and to varying degrees.

Xeroderma Pigmentosum

Clinicians[6,7] and the XP Support Group[8] suggest that there are around 45 to100 cases of XP in the UK, with early onset in children. This is a genetic disease with sensitivity to UV light. XP has been reported in people of every ethnic group all over the world.

Congenital erythropoietic porphyria (CEP)

CEP is a very rare condition, with about 40 patients in the UK[7]. People with CEP have severe and disfiguring reactions to sun and artificial light. SCENIHR[2] noted that the prevalence of congenital erythropoietic porphyria (Günther's disease) in the UK is approximately 2 per 3,000,000 live births.

Solar urticaria

This is an abnormal reaction to sunlight and artificial light, affecting both sexes and may occur at any time of life. The prevalence of idiopathic SU in Tayside, Scotland was estimated at 3.1 per 100,000[9] (Beattie et al 2003). The most common provoking wavelengths are longer UVA and shorter visible. The mean age of onset was found to be 41 years. People with this condition can also be affected by transmission of the light radiation through glass.

Polymorphic light eruption (PLE)

PLE affects ten to twenty per cent of the northern european population, is more common in females than males and affects all ethnic groups. Those suffering from PLE can arise from as little as 20 minutes exposure to the sun, including through window glass, and in some cases from fluorescent lighting. PLE usually do so before the age of 30 years. Both long (UVA) and short (UVB) wavelengths of UV light can cause PLE\in a susceptible person[10].

Chronic actinic dermatitis (CAD)

Skin becomes inflamed in areas exposed to sunlight or artificial\light, and the majority of sufferers have an allergy of some kind. CAD is most prevalent in men over 50 years of age. It also affects women and is increasingly found in young male and female patients with atopic eczema. CAD patients are particularly affected by long wavelength UV and visible light wavelengths. They are advised to avoid direct exposure to fluorescent and metal halide lights[11].

Actinic prurigo

Evidence on this condition was reviewed by SCENIHR[2]. This is an uncommon condition that particularly affects American Indians and less frequently Caucasian and Asian populations. Age of onset is usually before 10 years and it predominantly affects females. Its prevalence is estimated at 3.3 per 100,000 of the general population.

Fluorescent light immediate photosensitivity syndrome

Dr Sarkany (St Thomas' Hospital[7]) informed us of patients with this condition. The numbers affected are unknown.

Autistic spectrum disorders (ASD)

The prevalence of ASD is given as 1 in 167 (ref 12). The National Autistic Society informed us that from the 500,000 people in the UK estimated to have ASD, around 120,000 could be affected by light sensitivity in some form, but this has not yet been subjected to rigorous research. We have seen references to several papers relating to the effects of fluorescent light on autistic patients[13,1485], however further literature searches and assessment of the science would be useful. A study in 2006[15] indicated that as many as 1/100 children may have an ASD, which is four times as common in boys as girls. The prevalence of childhood ASD is around 116 per 10,000.

Epilepsy

In March 2008 the National Society for Epilepsy indicated that they had not received reports of seizures resulting from new generation CFLs (which operate at high frequency) but some members had expressed anecdotal concern. The NSE cite the prevalence of epilepsy at around five to ten cases per thousand people[16]. Another study[17] quotes the prevalence at 7.5 per thousand. Around five percent of epilepsy patients are thought to have photosensitive epilepsy. One study[18] indicates that around three percent of epilepsy patients aresensitive to flicker up to 110 Hz. Epilepsy affects all ages and both sexes, though photosensitive epilepsy is twice as common in females as in males[19]. There are differences in treatment regimes for men and women.. A study by Kobau et al[20] in the USA found no significant differences in prevalence by sex or ethnicity. A website survey by Epilepsy Action[19, 21] indicated that 7/174 responders (4%) thought their seizure had been caused by a CFL. Three reported seizures due to a 2-D low energy light bulb. One respondent out of 174 reported a seizure due to an incandescent light bulb.

Migraine

A study by Becker et al (2008) found a prevalence of migraine at 14% in European countries, around 2.5 times higher in women than men. Migraine can occur at all ages[23]. An American study[24] found the prevalence highest in the 35 to 45 age group and more common in low income groups. A study by Lipton et al 2001[25] found migraine was more common in white people than black people. The number affected by low energy lighting is unknown.

Chronic fatigue syndrome/myalgic encephalopathy (CFS/ME)

One clinician[26] indicated a prevalence of 1 in 250 people. The ME association indicate from their website[27] that around 250,000 people in Britain have CFS/ME, of all ages. People with CFS/ME may find the brightness or intensity of light affects them and also its quality. SCENIHR[2] noted that according to self-reporting, about 52,500 people in the UK (= 21% of myalgic encephalomyelitis) have increased sensitivity to light[61]. It is not known how many with CFS/ME may be affected by CFLs or other specific low energy bulbs.

Ménières disease

NHS choices website[28] indicates that approximately one in a thousand people develop Ménières disease and though it can occur at any age it is rare in children. The Ménières

Society[29] indicates an incidence of one in 2000, affecting both sexes equally and all ages, though most frequently between the ages of 20 and 50 years. They indicate that Ménières disease affects mainly white people. Further information would be required to establish whether low energy lighting is an aggravating factor.

Fibromyalgia

From the orphanet website[30] fibromyalgia affects two to five percent of the population, and is four times as common in women as in men. Onset is usually between 30 and 50 years of age. To our knowledge the effect of low energy lighting on fibromyalgia has not been investigated.

Irlen-Meares syndrome

A review[31] states that around 12 to 14 percent of the population suffers from Irlen syndrome, rising to 46% of those with dyslexia, attention deficit disorders and learning difficulties. Bright lights or fluorescent lights are described as often making the situation worse. Coloured overlays and lenses can be a remedial intervention in some cases. We have not come across information specifically on low energy lighting and Irlen-Meares syndrome.

Dyspraxia

Statistically, there is likely to be one child with dyspraxia in every class of 20-30 children. Dyspraxia affects more boys than girls[32]. The effect of low energy lighting has not to the Department for Health's knowledge been investigated.

HIV/AIDS

It is estimated that over 730,00 people have HIV in the UK[33]. SCENIHR[2] concluded that no risk from flicker concerning other symptoms than retinal diseases has been found for HIV-positive persons.

Consultation that has taken place with each equality target group either externally or internally:

Issues surrounding the potential for there to be negative impacts associated by the use of energy-efficient lighting, as a result of EU measures to phase out incandescent lamps (as well as UK action with retailers and energy suppliers to phase out incandescent lamps on a voluntary basis in advance) were noted in 2007 by patient support groups and individual members of the public. Early discussions were held with representatives from these groups in summer 2007 to assess the scale and extent of the problem, though at this stage there was an absence of scientific evidence that allowed the Government to properly assess the scale and extent of the problem. Discussions with the Department for Health and Health Protection Agency began in autumn 2007.

The Government has maintained engagement with support groups, including Right to Light, SPECTRUM and Lupus UK by:

- By receiving comments on the Governments analysis, targets and standards for domestic lighting via public consultation between December 2007 and March 2008 and, as part of this process, in person in January 2008. Comments and feedback were published in July 2008.

- Close engagement at official and Ministerial level with the All Party Parliamentary Group on Lupus, which held specific discussions (not limited to lupus) three times during 2008, including officials and Minsters from both Defra and the Department for Health as well as photo-dermatology specialists.

- Specific meetings with DoH and HPA held at the UK's Lighting Association in the summer of 2008.

- Informal consultation on the proposed EU Regulation three times, in March 2008, October and November 2008 in order to inform the UK's negotiation position. In addition to this, patient support groups fed directly to the Commission's stakeholder consultation processes throughout, in particular the Stakeholder Forum in October 2007, in Brussels.

This engagement has throughout the period of negotiation with the European Commission allowed the UK to develop a firm line that the phase out of incandescent lighting

List of consultees and research material was obtained:

HPA conducted preliminary research[34] into the emissions from CFLs. HPA found that some CFLs (the open type) could, under close situations such as desk lighting, emit UV light at levels to give exposures above international Guidelines, whereas UV emissions from double envelope CFLs were very low. The international guidelines were established by the International Commission on Non-ionising Radiation Protection (ICNIRP)[35]. The HPA also detected a degree of flicker in CFLs.

The European Commission's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) reviewed relevant scientific work on light sensitivity. Some support groups including SPECTRUM [36], submitted information in the course of preparatory work for the EuP directive 2005/32/EC domestic lighting Lot 19. This was also given to SCENIHR. SCENIHR published their Opinion on light sensitivity on 23 September 2008[2].

SCENIHR concluded that they "did not find suitable direct scientific data on the relationship between energy saving lamps and the symptoms in patients with various conditions (i.e xeroderma pigmentosum, lupus, migraine, epilepsy, myalgic encephalomyelitis, Irlen-Meares syndrome, fibromyalgia, electrosensitivity, AIDS/HIV, dyspraxia, and autism). Therefore, SCENIHR examined whether three lamp characteristics (flicker, electromagnetic fields, and UV/blue light emission) could act as triggers for disease symptoms. Due to lack of data on CFLs, existing data on traditional fluorescent tubes were extrapolated to situations when compact fluorescent lamps may be used.
While for some conditions either flicker and/or UV/blue light could exacerbate symptoms, there is no reliable evidence that the use of fluorescent tubes was a significant contributor. Of all compact fluorescent lamps properties, only UV/blue light radiation was identified as a potential risk factor for the aggravation of the light-sensitive symptoms in some patients with such diseases as chronic actinic dermatitis and solar urticaria."

SCENIHR reviewed the available scientific literature for each clinical condition potentially affected by low energy lighting.

The DoH has also engaged clinical experts, scientists and support groups throughout this process concerning the conditions described. Information on these conditions is summarised below:

Lupus
SCENIHR's observations were that some patients do describe artificial light causing problems. Provoking wavelengths seem to be predominantly in the UVB extending into UVA2. A range of skin presentations include butterfly rash, a polymorphic light eruption presentation and lupus erythematosus tumidus are examples. SCENIHR concluded that "Through their UV component, chronic exposure to CFL could possibly be a problem. Systemic lupus is an important condition in that skin flares can be associated with internal disease activity."

Our own investigations indicate that there is fairly strong evidence from the scientific literature that non-incandescent sources of lighting can aggravate symptoms of people with certain skin conditions, for example In one study[37] thirteen out of thirty photosensitive systemic lupus erythematosus patients described increases in disease activity following exposure to unshielded fluorescent lamps. However standard acrylic diffusers appeared to afford protection. It is known that ultraviolet UVA and UVB radiation can provoke skin rashes and other symptoms seen in lupus patients[38].

Xeroderma pigmentosum
SCENIHR commented that in XP's classical excision repair defective form, there is a marked photosensitivity to UVB wavelengths. Childhood development of skin cancer makes photoprotection against these wavelengths a priority. SCENIHR concluded that "It is possible that unfiltered CFL could be associated with increased disease activity. Patients are currently advised to avoid unfiltered fluorescent lighting. There could be assumed to be a similar problem with other members of the group (of genophotodermatoses)"

Information we have is from UK clinicians and the XP support group[6,7,8]. The sensitivity is so great, and the long term consequences (fatal cancers) of even very tiny amounts of UV, especially UVB, are so severe that XP patients are generally careful about fluorescent lights as well as the more obvious threat from daylight.

Porphyrias
Erythropoietic protoporphyria develops in childhood, or even during infancy. SCENIHR noted that cutaneous porphyrias are particularly sensitive to the blue light region so there would be a theoretical argument when comparing tungsten bulbs (which have less blue light). Porphyrias are rare disorders. SCENIHR concluded that "CFL in extremely sensitive patients could possibly produce a slight increase in the problem compared to tungsten light sources, although there is published evidence against this[39]." A clinician we contacted [7] indicated that congenital erythropoietic porphyria patients have symptoms from wavelengths between 400 and 420nm.

Solar urticaria
Solar urticaria wavelength dependency is most commonly in the UVA region extending into the visible and occasionally also affecting the UVB region. SCENIHR concluded that "It is possible that some patients could be at risk from CFL. It should be noted that incandescent light sources also cause problems in some patients".

Polymorphic light eruption (PLE)
SCENIHR noted that Polymorphic light eruption is thought to be a delayed hypersensitivity response to cutaneous neo-antigens induced in susceptible individuals by UVA and UVB sunlight containing exposure. It may be provoked by exposure to high output artificial sources. Characterisation of the effect of UV emissions on patients with polymorphic light eruptions has been undertaken[40]. SCENIHR concluded that "It is possible that in the most severely affected, CFL could produce the eruption."

Chronic actinic dermatitis (CAD)
SCENIHR concluded that "the degree of photosensitivity suggests there may be a problem with CFL [41](Moseley 2008)". Professor Moseley also indicated to us that his group has been assessing the impact of CFLs on patients with light sensitivity and found that there may be effects on skin at close quarters with the open type of CFL. Other clinicians[7,42] have also indicated that patients with CAD are very sensitive to UV light (UVB, sometimes also UVA).

Fluorescent light immediate photosensitivity syndrome
Dr Sarkany (St Thomas' Hospital[7]) informed us of patients with this condition. These patients have problems with fluorescent and halogen lights but generally not with incandescent light sources. The commonest reaction is for redness and severe burning and prickling feelings in the skin within seconds to minutes of exposure. The numbers affected are unknown.

Actinic prurigo
SCENIHR concluded that severe cases may potentially be at risk from CFL.

Drug/chemical induced photosensitivity
Many drugs are recognised as capable of inducing photosensitivity. SCENIHR indicated that Given the degree of photosensitivity, it is not anticipated that drug induced photosensitivity to the above will be a particular problem for the use of Amiodarone , Phenothiazine , Fluoroquinolone Antibiotics when patients are exposed to CFL compared with incandescent sources. For patients on Photofrin and other Anti-cancer Agents, potent intentional visible wavelength dependent photosensitisers, photosensitivity might be expected to arise with CFL to a greater extent than that seen currently with incandescent light sources because of the greater amount of blue light. However SCENIHR state that these patients are closely managed because of their known temporary phototoxicity, and so in practice this is not likely to constitute a significant problem.

Autistic spectrum disorders (ASD)
SCENIHR concluded that "There is no evidence showing negative effects of fluorescence light on autistic behavior, however, an influence cannot be excluded." SCENIHR noted that the studies of Colman et al. (1976)[13], which suggested that repetitive behavior can be aggravated by the flickering nature of fluorescent illumination, had interpretative problems and could not be replicated (Turner 1999[43]). However, a putative relationship between autism and migraine is still suggested by similarities between the two conditions, including the presence of sensory over-stimulation (Casanova 2008[44]). We have also noted a paper by Gluskin [14] which attempts to explain fluorescent light sensitivity of some people with autism. The National Autistic Society[45] informed us that flicker, wavelength and hum from lighting can aggravate ASD. A paper by Ludlow[84] et al indicated that abnormalities of colour perception in children with autistic spectrum disorders have been reported anecdotally. These authors investigated the use of coloured overlays for reading and found that these helped children with autistic spectrum conditions to read more quickly. Another study[85] supported the theory that autistic children engage in a significantly greater frequency of stereotypical behaviour under fluorescent as compared to incandescent lighting, however the numbers of children in the study were small.

Epilepsy
SCENIHR noted that while photosensitivity of epileptics is scientifically proven, it has not been analyzed if the flicker frequency range above 120 Hz causes seizures, as do frequencies of 15Hz to 18 Hz. SCENIHR concluded that "Seizures are induced by flicker but can be accurately correlated to the frequency only for a small range (3 Hz, 15 to 18 Hz). There is no scientific evidence that fluorescent lamps including CFL induce seizures." We have contacted several clinicians on this issue. Professor Harding[19] indicated that between ten and twenty percent of patients have seizures provoked by artificial light of some sort, including discos, fluorescent lighting in supermarkets and lighting in the walls of underpasses. Professor Harding indicated that, regarding low energy lighting, it is difficult to provide accurate information except by surveys, such as the one carried out by Epilepsy Action, where 4% of the 174 responders thought their seizure had been caused by a CFL. We also note the research by the HPA[34] which detected a degree of flicker in CFLs (100Hz envelope with a modulation in excess of 15%)..

Professor Wilkins [46] informed us that the highest frequency at which flicker can be perceived (critical flicker fusion threshold) is individual and influenced by age and attention, by brightness, modulation depth, field size etc. The highest frequency at which an individual perceives flicker (typically about 70-90Hz) predicts that individual's susceptibility to discomfort from flicker, including flicker at higher, imperceptible, frequencies such as flicker from fluorescent lighting. 100Hz flicker that is imperceptible because it is of too high a frequency or of too low a modulation can nevertheless:-be resolved by the human retina[47], and disturb the control of eye movements[48]. Professor Wilkins indicated that if some people can actually see flicker from compact fluorescent lamps they are unlikely to tolerate it and it is likely to be a health hazard. He had come across second hand reports of "seizure-like" feelings attributed to compact fluorescent lamps. He had been unable to track these down. The upper frequency limit for a photoparoxysmal EEG response to intermittent light is probably 70-80Hz, though sensitivity above 60Hz is rare. Intermittent photic stimulation during the EEG examination uses only brief bursts of stimulation. It is not known whether long-term exposure to higher frequencies increases the risk of seizures, as it does of headache. He has encountered anecdotal reports of seizures from 100Hz fluorescent lighting, although EEG studies would indicate that seizures are unlikely unless the lamps malfunction[49].

Migraine

SCENIHR noted that fluorescent lamps can cause eye-strain and headache (Wilkins et al. 1991[50]). Patients with migraine show somewhat lowered flicker fusion thresholds during migraine-free periods (Kowacs et al. 2004[51]). In addition, photophobia, which is an abnormal perceptual sensitivity to light experienced by most patients with headache during and also between attacks, is documented in many studies (Main et al. 2000[52]).
People with migraine claim to be particularly sensitive to blue light (European Lamp Companies Federation). SCENIHR concluded that "Migraine can be induced by flicker in general (up to about 50 Hz) and patients are light sensitive during and between attacks. Scientific support for aggravating symptoms by flicker from fluorescent tubes was not found. There is anecdotal evidence of problems with blue light."

We contacted several clinical experts regarding the effect of low energy lighting on migraine. One, Dr Steiner[53] indicated that, amongst the patients he sees, complaints about old style fluorescent lighting are much less common than 20 years ago. He felt that claims relating to CFLs are equally unsupported and are rather less likely to be true in any significant number of cases since CFLs are much less associated with flicker than old style fluorescent lights. He did not feel that there is a significant public health issue arising from CFLs as a possible trigger of migraine. However, if the onus of proof lies with those who argue CFLs are safe, there may be a problem since the claims are difficult to disprove objectively as they are to prove.

Another expert, Professor Wilkins[46] indicated that 100 Hz flicker can affect visual search performance[54], cause somatic changes[55], including headache[56]. He commented that there are large differences in fluorescent lamps due to the nature of the phosphor coating, and overall modulation can vary between 100% and about 30%[57]. The halophosphate coating often exhibits persistence, retaining light from one discharge to the next. The more recent and more efficient phosphors, such as those used in CFLs, exhibit less persistence so the modulation depth is potentially greater. Regarding halogen lamps, Professor Wilkins commented that these have been associated with complaints of glare and some of his migraine patients find them uncomfortable, possibly due to multiple high brightness sources in the field of view.

Ménières disease

Ménière's disease is a disorder of the inner ear. Although the cause is unknown, it probably results from an abnormality in the fluids of the inner ear. Ménière's disease is one of the most common causes of dizziness originating in the inner ear. SCENIHR's conclusion was "Light conditions are not associated with Meniere's disease. However, the attacks may be aggravated by flicker."

One expert on Ménières disease we contacted, Professor Yardley[58] indicated that there are reports that certain kinds of lighting make dizziness worse, these are not hard evidence and it is hard to know what kinds of lighting cause the worst proplems, but certainly any lighting that flickers of flashes could be a problem. In a survey carried out for the Ménières Society[59] lighting was cited as a problem for Ménières sufferers in 31% of respondents (10/32 patients), though this was not analysed according to lighting type.

Another clinical expert, Mr Peter Rea[60] indicated that many patients with balance disorders find bright lights as seen in supermarkets uncomfortable, and flickering lights. Flicker is particularly a problem for those with “visual preference”, where the eyes effectively take over the part of the balance function lost by the ears. However Mr Rea is unaware of any research looking at different types of lighting for those with Ménière’s disease, and there is a lack of information to suggest this relates to low energy lighting.

Chronic fatigue syndrome/myalgic encephalopathy (CFS/ME)
SCENIHR noted that chronic fatigue syndrome is one of several names given to a potentially debilitating disorder characterized by profound fatigue which lasts for at least six months. People with chronic fatigue syndrome most often function at a substantially lower level of activity than they were capable of before the onset of illness. Patients report various nonspecific symptoms, including weakness, muscle pain, impaired memory and/or mental concentration, insomnia, and post-exertional fatigue.
SCENIHR concluded that ” There is conflicting evidence regarding patients’ sensitivity towards light.”

One clinician, Professor Pinching[26], indicated that the consistency of the stories about the adverse experiences of some CFS/ME patients with fluorescent strip lighting is enough to say there is a definite question to answer, but does not know the extent this relates to new low energy lighting. It is probably related to the distorted sensory processing that is a common part of the neurological effect of CFS/ME. Professor Pinching indicated that the issue is not just about the intensity of the light, but about the quality.

Another clinician Dr Maurice Murphy[62] did not know of any evidence that demonstrates that CFLs or any other lighting has any effect, detrimental or otherwise, on CFS/ME. Some patients do indicate light sensitivity, but this could be part of a general hypersensitivity to various stimuli. Dr Murphy thought there may be a maladaptive response, for example patients confining themselves indoors then finding it difficult to adapt to brighter lighting. Proper evidence would require a controlled study but this would be difficult practically.

Professor White[63] indicated that he would be surprised if radiation from low energy lighting had a detrimental effect on patients with CFS/ME, but would not be surprised if open studies supported such a relationship. This is because, for some patients, the knowledge that they were being exposed to radiation reported anecdotally to cause harm would be enough to cause such a reaction. Dr White was not aware of any studies to test a reaction to CFLs.

Fibromyalgia
SCENIHR concluded that “Light conditions do not play a role in fibromyalgia. Problems with fluorescent lamps are not investigated but are very unlikely.”

Irlen-Meares syndrome
Irlen-Meares is a learning disability that manifests itself primarily as a difficulty with reading and spelling which may be improved by use of coloured lens or overlays. The Irlen-Meares syndrome is also known as Meares-Irlen syndrome and closely linked to Scotopic Syndrome. SCENIHR indicated that there is no consensus reached within the scientific community about its actual distinctiveness from other forms of dyslexia. SCENIHR noted that self-reporting suggests that fluorescence lighting in contrast to incandescent light aggravate the symptoms of dyslexia. Probably the main problems are caused by UV radiation and blue light, emitted by cool white tubes (Irlen method [64]). SCENIHR concluded that “It is has been shown that dyslectics and Irlen-Meares patients tend to have difficulties detecting flicker. Therefore, flicker from fluorescent tubes should not be a problem. There are self-reported indications that the condition is aggravated by mainly UV and blue light.”

Dyspraxia

SCENIHR concluded that “No evidence in the scientific literature is found regarding any influence of light conditions on dyspraxia.”

Photophobia
SCENIHR noted that photophobia is eye discomfort in bright light, which occurs in many diseases including migraine. Photophobia is a symptom most often associated with pathological eye conditions such as cataracts, corneal damage, burns, infections, inflammation, injury, retinal detachment, etc. People with lighter-coloured eyes and albinism often suffer from photophobia. SCENIHR concluded that “Any effect of flicker, blue light and fluorescent tubes has not been investigated, but cannot be ruled out.”

UV radiation, snow blindness and cataract
SCENIHR concluded that “Fluorescent light does not cause snow-blindness or cataract. This holds true for CFL, provided that UVC and UVB radiations are adequately filtered out.”

Skin cancer
SCENIHR noted that ultraviolet radiation is a major environmental risk factor for skin cancers. Therefore, UV radiation from artificial illumination sources should be reduced to a minimum. The UVC and UVB radiations are especially effective in damaging DNA, and in causing gene mutations and cancerous transformation of cells. The HPA[34] showed that some commercially available CFL emit short wavelength UV radiation down to the UVC region (254 nm). SCENIHR noted that UVA exposure from fluorescent lamps for indoor illumination is still far lower than from the sun or artificial tanning lamps. A case-control study in a population with low sun exposure showed that melanoma risk was not associated with fluorescent lighting in the home or offices[66]. SCENIHR concluded that “Fluorescent lamps do not contribute significantly to the melanoma risk and by analogy CFL will not. Fluorescent lamps, including CFL, are estimated to contribute insignificantly to UV doses effective in causing skin carcinomas.”

HIV/AIDS
SCENIHR noted that HIV-positive persons with retinal damage have been shown in one study to have increased sensitivity to flickering light (Plummer et al. 1998[65]). Problems with fluorescent tubes have not been reported. SCENIHR concluded that “No risk from flicker concerning other symptoms than retinal diseases has been found for HIV-positive persons.”

Retinal diseases
SCENIHR noted that photochemical damage from blue light may induce several harmful effects to the retina mainly by the production of singlet oxygen .Therefore filters are recommended to protect lens and retina from blue light if the antioxidant defence mechanisms and the presence of melanin cannot protect against the damage. SCENIHR noted that HIV-positive patients may have retinal damage such as infectious retinopathies and noninfectious complications, which makes them more sensitive to blue light. SCENIHR concluded that “Blue light may be harmful to those with retinal diseases. There is also some evidence that prolonged exposure to blue light may reduce the colour sensitivity of the intact retina.”

Physical properties
Electromagnetic fields
The limit of exposure to the general public from EMF is based on guidelines by the International Committee on Non Ionising Radiation Protection (ICNIRP, 1998[67]). The science relating to EMFs is kept under review by the World Health organisation[68] and by SCENIHR[69], and by the Health Protection Agency[70]. Information was provided to us, although not peer reviewed, that the electromagnetic fields (EMF) emitted from CFL could potentially cause symptoms among persons that consider themselves sensitive to CFL[71]. Recent extensive reviews indicate that there is no connection between acute EMF exposure from Extremely Low Frequency (ELF) and radiofrequency (RF) fields and perceived symptoms[72,73,74]. The HPA has also reviewed information on electrosensitivity[75]. There is, however, little information on long term effects. SCENIHR noted that the literature on the kinds and strength of EMF that are emitted from CFL

is sparse. Like other devices that are dependent on electricity for their functions, CFLs emit electric and magnetic fields in the ELF range (mainly 50 Hz in Europe). In addition, CFL, in contrast to the incandescent light bulbs, also emit in the high frequency range (30-60 kHz). In a Swiss study[76] eleven different energy saving lamps were investigated and compared with two types of ordinary incandescent light bulbs regarding EMF emissions. All measured EMF values were far below any limits set by guidelines of international organizations like ICNIRP. SCENIHR concluded that “Although there is scarce literature in the area, it seems that the electromagnetic fields generated from CFL are not unique to these lamps, and also not strong in comparison with EMF from any other devices. It has never been conclusively and convincingly shown that there exist any connections between EMF and the symptoms that are reported by persons with so-called electromagnetic hypersensitivity, although their symptoms are real and in many cases very severe. Thus, based on current scientific knowledge, there do not seem to be any correlation between EMF from CFL, and symptoms and disease states.”

Colour quality/rendering
An HPA study[34] showed that the emission of all the tested CFLs in the visible spectral range consisted of a few narrow peaks, with very low emission between them. The authors commented that such a low emission in wide parts of the visible spectrum may require an increase in CFL brightness to perform similar visual tasks compared with other light sources, including tungsten halogen lamps. Professor Wilkins[46] commented that the spectral power distribution of light from CFLs is very uneven, those CFLs with the most efficient television phosphors exhibit just a few peaks, which means that the rendering of surface colours by such lamps is correspondingly poor. Where colour rendering is an important part of visual processing, this could affect visual comfort. There has been little, if any, investigation of these issues.

Ultraviolet light emissions
An HPA study[2] concluded that the UV emissions from a significant percentage of tested CFLs with single envelopes may result in foreseeable overexposure of the skin when these light bulbs are used in close proximity, for example in desk lighting applications. The UV emissions of the tested lamps were not expected to present a realistic hazard to eyes due to aversion responses to bright sources. The HPA issued advice[1] to the general public that these single envelope lamps should not be used less than 30 centimetres or one foot away, however doubly encapsulated CFLs could be used instead.

Cesarini and Muel [77] tested halogen lamps with a quartz envelope on human volunteers. At 10cm from human skin a minimal erythema was induced in about 10 minutes on clear back skin. At a working distance of 50cm erythema could be observed on the back of the hands after 8 hours consecutive working.

Bloom et al [78] studied a 12volt 50 watt quartz halogen lamp, measuring the pyrimidine dimer forming potential of the lamps relative to the sun for the purpose of estimating the DNA toxicity of the lamps. The authors estimated that the relative risk to keratinocyte DNA in human skin, due to UVB and UVC output at a distance of seven centimetres is between 27 and 400% of the noontime summer sun in Michigan.

Studies by the D’Agostini group [79-81] showed that UV from uncovered halogen sources was potentially hazardous by the effects on human peripheral blood lymphocytes, and cell damage and carcinogenic effects in mice.

Most of the studies quoted above relating to potential health effects from halogen bulbs are at least ten years old. Improvements to lamp design and shielding may have been made since then. Further studies on emissions from commonly available contemporary halogen sources would be welcome.

Flicker

The HPA study[2] found that the optical output of all the tested CFLs was modulated at a frequency between 15kHz and 40kHz, representing the frequency of the electronic ballast. In addition, all the CFLs had a 100Hz envelope with modulation in excessof 15%. This degree of modulation at this frequency may be perceivable.

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What does the consultation indicate about the negative impact of the policy, strategy or project?

With regard to the general public, SCENIHR concluded that "In the case of light sources such as table lamps to which individuals may be in close proximity (around 20 cm or less) the exposure to UV radiation, if the use of such sources is prolonged, might approach but is not likely to exceed the workplace limit. Thus, for this particular use, there may be a health risk for the general public. The committee notes that the use of double envelope bulbs or similar technology for such lighting devices would remove this risk[34]. In other use situations the risk is considered negligible. Compact fluorescent lamps could create a risk of blue light over-exposure contributing to some retinal damage when in close proximity to the eye."

SCENIHR[2] concluded overall, given the current state of scientific knowledge, for non skin conditions that:

- There is evidence showing that flicker can cause seizures in patients with photosensitive epilepsy, although there are no reported effects of CFL having such effects [Evidence level E].
- Migraine can be induced by flicker, but no evidence has been provided that CFL induce migraine.
- Blue light can aggravate retinal diseases in susceptible patients, or possibly aggravate migraine.
- It cannot be excluded that Photophobia is induced or aggravated by different light conditions, but it is not mentioned in self-reports.
- People with Autism/Aspergers syndrome have reported problems which they attributed to fluorescent lighting.
- There is sufficient evidence that the conditions of patients with Irlen-Meares syndrome are not influenced by CFL. No reported effects indicate that symptoms in patients with ME, fibromyalgia, dyspraxia, and HIV would be aggravated by CFL.
- It is unlikely that fluorescent lamps can cause snow-blindness or cataracts.
- It is unlikely that any EMF emitted from CFL or other fluorescent lamps would contribute to electromagnetic hypersensitivity
- However, any possible health problems related to flicker and UV/blue light emission are minimized, if CFL are equipped with functional high-frequency electronic ballasts, double envelopes and adequate coating.

SCENIHR concluded for skin conditions that:

- There is sufficient evidence to show that UV and in some cases visible radiation from lamps can provoke a clinically significant skin reaction in light-sensitive patients.
- Fluorescent lamps, including CFL emit UV radiation that may be harmful to a sub-set of particularly sensitive patients.
- CFL may be harmful when in close proximity to the skin (around 20 cm or less).

Overall SCENIHR concluded that "*Of all CFL properties, only UV/blue light radiation was identified as a potential risk factor for the aggravation of the light-sensitive symptoms in some patients with such diseases as chronic actinic dermatitis and solar urticaria. No evidence was found that would indicate that either EMF or flicker could be a significant contributor"* and *"That the use of double-envelope energy saving bulbs or similar technology would largely or entirely mitigate both the risk of approaching workplace limits on UV emissions in extreme conditions and the risk of aggravating the symptoms of light-sensitive individuals."*

SCENIHR's preliminary rough estimation of the worst-case scenario yields a number of around 250,000 light sensitive individuals (0.05% of the population) in the EU, which equates to about 30,000 in the UK given a population of 60 million.

We note that SCENIHR identified that UV/blue light radiation was a potential risk factor for the aggravation of the light-sensitive symptoms in some patients. The Government's opinion has been that UV emissions should be considered in setting standards for CFLs, halogen lamps and indeed for all light bulbs where appropriate allowed onto the market under the EuP Directive and this has been included in the proposed Regulation. We would encourage that the maximum emissions for UV allowed should not be set such that they could lead to exposures above ICNIRP guidance levels. ICNIRP set guidelines for blue light emissions in 1997[82]. The possibility of technical criteria relating to blue light emissions could be investigated further should further information become available.

It is recognised that there is little or no medical evidence on adverse health effects of flicker from low energy lighting; however, a number of research studies indicated that flicker from fluorescent lighting may cause eyestrain, fatigue, affect visual performance, at some frequencies potentially cause seizures in epileptic patients, and aggravate repetitive behaviour in autistic patients. The physiological and health implications of flickering light needs further research.

Mercury: CFLs contain a very small amount of mercury, the typical amount is under 4 milligrams per lamp. HPA advice[83] is that the mercury cannot escape from an intact lamp and, even if the lamp should be broken, the very small amount of mercury contained in a single, modern CFL is most unlikely to cause any harm. However it makes sense to avoid unnecessary contact with mercury; and a broken light bulb will also produce sharp pieces of glass. HPA give advice on safe disposal methods.

Changes that have been made to the policy as a result of research and/or consultation:

The policy proposals are made at a European level and voted on via comitology, as set out in the Framework Directive for the Eco-design of Energy-using Products (2005/32/EC). The UK has, in light of the engagement with specialists, clinicians, scientists, and patient support groups, been very pro-active in raising this issue at EU level from the very early stages of negotiation, and has been the only Member State to do so. In light of this pressure, the Commission's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) was tasked to assess the issue in more detail in order for the Commission's proposed Regulation to be fully evidence-based.

The UK has consistently pressed for the most ambitious measures to make the greatest energy-savings but which will avoid unintended impacts. In light of the evidence presented above, the

Government recognises the need for halogen lamps to remain on the market in order to mitigate the scale of the problems associated with the use of energy-efficient lighting.

In making its final proposals, the European Commission stated in November 2008 *: "From the point of view of energy-efficiency alone, it is clear that the aim would be to go for a minimum requirement for energy class "A" as soon as possible, which would only leave compact fluorescent lamps and LEDs on the market. However, Article 15 paragraph 5 of the Ecodesign Directive (2005/32/EC) requires the Commission to also look into other aspects than the environmental improvement potential before adopting ecodesign implementing measure, in particular that: '(a) there shall be no significant negative impact on the functionality of the product, from the perspective of the user; (b) health, safety and the environment shall not be adversely affected; (c) there shall be no significant negative impact on consumers in particular as regards the affordability and the life-cycle cost of the product; (d) there shall be no significant negative impact on industry's competitiveness.' Taking into account these aspects, there should be alternatives to CFLs and LEDs on the market, and the phasing out of incandescent lamps should be carefully scheduled. Details are provided in the accompanying Explanatory memorandum and in the draft regulation itself."*

The UK has also consistently pressed for ambitious 'functionality requirements' to be set on lamps as part of the Regulation and the draft Regulation proposes minimum standards for UV emissions, as referred to above. This is primarily to protect the public at large from over exposure to UV light, but will help limit the UV light that those with photo-sensitive conditions will be exposed to.

Policy review:

The European Commission will assess the policy 5 years after entry into force (i.e. circa 2014).