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COMMISSION STAFF WORKING DOCUMENT

Accompanying document to the

Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps

FULL IMPACT ASSESSMENT

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Other involved services: SG, LS, ENV, COMP, ECFIN, INFSO, MARKT, SANCO, TRADE, RTD, ENTR

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EXECUTIVE SUMMARY

Introduction

The Ecodesign Framework Directive[1] lists products which have been identified by the Council and the European Parliament as priorities for the Commission for implementation, including "lighting in both the domestic and tertiary sectors" (Article 16). The Spring Council 2007 called for thorough and rapid implementation of the five priorities[2] set by the Energy Council on 23 November 2006[3], based on the Commission's Action Plan on Energy Efficiency. It also explicitly invited the Commission to "rapidly submit proposals to enable increased energy efficiency requirements (…) on incandescent lamps and other forms of lighting in private households by 2009". The emphasis on lighting was further supported by the European Parliament.[4]

Household lamp technologies include traditional incandescent lamps (GLS), halogen lamps, self-ballasted compact fluorescent lamps (CFLs), and to some extent also single and double capped fluorescent lamps without integrated ballast, light emitting diodes (LEDs) and high intensity discharge lamps. These technologies include also control gear and luminaires designed for these lamps.

The approach for developing the regulation on non-directional household lamps and this impact assessment was structured in four steps.

Step 1 - Assessment of the criteria for an ecodesign implementing measure

In order to assess the criteria for ecodesign implementing measures as set out in Article 15(2) of the Ecodesign Directive, the Commission has carried out a technical, environmental and

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1 Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC, OJ L 191, 22.7.2005, p. 29., **amended by** Directive 2008/28/EC of the European Parliament and of the Council of 11 March 2008 amending Directive 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products, as well as Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC, as regards the implementing powers conferred on the Commission, OJ L 81, 20.3.2008, p. 48

2 Brussels European Council 8/9 March 2007, Presidency Conclusions, 7224/07.

3 TTE (Energy) Council on 23 November 2006, 15210/06.

4 European Parliament resolution of 31 January 2008 on an Action Plan for Energy Efficiency

economic study for “domestic lighting” products, which follows the provisions of Article 15(4a) and Annex II of the Directive. During the study, it was decided to examine the lighting technologies not only when used in “domestic lighting” but also when used in the other applications (including HORECA, shop lighting etc.).

With regard to the criteria set out in Article 15(2) of the Ecodesign Directive, the preparatory study has established the following results fornon-directional household lamps sold in the Community:

Article 15 (2a):	Annual sales volume in the Community:	several hundred million (if not billions) of units a year in the EU
Article 15 (2b):	Environmental impact of installed base in 2007 a.) use phase energy consumption: b.) mercury emissions due to lamps: [5]	a.) 112 TWh b.) 2.9 tons of mercury
Article 15 (2c):	Improvement potential of installed base in 2020 compared to Business As Usual: a.) use phase energy consumption (applying cost effective existing technology in new products): b.) mercury emissions due to lamps:	a.) 87 TWh less consumption per year b.) 2.3 tons of mercury less from the installed base

The improvement potential is due to the fact that technical solutions exist which

– reduce the electricity consumption in non-directional household lamps compared to the market average, while providing the same functionality;

– reduce the life cycle cost for the end-user;

– improve the products to such an extent that it leads to wide disparities of electricity consumption of the non-directional household lamps available on the market.

The mercury content of CFL lamps currently sold varies greatly, although variations are not necessarily linked to additional features or performance; therefore there is a technical potential to reduce the mercury content without affecting product functionality.

The electricity consumption of the installed stock of lamps is of the order of the total electricity consumption of the Netherlands, while the improvement potential is comparable to

[5] Including the mercury content of both the discarded compact fluorescent lamps and the emissions from the generation of electricity operating the all the lamps within scope. For discarded compact fluorescent lamps 4 mg of mercury / lamp and a recycling rate of 20% is assumed.

the total electricity consumption of Romania, therefore they are both considered to be significant. The potential of reducing the mercury emissions of the installed base of lamps by almost 75% compared to BAU in 2020 is also considered to be significant.

Step 2 - Consideration of other relevant initiatives

As set out in Articles 15(2) and 15(4c) of the Ecodesign Directive, relevant Community and national environmental legislation are considered, and related voluntary initiatives both on Community and Member State level are taken into account.

Directive 98/11/EC (Energy labelling of household lamps) is relevant to the use phase energy consumption of non-directional household lamps. However, this directive alone has not been able to achieve the desired market switch. The higher upfront cost to the customer is still an obstacle to a more generalised use of energy-saving lighting, despite awareness of life cycle cost savings raised through the energy label.

Directive 2002/95/EC (RoHS) contains provisions on the mercury content of compact fluorescent lamps and it is considered appropriate to leave the setting of mercury content requirements to that Directive. Nevertheless, mercury content benchmarks are identified for the lamp types covered by the Ecodesign implementing regulation also as an input for the review of the RoHS.

No relevant existing Member States legislation at the national or Community level were identified by the preparatory studies or the consultation process; however several draft legislations were being prepared (e.g. Spain, Ireland, Italy). Voluntary initiatives involving retailers to phase out incandescent bulbs are planned or ongoing in some Member States (France, United Kingdom). However, these initiatives address only a limited subset of products, and only a limited number of retailers take part. Their extension to the entire Community is not a realistic option.

Conclusion of Step 1 and Step 2

Non-directional household lamps are sold in large quantities on the Community market. The electricity consumption and the mercury content of these lamps are significant, and cost effective improvement potentials exist, which are linked to wide disparities of the environmental performance of the equipment on the market with identical functionality.

Mercury content is addressed by other relevant Community legislation which needs update. Market forces and existing legislation or initiatives at Community and Member States level do not address properly the electricity consumption of non-directional household lamps.

It is concluded that the criteria for ecodesign implementing measures as set out in Article 15(2) of the Ecodesign Directive are met, and non-directional household lamps shall be covered by an ecodesign implementing measure pursuant to Article 15(1) of the Ecodesign Directive as regards electricity consumption.

Step 3 – Policy objectives and policy options

Further to Annex II of the Ecodesign Directive, the level of ambition for improving the electricity consumption of non-directional household lamps is determined on the basis of an analysis of the least life cycle cost for the end-user. In addition, benchmarks for technologies yielding best performance, as developed in the preparatory study and the discussions with stakeholders during the meeting of the Ecodesign Consultation Forum on 28 March 2008, are considered. The results are reflected in the objectives that the implementing measure aims to achieve.

The impact assessment looked into several options to trigger the market transformation that would enable the realisation of most of the improvement potentials, such as:

- the repeal of existing legislation,
- no EU action,
- self regulation,
- labelling (energy label, ecolabel),
- minimum requirements set out in an Ecodesign implementing regulation.

Their appropriatenesss to achieve the objectives was examined. However, due to the clear mandate of the Legislator for establishing ecodesign requirements for non-directional household lamps, the depth of the analysis for options other than an ecodesign implementing measure is proportionate for an implementing legal act, and the focus is on the assessment of its key elements taking into account the preparatory study and the input from stakeholders.

Step 4 – Impact assessment

An assessment of the proposed implementing measure is carried out, taking into account the criteria set out in Article 15(5) of the Ecodesign Directive, and the impacts on the affected stakeholders.

Main aspects for consideration in the impact analysis

From a consumer's perspective, quality and performance of lamps refer to:

- colour rendering
- lamp start and warm-up times
- lifetime
- aesthetics: bright point light sources are possible only with transparent (clear) glass lamps and are needed in certain lighting installations
- dimmability
- size for compatibility with luminaries

Mercury content is needed for the high efficiency of Compact Fluorescent Lamps (CFLs). It is established that the decrease of mercury emissions resulting from energy savings overweigh the need for mercury in the lamps. The mercury content in CFL lamps remains to some extent a risk factor to the user and to the environment (e.g. broken CFLs that are not properly cleaned up or disposed of).

Other alleged health effects of CFLs

The Scientific Committee on Emerging and Newly Identified Health Risks (on a mandate from the Commission services) looked into the question of health effects of Compact Fluorescent Lamps on people with certain diseases and on the general public, following up to complaints from certain patients' associations. In its report[6], the Committee concluded that the symptoms of about 250.000 people in the EU suffering from diseases accompanied by light sensitivity could be aggravated in the presence of bare CFLs (independent of distance) due to UV and blue light emissions.

6 http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_019.pdf

Using CFLs with an outer non-breakable lamp envelope (common on the market) can largely solve these problems and also that of mercury pollution in case of lamp breakage, but the envelope slightly lowers (about 10%) their efficacy. Improved halogen lamps offer light that is very similar in spectrum to incandescent bulbs, so that they are unlikely to aggravate the symptoms of patients with light sensitivity. In addition, using appropriate luminaires that filter the problematic part of the light should allow the use of any bulb.

Alleged impact on European industry / jobs

Most incandescent lamps sold today in the EU are produced in the EU, whilst most lamps with integrated electronics (such as compact fluorescent lamps) are produced in third countries (due to their higher labour-intensity). Halogens lamps (class C) can be made on the production lines of incandescent lamps, which will mitigate the loss of jobs resulting from a ban of incandescent bulbs. Overall, about 2-3000 jobs (out of the 50.000 people producing lamps in the EU) are estimated to be at stake as a consequence of the incandescent lamp phase-out. Any job losses should be counterbalanced by the macro-economic benefits of reinjecting 5 billion euros / year into the EU economy through the energy savings realised in each household.

Global CFL production capacity

Building on past trends and considering all possible demand scenarios in Europe and in the world (including where other large countries such as China or India join in the incandescent ban in coming years), it is unlikely that any of the options envisaged for the measure would lead to major production capacity problems. No information from any party has given robustness to allegations on a possible capacity issue.

Affordability to the consumer

The increase in purchase price is significant but affordable and it is not considered to be an obstacle to households: incandescent bulbs cost 60 cents, the price of all the alternatives varies between 2 euros up to 10 euros, and is due to lower in the future (higher competition, drop of excise duties on imported CFLs). All the alternatives to incandescent lamps bring substantial savings to consumers over the life cycle of the product.

Description of the main lamp types

I. Incandescent lamp (GLS)

Standard incandescent lamp

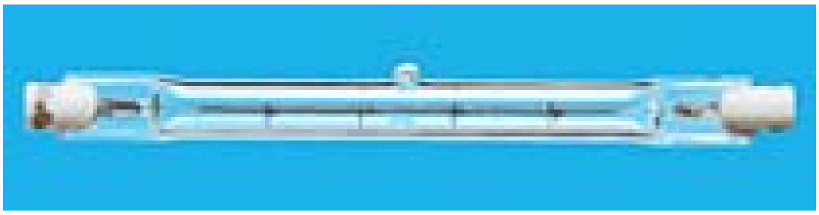
Advantages	Disadvantages

Bright point light source (if transparent glass)	Low efficiency (E, F or G-class)
Full compatibility with existing luminaires	Risk of burning due to operating temperature
Fully dimmable on any dimmer	
Very good quality and performance	
No mercury content	
No presumed health issues	
No impact on EU industry / jobs	

II. Halogen lamps (Halo)

Improved incandescent lamp technology. Much smaller lamp size, equal or slightly higher efficacy than incandescents. Their market share has been rapidly increasing in the past decade as their small size makes them more versatile for lighting design (luminaries and installations).

1.) Conventional halogen lamps (Halo conv)



Conventional halogen lamps

Many standard halogen lamps are low voltage lamps, which are more efficient than mains voltage (220 V) lamps. Low voltage lamps (12 V) require a transformer either in the luminaire or integrated into the lamp.

Advantages	**Disadvantages**
Bright point light source	Low efficiency, no or at best 15% energy savings at mains voltage compared to incandescent lamps (D, E, or F class, low voltage: C class, 25% savings)
Full compatibility with existing luminaires	Risk of burning due to operating temperature
Fully dimmable on any dimmer	
Very good quality and performance	
No mercury content	
No presumed health issues	
No impact on EU industry / jobs	

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

Recent technology. With xenon gas filling, the halogen lamp will use **about 25% less** energy for the same light output compared to incandescents, even at mains voltage. There exist two versions of this halogen lamp:

– only the filling gas is replaced, the socket and the dimensions of the lamp are the same as for conventional halogens above, and therefore can only be used in luminaires with the special halogen sockets **(Halo socket C)**.

– the improved halogen capsule is placed in glass bulbs shaped like incandescent lamps with traditional socket, which makes it compatible with all luminaires using incandescent lamps (sold as retrofit “energy saver lamps”) (**Halo retro C**).

C-class pear-shaped retrofit halogen lamp

Advantages	Disadvantages
Bright point light source	25% energy savings (C class) compared to incandescent lamps
Full compatibility with existing luminaires	Risk of burning due to operating temperature
Fully dimmable on any dimmer	
Very good quality and performance	
No mercury content	
No presumed health issues	
Positive impact on EU industry / jobs	

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

Recent technology. Applying an infrared coating to the wall of halogen lamp capsules considerably improves their energy efficiency, the lamp will use **about 45% less** energy for the same light output compared to incandescents (**Halogen B**). However, for technical reasons, this is only possible with low voltage lamps, so a transformer is needed, either as a separate unit, or integrated into the luminaire, or integrated into the lamp for an incandescent retrofit solution. As with the Halogen C lamps, both the halogen socket capsules and incandescent retrofit lamps are available in B class, however currently only one manufacturer is producing retrofit lamps (even though the technology is not protected by patents). Because of the heat coming from the lamp which affects the operation of the integrated transformer, their lamps are available only up to the equivalent of a 60W incandescent bulb.

B-class pear-shaped retrofit halogen lamp with integrated transformer

Advantages	Disadvantages
Bright point light source	45% energy savings (B class) compared to incandescent lamps
Fully dimmable on any dimmer	Its manufacturing is unlikely to replace incandescent lamp production in the EU
Very good quality and performance	Not compatible with many luminaires (size/socket)
No mercury content	No equivalent yet to GLS > 60W
No presumed health issues	Only one producer currently for GLS retrofit
	Risk of burning due to operating temperature

III. Compact fluorescent lamps (CFLs)

It consists of fluorescent lamp tubes, for which the ballast is not sold as a separate item as for large tubes, but integrated into the lamp, which becomes a standalone retrofit solution to incandescent lamps. Its main interest lies in its long lifetime and high efficiency, the lamp will use **between 65% and 80% less** energy (from a third up to the fifth of the energy) for the same light output compared to incandescents. For decorative reasons, for filtering of UV radiation or for preventing mercury leakage in case the lamps breaks accidentally, CFLs sometimes come with external envelopes which hides the tubes and makes them even more similar to light bulbs (though decreasing their efficiency).

Compact fluorescent lamps with bare tubes and with bulb-shaped outer lamp envelope

Advantages	Disadvantages
Up to 80% energy saving (A class or upper end of B class) compared to incandescent lamps	No bright point lighting
Long lifetime (6 times longer compared to incandescent lamps)	Often not dimmable
No burning risk due to temperature	Mediocre colour rendering
	Low starting and warm up time
	Mercury content
	Its manufacturing is unlikely to replace incandescent lamp production in the EU
	Not compatible with many luminaires (size/socket)
	Some alleged health issues

Efficiency of lamp technologies compared with incandescent lamps

Lamp technology	**Energy savings**	**Energy class**
I. Incandescent lamps	-	E, F, G
II.1 Conventional halogens (mains voltage 220 V)	0 – 15 %	D, E, F
II.1 Conventional halogens (low voltage 12 V)	25%	C
II.2 Halogens with xenon gas filling (mains voltage 220 V)	25%	C
II.3 Halogens with infrared coating	45%	B (lower end)
III. CFLs with bulb-shaped cover and low light output	65%	B (higher end)
III. CFLs with bare tubes or high light output	80%	A

Analysis of the options

All of the considered policy options justify a complete phasing out of incandescent lamps and conventional halogen lamps. They also show the same need to set functionality and product information requirements on the lamps within scope (with the exception of LEDs at this stage) so that consumers obtain more or less equivalent performance with all the alternatives and proper information on any remaining differences. The main questions to be answered are what kind of alternative lamps are left on the market and how fast the banning of the less efficient technologies is implemented.

Sub-Option 1:

From a purely energy efficiency perspective, only compact fluorescent lamps (CFL) should be left on the market. This could save up to **86 TWh** of energy in 2020 compared to business as usual (equivalent to the final total electricity consumption of Finland in 2006 or of 25 million households).

However, the Ecodesign Directive (2005/32/EC) also requires taking into account functionality from the user's point of view (Article 15.5.a) and possible adverse health impacts (Article 15.5.b).

As discussed above, although health issues seem to be affecting only a restricted number of people (about 250000 in the EU), following the precautionary principle, it is advised to leave alternatives to CFLs on the market.

This would also limit the impact on the functionality of the product (detailed under Sub-Option 2).

Options hereunder are ranked following their potential for energy savings.

Sub-Option 2:

Sub-Option 2a:

- require all non-transparent (frosted) lamps to be CFLs as soon as possible (for applications which do not need to be bright point sources)
- allow the most efficient halogen lamps (class B) to exist if they are transparent lamps. This would offer equivalent light quality to incandescent bulbs, full dimmability, no health issues. If class C halogen lamps are allowed to exist for a sufficiently long transitional period, existing GLS and halogen production lines in Europe could be at least partially converted to produce class C halogen lamps in the short term.

Energy savings could drop from 86 TWh to about **51 TWh**.

Dimmability, size/socket compatibility, performance and possible health issues are still present for non-transparent lamps. Consumers facing such problems would have the possibility to use the full range of transparent lamps as replacement, while others keen on the diffuse light of non-transparent lamps could move to CFLs, at the same time realising substantial energy savings.

Currently, the light output of transparent GLS retrofit lamps would be restricted to the equivalent of a 60W GLS, and they are currently produced by only one manufacturer (even though the technology is not protected by patents).

CFLs or class B halogens, due to incorporated electronics or socket incompatibility, will not fit in all luminaires. Consumers would be forced to change the affected luminaires as soon as they run out of replacement lamps. This is also an issue for European (especially Italian

SMEs) luminaire producers, some of whom may have to completely change their product range.

Sub-Option 2b:

- require all non-transparent (frosted) lamps to be CFLs as soon as possible (for applications which do not need to be bright point sources)
- allow the most efficient halogen lamps (class B) to exist if they are transparent lamps. This would offer equivalent light quality to incandescent bulbs, full dimmability, no health issues. If class C halogen lamps are allowed to exist for a sufficiently long transitional period, existing GLS and halogen production lines in Europe could be at least partially converted to produce class C halogen lamps in the short term.
- allow special socket halogens to be class C ("Halo socket C"), as it would solve the socket/luminaire incompatibility issue. The phase-out of such lamps could be tackled instead through luminaire requirements.

Energy savings could further drop down to about **39 TWh**.

Dimmability, size/socket compatibility, performance and possible health issues are still present for non-transparent lamps. Consumers facing such problems would have the possibility to use the full range of transparent lamps as replacement, while others keen on the diffuse light of non-transparent lamps could move to CFLs, at the same time realising substantial energy savings.

The light output of transparent GLS retrofit lamps would still be restricted to the equivalent of a 60W GLS, currently produced only by one manufacturer (even though the technology is not protected by patents).

Sub-Option 2c:

- require all non-transparent (frosted) lamps to be CFLs as soon as possible (for applications which do not need to be bright point sources)
- allow all transparent lamps to be class C indefinitely. This would allow C-class retrofit halogen lamps ("Halo retro C") to exist, offering equivalent light quality to incandescent, full dimmability, no health issues and no incompatibility issues. Existing GLS and halogen production lines in Europe could be at least partially converted to produce these lamps.

Energy savings could further drop down to about **33 TWh**.

Dimmability, size/socket compatibility, performance and possible health issues are still present for non-transparent lamps. Consumers facing such problems would have the possibility to use the full range of transparent lamps as replacement, while others keen on the diffuse light of non-transparent lamps could move to CFLs, at the same time realising substantial energy savings.

Sub-Option 3:

allow the full range (both transparent and frosted) of improved halogen lamps (class C) to exist, because they do not need integrated electronics and come in all sizes and sockets. Energy savings may go down to **22 TWh**.

The sub-options are summarised in the table below, together with the lamp types authorised in the given sub-option, the main consequences of the use of those lamp types and the respective savings potential.

<u>The following should be considered when interpreting the table:</u>

- The remaining problems indicated with "*" and "**" relate to the particular lamp category (being either transparent or frosted) and can be solved by using a lamp of the other technology (e.g. in Sub-option 2b, mercury content issues with CFLs – which are frosted - can be solved completely by using halogen lamps - which are transparent).
- The remaining problems that are not marked with stars are applicable to both lamp categories (transparent and frosted).
- The estimate on the net cost saving per household in 2020 compared to business as usual is taking into account also the lifetime of the lamps and the cost of their replacement. The method of calculation is presented in Section 5.

Overview table of available options and their estimated impacts in 2020 compared to business as usual

Sub-option	**Lamps allowed**		**Remaining Problems not solved by the option**	**EU-27 yearly energy savings in 2020**	**Net cost saving / household yearly in 2020**
	Transparent	**Frosted**			
1	–	CFLs	No bright point light source available Partial compatibility with existing luminaires Probably no replacement to EU GLS production Often not dimmable Alleged health issues Sub-optimal quality and performance Mercury content	86 TWh	59 €
2a	Halogen B *	CFLs **	Partial compatibility with existing luminaires Probably no replacement to EU GLS production * No equivalent to transparent GLS > 60W * Only one producer currently for GLS retrofit ** Often not dimmable ** Alleged health issues ** Sub-optimal quality and performance ** Mercury content	51 TWh	31 €
2b	Halogen B * Halo socket C	CFLs **	Probably no replacement to EU GLS production * No equivalent to transparent GLS > 60W * Only one producer currently for GLS retrofit ** Often not dimmable ** Partial compatibility with existing luminaires ** Alleged health issues ** Sub-optimal quality and performance ** Mercury content	39 TWh	22 €
2c	Halogen B Halo socket C Halo retro C	CFLs **	** Often not dimmable ** Partial compatibility with existing luminaires ** Alleged health issues ** Sub-optimal quality and performance ** Mercury content	33 TWh	19 €
3	Halogen B Halo socket C Halo retro C	CFLs Halogen B Halo socket C Halo retro C	*This option satisfies all possible comfort criteria, as frosted halogen lamps remain available, offering the same service as frosted incandescents.*	22 TWh	10 €

Conclusion on the options

In the **frosted** lamps category, the analysis has shown that it is cost-effective to only allow class A level lamps (= CFLs).

Where consumers look for a particular light quality/aesthetics there is a need to offer alternatives to CFLs. Following the precautionary principle, there is also a need to keep alternatives to CFL lamps for some patients with alleged health issues. This means leaving certain transparent halogen lamps on the market.

The best halogens (class "B") can be considered as an alternative to incandescent for normal screw sockets and for wattages up to 60W.

Leaving halogens retro class "C" (at least in the short/medium term) would provide for wattages above 60W and the possibility to adapt the production lines currently dedicated to incandescent bulbs (mitigating impact on jobs in the EU).

If the special socket halogen lamps were banned in the short term, people would be forced to change their luminaires when they run out of replacement lamps. The impact on luminaire manufacturers (in particular Italian SMEs) would also be significant.

Special socket halogens in class C should be removed from the market in the longer term as more efficient alternatives exist with different lamp caps. It could be considered to phase out luminaires designed for exclusive use with inefficient lamps in a second step that would deal with luminaires and reflector lamps.

Overall, following the assessment of impacts, Option 2b seems to strike the appropriate balance between optimising energy savings, offering sufficient alternatives in terms of functionality and minimising negative economical, social and environmental impacts.

Timing

Staged introduction of requirements (in particular banning incandescent bulbs in several stages) would affect accumulated savings up to 2020 but mitigate impacts on industry and should avoid the risk of supply shortage; the annual savings as from 2020 would remain more or less unchanged.

A possible scenario could be as follows (considering adoption of the measure in March 2009):

Stage	Date	Main result
Stages 1-4	September 2009 – September 2012	Incandescent lamp phase-out in 4 steps, one step each year (100W and above, 75W, 60W, 40W and below), first level of functionality requirements for all lamps in Stage 1
Stage 5	September 2013	Second level of functionality requirements for all lamps
Stage 6	September 2016	Raising the level of the requirements to the maximum planned (class B)

While for non-transparent lamps it is possible to keep only A-class lamps to reap the large potential savings as soon as possible, namely from the first stage, for transparent incandescent bulbs a staged phase-out should be applied with a view to allow for leaving alternative technologies to CFLs for functionality reasons and for alleged health issues for a number of patients. In addition, sufficient time should be left to justify investment to produce class C halogens (for ensuring a smooth transition without supply shortages). At a later stage (around 2016), the level of efficiency for halogens could be raised to class B.

Monitoring of the impacts will mainly be done by market surveillance carried out by Member State authorities ensuring that the requirements are met. The appropriateness of scope, definitions and concepts will be monitored by the ongoing dialogue with stakeholders and Member States. A review of the measure should be planned taking into account market evolution and in particular the development of LED technology.

SECTION 1: PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

Organisation and timing

This implementing measure is one of the priorities of the Action Plan on Energy Efficiency[7], and is part of the 2009 Catalogue of actions to be adopted by the Commission for the year 2009.[8]

The proposed implementing measure is based on the Directive 2005/32/EC of the European Parliament and of the Council establishing a framework for the Commission, assisted by a regulatory committee to set ecodesign requirements for energy-using products[9], in the following abbreviated as "Ecodesign Directive". An energy-using product (EuP), or a group of EuPs, shall be covered by ecodesign implementing measures, or by self-regulation (cf. criteria in Article 17), if the EuP represents significant sales volumes, while having a significant environmental impact and significant improvement potential (Article 15). The structure and content of an ecodesign implementing measure shall follow the provisions of the Ecodesign Directive (Annex VII).

Consultation of stakeholders is based on the Ecodesign Consultation Forum as foreseen in Article 18 of the Directive (see next section for details).

Article 19 of the Directive 2005/32/EC foresees a regulatory procedure with scrutiny for the adoption of implementing measures. Subject to qualified majority support in the regulatory committee and after scrutiny of the European Parliament and of the Council, the adoption of the measure by the Commission is planned by March 2009.

A separate implementing measure on tertiary sector lighting products ("office and public street lighting") is planned for adoption in parallel to this measure.

Impact Assessment Board

A preliminary version of this impact assessment was discussed by the Commission's Impact Assessment Board on 11 November 2008.

The present version of the impact assessment takes these recommendations into account.

Transparency of the consultation process

External expertise on non-directional household lamps was gathered in particular in the framework of a study providing a technical, environmental and economic analysis (in the following called "preparatory study") carried out by a consortium of external consultants[10] on behalf of the Commission's Directorate General for Energy and Transport (DG TREN). The preparatory study followed the structure of the "MEEuP" ecodesign methodology[11] developed for the Commission's Directorate General for Enterprise and Industry (DG ENTR). That methodology has been endorsed by stakeholders and is used for all ecodesign preparatory

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7 COM(2006)545 final.

8 COM(2008)11 final.

9 Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC, OJ L 191, 22.7.2005, p. 29.

10 EuP preparatory study "Lot 19: Domestic lighting", by VITO, documentation available on the ecodesign website of the Commission's Directorate General Energy and Transport http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm.

11 "Methodology for the Ecodesign of Energy Using Products", Methodology Report, final of 28 November 2005, VHK, available on DG TREN and DG ENTR ecodesign websites:
http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm
http://ec.europa.eu/enterprise/eco_design/index_en.htm

studies. The preparatory study was developed in an open process, taking into account input from relevant stakeholders including manufacturers and their associations, environmental NGOs, consumer organizations, and EU Member State experts. The preparatory study provided a dedicated website[12] where interim results and further relevant materials were published regularly for timely stakeholder consultation and input. The study website was promoted on the ecodesign-specific websites of DG TREN and DG ENTR. An open consultation meeting for directly affected stakeholders was organised at the Commission's premises in Brussels on 23 November 2007 for discussing and validating the preliminary results of the study.

In order to meet the objectives and deadlines set by the Spring European Council 2007 and further confirmed by the European Parliament relating to the desired phase-out of incandescent bulbs (which are non-directional lamps), it was decided at the start of the study to split the work in two parts and deal first with non-directional lamps. Directional lamps (such as spots and reflector lamps) will be treated in the second part of the study and will be addressed by another Ecodesign implementing measure.

On 28 March 2008, a meeting of the Ecodesign Consultation Forum[13] was held. Building on the results of the first part of the preparatory study, the Commission services presented working documents suggesting ecodesign requirements related to non-directional household lamps.[14] About one month before the meeting, the working document was sent to the members of the Consultation Forum, and to the secretariats of the ENVI (Environment, Public Health and Food Safety) and ITRE (Industry, Research and Energy) Committees of the European Parliament for information. The working document was published on DG TREN's ecodesign website, and it was included in the Commission's CIRCA system alongside the stakeholder comments received in writing before and after the meeting. The most important parts of the minutes of the Consultation Forum meeting are presented in Annex VII of this impact assessment.

Outcome of the consultation process

The stakeholders' views, as expressed before, during and after the Consultation Forum meeting on 28 March 2008 as a reaction to the Commission services' working documents can be summarised as follows.

All stakeholders support ecodesign legislation on non-directional household lamps. CFL-technology was generally recognised as being the most energy-efficient available technology, economical and affordable. However a number of issues were pointed out in particular regarding functionality from the user’s perspective with some divergence on the speed of change and alternatives to be left on the market.

Member States are mostly concerned about the « quality of light » and support a scenario where there is room -besides CFLs- for other types of light sources, at least in a transitory phase. Further points were raised on the relation to existing waste legislation (RoHS, WEEE), quality aspects of lamps, and on some health aspects.

There is general support to give the measure the form of a directly applicable decision or regulation.

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12 www.eup4light.net

13 Further to Article 18 of the 2005/32/EC Directive, formal consultation of stakeholders is to be carried out throughout the Ecodesign Consultation Forum consisting of a "balanced participation of Member States' representatives and all interested parties concerned with the product group in question ".

14 Available on DG TREN's ecodesign website: http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm#consultation_forum

The general approach to set mandatory minimum requirements in the framework of ecodesign is largely supported by **Industry associations**.[15] Main concerns by Industry relate to the production capacity (« empty shelf syndrome »), product quality and the scope of the measures. The lamp manufacturers association ELC advocates including a list of exemptions for a number of special incandescent lamp types -including coloured lamps, decorative lamps and lamps with < 150 lumen. This would facilitate market surveillance, fight abuse or unintended side-effects. The introduction of minimum product functionality requirements (product life, lumen maintenance, warm-up time, mercury content etc.) is seen as important from the consumer point of view as well as for the global competitiveness of the EU lamp industry. The luminaire manufacturers association support a slower phase-out of incandescent lamps, considering that many luminaires would need to be changed to adapt to other types of lamps. ELC would ask for an exemption for double capped halogens as there is no alternative in current uplighters; the way forward is to ban the luminaires first.

Environmental NGOs considered CFL and energy-saving halogen as transitional solutions until even more efficient lighting is obtained with LEDs (light emitting diodes), while acknowledging that the latter are very new technology not yet largely available for general lighting purposes. NGOs propose to ban uplighter-luminaires with double-capped halogen lamps. They would welcome provisions (not necessarily in the Ecodesign framework) to tackle the waste issue related to CFLs and in particular their mercury content.

Consumer organisation **ANEC/BEUC** mentioned that lumen maintenance for the entire life of the lamp is important and advocated that short switching cycles be taken as a base for the determination of the maximum switching cycles per lamp life. Also, warm up time should be shorter for CFLs (at least 80% in 60 seconds.) They are in favour of a measure that would leave sufficient choice to the consumers in terms of lamp/lighting quality. Product information should be detailed enough to appropriately guide consumers in their choices.

SECTION 2: PROBLEM DEFINITION

The underlying problem can be summarised in the following way: environmentally better performing non-directional household lamps (also representing life cycle cost savings for the users) exist on the market, but are not used as widely as they could be (details on the improvement potential are available below under "Level of ambition and benchmarks").

As requested by Article 15 of the Ecodesign Directive, the preparatory studies identified the environmental aspects in relation to non-directional household lamps:

- they have a significant environmental impact within the Community
- they present significant potential for improvement without entailing excessive costs
- they are not addressed properly by market forces
- they are not sufficiently addressed by other relevant Community legislation.

The identified environmental aspects are <u>energy consumption</u> (in particular during the use phase) and <u>heavy metals (mercury emissions)</u>.

[15] See e.g. contributions of ORGALIME and CECED to the consultation of Directive 92/75/EEC, available on http://ec.europa.eu/energy/demand/legislation/domestic_en.htm#consultation; "CECED vision on Energy Efficiency" of 1st July 2007, available on www.ceced.eu; letter of EICTA to DG TREN of 28 March 2007 related to the termination of the industry self-commitment of consumer electronics (cf. footnote …).

According to the preparatory study, environmental impacts in the production and end-of-life phase were negligible compared to the use-phase impacts in the 15 examined environmental impact categories for all examined technologies, with a few exceptions detailed further. As the use phase environmental impacts relate exclusively to electricity consumption, the most appropriate way to improve the environmental performance of the products in question in all environmental impact categories is to increase their energy efficiency.

Additional issues were identified concerning the functionalities of some of the more energy efficient technologies. Functionality parameters of compact fluorescent lamps such as warm-up times or colour rendering can be quite variable, and in any case not meeting the performance of incandescent lamps. This is detailed below in section 5. Article 15.5.a of the Ecodesign Directive stipulates that “there shall be no significant negative impact on the functionality of the product, from the perspective of the user”. Therefore it is justified to consider functionality requirements to ensure availability of alternative technologies that would provide proper service to the users.

Existing legislation and other relevant initiatives

There are legislative and other types of initiatives at both national and Community level, as well as in third countries.

Community level

Directive on the Energy Labelling of Household Lamps (98/11/EC)

The Directive covers mains-powered filament lamps (both incandescent and halogens) and fluorescent lamps of all types, even when marketed for non-household use. Notable exceptions are low voltage lamps and reflector lamps (many halogens and LEDs are thus exempted, and also a number of incandescent lamps and compact fluorescent lamps). As opposed to other energy labelling product directives, there is no display requirement on retailers, because the small size of the product would make it difficult to properly display the respective energy labels on the shelves containing the lamps. Thus the lamp manufacturers alone are held responsible for displaying the energy label on the packaging. A black and white outline version of the label is tolerated due to the high costs of colour printing on the packaging.

The 98/11/EC Directive clearly rewards energy efficient compact fluorescent lamps by allocating an “A” (or in some cases B) class to them. At the other end of the scale, incandescent lamps receive classes G, F or at best E. The efficiency of existing halogen lamps ranges from classes F to B. It is worth noting that class B is very wide, there is a substantial difference between the efficacy of the B-class halogens at the lower end and the B-class compact fluorescent lamps at the higher end.

The Energy labelling of household lamps Directive has not achieved until now the desired market transformation towards more efficient lamps, as ten years after adoption of the label, class E, F and G incandescent lamps continue to catch the highest market share in terms of volume against the class A "energy saving lamps". The following factors are likely to have played a role in this:

– the relatively low visibility of the lamp energy label to the consumers (most often black and white outline, displayed only on the packaging, at the rear when scoring poorly and often in very small size due to the size of the packaging itself)

– the purchase price difference (0.6 € for an incandescent lamp versus at least 4 € for a compact fluorescent lamp) constitutes a psychological barrier to consumers who do not realise the substantial life cycle cost saving of buying a more efficient lamp

– compatibility and functionalities issues with the compact fluorescent lamps (see section 5 below for details) when compared to incandescent lamps.

Regulation on voluntary Ecolabelling of light bulbs (2002/747/EC)

The voluntary Ecolabel on light bulbs was put in place in 1999 and last amended in 2002. Manufacturers may display the "EU flower" rewarding outstanding environment-friendly products if they comply with the requirements set out in the Ecolabel Regulation. Class A of the energy label is required as minimum energy efficiency level to qualify for the Ecolabel (thereby effectively restricting the Ecolabel to efficient fluorescent lamps), but requirements are also set on the mercury content, the lamp lifetime and other performance parameters. The Ecolabel on light bulbs has not been used by major European lamp manufacturers so far, only a couple of third country manufacturers have registered their products. In fact, European industry has preferred to establish its own voluntary environmental performance parameters for compact fluorescent lamps in the form of an ecoprofile (available on the ELC website). They have also signed the European CFL Quality Charter (see below). It can be considered that the Ecolabel on light bulbs has had a very marginal impact so far on the environmental performance of non-directional household lamps.

The Energy Performance of Buildings Directive (2002/91/EC) requires the Member States to set minimum energy performance requirements for new buildings or for major renovations of large buildings (at least 1000m2). Lighting is mentioned as one of the applications that have to be included in building energy use calculation. However, the effect of this Directive on non-directional household lamps is likely to be limited because of the following reasons:

a) There are no lighting-specific requirements in the Directive and it is left to the Member States, or failing that, to the building planners to use or not the potential of energy efficient lighting systems in complying with the requirements.

b) As the requirement currently only concerns large buildings that are new or undergoing major renovation, it only affects a limited portion of products installed in indoor lighting. Also, the lighting technologies mostly addressed by the proposed regulation are to a great extent installed in domestic lighting, where the tendency is to leave the choice to the end-user in customizing their home lighting installations even in large buildings that would be covered by the Directive.

c) The Directive targets entire buildings and not individual products. System efficiency improvements may be achieved through other means (e.g. building orientation) than incorporating more efficient products.

At the time of drafting this document, the outcome of the ongoing revision of Directive 2002/91/EC was unknown, but it is unlikely that it will bring substantial changes to these conditions (with the exception of the threshold for major renovations).

The Energy End-use Efficiency and Energy Services Directive (2006/32/EC) requires the Member States to adopt national energy efficiency action plans and public procurement rules for increased efficiency. For both, lighting is a recommended but not mandatory area of action, which may target both indoor and outdoor lighting, set system level requirements or promote energy efficient products. The effect of system requirements on non-directional household lamps is limited as explained under Directive 2002/91/EC above. At the product level, Member States have little possibility to set minimum efficiency requirements in national legislation due to internal market rules. The implementing measures of the Ecodesign Directive are meant to create a framework of such product requirements harmonised across the EU. Other possible actions on products, such as public procurement rules, fiscal incentives, voluntary agreements with retailers, promotional campaigns are eligible but have been announced so far in the national energy efficiency action plans of a few Member States only.[16] Some improvement could also be expected due to the development of Energy Services Companies as a result of the Directive, but it is uncertain to what extent that would affect lighting systems and more particularly the installed lighting products themselves, without further supporting measures. At the time of drafting of this document, the effect of Directive 2006/32/EC on non-directional household lamps is difficult to quantify but by all means limited.

In any case, both Directive 2002/91/EC and 2006/32/EC would actually benefit from product level minimum efficiency and information requirements on non-directional household lamps, as they are the building blocks of the more efficient lighting systems promoted by both directives. And even if the latter were implemented to their full potential, there would be still additional improvements to be made through product minimum efficiency requirements (which are based on Article 95 of the Treaty and apply to the internal market, contrary to provisions based on Article 175).

The Directive on the Restriction of Hazardous Substances (2002/95/EC) regulates the mercury content of compact fluorescent lamps. The Directive generally forbids the use of mercury in electronic equipment, however in the Annex on exemptions, mercury is tolerated in compact fluorescent lamps up to 5 mg / lamp. Both the exemptions and the directive are under review at the time of drafting of this document.

The Directive on Waste Electric and Electronic Equipement (WEEE, 2002/96/EC) regulates the way products (including lighting equipment) should be handled when they are discarded at end of life. Manufacturers are required to set up national take-back schemes for used discharge lamps (including compact fluorescent lamps). As the WEEE Directive has specific and stringent requirements on recovery levels of discharge lamps, it does have the potential of improving the end-of-life impact of those lamps. Unfortunately, in practice recycling rates of compact fluorescent lamps are still extremely low across the EU[17], as CFL recycling schemes have been only recently set up in many countries, and there is low public awareness of the need to recycle them. Incandescent lamps and halogen lamps are not covered by the WEEE directive and the related recycling schemes; this contributes to low public awareness of the need to recycle CFL lamps containing mercury.

Regulation 1205/2007/EC imposing anti-dumping duties on imports of compact fluorescent lamps from China and other third countries[18]

In order to stop dumping of import CFLs at a price lower than normal on the EU market, anti-dumping duties were put in place in 2001 on CFLs originating from China, at a rate up to 66.1%. The duties were later prolonged and extended to several other countries. The last one-year extension in October 2007 was heavily criticised by retailers, environmental and consumer NGOs, as such duties are blamed for high CFL prices on the EU market, which are in turn thought to be deterrents to a wider use of CFLs. The duties were removed in October 2008.

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16 Examples include national energy effiency action plans of the United Kingdom, Italy and Romania.

17 It has been difficult to obtain reliable statistics, but according to the survey of a large retailer, even among their eco-conscious consumers the CFL recycling rate is around 20%.

18 COUNCIL REGULATION (EC) No 1205/2007 imposing anti-dumping duties on imports of integrated electronic compact fluorescent lamps (CFL-i) originating in the People's Republic of China following an expiry review pursuant to Article 11(2) of Council Regulation (EC) No 384/96 and extending to imports of the same product consigned from the Socialist Republic of Vietnam, the Islamic Republic of Pakistan and the Republic of the Philippines, OJ L 272/1 17.10.2007

While the removal of the duties could indeed bring lower priced CFLs on the market, it should be kept in mind that the price factor is not necessarily the only deterrent factor to CFL use, as from the point of view of consumers, there are also compatibility and functionalities issues as compared to incandescent and halogen lamps (detailed in section 5).

Another aspect to consider is that a lower price increases the need to cut on production costs thus on quality, which makes the functionality requirements envisaged under the ecodesign implementing measure even more important in case the duties are removed.

<u>Voluntary initiatives</u>

Among the different existing voluntary initiatives at the EU level we can distinguish two main types: the ones that promote compact fluorescent lamps to consumers in order to foster their use[19], and the others that set voluntary functionality parameters for compact fluorescent lamps in order to guarantee their quality.[20]

Both approaches have their limitations. While there is some scope in changing consumer behaviour to install efficient lamps instead of incandescents, a market saturation point is likely to be reached soon, as pointed out in the preparatory study, and discussed in section 5 below. Beyond that point, higher penetration rates of efficient lamps can only be achieved by addressing the market failure with mandatory requirements.

Voluntary functionality requirements only bind the signatories of the agreement, which means that it is most likely that there will be free-riders on the market that do not comply with the voluntary parameters in order to offer cheaper products which may affect consumer's confidence in investing in better products.

Member States level

<u>UK retailers' voluntary agreement to phase out incandescent lamps</u>

The UK government announced in September 2007 a voluntary initiative that is being led by a number of retailers in the UK[21] to phase out incandescent (GLS) lamps over the period to 2011.

The government has proposed, as an illustrative schedule for the phase out of inefficient lamps that retailers might want to follow:

- By January 2008, cease replacing stock of all inefficient GLS A-shaped incandescent lamps of energy rating higher than 100W (predominantly 150W lamps).
- By January 2009, cease selling all inefficient GLS A-shaped lamps of energy rating higher than 60W (predominantly 150W lamps, 100W lamps, plus some 75W lamps)
- By January 2010, cease selling all GLS A-shaped lamps of efficacy of energy rating higher than 40W (predominantly 60W lamps)

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19 Examples include demonstration projects financed under the Intelligent Energy Europe programme such as Greenlight, or the voluntary agreement signed between the European retailers', electricity providers, and lamp producers associations in presence of Energy Commissioner Andris Piebalgs in January 2008, aiming to increase the sales of compact fluorescent lamps across Europe.

20 Such as the European CFL Quality Charter organised by the services of the Commission's Joint Research Centre and signed by the European lamp producers and also by the electricity providers, or the European Lamp Companies Federation's own CFL ecoprofile.

21 The following retailers support this initiative in the UK: ASDA, B&Q, The Co-operative Group, Home Retail Group (Argos and Homebase), IKEA, John Lewis, Marks & Spencer, Morrisons, Sainsbury's, Somerfield, Tesco, Waitrose, Wickes, Woolworths, British Retail Consortium, Association of Convenience Stores and the British Hardware Federation.

- By 31 December 2011, cease selling all remaining inefficient GLS A-shaped lamps and 60W "candle" and "golfball" lamps (predominantly 40W and 25W A-shaped GLS bulbs, and 60W candles and golfballs).

It is expected that candles and golfballs of 40W and less, tungsten halogen lamps and lamps supplied with non-lighting electrical appliances will remain on sale.

There is no formal agreement or commitment on retailers to deliver to this schedule – and the UK government has no way of making sure that lamps are actually removed from shelves. However the competitive climate is such that retailers are unlikely to break the schedule timing, while some retailers are moving faster depending on their marketing positioning. It is also important to note that only a fraction of the market is meant to be covered because of shape and wattage restrictions.

The initiative is also being led by the energy suppliers through the UK's Carbon Emission Reduction Target (CERT) commitments which oblige energy suppliers to subsidise household energy efficiency measures, including provision of energy efficient lamps. The UK's intention with following this voluntary approach is to prepare for the introduction of the Ecodesign regulatory measure.

Plans to introduce national legislation to phase out incandescent bulbs

Since the Australian government's announcement in February 2007 about its plans to phase out incandescent bulbs from 2009, the idea has been on the agenda in several Member States. In some of them the government announced similar plans (such as in Ireland) or the national parliament voted resolutions or laws that the government is supposed to implement (such as in Spain or Italy). In other Member States the idea was raised by the government or in the parliament but no decision has been made so far (reportedly in the Netherlands, France, Finland, Portugal, Belgium). In some cases the Commission received enquiries from these countries about the legal possibilities of such national legislation.

These initiatives from the Member States confirm the European Council's declaration in March 2007 requesting the Commission to adopt minimum efficiency requirements for domestic lighting, including incandescent bulbs.

Third countries

In 2006 and 2007, Cuba implemented a complex incandescent lamp phase-out programme, which consisted of banning sales and also forcing people to replace already installed bulbs by compact fluorescent lamps. Argentina also started to phase out certain categories of incandescent lamps from June 2008 onwards.

The United States and Australia have both adopted national legislation in the past year that will phase out certain categories of incandescent lamps in favour of more energy efficient lamps, while Canada is about to adopt it. The fastest is Australia, where the phase out starts in November 2008 and finishes in 2011. Canada is planning to implement a one-year phase-out in 2012, while the United States will do it between 2012 and 2014.

The efficacy requirements in all three countries are such that current C class halogens comply. However, in the U.S., an ambitious mid-term target has been set for new legislation to be adopted in 2014: the efficacy requirements for 2020 have to be then raised at least to a level that only compact fluorescent lamps can fulfil today. Australia is also planning a slightly less ambitious second phase for 2015, still beyond reach for currently availably efficient halogen bulbs.

For the United States, the scope is most of the time restricted to the most common shapes of lamps, namely the traditional bulbs (A-shape). Many incandescent lamp shapes are exempted, providing an easy loophole for free-riders.

Rumours of China or India planning similar measures have been circulating recently, however no concrete announcement of upcoming legislation has been made so far by the governments.

Many other countries in the world are applying a voluntary approach to phase out incandescent lamps or seriously considering regulatory phase-out. Their list is available in Annex I.

Market failures

Energy consumption

For energy use, the major market barriers that are hindering the achievement of the cost-effective potential of energy-efficient lighting could be described as follows.

- Asymmetric information on purchasing price and running costs / life cycle cost savings: Purchasing price is visible at first sight while information on cost savings/running costs is not explicit. Moreover, for efficient lamps the purchasing price is not 10-20% higher as in the case of the most efficient white goods, but 5-10 times higher than for incandescent lamps and such a price difference deters people from buying more efficient lamps. The information on potential energy savings is displayed in the form of the energy label’s class A to G on their packaging. However, the message may not be explicit enough due to its format (see the Energy label section under Existing legislation above) and the savings seem to be too distant compared to the substantially higher investment at the moment of purchase.

- Negative externality related to energy use: not all environmental costs are included in electricity prices. This leads to a lower awareness of potential future savings linked to energy efficient lamps in case one day prices started to better reflect all costs including environmental ones (the Climate and Energy package, if adopted, will very probably increase electricity prices). As this is combined with the previous market failure related to asymmetric information, the consumer has a biased perception of an immediate and substantial difference in purchasing price with energy saving lamps but does not see the much higher running costs of incandescent lamps that are likely to increase in the future.

- Split incentives: when it comes to larger buildings in the non-domestic sector, the deployment of more energy efficient lighting infrastructures is impaired by the fact that those buildings are generally built by construction companies with the sole purpose to be lent or sold, i.e. the costs for operating the building, including the electricity costs for lighting, are not paid by the investor. For buildings to be successfully placed on the market their price is to be competitive and, unless prospective tenants or buyers explicitly require the building to be equipped with the most energy efficient lighting infrastructures, the installation of more energy efficient lighting systems will not be a priority.

Other environmental parameters of non-directional household lamps

- Negative externality related to mercury content - Market forces have little impact on product environmental improvements not accompanied by cost savings over the product's life cycle, such as reducing their mercury content. This is a negative externality as environmental costs are not accounted for, consequently there are no market incentives to decrease mercury content in compact fluorescent lamps. The problem is addressed by mandatory information requirements and indicative benchmarks in the Regulation, whereas minimum requirements on mercury content of compact fluorescent lamps are set in Directive 2002/95/EC.

In addition to the market failures mentioned above, it has to be mentioned that all compact fluorescent lamps are not necessarily proper substitutes to all incandescent lamps. Their functionalities are much more variable, and their size does not always match (even if they are said to belong to the same category, e.g. golfball-lamps). This is discussed further in section 5. Consumers are likely to be disappointed by the CFL if its functionalities differ substantially from the incandescent lamp it is meant to replace (colour rendering, warm-up times, dimmability…), or if it does not perform well due to some installation related condition (e.g. ambient temperature, luminaire type, position of the lamp etc.). They could also be disappointed by poor quality CFLs that do not live as long as intended (compared with the declared lifetime expectancy). Consequently, there would be a need to ensure that CFLs fulfil certain functionalities, and if they do not, or if they are linked to some installation aspects, consumers are clearly informed about it on the packaging. In order to avoid consumer dissatisfaction as compared to incandescent lamps, there is a need to harmonise both the minimum requirements on the CFL's functionalities and the product information that is provided about them.

Conclusion

The problems described above lead to higher life cycle costs for consumers as electricity consumption and related costs are higher than necessary and subsequently to negative impacts on environment due to higher electricity consumption and more CO2 emissions. They also lead to uninformed consumers buying compact fluorescent lamps not fulfilling the same functionalities as incandescent lamps, and to non-directional household lamps whose environmental parameters such as mercury content could be improved. Therefore (additional) measures have to be taken in order to realize the significant cost-effective improvement potentials.

Baseline scenario for the environmental impact related to non-directional household lamps

In order to carry out a technical, environmental and economic analysis the preparatory study has considered typical non-directional household lamps, with a detailed analysis of representative models of each concerned product. In particular the study has, amongst others, provided the following key elements:

– a set of definitions (functional unit for measuring performance, relevant product parameters);

– technical analysis of the environmental performance and typical usage patterns;

– the installed base ("stock"), the annual sales, and the typical life time;

– technologies yielding improved environmental performance and the additional costs for applying them compared to the current "market average"

– potential trade offs between environmental impacts related to the different improvement options

The structure of the methodology of the technical, environmental and economic analysis is displayed in Annex VIII.

Environmental impact of non-directional household lamps in 2007

Although the electricity consumption of a *single* product is usually small, the large number of lighting products installed leads to important overall electricity consumption. For the year

2007 the preparatory study estimated that a total of 4.2 bln lighting points equipped with incandescent lamps, halogens or CFLs lead to an annual electricity consumption of 112 TWh per year in the EU-27. This corresponds to an annual spending of 15.3 billion Euro[22], and annual 48.3 million tons of CO2 emissions.[23]

The total mercury emissions caused by these lamps (including the mercury emitted during the generation of the electricity used by the lamps) amounts to approximately 2.9 tons / year.

Environmental impact of non-directional household lamps in 2020

Building on the technical, environmental and economic analysis, the baseline scenario for estimating the future evolution of the environmental impact related to incandescent lamps, halogens and CFLs until the year 2020 was developed under the following assumptions.

The total number of lamps in the domestic sector was assumed to constantly increase (+20% in 2020 compared to 2006), due to economic growth (increasing number and size of households, more complex lighting systems). For the extrapolation of the stock and sales from 2007 to 2020 in all sectors, it was assumed that the share of the domestic sector remains constant.

The sharp increase in the number of CFLs per household experienced in the past five years is assumed to slow down after 2011, as by then the market is likely to reach a natural saturation point. Most of the environmentally conscious consumers will have replaced their installed lamp stock with CFLs in those luminaires where they fit.

Similarly, the current trend to replace or buy new luminaires that are only compatible with halogen lamps due to their sockets is likely to reach a saturation point when design-conscious consumers will have replaced their most prominent Edison-socket luminaires. Therefore the growth rate of the G9 and R7s socket halogens is also assumed to slow down after 2011.

As the natural expansion of both CFLs and halogens is assumed to replace incandescent lamps, the market share of the latter is predicted to fall significantly until 2011 and more slowly between 2011 and 2020. Compared to 2006, about 25% of the incandescent lamps are predicted to be replaced by some other (most often more efficient) lamp technology.

These trend assumptions are quantified in more detail in Annex II.

The preparatory study was taking into account the assumptions described above when calculating a Baseline scenario in 2020 of 135 TWh electricity consumption and 3.1 tons of mercury emissions of the installed stock per year.

The main reason for the increase from 2007 is that the number of lighting points is expected to increase to 4.9 bln due to infrastructural development, as quoted above.

Structure of the industry sectors manufacturing household lighting products

There is a marked difference in the structure of the lighting industry according to the product group they manufacture (lamps or ballasts/luminaires). Lamp producers are usually large companies: the European Lamp Companies' Federation has 7 members (including multinationals such as Philips, OSRAM and GE) and covers 95% of the European production

[22] average electricity price in the EU 2005: of 0.136 €/kWh

[23] average specific EU emissions in 2003: 400g CO2 per kWh (EURELECTRIC, Environmental Statistics of the European Electricity Industry, Trends in Environmental Performance 2003-2004); this figure is higher if e.g. mining related effects are taken into account (methodology used in preparatory study: roughly plus 10%)

with a turnover of 5 billion € a year and 50.000 employees in the Community. More information on lamp production facilities in Europe is provided in Annex III.

Although some lamp manufacturers also produce ballasts and luminaires, in those product groups the market is much more fragmented and is largely constituted of SMEs. CELMA is the European federation of national luminaire and ballast manufacturers' associations. It has 18 member associations in 13 Member States, representing 1000 companies employing 60.000 people with a turnover of 12 billion €, which is only part of the EU-27 market. It can be derived from Prodcom statistics that in total the luminaire and ballast manufacturers in EU-27 have a total of 18 billion € turnover and employ about 108.000 people.

Improvement potential, level of ambition and benchmarks

The preparatory study has shown that existing cost effective technical solutions allow for the reduction of the environmental impact of non-directional household lamps over the life cycle. All of the identified solutions (detailed in Section 5), including those considered as benchmarks (Best Available Technology) remain cost-effective when considering life cycle costs. Increase in the purchase price of new products as a consequence of higher requirements is acceptable providing it does not impact significantly on consumers as regards affordability of the product.

Limitations on mercury emissions will be an indirect consequence of other requirements (e.g. reducing the consumption of electricity whose generation process often emits mercury). The preparatory study has shown that there is potential to reduce the mercury content of compact fluorescent lamps themselves beyond the current tolerances set in the RoHS Directive (2002/95/EC). Future direct requirements on mercury content should be set at levels that do not negatively affect other environmental aspects (such as the efficacy of fluorescent lamps).

If best available technology was applied as minimum requirements without delay, it would result in a reduction of 87.2 TWh in yearly electricity consumption and in a reduction of 2.3 tons of the mercury emissions caused by the installed non-directional household lamps compared to the baseline scenario above.

Legal basis for EU action

The Ecodesign of Energy Using Products Directive (2005/32/EC), more specifically its Article 16 provides the legal basis for the Commission to adopt implementing measures on this particular product category, once the conditions set down in Article 15 are fulfilled.

SECTION 3: OBJECTIVES

As explained in Section 2 "Level of ambition and benchmarks", the preparatory study has confirmed that large potentials exist to reduce the environmental impact of non-directional household lamps, including a cost effective potential for reducing their electricity consumption. This potential is not tapped due to market failure and absence of other relevant Community legislation, as outlined above. The general objective is to develop a policy which

- leads to a significant improvement of the environmental performance of the affected equipment throughout the life cycle, including significant reductions in electricity consumption;
- ensures the free movement of affected products within the internal market.

The Ecodesign Directive, Article 15 (5), requires that ecodesign implementing measures meet the following criteria:

a) there shall be no significant negative impacts 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 affordability and life cycle cost of the product;

d) there shall be no significant negative impacts on industry's competitiveness;

e) in principle, the setting of an ecodesign requirement shall not have the consequence of imposing proprietary technology on manufacturers;

f) no excessive administrative burden shall be imposed on manufacturers.

SECTION 4: POLICY OPTIONS

Option 1: Repeal of existing legislation

Existing legislation directly affecting product design (energy labelling, ecolabel, RoHS) would be repealed.

- The market failures would persist, improvement potentials in the environmental performance of non-directional household lamps would not be realised.
- No stakeholder has asked for this option, on the contrary there is a consensus that legislation on these products is necessary (cf. option 3).
- It is to be expected that some Member States would want to take individual, non-harmonized action on non-directional household lamps (as it has been already announced by some of them, see part on Existing legislation above). This would hamper the functioning of the internal market and lead to high administrative burdens and costs for manufacturers, in contradiction to the goals of the ecodesign framework Directive.
- Competition would penalize in particular those manufacturers designing their products to good standards vis-à-vis competitors not using state of the art technology.
- The specific mandate of the Legislator would not be respected.

Therefore this option is discarded from further analysis.

Option 2: No EU action

Existing legislation directly affecting product design (Energy labelling, Ecolabel, RoHS) currently in place would not be amended, no new legislation would be adopted.

- As it has been demonstrated that the existing legislation alone is insufficient to address the market failures, these would persist, and improvement potentials in the environmental performance of non-directional household lamps would not be realised.
- No stakeholder has asked for this option, on the contrary there is a consensus that mandatory requirements on the environmental performance of these products are necessary (cf. option 3).
- It is to be expected that some Member States would want to take individual, non-harmonized action aiming at mandatory requirements on the environmental performance of non-directional household lamps (as it has been already announced by some of them, see part on Existing legislation). This would hamper the functioning of the internal market and lead to high administrative burdens and costs for manufacturers, in contradiction to the goals of the Ecodesign framework Directive.

- The specific mandate of the Legislator would not be respected.

Therefore this option is discarded from further analysis as the only policy option.

Option 3: Self regulation

Self-regulation put forward by industry and conforming to the requirements of Annex VIII of the Ecodesign Directive could be endorsed by the Commission after having heard the Consultation Forum, as a valid alternative to legislation.

However, the European industry itself has called for a clear legal framework ("level playing field") ensuring fair competition,[24] as voluntary agreements could lead to competitive advantages for free-riders and/or non-participants to the "self-commitment" (large share of the actors). Also, the specific mandate of the Legislator to adopt legislation (confirmed by Spring European Council conclusions 2007) would not be respected.

Therefore this is no longer an option for this impact assessment and can be discarded.

Option 4: Ecodesign implementing regulation on non-directional household lamps with labelling showing their environmental performance (Energy label, Ecolabel)

This option aims at improving the environmental impact of non-directional household lamps through a regulation setting minimum levels on energy efficiency and certain performance parameters related to additional environmental aspects. An updated energy label complements the new minimum requirements.

The key elements of the package include the following.

Minimum requirements on product parameters

Energy efficiency

Minimum requirements would be set on the energy efficiency of the lamps used in general lighting. The requirements would be applicable to all lamps, but they would mostly affect incandescent lamps and halogen lamps, due to their low efficiency.

The requirements would be set at such level (at least class C of the current energy label) that incandescent lamps would be phased out in practice.

The two principle variables are the level of ambition beyond class C and the timing of the introduction of the requirements. The different sub-options are presented in section 5, together with their likely impacts.

Mercury content

As mentioned above under Existing legislation, the RoHS Directive already sets the allowed mercury content of compact fluorescent lamps at 5 mg / lamp in its annex on exemptions. As these exemptions (currently under review) cover more lamp types than the ones used in general lighting and targeted by the planned Ecodesign implementing regulation, it is considered appropriate to leave the setting of specific mercury content requirements to the ongoing review of exemptions under Directive 2002/95/EC. Nevertheless, mercury content benchmarks are proposed to be identified for the lamp types covered by the Ecodesign implementing regulation and are a concrete input for the revision of the RoHS.

Waste at end of life

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24 As ELC in their press release of 6 June 2007, announcing a proposal for EU legislation phasing out incandescent bulbs.

Although the preparatory study did not identify waste at the end of life to be a significant environmental impact of the products in question, it was considered useful – as provided for in Annex I Part 1 of the Eco-design Directive - to introduce a provision on design for recycling in the working documents discussed in the Consultation Forum on 28 March 2008 in order to facilitate the implementation of the WEEE Directive (2002/96/EC), leaving to standardisation to define how to implement this provision. Stakeholder reactions were rather sceptical and further analysis has shown that other planned requirements on product lifetime are already achieving a substantial reduction of waste at end of life, and also that the WEEE Directive itself has specific and stringent requirements on recovery levels of compact fluorescent lamps. Therefore it was considered disproportionate to keep the specific provision on waste in the planned measure.

Product functionalities

Minimum requirements would be set on the functionalities of non-directional household lamps as regards the following parameters (separately for fluorescent and non-fluorescent lamps):

- lamp life
- lumen maintenance
- number of switching cycles
- starting time
- warm-up time
- power factor
- premature lamp failure rate
- ultraviolet light emissions

These requirements would ensure that compact fluorescent lamps offer a near equivalent service to incandescent lamps (at least for the targeted parameters) and that other lamp technologies are up to certain quality standards. The lifetime requirement indirectly decreases the quantity of end-of-life waste.

A more detailed analysis of the product functionalities and other issues tackled by these requirements is provided in section 5.

Minimum requirements on product information

Consumer Information

Information on the proper selection, installation and recycling of non-directional household lamps could avoid consumer dissatisfaction with improperly selected or used lamps and reduce non-recycled waste at the end of life (issue especially with compact fluorescent lamps).

Energy label

A combination of option 4 without the Energy label is not envisaged, as product differentiation according to energy efficiency will be useful for consumers even after the introduction of minimum energy efficiency requirements. Since the intended measure will result in the elimination of the low-cost incandescent lamps, consumers will be more sensitive to differentiation among the remaining alternatives as shown on the energy label (Directive 98/11/EC). The difference of energy efficiency between the best halogen lamps and the CFLs should be made obvious to consumers.

An update of the lamp energy label could include:

1. the currently exempted low voltage lamps, so that consumers may make appropriate choices among the different available halogen lamps (low voltage halogens are the most efficient halogens, in theory many of them could be in class B of the label);
2. covering reflector lamps, for which a preparatory study is currently carried out;
3. the label classes could be redistributed to reflect the new range of lamp energy efficiency after the phase-out of incandescent lamps.

Taking into account the above, an update of the Energy label could be scheduled in parallel to the second domestic lighting ecodesign implementing measure planned for 2010 and affecting reflector lamps and luminaires.

SECTION 5: ANALYSIS OF IMPACTS OF THE PROPOSAL FOR AN ECODESIGN IMPLEMENTING REGULATION ON NON-DIRECTIONAL HOUSEHOLD LAMPS

Given that options 1-3 have been discarded already in Section 4, this section only looks into possible impacts of option 4. To this end an assessment of possible sub-options as regards the "intensity" of the measure – the combination of the levels of requirements and the timing for the levels pursuant to Article 15(4f) of the Ecodesign Directive – is carried out.

The assessment is done with a view to the criteria set out in Article 15(5) of the Ecodesign Directive, and the impacts on manufacturers including SMEs. The aim is to find a balance between the quick realization for achieving the appropriate level of ambition and the associated benefits for the environment and the user (due to reduction of life cycle costs) on the one hand, and potential burdens related e.g. to unplanned redesign of equipment for achieving compliance with ecodesign requirements on the other hand, while avoiding negative impacts for the user, in particular as related to affordability and functionality.

A number of representative scenarios for the intensity of the measure are examined which take into account the complexity of the measure and the possibility of staged introduction.

I. Description of major lamp technologies involved

In order to allow a better understanding of the choice of sub-options to be analysed, it is useful to recall at this point the major lamp technologies currently available alongside incandescent lamps. The advantages and disadvantages mentioned are discussed in parts III, IV and V of this section.

1. Incandescent lamp (GLS)

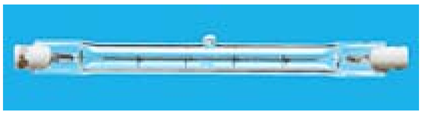
Standard incandescent lamp

Advantages	Disadvantages
Bright point light source (if transparent glass)	Low efficiency (E, F or G-class)
Full compatibility with existing luminaires	Risk of burning due to operating temperature
Fully dimmable on any dimmer	
Very good quality and performance	
No mercury content	
No presumed health issues	
No impact on EU industry / jobs	

2. Halogen lamps (Halo)

Improved incandescent lamp technology. Much smaller lamp size, equal or slightly higher efficacy than incandescents. Their market share has been rapidly increasing in the past decade as their small size makes them more versatile for lighting design (luminaires and installations).

a.) Conventional halogen lamps (Halo conv)

Conventional halogen lamps

Many standard halogen lamps are low voltage lamps, which are more efficient than mains voltage lamps. Low voltage lamps require a transformer either in the luminaire or integrated into the lamp.

Advantages	Disadvantages
Bright point light source	Low efficiency no or at best 15% energy savings at mains voltage compared to incandescent lamps (D, E, or F class, low voltage: C class, 25% savings)
Full compatibility with existing luminaires	Risk of burning due to operating temperature
Fully dimmable on any dimmer	
Very good quality and performance	
No mercury content	
No presumed health issues	
No impact on EU industry / jobs	

b) Halogen lamps with xenon gas filling (C-class)

Recent technology. With xenon gas filling, the halogen lamp will use about 25% less energy for the same light output compared to incandescents. There exist two versions of this halogen lamp:

– only the filling gas is replaced, the socket and the dimensions of the lamp are the same, and therefore can only be used in luminaires with the special halogen sockets **(Halo socket C)**.

– the improved halogen capsule is placed in glass bulbs shaped like incandescent lamps with traditional socket, which makes it compatible with all luminaires using incandescent lamps (sold as retrofit "energy saver lamps") (**<u>Halo retro C</u>**).

C-class pear-shaped retrofit halogen lamp

Advantages	Disadvantages
Bright point light source	25% energy savings (C class) compared to incandescent lamps
Full compatibility with existing luminaires	Risk of burning due to operating temperature
Fully dimmable on any dimmer	
Very good quality and performance	
No mercury content	
No presumed health issues	
Positive impact on EU industry / jobs	

<u>c) Halogen lamps with infrared coating (B-class)</u>

Recent technology. Applying an infrared coating to the wall of halogen lamp capsules considerably improves their energy efficiency, the lamp will use about 45% less energy for the same light output compared to incandescents (**<u>Halogen B</u>**). However, for technical reasons, this is only possible with low voltage lamps, so a transformer is needed, either as a separate unit, or integrated into the luminaire, or integrated into the lamp for an incandescent retrofit solution. As with the Halogen C lamps, both the halogen socket capsules and incandescent retrofit lamps are available in B class, however currently only one manufacturer is producing retrofit lamps (even though the technology is not protected by patents). Because of the heat coming from the lamp which affects the operation of the integrated transformer, their lamps are available only up to the equivalent of a 60W incandescent bulb.

B-class pear-shaped retrofit halogen lamp with integrated transformer

Advantages	Disadvantages
Bright point light source	45% energy savings (B class) compared to incandescent lamps
Fully dimmable on any dimmer	Its manufacturing is unlikely to replace incandescent lamp production in the EU
Very good quality and performance	Not compatible with many luminaires (size/socket)
No mercury content	No equivalent yet to GLS > 60W
No presumed health issues	Risk of burning due to operating temperature
	Only one producer currently for GLS retrofit

3. Compact fluorescent lamps (<u>CFLs</u>)

Technology developed in the 1970's, constantly improving. It consists of fluorescent lamp tubes, for which the ballast is not sold as a separate item as for large tubes, but integrated into the lamp, which becomes a standalone retrofit solution to incandescent lamps. Its main interest lies in its long lifetime and high efficiency, the lamp will use between 65% and 80% less energy (from a third up to the fifth of the energy) for the same light output compared to incandescents. For decorative reasons, for filtering of UV radiation or for preventing mercury leakage in case the lamps breaks accidentally, CFLs sometimes come with external envelopes which hide the tubes and makes them even more similar to light bulbs (though decreasing their efficiency).

Compact fluorescent lamps with bare tubes and with bulb-shaped outer lamp envelope

Advantages	Disadvantages
60 to 80% energy saving (A class or upper end of B class) compared to incandescent lamps	No bright point lighting
Long lifetime (from 3 to 6 times longer than incandescent lamps)	Often not dimmable
No burning risk due to temperature	Mediocre colour rendering
	Low starting and warm up time
	Mercury content
	Its manufacturing is unlikely to replace incandescent lamp production in the EU
	Not compatible with many luminaires (size/socket)
	Some alleged health issues

4. Light emitting diodes (LEDs)

LEDs are a rapidly emerging mercury-free technology, meeting or even surpassing compact fluorescent lamps in efficiency. However, at this stage they are not yet commercially and technically valid alternatives to the full range of household incandescent bulbs (they are currently limited in terms of light ouput, equivalent to 25W incandescent bulbs). It is hoped that in the coming years they will develop to become valid alternatives to more existing lamps. The Commission is financing research into LEDs for general lighting through the ongoing and future calls of the EU's 7th Research Framework Programme. Due account will be taken of the state of development of the LED market during the revision of the regulation.

In the meantime, the non-directional LED lamps that appeared recently on the market should be within scope of the regulation only as far as their efficiency is concerned, because no sufficient information has been gathered yet on the other functionalities (the second part of the preparatory study will examine the LED technology in more detail as they have been so far typically directional light sources). LEDs are most of the time able to fulfil requirements of class A.

Efficiency of the lamp technologies compared with incandescent bulbs

Lamp technology	Energy savings	Energy class
1. Average conventional GLS / 2.a Halogens	-	E
2.b Halogens with xenon gas filling	25%	C
2.c Halogens with infrared coating	45%	B (lower end)
3. CFLs with bulb-shaped cover and low light output	65%	B (higher end)
3. CFLs with bare tubes or high light output	80%	A

II. Envisaged sub-options

All of the policy options considered hereafter phase out completely incandescent lamps and conventional halogen lamps. There is broad agreement on the feasibility of such a phase-out.

In the working documents for the Consultation Forum of 28 March 2008, three main sub-options were discussed for the level of ambition of the measure, and two for the timing. On the basis of these sub-options and of further impact assessment, the preparatory study developed detailed scenario analysis for five sub-options and three timelines (in addition to the scenarios for business as usual and for the theoretical improvement potential).

Sub-Option 1:

- only compact fluorescent lamps (CFL) would be left on the market.

Sub-Option 2:

Sub-Option 2a:

- require all non-transparent (frosted) lamps to be CFLs
- allow the most efficient halogen lamps (class B) to exist if they are transparent lamps.

Sub-Option 2b:

- require all non-transparent (frosted) lamps to be CFLs
- allow the most efficient halogen lamps (class B) to exist if they are transparent lamps.
- allow special socket halogens to be class C ("Halo socket C").

Sub-Option 2c:

- require all non-transparent (frosted) lamps to be CFLs
- allow all transparent lamps to be class C. This would allow C-class retrofit halogen lamps ("Halo retro C") to exist.

Sub-Option 3:

- allow the full range (both transparent and frosted) of improved halogen lamps (class C) to exist

Summary table of the sub-options:

Sub-option	**Lamps allowed**	
	Transparent	**Frosted**
1	--	CFLs
2a	Halogen B	CFLs
2b	Halogen B Halo socket C	CFLs
2c	Halogen B Halo socket C Halo retro C	CFLs
3	Halogen B Halo socket C Halo retro C	CFLs Halogen B Halo socket C Halo retro C

The three timelines considered correspond to the ones put forward by the preparatory study (three stages), by the European industry in 2007 (five stages) and the one used in the draft regulation (six stages).

The preparatory study's scenario analysis combined timelines and sub-options the following way:

3 Stages (for sub-options 1, 2b and 2c): 2009, 2011 and 2013

5 Stages (for sub-options 2a and 3): 2009, 2011, 2013, 2015 and 2017

6 Stages (for sub-option 2b): 2009, 2010, 2011, 2012, 2013 and 2016

A more detailed explanation of the sub-options and the assumed order and timing of technology substitution due to the staged introduction of requirements are presented in Annex IV.

III. Economic impacts

1. Life cycle costs to the end user

The proposed regulation leads to a reduction of the life cycle cost for the affected equipment from an end user perspective, as demonstrated in the preparatory study. Although the purchasing cost of equipment increases, the expected increase is outweighed by the savings made in operating costs (there is a 10-30% reduction in life cycle costs with efficient halogen technologies, and 70% reduction with compact fluorescent lamps). For example, using the scenario analysis for Sub-option 2b in the preparatory study, we can make the following calculation.

Lamp type	Average price (AP)	Average life (AL)	Number of lamps / household in 2020 Business As Usual (NLB)	Number of lamps / household in 2020 Sub-option 2b (NLS)	Diffence in investment into replacement lamps / household / year (NLS-NLB)*AP/AL
Incandescent	0.60 €	2.5 years	5.63	0	- 1.35 €
Halogen	3.50 €	3 years	7.63	10.17	+ 2.96 €
CFL	4.63 €	7.5 years	10	11.98	+ 1.22 €
		Total difference lamp investment / household / year			+ 2.83 €
		Total EU-27 running cost saving / year in 2020			5.3 billion €
		Number of households in EU-27			210 million
		Running cost saving / household / year in 2020			25.09 €
		Net cost saving / household / year in 2020			22.25 €

The result of this calculation for the other sub-options is presented in the Overview table in the conclusions.

The statement remains valid when a lower electricity price is assumed, i.e. the measure is cost-effective also in Member States with electricity prices lower than the average. Due to economy of scale effects it is to be expected that added purchasing costs will decrease after ecodesign requirements are introduced, however the extent of this decrease is difficult to foresee. Furthermore, electricity costs are likely to further increase, and the resulting cost savings will be higher.

2. Annual and accumulated electricity cost savings in 2020

The likely impact of the examined sub-options is summarised in the following table:

Sub-Option	Annual savings in 2020			Accumulated savings 2009-2020		
	Electricity savings (TWh)	Cost savings (billion €) [25]	CO2 emiss. reduction (Mt) [26]	Electricity savings (TWh)	Cost savings (billion €)	CO2 emiss. reduction (Mt)
1	86.4	11.8	34.6	740	101	296
2a	50.9	6.9	20.4	361	49	144
2b (3 stages)	38.7	5.3	15.5	419	57	168
2b (6 stages)	38.6	5.2	15.4	399	54	160
2c	33.1	4.5	13.2	314	43	126
3	22.1	3.0	8.8	116	16	46

Annual and accumulated savings due to the sub-options in 2020

The detailed scenario analysis behind this table is described in detail in the preparatory study and the related spreadsheet.

The table shows that there is a very significant (almost two-fold) difference in savings between the first option that allows only CFLs and the others that tolerate other lamp types as well. Considering the accumulated savings, it becomes apparent that timing is more important in distinguishing the remaining sub-options than slight changes in the level of ambition. Even more ambitious sub-options such as 2a, ultimately phasing out even special socket C-class halogens, will be weaker in accumulated savings than the less ambitious sub-option 2b (6 stages), which leaves the same lamps on the market, but for the non-transparent (frosted) lamps introduces the A-class requirement already in the first stage. Sub-Option 3 (leaving all lamps at C-class after 5 stages) lags by far behind all other options.

Impacts in other life cycle phases, such as raw material extraction, production, distribution and end-of-life phase impacts are not included in the estimates of table above, which only quantifies use-phase savings. The other life cycle impacts partially or fully occur outside the EU and therefore they affect economic costs and benefits to an unpredictable extent within the Community. A sensitivity analysis carried out in the preparatory study demonstrates that if all life cycle impacts are considered together, energy savings are higher in all sub-options by 2-5 TWh per year in 2020 (although much of these extra savings will not occur in the EU). This

[25] Average electricity price in 2005 in EU-27: 13.6 Cent/kWh.

[26] assuming the specific CO2 emissions of 2003 (see footnote 25) which, however, is expected to change e.g. due to the Community's strategy for promoting renewable energy sources.

shows that even though CFLs incorporate more material (and therefore more energy is used in the other life cycle phases), they also last much longer than incandescent bulbs or halogen lamps, so fewer of them are needed.

3. Additional costs related to the use of CFLs

One of the alternative technologies, compact fluorescent lamps has an influence on the electricity grid on which they are operated. This is characterised by their power factor[27] and results in quantifiable extra energy needed to power a grid operating with such lamps.

However, one has to consider that there exists inductive, reactive power as well as capacitive, reactive power in the electrical grid and the two compensate each other. Motors (e.g. refrigerators, elevators, vacuum cleaners, pumps,...) or inductors (magnetic ballasts for fluorescent or high intensity discharge lamps) are typically inductive loads, while many electronic sources (CFL, PCs, TVs, ..) are capacitive. In general the grid tends to be more inductive due to the high amount of motor loads, and in industrial applications power factor compensation capacitors are frequently installed. Hence CFL that are capacitive are unlikely to create strong negative grid influences because they rather compensate inductive loads and are unlikely to dominate the total active power demand of the grid.

The preparatory study already quantified in its modelling the extra power needed when operating a CFL (in the order of 5%), if no inductive loads are present on the grid. The study used such corrected figures in the CFL-related parts of the scenario analysis, so the obtained savings already include a worst-case assumption on the impact of their lower power factor.

A massive switch to lower power factor lamps has never been experimented on the European scale, and some sources have also reported harmonic interference issues in grids with high number of CFLs.

For security, requirements on minimum power factor for CFLs are proposed to be set in the measure.

4. Costs for re-designing products currently not compliant to the proposed requirements

Qualitatively, the shorter the period for entry into force of requirements stage and the shorter the delay between the stages, the higher the potential costs related to unplanned re-design. On the other hand, the longer the period for entry into force of requirements, the better re-design can be integrated into planned re-design without additional costs.

Typical redesign cycles for equipment covered by this proposal are 10 years for lamps and 5 years for luminaires (although many products have been around on the market for 40 to 50 years). In order to keep an ambitious timing in face of the urgency of action on climate change, it is likely that neither of the envisaged timelines for the introduction of requirements fully respect redesign cycles. Thus for equipment not complying with the requirements, certain production lines may have to be adapted outside planned redesign cycles (e.g. from

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27 The power factor of an AC electric power system is defined as the ratio of the real power to the apparent power and is a number between 0 and 1. Real power is the capacity of the circuit for performing work in a particular time. Apparent power includes the reactive power that utilities need to distribute even when it accomplishes no useful work. Low-power-factor loads increase losses in a power distribution system and result in increased energy costs. GLS and halogen lamps (HL) have a power factor equal to 1. For lamps operating on a ballast or electronics such as CFLi's, this power factor can go down to 0.50; the lower the power factor, the higher the electrical current that is needed to result in the same real power. This higher current causes 5% more losses in the electrical grid that feeds the lamp.

conventional halogens to improved halogens), even though the effect would be obviously more attenuated with the longer timeline.

This approach could also cause some competitive disadvantage for low volume producers (in particular SMEs) vis-à-vis high volume producers because it may require high upfront investments. However in reality, most manufacturers offer ranges of products, some would comply and other would not, so it would be more a question of transfer across production lines than complete change of production.

Also, the switch from incandescent lamps is due to take place largely towards already existing more efficient products with higher added value accompanied with higher profit margin (such as compact fluorescent lamps). An analysis of the price components of the products and the likely effects of the requirements shows that the lamp manufacturing industry should ultimately experience a substantial increase in its turnover (more details in Annex V).

5. Costs - possible reorganization of the supply chain

Compliance with the proposed ecodesign requirements can be achieved by applying readily available non-proprietary technologies, and no risks for shortages in the supply chain, e.g. for certain components necessary to achieve compliance, leading possibly to unforeseen cost increases have been flagged by the stakeholders.

6. Costs – global production capacity of alternatives

a) Risk of empty shelves

Some stakeholders (especially the European lamp industry) have flagged as a potentially serious problem that if the phasing out of incandescent lamps happens too fast, it could lead to global production capacity shortages of the alternatives (mainly compact fluorescent lamps) when the demand reaches its peak, and to empty shelves in European shops.

With the envisaged slow scenarios, the peaks are low (not significantly more than current sales at any time in Sub-Option 3, and 584 million for Sub-Option 2a, but only in 2013), so global production capacity should not be a problem. In the fast scenarios, the peak occurs early (2009 to 2011) and between 600 and 700 million compact fluorescent lamps may be needed a year depending on the level of ambition.

The following additional factors should be taken into account when determining to what extent this issue should influence decision making.

- The scenario analysis does not take into account factors that could delay the occurrence of the peak in demand, such as the likely tendency of consumers to stock up on incandescent lamps when the phase out will be announced, use of alternative technologies (halogens), longer life of rarely used incandescent lamps.
- It is estimated that already today out of the nearly 3 billion CFLs produced yearly in China alone (80% of total world production), about 40% (1100 billion) are up to European product requirements. The reviews preceding European anti-dumping regulations on CFLs (see Existing legislation above) have pointed out on several occasions that the Chinese market is capable of expanding rapidly to adapt to demand. It is therefore safe to say that the global CFL production capacity could meet European demand, serious uncertainties arise only with the most ambitious scenario (Sub-Option 1, almost everything to be replaced by CFLs already from the first stage).
- Alongside the already announced initiatives, it is impossible to tell when other large countries such as India or China will decide to phase out incandescent lamps. Such decisions obviously would have substantial impact on global demand. However, in recent

years we have already seen spectacular increases in compact fluorescent lamp demand in certain parts of the world, for example due to the unexpected incandescent lamp replacement programmes in Cuba and in other Latin American countries. Industry has been able to cope with the increase. On the other hand, there is no point in making the EU the dumping ground of lamps banned elsewhere, just to facilitate such ban in other parts of the world.

b) Risk of stranded assets

Because of the long life of CFLs (on average 7 years according to the preparatory study), a massive and sudden switch to their use could result in peak sales in a given year, followed by a backdrop in sales until the newly purchased CFLs burn out and need to be replaced. This could cause problems to manufacturers who invest massively into new production lines and then need to stop them temporarily waiting for the resurge in demand.

Due to the incandescent phase-out taking place in many places in the world with a couple of years of difference in timing, the risk of facing stranded assets at any given point in time is very low as there will always be substantial demand for CFLs somewhere in the world. This is especially the case if manufacturers can plan ahead where they can sell their production, which is more likely in the slower scenarios.

7. Cost – assessment of conformity with ecodesign requirements

The form of the proposed legislation is a regulation which is directly applicable in all Member States. This ensures no costs for national administrations for transposition of the implementing legislation into national legislation.

In general assessing the conformity to the ecodesign requirements implies costs for manufacturers. Furthermore, products not complying with ecodesign requirements need to be re-designed, which, in general, implies the need for re-assessing conformity with further requirements. The costs for assessing conformity are estimated to be in the order of several thousand Euros. On the other hand

– all manufacturers are affected by the need for a conformity assessment, because the proposed regulation creates a level playing field;

– possible costs for re-assessment due to re-design are occurring only once upon introduction of the regulation;

– costs for assessing conformity are much smaller than further cost factors, therefore competitiveness of SMEs vis-à-vis high volume producing manufacturers is not significantly affected;

– for lamps, there is little redesign due to the requirements, it is mainly a shift of production.

Since conformity assessment is part of all the envisaged sub-options, this aspect is not a distinctive feature among them.

IV. Social impacts

1. Employment

As more than half of the EU production of non-directional household lamps is going to the EU market, the potential impact of the proposed requirements on European factories has to be examined. As pointed out above, the lighting product manufacturers employ 157.000 people in EU-27 producing lamps, ballasts and luminaires for all application areas. Production facilities for the three lighting components tend to be separate.

The envisaged sub-options have the largest impact on lamp production, however luminaire production could also be affected by some of them indirectly.

a) Jobs in lamp production

The EU is a major producer of incandescent lamps, of which the majority is sold on the EU market. On the other hand, only a negligible part of the compact fluorescent lamps is produced locally, the majority is imported. For halogen lamps, both the local production and the imports are significant.

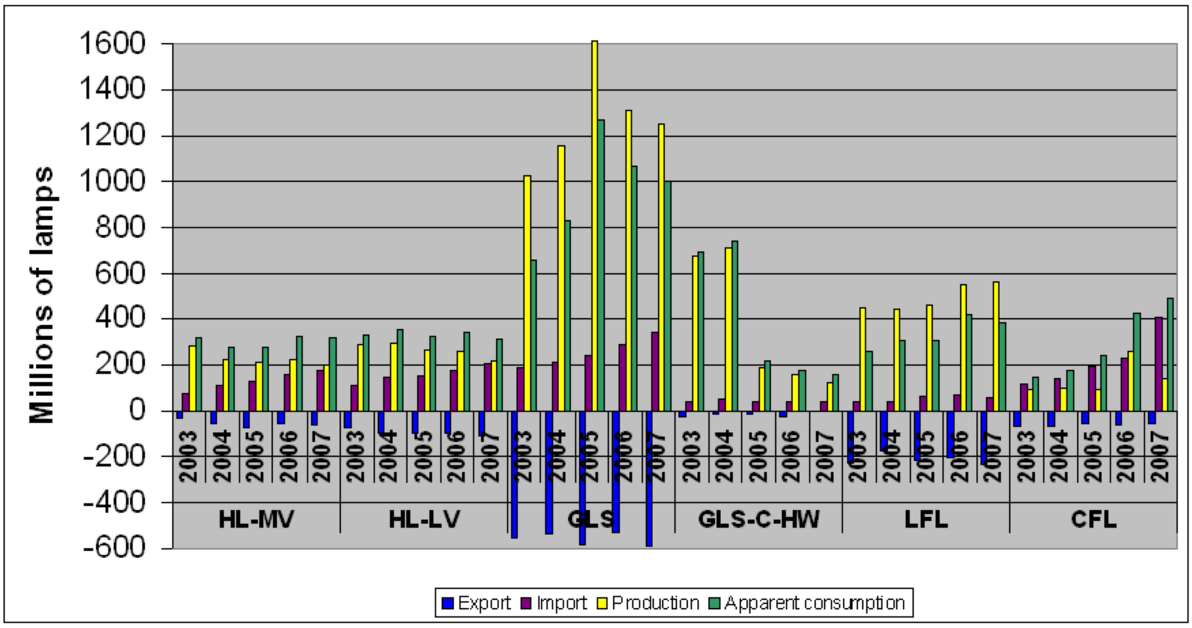

Figure 1: Volume of production, trade and sales of lamps for EU-27 (source: preparatory study)

Therefore, a shift from incandescent lamps to compact fluorescent lamps would likely result in a shift from local production to imports. Because of the completely different production process of the compact fluorescent lamps (electronics and more manpower involved), manufacturers are unlikely to convert their incandescent production lines, being multinational companies they will rather switch to import of compact fluorescent lamps. The declining production of incandescent lamps in recent years has confirmed this trend.

The long term tendency in the business as usual scenario to switch from incandescent to halogens and compact fluorescent lamps would anyway bring such changes in production processes, however the envisaged sub-options of the requirements would accelerate and intensify them to different extents. If manufacturers have the time to restructure their factories, they could reduce the job impacts of the market shift by assigning the workforce to the production of other appliance categories. The extent to which they would do this is obviously difficult to predict and there are limits to the versatility of the production tool and of the workforce to take up other tasks in the same company. Thus, ELC claimed in the Ecodesign Consultation Forum that the envisaged faster sub-options could cause about 10.000 people to lose their jobs across the EU. This is one fifth of the 50.000 people employed in lamp production in Europe today. A closer look at the industrial sites concerned shows that the total number of workforce assigned to incandescent lamp production for European sales is in the order of 8000 people in total (see Annex III).

The trend towards phasing out incandescent bulbs has been known since some time now and further transition periods would give the possibility to the manufacturers to reduce the job impact, because of the possibility to plan the restructuring instead of simply closing factories.

Some of the sub-options do not entail a complete shift to compact fluorescent lamps alone, but leave improved halogen lamps on the market. Although these lamps are currently not produced in great numbers in Europe, it is expected that the demand for such bright point lamps (as a replacement to incandescent) will increase substantially; the existing incandescent production lines are thought to be more easily convertible to improved halogen production than to compact fluorescent lamp production. These sub-options are therefore considered to have a lesser impact on jobs in Europe. In fact, these technologies would probably never obtain higher market shares without the ecodesign requirements in this measure, which could be seen as an opportunity to reinforce product ranges that can be manufactured in Europe.

Overall, with these scenarios, at most 2-3000 jobs are estimated to become redundant after the incandescent lamp phase-out (more detailed analysis in Annex VI).

b) Jobs in luminaire production

In sub-option 1, all halogen lamps are replaced by compact fluorescent lamps, including those with special socket which are the only compatible lamp for their luminaire. This would mean that the sales of those luminaires become pointless due to the lack of replacement lamps for the luminaire.

In sub-option 2a, halogen lamps with G9 and R7s caps are proposed to be banned in the last stage so that those (at best) C-class mains voltage halogen lamps are removed from the market. The corresponding luminaires cannot take any other lamps because of socket compatibility, and there is currently no known way of improving lamp efficacy further for those lamps. Users would be forced to replace luminaires after the last stage, so that they would probably stop buying those luminaires well before, but at the latest in the last stage.

Luminaire designers have recently made extensive use of the G9 and R7s socket lamps. Manufacturers (especially in Italy) are claiming that their companies (all SMEs) may go bankrupt, because if they need to redesign luminaires to be compatible with other lamp types, it requires new moulds for all their production lines.

For this reason it is possible that Sub-Option 2a would put some luminaire manufacturers in difficulty as they would have to invest into new production lines while not having had return on investment with the current production lines. The corresponding number of jobs at stake could not be quantified.

2. Consumer impacts

a) Affordability of equipment

Although the alternatives to incandescent lamps are all substantially more expensive (from 4 to 15 times), even the most expensive among them are usually within the limits of 10 euros (except for some CFLs with special features such as dimmability which can be more costly). Normally an investment of this magnitude should not put any household into difficulty, be it the poorest one. The investment pays off within less than a year (depending on use) due to life cycle cost savings, without taking into account much shorter life of the incandescent lamps, and for the remainder of its life the lamp provides net benefits. Also, the initial expenditure is rarely cumulated, as people usually do not replace all their lamps simultaneously. The lamp market shift does not substantially affect product affordability to consumers, and once the requirements are in place, mass production (and the drop of excise duties on imported lamps) will bring the price of efficient products further down.

The affordability impact of those sub-options resulting in people having to change their luminaires at term due to the removal of replacement lamps from the market (see compatibility issues) is much more difficult to quantify, because luminaire prices can vary extensively, from a few dozens of euros up to several hundred or even several thousand, and there could be also installation costs involved. If an expensive luminaire needs to be replaced, the lower energy consumption of the lamps will pay off only after a long time. This negative impact could be minimized in practice by preventive consumers who could stock up on replacements lamps.

b) Compatibility issues

The issue here is not how well the lamp will perform (for that see the next section), but whether it will fit at all and provide the expected minimum level of service. The following lamp parameters could cause problems when consumers switch to something else than incandescent lamps:

- lamp cap / luminaire socket compatibility: efficient halogens and compact fluorescent lamps exist with all the typical incandescent lamp caps. However, compact fluorescent lamps and low voltage halogen lamps with integrated transformer do not and probably will not exist with R7s halogen lamp caps. These lamp caps are widely used with double-ended halogen lamps that can only be improved to C class. So if the minimum requirement is raised to higher than C class and R7s cap lamps are not exempted (sub option 2a), consumers owning compatible luminaires will not find replacement lamps any more and ultimately will have to change their luminaires (see also "Affordability" above).
- dimensions: in compact fluorescent lamps with integrated ballast and low voltage halogen lamps with integrated transformer, the electronics which is incorporated into the lamp itself occupies substantial amount of space which is not compressible beyond a certain point. Although manufacturers claim that compact fluorescent lamps come in all existing shapes and sizes of incandescent lamps, in some cases when a CFL is claimed to be (for example) golf-ball shaped, it refers to the diameter of the bulb part, whereas the ballast part may add a couple of centimetres to the length of the lamp compared to its incandescent counterpart. Therefore they do not fit in certain luminaires. Similar problems could be encountered when the luminaire requires lamps that are narrow at the base (e.g. old chandeliers using candle shaped lamps), as the ballast's width is sometimes an obstacle to fully screwing in the lamp into the luminaires' lampholders. G9 capped halogen capsules are frequently used in luminaires that are specially designed for their very small size, meaning that replacement CFLs with G9 cap may not fit in. Low voltage halogen lamps with integrated transformer are a very recent technology, however the same constraints are likely with them.
- dimmability: the majority of compact fluorescent lamps cannot be dimmed with traditional dimmers (or even if they can in appearance, it may affect their performance negatively, or it could even be downright dangerous). There are special dimmable compact fluorescent lamps that can be dimmed with traditional dimmers, but they are very expensive. There are also special dimmers that can dim normal compact fluorescent lamps, however these dimmers cannot dim the special dimmable CFLs. There is much confusion in the market and consumers have to be extremely watchful for the compatibility of the spare parts of their lighting installations (lamps or dimmers). Standardisation is under way in order to ensure compatibility, however for now it has to be assumed that in many cases there will be incompatibility problems with the compact fluorescent lamps and dimmers. Contrarily to CFLs, low voltage lamps with electronic transformers are fully dimmable with any dimmer.

c) Functionality issues

Compact fluorescent lamps do not provide the same lighting functionalities as incandescent lamps and halogen lamps on a number of points, which could be a source of consumer dissatisfaction. The magnitude of the difference in the functionalities can be substantially decreased by the setting of minimum lamp functionality requirements, but for certain parameters CFLs will never provide exactly the same service as filament lamps, due to the fundamentally different technology. Consumers should be informed of these differences.

- start delay and warm-up times: when a CFL is switched on, it can take 1 or 2 seconds before it lights up, and up to several minutes before it reaches its full light output (although they can achieve 60% light output within one minute, beyond which further increase is less noticeable). Starting delay is an issue where instant light output is required (e.g. lamps used for signalling), longer warm-up times may cause people to perceive CFLs as providing insufficient light.
- equivalence claims with incandescent lamps: very often the wattage of the incandescent lamp claimed to have equivalent light ouput to the CFL is exaggerated (e.g. a 20W CFL is claimed to be equivalent to a 100W incandescent, whereas it is more likely to produce as much light as a 75W incandescent), resulting in consumer dissatisfaction with the CFL that was expected to provide more light. This problem could be remedied by establishing rules on CFL/incandescent equivalence claims.
- lamp glass type: incandescent and halogen lamps with clear glass are bright, point-like light sources, contrarily to compact fluorescent lamps where the fluorescent tubes are always frosted and produce a more diffuse light. Bright point like light sources create nice-looking reflections on shiny objects (such as crystal luminaires), which cannot be generated with CFLs. Lighting design for luminaires and installations can be significantly different for the two light sources, in which case changing the lamp type could negatively influence the visual appearance of the lighting appliances and the lit areas. In extreme case, if the clear lamp was used in a luminaire with a reflector adjusted to the point source, the change to a diffuse source could entail substantial decrease in luminaire performance (borderline case with compatibility issues).
- light distribution: even if the integrated ballast or transformer is fully compatible with the luminaire's socket, it does not mean that the lamp itself will provide the same light distribution as its incandescent predecessor in the same luminaire. Whereas incandescent lamps provide light in a more or less 360 degrees angle, the integrated ballast or transformer shields a certain angle of the light coming from the lamp. This is an aesthetics issue in certain partially transparent luminaires which build their design on wide light distribution, but it also could be a functionality issue with traditional looking table or reading luminaires in which the lamp is in upright position and whose lampshade does not sufficiently reflect the light down to the work area. In these luminaires, incandescent lamps provided direct downward light, but the ballast or transformer of the energy saving lamp is shading most of the useful light coming from the lamp. Therefore the overall lighting performance of the luminaire may decrease substantially (borderline case with compatibility issues). There are compact fluorescent lamp designs that overcome this problem with spiral tubes that offer an all-round light distribution, however consumers have to be aware of such solutions, and until they are educated to watch out for such lamp features, their dissatisfaction due to this problem may be frequent.
- operating temperatures: incandescent lamps and halogen lamps offer the same performance at any ambient temperature, however fluorescent lamps are often optimised for a rather narrow range (e.g. room temperature), and their light output decreases at other

temperatures. This is an issue with CFLs used outdoors where it can be quite cold depending on the country, or with CFLs that are used in closed luminaires where on the contrary the temperature may rise well above room temperature from the heat coming from the operation of the lamp. Adding amalgam rather than simply mercury to the lamp widens the range of optimum temperature of the lamp, on the downside it increases the lamp's warmup time. Consumers should be made aware to ensure that they choose the proper lamp for the proper application.

- light spectrum and colour rendering: the light emitted by filament lamps is well distributed across the spectrum of visible light, whereas CFLs tend to emit most of their light output at certain wavelengths and almost nothing at others. This may cause a subtle difference in the perception of the light they produce (more "artificial" than filament lamp light), but it also leads to a poorer colour rendering (meaning how well the colour of the different objects lit is rendered). Filament lamps obtain the almost the maximum colour rendering index of 100, CFLs are between 80 and 90, only the quality ones go beyond 90 but never reach 100. Colour rendering qualities beyond 90 do not result in perceptible differences for the majority of people.
- colour temperature: compact fluorescent lamps are sometimes perceived as providing cold light. In fact, their colour temperatures can range from 2700 K equivalent to incandescent lamps up to 5000K and beyond, which correspond to cold white light. While the colour temperature of incandescent lamps at full light output is always 2700K, CFLs can have a variety of colour temperatures, which is actually an advantage, provided consumers are aware of the variability of this lamp parameter at the moment of purchase. The colour temperature of incandescent lamps decreases below 2700K when dimmed (they provide orange light), while the same parameter remains constant for CFLs even when they are dimmed. Whether this is regarded as an advantage or a disadvantage depends on the user's expectations.
- number of switching cycles: average CFLs are built to live up to their claimed lifetime with a switching frequency in average domestic circumstances, which would be around 3 times on/off per day. However, if such a CFL is installed in a location where it is switched on/off more often (for example in a toilet or in a corridor with motion sensors), it can substantially reduce its life time. There are specific CFL that are designed for long life even under high switching frequencies (600,000 on-off cycles for 15,000 hours of life), however these are more expensive and consumers must be aware of their existence and make the appropriate choices.

d) Health issues

A number of health problems related to the use of compact fluorescent lamps have been flagged by some stakeholder groups.

- Light quality for vision: as pointed out above, compact fluorescent lamps have lower colour rendering than filament lamps. With quality CFLs the difference could be imperceptible to most people, however it could cause difficulties to the elderly and poor-sighted. The same is true for the slow warm-up time of the CFLs, which as explained above do not provide their full light output before several minutes. People with normal vision can more easily live with the temporarily slightly lower light levels, whereas the security of poor-sighted people could be at stake in some extreme situations (e.g. improperly lit staircases).
- Lamp breakage: few consumers are aware that compact fluorescent lamps contain mercury (contrarily to incandescent lamps and halogen lamps). This is an issue for their recycling

(see section on environmental impacts), but also when a CFL is breaking and is not disposed properly. Instructions on how to clean up a broken CFL could be usefully communicated to consumers. The use of a non-breakable second envelope around the fluorescent tubes of the lamp can significantly reduce this risk (but adds to the production cost and decreases the energy efficiency of the lamp of about 10 %).

- Impact of CFLs on existing diseases: complaints were received by the preparatory study consultants from some patients' associations on the aggravation of the symptoms of their diseases in the presence of compact fluorescent lamps. In order to gather the latest scientific evidence on these complaints, the Commission services gave a mandate to the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), to look into this issue; the Committee provided its opinion in September 2008.[28] They analysed existing evidence on the potential impact on patients of the following three lamp parameters: flicker, electromagnetic fields generated by the integrated ballast, and ultraviolet and blue light radiation. Of the three parameters, only UV/blue light radiation was identified as a potential risk factor for the aggravation of the light-sensitive symptoms in some patients with conditions such as chronic actinic dermatitis and solar urticaria. The number of all light-sensitive patients in EU-27, who might be at risk from the increased levels of UV/blue light radiation generated by CFLs, is estimated at around 250,000 individuals. The Committee also identified a risk to the general public of transgressing workplace UV limits in case of prolonged exposure from less than 20 cm to the light of some CFLs. The use of CFLs with second envelope would largely or entirely mitigate those risks (but as seen above, also slightly decreases the energy efficiency of the lamp and add to the cost).

- Electromagnetic fields generated by CFLs: compared to incandescent lamps and to most halogen lamps, the ballasts incorporated into CFLs generate additional electromagnetic fields. In the SCENIHR opinion on light sensitivity (see previous point) the issue of electromagnetic hypersensitivity due to the use of such lamps has been examined. SCENIHR concluded that it has never been conclusively and convincingly shown that there exist any connections between electromagnetic fields (EMF) and the symptoms that are reported by persons with so-called electromagnetic hypersensitivity, although their symptoms are real and can be severe. There is no scientific evidence of correlation between EMF from compact fluorescent lamps, and symptoms and disease states. SCENIHR also stated in its recent opinion on Health Effects of Exposure to EMF[29] that the emissions from compact fluorescent lamps have been investigated recently and that available results showed compliance with existing limits (as in Council recommandation 1999/519/EC[30]). The levels decrease drastically beyond 30 cm from the lamps. In any case, compact fluorescent lamps available on the market have to fulfil the requirements of Directive 2006/95/EC on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits. In conclusion, there is no scientific evidence of any link between the electromagnetic fields (EMF) emitted by compact fluorescents lamps and the symptoms of "electrically sensitive" people. EMF emissions from CFLs are within international limits on public exposure to EMF.

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28 http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_019.pdf

29 http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_022.pdf

30 COUNCIL RECOMMENDATION of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz).

V. Environmental impacts

1. Electricity savings and reductions of CO2 emissions

The annual improvement in 2020 compared to business as usual and the accumulated savings until 2020 for the different sub-options were demonstrated under Economic impacts above.

In addition to those savings, proportionate reductions of further electricity production related environmental impacts (e.g. SO_2, NOx, heavy metals) are to be expected, as demonstrated in the preparatory studies.

2. Possible trade-offs between lower electricity consumption in the use-phase and impacts in the other phases of the life cycle of the products

The preparatory studies have assessed possible trade offs between reductions of non-directional household lamps power consumption, and impacts related to other life cycle phases which may be arising due to, e.g., additional integrated circuits. Trade-offs are not to be expected in any of the sub-options, because the reduction of the use phase power consumption environmental impact is larger than possible additional environmental impacts related to other life cycle phases.

This holds also for the mercury pollution attributed to the different lamp types. Compact fluorescent lamps contain a small amount of mercury (maximum 5 mg according to the RoHS Directive 2002/95/EC, in practice on average 4 mg[31]). On the other hand, there are quantifiable emissions due to electricity generation.[32] As compact fluorescent lamps are supposed to be recycled under the WEEE Directive (2002/96/EC), in theory their mercury content is captured through extraction techniques and reused in other manufacturing processes at disposal phase. However, CFL recycling schemes under the WEEE Directive are in an early stage of development in most Member States, and the majority of the general public is not aware that CFLs are supposed to be recycled. The situation will hopefully improve in the future, for now the preparatory study used the assumption that only 20% of the CFLs were recycled in Europe. Mercury from the rest of the lamps was deemed to be released to the environment (disregarding the fact that landfills and waste incinerators are increasingly equipped with filters limiting mercury emissions from the waste). The study came to the conclusion that over their life cycle, compact fluorescent lamps released about 10% less mercury than incandescent lamps for every lumen delivered during one hour of operation (if all CFLs were recycled, they would release 75% less mercury than incandescents). Low-voltage halogen lamps release about 20% less mercury than incandescent lamps for every lumen delivered during one hour of operation.

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31 By comparison, each tooth with an amalgam filling contains on average 500 mg of mercury.

32 Only from coal-fired electricity generation, however the preparatory study was using mercury emissions from the European average electrictiy mix (0.016 mg / kWh), contained in the European Reference Life Cycle Database (data set version 01.00.001). Source: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/Power_grid_mix_UCTE__83c1f02c-f2ef-4ac4-9a57-ac2172c38D15__01.00.001.html

The estimated impact of the sub-options on total mercury emissions compared to business as usual is calculated in the preparatory study:

	Mercury emissions from general lighting (EU-27, in tons of mercury)	
	In 2020	**2009-2020**
BAU	3.1	36.2
Sub-Options	**Annual reduction in 2020**	**Accumulated reduction by 2020**
1	2	12.9
2a	1.7	8.6
2b (3 stages)	1.5	11.5
2b (6 stages)	1.5	8.8
2c	1.5	10.5
3	1	4.6

3. Environmental improvement in the world through exports

The equipment covered by this regulation is also produced for the world market (about 20% of EU production). Therefore the requirements set in this regulation may impact on the design of equipment shipped to markets other than the EU, and the resulting reductions of environmental impact are likely to be higher than those estimated for the EU alone. It is not possible to quantify this effect because market and environmental data for the equipment covered by this regulation could not be analysed for other parts of the world.

IV. Impacts on trade

The process for establishing ecodesign requirements for non-directional household lamps has been transparent, and after endorsement of the regulation by the Regulatory Committee a notification under WTO-TBT was issued.. Although the phasing out for the EU market of incandescent bulbs would have some impact on EU producers, no competitive disadvantages for EU manufacturers exporting the affected products to third countries have been flagged during the consultation process or are to be expected. Considering that most of the CFL production is out of the EU, there will be more imports. Anti-dumping duties on CFLs were lifted in October 2008.

SECTION 6: CONCLUSION - COMPARING THE OPTIONS

Following the principle of proportionality in the analysis effort, policy options 1 to 3 were discarded at an earlier phase of the analysis.

Section 5 provided a detailed impact assessment of the different sub-options available under option 4 (ecodesign implementing measure), which differ in the level of ambition and the timing of the requirements. Economic, social and environmental impacts were discussed.

All of the considered policy options justify a complete phasing out of incandescent lamps and conventional halogen lamps. They also show the same need to set functionality and product information requirements on the lamps within scope (with the exception of LEDs at this stage) so that consumers obtain more or less equivalent performance with all the alternatives and proper information on any remaining differences. The main questions to be answered are what kind of alternative lamps are left on the market and how fast the banning of the less efficient technologies is implemented.

Sub-Option 1:

From a purely energy efficiency perspective, only compact fluorescent lamps (CFL) should be left on the market. This could save up to **86 TWh** of energy in 2020 compared to business as usual (equivalent to the final total electricity consumption of Finland in 2006 or of 25 million households).

However, the Ecodesign Directive (2005/32/EC) also requires taking into account functionality from the user's point of view (Article 15.5.a) and possible adverse health impacts (Article 15.5.b).

As discussed above, although health issues seem to be affecting only a restricted number of people (about 250000 in the EU), following the precautionary principle, it is advised to leave alternatives to CFLs on the market.

This would also limit the impact on the functionality of the product (detailed under Sub-Option 2).

Options hereunder are ranked following their potential for energy savings.

Sub-Option 2:

Sub-Option 2a:

- require all non-transparent (frosted) lamps to be CFLs as soon as possible (for applications which do not need to be bright point sources)
- allow the most efficient halogen lamps (class B) to exist if they are transparent lamps. This would offer equivalent light quality to incandescent bulbs, full dimmability, no health issues. If class C halogen lamps are allowed to exist for a sufficiently long transitional period, existing GLS and halogen production lines in Europe could be at least partially converted to produce class C halogen lamps in the short term.

Energy savings could drop from 86 TWh to about **51 TWh**.

Dimmability, size/socket compatibility, performance and possible health issues are still present for non-transparent lamps. Consumers facing such problems would have the possibility to use the full range of transparent lamps as replacement, while others keen on the diffuse light of non-transparent lamps could move to CFLs, at the same time realising substantial energy savings.

Currently, the light output of transparent GLS retrofit lamps would be restricted to the equivalent of a 60W GLS, and they are currently produced by only one manufacturer (even though the technology is not protected by patents).

CFLs or class B halogens, due to incorporated electronics or socket incompatibility, will not fit in all luminaires. Consumers would be forced to change the affected luminaires as soon as they run out of replacement lamps. This is also an issue for European (especially Italian SMEs) luminaire producers, some of whom may have to completely change their product range.

Sub-Option 2b:

- require all non-transparent (frosted) lamps to be CFLs as soon as possible (for applications which do not need to be bright point sources)
- allow the most efficient halogen lamps (class B) to exist if they are transparent lamps. This would offer equivalent light quality to incandescent bulbs, full dimmability, no health issues. If class C halogen lamps are allowed to exist for a sufficiently long transitional period, existing GLS and halogen production lines in Europe could be at least partially converted to produce class C halogen lamps in the short term.
- allow special socket halogens to be class C ("Halo socket C"), as it would solve the socket/luminaire incompatibility issue. The phase-out of such lamps could be tackled instead through luminaire requirements.

Energy savings could further drop down to about **39 TWh**.

Dimmability, size/socket compatibility, performance and possible health issues are still present for non-transparent lamps. Consumers facing such problems would have the possibility to use the full range of transparent lamps as replacement, while others keen on the diffuse light of non-transparent lamps could move to CFLs, at the same time realising substantial energy savings.

The light output of transparent GLS retrofit lamps would still be restricted to the equivalent of a 60W GLS, currently produced only by one manufacturer (even though the technology is not protected by patents).

Sub-Option 2c:

- require all non-transparent (frosted) lamps to be CFLs as soon as possible (for applications which do not need to be bright point sources)
- allow all transparent lamps to be class C indefinitely. This would allow C-class retrofit halogen lamps ("Halo retro C") to exist, offering equivalent light quality to incandescent, full dimmability, no health issues and no incompatibility issues. Existing GLS and halogen production lines in Europe could be at least partially converted to produce these lamps.

Energy savings could further drop down to about **33 TWh**.

Dimmability, size/socket compatibility, performance and possible health issues are still present for non-transparent lamps. Consumers facing such problems would have the possibility to use the full range of transparent lamps as replacement, while others keen on the diffuse light of non-transparent lamps could move to CFLs, at the same time realising substantial energy savings.

Sub-Option 3:

- allow the full range (both transparent and frosted) of improved halogen lamps (class C) to exist, because they do not need integrated electronics and come in all sizes and sockets. Energy savings may go down to **22 TWh**.

The sub-options are summarised in the table below, together with the lamp types authorised in the given sub-option, the main consequences of the use of those lamp types and the respective savings potential.

The following should be considered when interpreting the table:

- The remaining problems indicated with "*" and "**" relate to the particular lamp category (being either transparent or frosted) and can be solved by using a lamp of the other technology (e.g. in Sub-option 2b, mercury content issues with CFLs – which are frosted - can be solved completely by using halogen lamps - which are transparent).
- The remaining problems that are not marked with stars are applicable to both lamp categories (transparent and frosted).
- The estimate on the net cost saving per household in 2020 compared to business as usual is taking into account also the lifetime of the lamps and the cost of their replacement. The method of calculation was presented in Section 5.

Overview table of available options and their estimated impacts in 2020 compared to business as usual

<table>
<tr><th rowspan="2">Sub-option</th><th colspan="2">Lamps allowed</th><th rowspan="2">Remaining Problems
not solved by the option</th><th rowspan="2">EU-27 yearly energy savings in 2020</th><th rowspan="2">Net cost saving / house-hold yearly in 2020</th></tr>
<tr><th>Transparent</th><th>Frosted</th></tr>
<tr><td>1</td><td>–</td><td>CFLs</td><td>No bright point light source available
Partial compatibility with existing luminaires
Probably no replacement to EU GLS production
Often not dimmable
Alleged health issues
Sub-optimal quality and performance
Mercury content</td><td>86 TWh</td><td>59 €</td></tr>
<tr><td>2a</td><td>Halogen B *</td><td>CFLs **</td><td>Partial compatibility with existing luminaires
Probably no replacement to EU GLS production
* No equivalent to transparent GLS > 60W
* Only one producer currently for GLS retrofit
** Often not dimmable
** Alleged health issues
** Sub-optimal quality and performance
** Mercury content</td><td>51 TWh</td><td>31 €</td></tr>
<tr><td>2b</td><td>Halogen B *
Halo socket C</td><td>CFLs **</td><td>Probably no replacement to EU GLS production
* No equivalent to transparent GLS > 60W
* Only one producer currently for GLS retrofit
** Often not dimmable
** Partial compatibility with existing luminaires
** Alleged health issues
** Sub-optimal quality and performance
** Mercury content</td><td>39 TWh</td><td>22 €</td></tr>
<tr><td>2c</td><td>Halogen B
Halo socket C
Halo retro C</td><td>CFLs **</td><td>** Often not dimmable
** Partial compatibility with existing luminaires
** Alleged health issues
** Sub-optimal quality and performance
** Mercury content</td><td>33 TWh</td><td>19 €</td></tr>
<tr><td>3</td><td>Halogen B
Halo socket C
Halo retro C</td><td>CFLs
Halogen B
Halo socket C
Halo retro C</td><td>This option satisfies all possible comfort criteria, as frosted halogen lamps remain available, offering the same service as frosted incandescents.</td><td>22 TWh</td><td>10 €</td></tr>
</table>

Conclusion

In the **frosted** lamps category, the analysis has shown that it is cost-effective to only allow class A level lamps (= CFLs).

Where consumers look for a particular light quality/aesthetics there is a need to offer alternatives to CFLs. Following the precautionary principle, there is also a need to keep alternatives to CFL lamps for some patients with alleged health issues. This means leaving certain transparent halogen lamps on the market.

The best halogens (class "B") can be considered as an alternative to incandescent for normal screw sockets and for wattages up to 60W.

Leaving halogens retro class "C" (at least in the short/medium term) would provide for wattages above 60W and the possibility to adapt the production lines currently dedicated to incandescent bulbs (mitigating impact on jobs in the EU).

If the special socket halogen lamps were banned in the short term, people would be forced to change their luminaires when they run out of replacement lamps. The impact on luminaire manufacturers (in particular Italian SMEs) would also be significant.

Special socket halogens in class C should be removed from the market in the longer term as more efficient alternatives exist with different lamp caps. It could be considered to phase out luminaires designed for exclusive use with inefficient lamps in a second step that would deal with luminaires and reflector lamps.

Overall, following the assessment of impacts, Option 2b seems to strike the appropriate balance between optimising energy savings, offering sufficient alternatives in terms of functionality and minimising negative economical, social and environmental impacts.

Timing

Staged introduction of requirements (in particular banning incandescent bulbs in several stages) would affect accumulated savings up to 2020 but mitigate impacts on industry and should avoid risk of supply shortage; the annual savings as from 2020 would remain more or less unchanged. The lamp industry has been lately supporting an implementation of the measure in 5 years rather than 9 years, provided the phase-out of the incandescent bulbs is done as gradually as possible within this shorter time frame.

Class C halogen lamps should be allowed to exist for a sufficiently long transitional period, in order to ensure that industry starts mass-producing these one-to-one replacements to incandescent bulbs and does not skip directly to class B halogen lamps, which do not fit yet in all luminaires and are not yet available in all wattages. In the short term, existing GLS and halogen production lines in Europe could be at least partially converted to produce class C halogen lamps.

On the other hand, there is no reason to delay beyond the first stage of implementation the requirement for non-transparent lamps to be A-class, as the energy saving is substantial and alternatives (transparent halogen lamps) exist for consumers not willing to use CFLs.

In order to plan in an optimal way their production that follows seasonal patterns, industry has expressed its preference for the application dates of the different stages to be set in early Autumn of each year.

A possible scenario could be as follows for implementing Sub-Option 2b (considering adoption of the measure in March 2009):

	Non-clear lamps				Clear lamps						
Date	Require-ment	Incandes-cent	All Halogen	CFLs	Requirement	Incandescent / Conventional halogen				Halo-gen C	Halo-gen B
						≥ 100 W	≥ 75 W	≥ 60 W	60 W >		
Today	None				None						
Sept 2009	A				C for ≥ 100W, E for the rest [1]						
Sept 2010	A				C for ≥ 75W,						
Sept 2011	A				C for ≥ 60W,						
Sept 2012	A				C for all						
Sept 2013	Second level of functionality requirements										
Review 2014	Review										
Sept 2016	A				B / C [2]					[3]	

Notes to the table:

[1] The requirement is raised for all clear lamps to class E, phasing out F and G class incandescent and halogen lamps in all wattages already in September 2009. After the first stage, only E-class incandescent lamps remain available in some wattages until they are also gradually phased out by September 2012.

[2] Special cap halogen lamps will be required to be at least class C, all other clear lamps will have to be at least class B.

[3] Only special cap halogen lamps are allowed to be C-class.

General remarks about the table:

- Wattage categories refer to all lamp technologies (also halogen lamps) that have the same luminosity as incandescent lamps of that wattage.
- A grey cell indicates that the lamp category given in the column header is still available in the particular stage.
- The capitalised letters refer to energy classes defined for the lamp energy label (Directive 98/11/EC).

SECTION 7: MONITORING AND EVALUATION

The appropriateness of scope, definitions and limits will be reviewed after maximum 5 years from the adoption of the measure (as required by Annex VII.9 of the framework Directive and laid down in the implementing measure). Account will be taken also of speed of technological developement and input from stakeholders and Member States. Compliance with the legal provisions will follow the usual process of "New Approach" regulations as expressed by the CE marking. Compliance is mainly checked by market surveillance carried out by Member State authorities ensuring that the requirements are met. Further information from the field (e.g. complaints by consumer organisation or competititors) could alert on possible deviations from the provisions and/or of the need to take action.

Contributions are also expected from international cooperation as e.g. in the framework of the IEA Implementing Agreement for Energy Efficiency End-Use Equipment.

Annex I
Incandescent lamp (GLS) phase-out legislative initiatives in third countries

Country	Legislation adoption	Start of GLS phaseout	End of GLS phaseout
Cuba	Adopted unknown date	2006	2007
Argentina	Adopted June 2007	June 2008	?
Australia and New Zealand	Adopted unknown date	Nov 2008	Nov 2011
Canada	Drafted	01/01/2012	31/12/2012
USA	Adopted January 2008	01/01/2012	01/01/2014
Switzerland	Adopted?	*early 2008 (plan)*	*2012 (plan)*
Philippines	Planned end of 2008	?	*2010 (plan)*
Brazil	In drafting	?	*01/01/2010 (plan)*
Colombia	Drafted	?	*mid 2010 (plan)*
Japan	Planned	?	*2012 (plan)*

Other countries applying a voluntary approach or seriously considering regulatory phase-out:

Bolivia, China, Ecuador, India, Korea, Norway, Thailand, Tunesia, Venezuela.

Annex II
Forecasts of number of lamps per household in the domestic sector

GLS-F: frosted incandescent, GLS-C: clear incandescent, HL-MV-LW: halogen mains voltage low power, HL-MV-HW: halogen mains voltage high power, HL-LV: halogen low voltage, CFLi: self-ballasted compact fluorescent lamp.

	GLS-F	GLS-C	HL-MV-LW	HL-MV-HW	HL-LV	CFLi	TOTAL
	Nb/hh	Nb/hh	Nb/hh	Nb/hh	Nb/hh	Nb/hh	Nb/hh
2007	7.89	2.42	0.60	0.53	2.24	4.81	**18.48**
2008	6.89	2.22	0.86	0.67	2.30	5.85	**18.80**
2009	6.08	2.03	1.12	0.82	2.37	6.70	**19.13**
2010	5.43	1.84	1.39	0.96	2.43	7.40	**19.45**
2011	4.87	1.65	1.65	1.10	2.50	8.00	**19.77**
2012	4.47	1.64	1.76	1.13	2.55	8.47	**20.00**
2013	4.26	1.62	1.86	1.16	2.59	8.75	**20.24**
2014	4.07	1.61	1.97	1.19	2.64	9.00	**20.47**
2015	3.95	1.59	2.07	1.22	2.68	9.19	**20.71**
2016	3.83	1.58	2.18	1.25	2.73	9.38	**20.94**
2017	3.73	1.56	2.28	1.28	2.77	9.55	**21.18**
2018	3.64	1.55	2.39	1.31	2.82	9.70	**21.41**
2019	3.56	1.54	2.49	1.34	2.86	9.85	**21.65**
2020	3.48	1.52	2.60	1.37	2.91	10.00	**21.88**

Annex III
Lamp production sites on the territory of EU-27

The EU-27 has three main producers for GLSs (general service incandescent lamps), i.e.

- **Philips Lighting,** with GLS-related production in Piła and Pabianice (Poland), Dyon (France) and Alpignano (Italy).
- **GE Lighting,** with 11 sites in Hungary of which Nagykanizsa is the largest host of GLS-manufacturing .
- Main Production locations for GLS at **OSRAM** are Molsheim (France), Nové Zámky (Slovakia) and Wipperfürth (Germany).

GLS-manufacture is only one of the activities at the locations. Philips reports a total staff of approximately 7200 at the locations mentioned of which 2500 direct GLS related (excl. distribution, components)[33]. For instance, Piła (ca. 4000 staff) hosts manufacturing of LFLs[34], CFL[35]s, etc. as well as production of lead-in-wire and glass factory working for the whole of Philips and externals. Nagykanizsa (3800 staff) hosts a similar array of activities. Nové Zámky (2400 staff) is mainly a producer of automotive lighting, but appears destined to pick up GLS and CFL production. Molsheim (800 staff) is/was the main OSRAM GLS-manufacturing specialist, producing 450 mln. units annually, but presumably with significant external OEM-activity. OSRAM is transforming its Molsheim plant to energy-saving halogen lamps. [36]

All larger GLS manufacturing locations combine manufacturing with important European distribution centre activities.

The mix of activities makes it difficult to partition work force at the above locations specifically to GLS production.[37] Overall a rough estimate is a number of around 10.000-12.000 staff (± 15%) linked to GLS production and first-tier distribution is reasonable, split up between

- GLS manufacturing 4000-5000 (direct & indirect staff)
- GLS part suppliers 2500-3500 (internal and external; glass factory, lead-in-wire, caps, packaging)
- Distribution 2000-3000
- Head office and support 500 (locations Eindhoven, Budapest, München)

Production volume in 2007 is around 1.2 bln. GLS units[38], down from as much as 1.6 bln. units in 2005. Eurostat further shows extra-EU 2007 exports of 0.6 bln. and imports of around 0.35 bln. GLS units. The accuracy of these figures is debatable, but at least they seem to indicate that ca. 80% of the workforce should be partitioned to EU-27 sales, i.e. around 8000 staff.

Faced with an EU ban on GLS there are the following staff reallocation options:

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33 Pers. comm.. ELC, d.d. 10.10.08

34 LFL= Linear Fluorescent Lamp.

35 CFL= Compact Fluorescent Lamp. Intended are integrated CFLs, i.e. CFL-i

36 No GLS manufacturing data for Sylvania could be found. OSRAM Sylvania is the former NAFTA subsidiary of Sylvania. Other parts of Sylvania belong to Havell-Sylvania

37 E.g. unclear if Philips of 2500 GLS-related workforce statement includes glass factory.

38 Estimate based on Eurostat data 2003-2006

- Re-allocation to distribution activities. For instance, in 2006/2007 Philips has invested PLN 60 mln. in 2006/2007 in a warehouse space of 21,000 m² and office space of 4,000 m² for distribution to end-customers located in Central and Eastern Europe and Scandinavia. [39]
- Re-allocation to manufacturing of new growth products. For instance, Molsheim is set to produce energy saving halogens –a technology similar to GLS production.
- Early retirement and lay-offs, i.e. finding jobs outside the company. Given that most Eastern European locations are growing, opportunities for new jobs are realistic

Also, in all scenario's a small part of GLS-production (e.g. < 200 lm) is maintained.

Assuming a worst-case scenario of 2 to 3000 forced lay-offs the restructuring charges will be in the order of € 200 to 300 mln., including asset write-down and other costs.[40] Per company this may amount to € 80 mln. When spread over two years this is close to the equivalent of e.g. the average annual restructuring charges of Philips over the last five years, mainly as a consequence of closing its Western-European GLS operations.

The costs related to the restructuring are however quickly compensated by the substantial increase in industry margins on the sales (see Annex V).

Philips Lighting. Restructuring charges (Philips Annual Reports 2007 and 2004)

	2007	**2006**	**2005**	**2004**	**2003**
Lay-off costs* in mln.	22	32	32	30	29

* Note: lay-off costs were 0.1 mln./employee in 2004

What does **not** seem to be an option is a staff re-allocation to the extra CFL-production as a consequence of banning the GLS. The European CFL production takes place in the same Eastern European locations. In Western-Europe there is production plant in Augsburg (Germany) with ca. 500 out of 1700 staff employed in CFL-production.

In September 2008, OSRAM has announced laying off 360 staff in Augsburg, hinting at cheaper imports after the discontinuation of the EU anti-dumping penalty. Likewise, GE Lighting has announced a reduction of the head-count by 224 before the year's end. Philips has made no announcements regarding its CFL-production in Poland, but it has been one of the strongest advocates of abolishing the EU anti-dumping penalty.

Given these developments it is difficult to estimate employment linked to CFL-production. The European Commission estimated a 60 mln. /a unit production in the 2003-2006 period. Eurostat data suggest that it was over 100 mln units/a. In general it is assumed that ca. 80% of EU-27 CFL-consumption comes from Asia (China). With the latest restructuring operations, this percentage is bound to increase.

[39] http://www.paiz.gov.pl/. New Investment of Philips Lighting Poland. 26.3.2006.

[40] Key figures from Philips Annual Report. In Western Europe lay-off costs alone (without asset write down) are € 0.1 mln./employee. In Eastern Europe this will be substantially lower and for that reason asset write down and other costs are excluded.

Annex IV
Sub-options for the scenario analysis

Including the assumed order and timing of technology substitution due to the staged introduction of requirements

The abbreviations in the first column are explained in Annex II. Further abbreviations:

CFLi (combination 1): CFLs with functionality requirements under the implementing measure

G9 and R7s are halogen lamp socket types. "Xenon" halogen lamps' efficacy is improved to class C. "IRC" means "infrared coating" and covers halogen lamps with efficacy improved to class B.

In yellow = change from previous phase; in red = change that requires luminaire change

Sub-Option 1 ("1 Bis Fast" in the preparatory study)

present	2009	2011	2013
requirements:	C except below 450lm	C (with CFL combination1)	A (with CFL combination1)
GLS-C	CFLi (except below 450 lm)	CFLi (combination 1)	CFLi (combination 1)
GLS-F	CFLi (except below 450 lm)	CFLi (combination 1)	CFLi (combination 1)
HL-MV-LW (G9)	Xenon HL-MV-LW	Xenon HL-MV-LW	CFLi (combination 1)
HL-MV-HW (R7s)	Xenon HL-MV-HW	Xenon HL-MV-HW	CFLi (combination 1)
HL-LV	HL-LV IRC	HL-LV IRC	CFLi (combination 1)
CFLi	CFLi	CFLi (combination 1)	CFLi (combination 1)

Sub-Option 2a ("2 Clear B Slow with G9/R7s phase-out" in the preparatory study)

Present	2009	2011	2013	2015	2017
Requirements:	C except below 1000 lm	C except below 450lm	clear: C (GLS); clear: B (HL-MV); frosted: A (CFL combination1)	clear: C (GLS); clear: B (HL-MV); frosted: A (CFL combination1)	clear: B; frosted: A (CFL combination1)
GLS-C	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 450 lm)	HL-LV IRC with integrated electronic transformer	HL-LV IRC with integrated electronic transformer	HL-LV IRC with integrated electronic transformer
GLS-F	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 450 lm)	CFLi (combination 1)	CFLi (combination 1)	CFLi (combination 1)
HL-MV-LW (G9)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW	Xenon HL-MV-LW	HL-LV IRC
HL-MV-HW (R7s)	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW	CFLi (combination 1)
HL-LV	HL-LV	HL-LV IRC	HL-LV IRC	HL-LV IRC	HL-LV IRC
CFLi	CFLi	CFLi	CFLi (combination 1)	CFLi (combination 1)	CFLi (combination 1)

Sub-Option 2b - 3 stages ("2 Clear B Fast" in the preparatory study)

Present	2009	2011	2013
requirements:	C except below 450lm	clear: C; frosted: A (CFL combination1)	clear: B; frosted: A (CFL combination1)
GLS-C	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW	HL-LV IRC with integrated electronic transformer
GLS-F	CFLi (except below 450 lm)	CFLi (combination 1)	CFLi (combination 1)
HL-MV-LW (G9)	Xenon HL-MV-LW	Xenon HL-MV-LW	Xenon HL-MV-LW
HL-MV-HW (R7s)	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW
HL-LV	HL-LV IRC	HL-LV IRC	HL-LV IRC
CFLi	CFLi	CFLi (combination 1)	CFLi (combination 1)

Sub-Option 2b - 6 stages (”2 Clear B Slow without G9/R7s phase-out” in the preparatory study)

present	2009	2010	2011	2012	2013	2016
requirements:	***Please refer to detailed description in Section 5***					
GLS-C	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 725 lm)	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW	Xenon HL-MV-LW	HL-LV IRC with integrated electronic transformer
GLS-F	CFLi	CFLi	CFLi	CFLi	CFLi (combination 1)	CFLi (combination 1)
HL-MV-LW (G9)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 725 lm)	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW	Xenon HL-MV-LW	Xenon HL-MV-LW
HL-MV-HW (R7s)	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW
HL-LV	HL-LV	HL-LV	HL-LV	HL-LV	HL-LV	HL-LV IRC
CFLi	CFLi	CFLi	CFLi	CFLi	CFLi (combination 1)	CFLi (combination 1)

Sub-Option 2c (“2 Clear C Fast” in the preparatory study)

Present	2009	2011	2013
requirements:	C except below 450 lm + G9	C with CFLi combi1	clear: C; frosted: A (CFL combination1)
GLS-C	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW	Xenon HL-MV-LW
GLS-F	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW	CFLi (combination 1)
HL-MV-LW (G9)	HL-MV-LW	Xenon HL-MV-LW	Xenon HL-MV-LW
HL-MV-HW (R7s)	Xenon HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW
HL-LV	HL-LV	HL-LV	HL-LV
CFLi	CFLi	CFLi (combination 1)	CFLi (combination 1)

Sub-Option 3 ("3 Slow" in the preparatory study)

present	2009	2011	2013	2015	2017
requirements:	C except below 1000lm + G9/R7s	C except below 1000lm + G9/R7s	C except below 1000lm + G9/R7s	C except below 450lm	clear: C
GLS-C	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW
GLS-F	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW
HL-MV-LW (G9)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 1000 lm)	Xenon HL-MV-LW (except below 450 lm)	Xenon HL-MV-LW
HL-MV-HW (R7s)	HL-MV-HW	HL-MV-HW	HL-MV-HW	Xenon HL-MV-HW	Xenon HL-MV-HW
HL-LV	HL-LV	HL-LV	HL-LV	HL-LV	HL-LV
CFLi	CFLi	CFLi	CFLi	CFLi (combination 1)	CFLi (combination 1)

Annex V
Impact of switching from incandescent lamps to compact fluorescent lamps on industry and wholesaler/distributor turnovers

Table 1. GLS estimated price built-up

	Euro/unit	*Note*
industry:		
ind. personnel	0.14	[1]
ind. energy & materials	0.09	[2]
ind. capital depr.	0.02	[3]
ind. margin & misc.	0.01	[4]
retail	0.45	[5]
VAT	0.13	[6]
Consumer price incl. VAT	0.84	[7]

[1] Overall personell OEM+manufacturing direct & indirect+distribution 10.000, of which 9.500 at € 15.000/yr and 500 head-office/central R&D at € 40,000/yr (see employment impact).. Total €1.625 bln/yr..GLS production 2007 is 1200 mln. units/yr--> per unit € 0.135

[2] Osram LCA of GLS --> Energy is equivalent of 0.86 kWh/GLS for production and distribution--> 0.04 (of which part in retail)

Transport to retail/wholesale central warehouse: 1500 km * 1/4-->375 litre * 1.4 --> 500 euro per 30 m3/20t truck with 100,000 bulbs --> 0.005 euro/bulb

Materials: 19 g. Glass (mostly energy), 1 g. aluminium cap. (€0.005), blister/cardboard/PE foil

Correction ELC--> € 0.09

[3] Estimate € 20-25 mln./yr. Based on e.g. warehouse Pila 2006 € 18 mln.. Asset write-downs at closure NL GSL plants (Philips Annual Report) etc.

[4] Margin, indication ELC

[5] Retail mark-up (DIY, Supermarkets, etc.). Includes all costs : 170-200% (ELC correction)

[6] VAT 19%. Recycling taxes and other levies not taken into account for GLS

[7] Average over all types. At ca. 1000 mln. unit sales (GLS>200 lm, excl. decorative etc.) in EU 2007: Total sales value is € 0.84 bln. in consumer prices and € 0.26 bln. In msp. Industrial margin + misc. is ca. € 10 mln.. Retail turnover € 0.45 bln.. VAT revenue € 0.13 bln

GLS est. price built-up

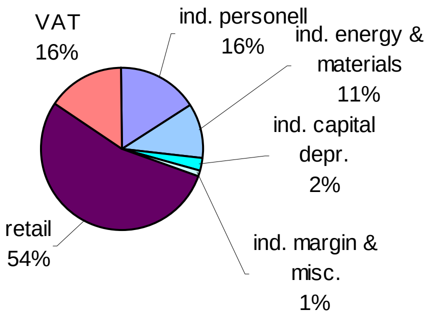


Table 2 . CFLi estimated price built-up

	Euro/unit	Note
industry:		
ind: buy CN	1.02	[1]
ind.transport CN-EU	0.10	[2]
ind. misc. costs	0.10	[3]
ind. margin+duties	0.75	[4]
Retail	2.10	[5]
VAT	0.79	[6]
Consumer price incl. VAT	4.86	[7]

[1] source: COUNCIL REGULATION (EC) No 1205/2007 of 15 October 2007 imposing anti-dumping duties on imports of integrated electronic compact fluorescent lamps (CFL-i).. ELC corrected dd 17.10.08[41]

[2] Estimate (high) for transport truck-seacontainer-truck.

Transport to retail/wholesale central warehouse: 1500 km * 1/4-->375 litre * 1.4 --> 500 euro per 30 m3/20t truck with 100.000 bulbs --> 0.005 euro/bulb

Materials: 19 g. Glass (mostly energy), 1 g. aluminium cap. (€0.005), blister/cardboard/PE foil

[3] Includes warehouse, distribution, share R&D and head office, capital deprec. etc.

[4] Margin & import duties until 18.10.2008. ELC corrected. Furthermore ELC states that margins should be halved because of import duties

[5] Retail mark-up ca. 100% (DIY, Supermarkets, etc.), includes all costs

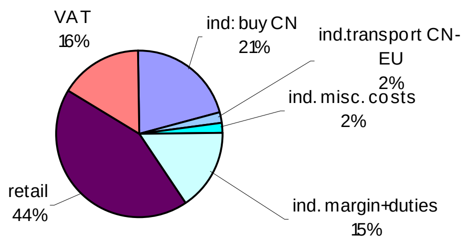
[6] VAT 19% excl. recycling levies

[7] Average over all types. At 426 mln. unit sales: 2007 total EU sales value is € 2.07 bln. in consumer prices and € 0.84 bln. in msp. Industry margin+import duties € 320 mln. (of which 50% duties)

Wholesale + retail turnover € 1.04 bln. VAT & levies € 0.34 bln

41 European Lamp Companies Federation. Pers. Comm., d.d. 17.10.2008

CFLi est. price built-up



Example:

Replacement of 1000 mln. GLS lamps (1000 h life) by 166 mln. CFLi lamps (6000 h life):

Business perspective: Turnover from € 840 to 807 mln.; industry margin & misc. from € 10 to € 62 mln. (assuming 50% for duties in figures above); Retail from € 450 to 350 mln. (but lower logistics costs overcompensate that); VAT stable at ca. € 130 mln.

Annex VI
Possible effect of the ecodesign requirements on employment in EU-27

Faced with an EU ban on GLS there are the following staff reallocation options:

- Re-allocation to distribution activities. For instance, in 2006/07 Philips has invested in Poland PLN 60 mln. in 2006/2007 in a warehouse space of 21,000 m² and office space of 4,000 m² for distribution to end-customers located in Central and Eastern Europe and Scandinavia. [42]
- Re-allocation to manufacturing of new growth products. For instance, Molsheim is set to produce energy saving halogens –a technology similar to GLS production. LED production is another option.
- Early retirement and lay-offs, i.e. finding jobs outside the company. Given that most Eastern European locations are growing, opportunities for new jobs are realistic

Assuming a worst-case scenario of 2 to 3000 forced lay-offs the restructuring charges will be in the order of € 200 to 300 mln., including asset write-down and other costs.[43] Per company this may amount to € 80 mln.. When spread over two years this is the equivalent of e.g. the annual restructuring charges of Philips over the last five years, mainly as a consequence of closing its Western-European GLS operations.

Philips Lighting. Restructuring charges (Philips Annual Reports 2007 and 2004)

	2007	**2006**	**2005**	**2004**	**2003**
Lay-off costs* in mln.	22	32	32	30	29

* Note: lay-off costs were 0.1 mln./employee in 2004

What does **not** seem to be an option is a staff re-allocation to the extra CFL-production as a consequence of banning the GLS. The European CFL production takes place in the same Eastern European locations. In Western-Europe there is production plant in Augsburg (Germany) with ca. 500 out of 1700 staff employed in CFL-production. The CFL anti-dumping regulation of 2007[44] reports CFL-production by Osram subsidiary Sylvania in Leeds (UK).

Osram has already announced laying off a total of 580 staff for Augsburg, hinting at cheaper imports after the discontinuation of the EU anti-dumping penalty. Likewise, GE Lighting has announced a reduction of the head-count by 224 before the year's end. Philips has made no announcements regarding its CFL-production in Poland, but it has been one of the strongest advocates of abolishing the EU anti-dumping penalty.

42 http://www.paiz.gov.pl/. New Investment of Philips Lighting Poland. 26.3.2006.

43 Key figures from Philips Annual Report. In Western Europe lay-off costs alone (without asset write down) are € 0.1 mln./employee. In Eastern Europe this will be substantially lower and for that reason asset write down and other costs are excluded.

44 COUNCIL REGULATION (EC) No 1205/2007 of 15 October 2007 imposing anti-dumping duties on imports of integrated electronic compact fluorescent lamps (CFL-i) originating in the People's Republic of China following an expiry review pursuant to Article 11(2) of Council Regulation (EC) No 384/96 and extending to imports of the same product consigned from the Socialist Republic of Vietnam, the Islamic Republic of Pakistan and the Republic of the
Philippines

Given these developments it is difficult to estimate employment linked to CFL-production. The CFL anti-dumping regulation of 2007 estimated a 60 mln. unit /a unit production in the 2003-2006 period. Eurostat data suggest that it was over 100 mln units/a. In general it is assumed that ca. 80% of EU-27 CFL-consumption comes from Asia (China). With the latest restructuring operations, this percentage is bound to increase.

Annex VII
Minutes of the meeting of the Ecodesign Consultation Forum of 28 March 2008 as related to ecodesign requirements for general lighting products[45]

Clarifying Statements

Mr Toth made some clarifying statements (summarised in a slide) in relation to some details of the working documents sent to the Forum members.

The comment was made that the General Lighting Ecodesign Requirements would address white light, for a certain Lumen output, for all cap types except those specifically listed in Annex 3. Ballasts (transformers/converters) for Halogen lamps would be included into Part II of General Lighting IM.

Discussion on the level of ambition

All stakeholders agreed that the order in which the different lamp types are presented in the slide in terms of efficacy is correct:

Lamp technology	Efficacy
Average conventional GLS	1
Average halogen lamps	1,4
Very efficient halogen lamps (best available)	1,8
CFLs with bulb-shaped cover and low light output	2,7
CFLs with bare tubes or high light output	4,6

Belgium agreed that CFL was the best available technology (BAT) but wanted to note that the Commission's figures didn't take the power factor (ratio of the real power to the apparent power, due to non-linear load) into account. Vito, the Commission's technical consultants explained that power factor was taken into account in the overall study and that it made no significant difference to the figures.

Professional Lighting Designs Association agreed that CFL are the BAT on the Commission list but queried the figures and level of energy savings in the working document.

The Chairman invited all stakeholders to provide input on refining the figures if they have better data.

An observer from the European Parliament (Green Group) asked whether LED lamps have been considered. The Commission clarified that directional and non-directional light sources are going to be treated separately. Only directional LEDs are currently available on the market (although ECOS found some non-directional ones available through the internet[46]) and will be looked at when the Commission looks at the second part of the study. LEDs higher efficiency will be shown by the future energy label as that is meant to apply to all lamps.

Best available technology will be benchmarked in the Implementing Measure for the significant environmental aspects.

Eurocommerce explained the two most important market forces are price and perceived quality.

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45 Complete minutes available on TREN ecodesign website

46 ECOS gave the example of V-LumTech® http://www.v-lumtech.com

On the issue of anti-dumping measures on CFLs, the chairman explained that excise duties are scheduled to end by the time the IM is in place, so anti-dumping will not be an issue for the availability of CFLs. As for the VAT option, if there are only efficient lamps available, it doesn't seem appropriate to ask MS to lower the VAT on it.

Italy said that it had tried to recreate the Commission's figures but with the uncertainties associated with Options 2 and 3, the range could be ±30%. The Chairman clarified that although there are uncertainties relating to respective market shares, they do not change the overall picture.

Presentation by ELC

ELC gave a presentation[47] describing their proposed planning for a phase out of incandescent lamps. The production capacity issue is critical and they are concerned about the peak demand in Vito's model. ELC propose a longer transition period where the lower classes are gradually phased out to alleviate this. Alternatives such as halogen lamps should be kept for quality of light and applications where no other alternatives are available.

Capacity Issue

The Chairman highlighted that the capacity issue was to be looked at also in a global market perspective – e.g. developments in India and China need to be taken into consideration. For instance, even if we delay the introduction of measures phasing out incandescent bulbs in order to tackle the capacity issue, major third countries could be adopting legislation at the same time which could again raise capacity problems of an equivalent order of magnitude.

ELC explained that all ELC members are global players and that there are ongoing discussions in Australia, China and the US on phasing out inefficient products. Even without the IM in the EU there was large growth in the use of CFLs. ELC stated that it is difficult to predict how a future ban in India and China would affect the industry. Any squeeze on future capacity by initiatives to phase out incandescent lamps in India and China would only make Option 2 in the EU tougher to respond to, especially by simultaneously fulfilling the quality requirements set for the European market. ELC believes that no plan is completely resistant to movements in other parts of the world but that their proposal took those potential risks into account and therefore is the most sustainable in terms of availability and avoidance of empty shelves.

Sweden added that out of 2.4 billion Chinese made lamps, 1 billion would meet current EU standards. If Australia, the US and EU all legislate together, then production will not meet demand.

ECOS believes that there is currently not enough data to determine production capacity and called for a transparent process for addressing the capacity issue in the Impact Assessment.

Greenpeace stated that they have spoken to a large number of CFL suppliers inside and outside of Europe who say that they will have no problem to meet peak demand if a phase out happens in 2011 and that, in light of the urgency of climate change, we need to act quickly and don't have the time to initiate studies to determine consumer behaviour patterns.

The "European Council for Energy Efficient Economy" asked if there was any estimate conducted on the stocks of lamps that people have at home as any projected savings will need to be delayed due to these stocks. The observer from the European Parliament commented that the ELC should have shown a scenario with LED as final technology and where CFL in

[47] The ELC presentation is available on CIRCA, alongside the other presentations made at the Forum.

EEL A&B would be a transition technology and not Halogen. He also asked for clarification on whether ELC had developed their own figures or if Vito provided the basis for the graph. ELC clarified that LED replacement lamps with adequate prices and performance are not widely available on the market at the moment.

The Professional Lighting Designers' Association commented that ELC has taken a holistic view of the process but that very little on the health issues and the quality of lighting was included. They are concerned that in 2020, lower quality lighting (CFL) will have the largest market share. They support the ambition but would like the figures on energy efficiency to be reviewed as their calculations are very different to those that Vito found. They think that the energy savings will be a lot less and would also like to see practical problems like health and recycling taken into consideration. The Chairman invited the parties who might have better data to send them to DG TREN to help refine the figures but commented that it is not possible to discuss the overall picture now as the preparatory study was launched several months ago with many opportunities for stakeholder submissions during the process.

Presentation by Vito

Vito gave a presentation on the figures and data used as a basis for the figures in the working document. They used a methodology that has been used and agreed before. It is difficult to find market data, there is an inevitable tendency to lag behind the facts because one needs to use often scarcely available or outdated data and nevertheless predict future trends, which logically includes a number of uncertainties. They strived to base their research on certainties like the Best Available Technology and the least life cycle cost from the consumers' perspective.

The Chairman again invited all stakeholders to send in any additional data they might have to refine the figures.

Quality Issues

At the outset of the discussion, the Chairman reminded the floor of Article 15 of the EUP Directive which states that “the measure should not have any significant negative impact from an end-consumer perspective”. The quality of the light and its perception by end-users is an important issue. Sweden commented that the colour-rendering index of technologies is critical here and that this issue is a critical one for specific groups such as countries with an aging population.

Consumer organisations feel that design is an issue for consumers and they support Option 2 which gives high energy savings but more options for consumers. They commented that it is very difficult to assess consumer behaviour and the choices we give them will impact this.

The Professional Lighting Designers' Association explained that CFLs have a diffuse light source and that cause problems for applications needing sparkling lights etc. The average consumer is always in favour of energy saving but doesn't always receive the correct information. An 11W CFL is not equal to a 60W incandescent lamp in terms of output, dimming, toxics, etc. Consumers would need more information to make an informed decision.

Denmark commented that quality issues are very important and that they view the availability of alternatives to CFLs as crucial. They support LEDs in the long-term but in the short term, other alternatives to CFLs are needed. All CFLs should at least meet the EU CFL quality charter and need to have more burning hours than what is in the working document. They agree with Sweden that colour rendering is important and in this respect would like to reserve the term "excellent" to lamps whose colour rendering is close to the value of 100, and call the ones above 90 by a less positive name, e.g. "above average".

Belgium agreed that there must be an alternative choice to incandescent lamps for consumers in terms of light quality.

The Chairman asked the ELC and Vito if alternatives are currently available to GLS under Option 2. The ELC stated that for existing incandescent lamps, both halogens ES types (EEL B&C) are fully dimmable and fulfil light quality requirements. Option 2 does allow a product comparable to GLS (B level halogens) but that the product is not yet widely available on the market to fulfil consumer need. There is still a high demand for lamps with a sparkling effect.

CELMA commented that they supported the position of ELC.

The Commission asked about the use of halogen lamps and if this would solve the problem for luminaires. ELC replied that there would be a need to redesign many small domestic luminaires. However, 1 for 1 replacement is for certain types possible. There are indeed 2 types of halogen lamps with different sockets which are being used in general lighting. The first kind can be used for 1 to 1 replacement of incandescent lamps in existing sockets (Edison and Bayonett) and the second kind are the high and low voltage halogen lamps with various specific sockets and for LV, with a ballast. For those halogen lamps, there are almost no replacements as of today above EEL C and this would mean for the end-consumers that they have to change their luminaries at home. ELC is responsible for providing alternative lamps for the installed light sources and if the intention would be to phase-out this kind of light sources, one should start with phasing-out the luminaries using those sockets. The ELC also commented that for Option 3, in terms of market surveillance, many improvements are needed, especially in regard of the high volumes directly imported. Quality on the European market needs to be assured in order to maintain fair competition.

Czech Republic supported the Danish and Belgian positions that time for improving alternatives is important and that alternatives to CFLs are essential.

CELMA commented that in the shift from GLS to CFL lamps, it should be taken into account that different dimmers are needed and the dimmers will need to be replaced. The consequence would be that end-consumers will have to change their luminaries. Furthermore, this is a safety warranty issue and under the Product Safety Directive the entire product life needs to be considered. Finally many luminaries sold have been designed with the dimensions of GLS lamps and the replacement lamps need first to have the same size.

ELC explained that dimensions are not as much a problem as new CFL bulbs are compatible with GLS sockets. They added that only some CFL are fully dimmable today. The CFL contains electronics as does the dimmer and they are not always compatible but more and more dimmable CFLs are coming onto the market. Both halogen options (with Edison and bayonet sockets) are fully dimmable and can be used in incandescent light fittings.

CELMA pointed out that it's important to review technical files of new products as testing is needed to ensure compliance with the Low Voltage Directive and Electromagnetic Compatibility Directive. Time is needed to put the right testing procedures in place and timing is the main reason why CELMA supports Option 3.

On quality issues, the European Environmental Bureau asked about mercury content. It will be discussed more fully but the assumption is made that if the switch is made to mercury containing lamps, the drop of mercury emissions stemming from electricity savings will at least offset the mercury content in CFLs.

Sweden commented that there is the assumption that alternatives can cover the transition period. It was also noted that from next year, Sweden will introduce automatic meter reading and they have noticed very high noise levels in the shift to CFLs when using the grid for communication. Thirdly, Sweden can experience very extreme temperatures and this is a serious issue when it comes to CFL lamps as they perform very badly or not at all at very low temperatures (-20 degrees).

ELC explained that the noise on the power grid is related to the power factor and that there is a way to eliminate this by enhancing the electromagnetic compatibility of these products and limiting electromagnetic interference. It is also a quality aspect of CFLs. The Chairman asked ELC to provide any further information they may have on this issue to the Commission.

Sweden commented that since there will be a quality requirement for CFLs and since there will be an obligation on Member States to monitor this, testing could prove very expensive for lamps of many different lumen values from many different producers. It should be possible to have a situation where, if a lamp is tested and meets the requirements (in accordance with agreed methods) in one Member State, it is good enough for the rest of Europe.

The Chairman agreed that on the issue of market surveillance, which is conducted at Member State level, information needs to circulate properly. He invited all stakeholders to look at the 2008 work programme for Intelligent Energy Europe where there is a slot for projects tackling the testing of products and ways to organise market surveillance more effectively.

Health Issues

A. Toth mentioned that several stakeholders had raised the issue of bad quality electronic components that cause lights to flicker. This can cause problems for people with conditions like epilepsy. Quality requirements and good market surveillance could address this issue.

However, some people also declare being light sensitive to CFL lamps. The Netherlands clarified that this is due to UV radiation and generally only affects people who are already affected by other symptoms. They will check if there is a Dutch report available on this.

The UK has also heard some concerns about this but believes that there are options apart from 2 or 3 to limit UV light (like ensuring alternative lighting sources for affected people) and that this issue need not affect the level of ambition. There is some work being done on this in the UK at the moment which they will share once it's completed.

Belgium added that a small percentage of the population are sensitive not to the light but to the electromagnetic fields from high voltage cables.

The Professional Lighting Designer's Association mentioned the effect of lighting on autistic children and that in a recent study, some of their negative symptoms decreased significantly with incandescent lighting.

The Commission services will continue to investigate this issue and invited all stakeholders to provide any information they have on it.

Sweden commented that they have received some documents from a group about a perception problem with fluorescent lighting (scotopic sensitivity syndrome) that makes it more difficult to read.

The UK Lighting Industry Federation stated that in the UK, with the phase-out of incandescent lamps, certain symptoms are becoming apparent. People with 6 types of symptoms had problems attributed to CFL lighting: people with lupus, skin disease, migraine sufferers, light sensitive people, deaf and partially sighted people (deaf people use incandescent lamps as sign posts).

ELC mentioned that a booklet containing the top 30 questions and answers they have received of this nature is available on their website. The ELC proposal (Option 3) would provide a solution to sufferers of the aforementioned health issues by allowing use of halogen lamps.

The Commission agreed that alternatives for CFLs will need to be considered if the health problems and symptoms are confirmed to be linked with the lighting technology used.

Delegate positions on the level of ambition and timing

The Chairman asked the delegates what position they would favour. He explained that if climate change and energy were the only considerations then option 1 would be the obvious option but other concerns also may need to be taken into account. Alternatives will need to be available at least in the beginning and new technologies like LEDs could solve these issues in the future.

The UK welcomed an ambitious timing and would support Option 1 or 2. Health and production capacity are issues but the UK also pointed out that, with regard to product capacity, a longer timeframe (9 years) might cause more problems than a shorter timeframe (5 years) because we don't know if China and India will move in this issue.

Portugal supports Option 3 (also the position of Spain) and would like to see a cautious transition.

Ireland supports the most ambitious option and would like the Commission to initiate the IA as soon as possible.

Belgium supports change but has some concerns about technical and consumer issues and for various reasons would not like to see Class C halogens phased out yet. Belgium is also very concerned about the mercury content and disposal and would not like to see new problems being created.

Czech Republic supports Option 3 which it believes is a more reasonable variant. It would leave class C on the market and give time to improve alternatives.

Germany supports ambitious goals in the long term but in the short term (5 years) would like to be more cautious and have class C products available so that consumers have alternatives with high colour rendering and other features discussed today.

Italy currently has a stakeholder consultation process underway. Italy is concerned about availability, quality, health and mercury content. If 1.3 billion lamps are substituted by CFLs it would equal to 9 tonnes of mercury. It is also concerned about the impact on SMEs (mostly regarding luminaires).

France has an ongoing consultation process where they are discussing which option to support. It has already been decided not to support Option 3 but Options 1 and 2 are still being discussed. They would welcome some more information on the impact of these options 1 and 2.

Poland agreed that consumers need to have alternatives and supported Option 3 but will analyse today's presentation. They would also welcome further information on various impacts that were outlined in the working document.

Netherlands supports Option 1 and see the big advantage as the fact that it doesn't leave too many loopholes. They are fully confident that manufacturers can solve the technical issues within the specifications of Option 1.

Austria supports a modified Option 2 based on the given information and would like to see more information on issues like the quality of Chinese lamps.

ECOS was concerned that the discussion only considers available products today but LEDs and CFLs will make quick progress. So an ambitious vision of "only A-rated products on the market" should be adopted, with potential transition products only tolerated for a short time period.

Mercury Content

Sweden mentioned that it produces no mercury in power generation. Also, electricity generation emits mercury in metallic form and in low concentration because dissipated over a large area. Metallic mercury doesn't easily become part of the food chain. However, when a CFL bulb breaks in a landfill, there is much less dissipation and bacteria convert metallic mercury into methyl-mercury which is 100 times more soluble in fat.

Environmental NGOs have been calling for reduced mercury levels over the entire European network. They are concerned that more mercury is used in power generation to switch on incandescents than in CFLs. Another issue for CFLs is recycling. Simple recycling systems are needed where consumers can return items to the point of sale. BEUC agreed with the position of Environmental NGOs and added that they do not share the Commission's views that energy savings from CFLs will outweigh the increase in mercury. A solution to the waste issue is needed.

The Commission informed that there is an ongoing review of the RoHS exemptions including lamps for which the consultation period closes in April.

The European Environmental Bureau is involved in the RoHS exemption process. They have considered the whole life cycle of lamps and support a 2mg target for mercury content. The issue of waste is also critical and in relation to this, they are particularly concerned by a production process involving the dripping procedure with high mercury losses.

The Chairman explained that the Ecodesign legislation regulates product design. He would welcome any suggestions for a legally solid information requirement as to how the product was manufactured which would be enforceable also out of the EU. ELC commented that as mercury content and production processes are linked, limiting the mercury content below a certain limit could help to solve this. Nevertheless the requirement should be only "in so far as they relate to product design". The ELC confirmed that the 2 mg limit is related to production methods and is right now only available through European manufacturing. Several participants suggested that such a limit could probably prevent the use of the dripping method.

Germany commented that 1.4mg mercury is possible today.

Eurocommerce/IKEA explained that mercury leakage at end of life is a big issue. IKEA operates take back systems in store. However, most retailers are not selling own-brand products but branded products. Facilitating take back through product design is a manufacturer responsibility.

The Chairman considered that requirements on packaging/lamp information could help the recycling of CFLs at end of life. Consumers may not keep the original packaging until the end of life of the lamp, but information on the packaging of the replacement lamp could also call for proper recycling of the dead lamp.

Waste Issue

Mr Toth presented in a slide the idea of removing the separate waste requirement from the implementing measure, as according to the preparatory study, the requirement would represent minor additional improvement potential in the 15 environmental impact categories compared to requirements affecting other life cycle phases. The issue is also already tackled through the lifetime requirements in the proposed measure and through the existing particularly ambitious lamp recovery rate requirements in the WEEE directive. The end-of-life of luminaires will be tackled in the second general lighting implementing measure.

The Netherlands agreed that the approach of the Commission in this regard seems logical but was concerned about the confusion that could result from one lamp being treated as chemical waste and another that could simply be thrown away. It would be much easier for consumers to have one set of waste requirements for all lamps.

ELC supported this point and stated that they are committed to lowering mercury content and support the lower exemption levels in RoHS. They cautioned that careful consideration of timing is necessary if quality requirements are introduced.

Sweden commented that lamps need to be of a certain quality and that only a few countries are testing. There is no quality requirement on lamps on the market today and there is a need for easy recycling systems.

The European Environmental Bureau commented that the EcoDesign Directive should complement the other Directives and they agreed that the quality criteria on longer life span are important. They support dropping the vague requirement related to waste minimisation (as it would probably mean unproductive standardisation work) and encourage the link with WEEE.

Consumer Organisations would like to see recycling systems in place before the requirements come into force. The point of sale should be the point of take back.

Product Information

On the issue of product information, the location and quality of the information are essential.

Eurocommerce commented that the probability of having a large percentage of LEDs on the market is very likely in the future. They don't want to have to use more packaging simply due to information requirements and would like to see requirements focused on what is important for the average consumer (the energy label for example). There is also a problem with displaying information in several languages and there needs to be a way of communicating more information through other means.

The chairman asked the stakeholders what they see as essential information for packaging.

Sweden replied that energy efficiency, how much light it will produce, the colour of the light and the life expectancy of the lamp are the most important.

Germany believed that the most important information was the energy label, luminous flux (support reorientation from wattage), wattage, lifetime. Other information is also important but not necessary to access from packaging.

The UK agreed with Germany on the need to display luminous flux and lumens on the packaging and with Sweden on the life of lamp.

The Czech Republic commented that Wattage, colour, energy label, efficiency and input were the most important.

Germany raised the issue of luminous flux and the need to standardise the levels of luminous flux.

Belgium commented that the quality parameters, mercury content, health issues and information on what to do if a bulb breaks need to be on the packaging.

The Consumer Organisations believed that on the front of the packaging, a customer would need to see wattage, lumen, lifetime, energy efficiency, colour, temperature (warm, cool, intermediate) and the back of packaging could contain information on the colour rendering level, warm up time of the lamp/light output (take it up to 80% not 60%). It is also important to give information on take back, disposal and accidental breakage.

Netherlands added that the number of years a lamp burns is also important.

The ELC referred to the detailed comments sent already and reminded of the issues of space, languages and complexity for the end-consumers.

European Environmental Bureau has also provided comments already and supports the consumer organisation position. They would like to support only the most energy efficient products on the market.

It was agreed that information on how to deal with the end of life product is essential and the mercury content could possibly be mentioned in that context. There would be no need to give the exact figure because affixing the CE mark will demonstrate its compliance.

Germany outlined the need to standardise the level of light produced by lamps. The idea is to have a standardised level of how many lumens a lamp provides (rather than wattage). ELC fully supported standardised levels but it needs to be reviewed carefully. There will need to be more discussions on this and there will not be time in this IM to include this element.

Consumers will need to know the general equivalent to wattage. Lumen is a value already mentioned on the Energy Label and this will need to be discussed in the context of the revision.

The European Environmental Bureau would like to see a change in how mercury content is declared. At the moment, a producer declares compliance with requirements by affixing the CE mark and the quantities of mercury in a product are only disclosed by producers to market surveillance authorities on request. They would like to see mercury content information become publicly available on websites. Furthermore they would like to see the use of the wording “energy saving” limited to products of Energy Class A. The ELC don't agree with this statement since the classification takes care of the efficiency of the lamps and the wording has to do with a comparison with less efficient products as long as they are available. This will be further discussed in the labelling directive.

Eurocommerce commented on how best to show disposal information on lamps. In the WEEE directive, the crossed out wheelie bin symbol was used to avoid the need to translate directions for end of life disposal. Information on the correct disposal for halogens and incandescent lamps might cause problems if it had to be given in different languages.

Scope and Key Definitions

The Chairman raised the issue of how best to define the scope and key definitions.

Vito cautioned that we need to avoid as many loopholes as possible with a good definition of white light. This will need to be discussed with the manufacturers. Any exemption for coloured lamps could lead to aggressive marketing of coloured lamps to keep the incandescent market share as in California. If all colours are included in the definition (to close loopholes) it would be necessary to lower efficiency criteria for white light. ELC worked with Vito on the definition and is strongly in favour of leaving it as it is as it may be used in the future for standard definition of white light.

On the issue of coloured lamps, the Chairman was concerned that depending on the colour a consumer may need a 100W incandescent coloured lamp to have the same light output as a 60-75W white incandescent. This could have the effect of promoting more energy consuming lamps. There are also issues around soft tone lamps which is a huge loophole. Even if the ELC self regulate, it would not affect importers.

ELC believes that consumers will not choose green or red over an energy efficient product. The soft tone bulbs all have A labels as they fall within the scope of the IM. ELC mentioned that their proposal (Option 3) was not limited to white light but included all colours of light. The Commission would like to discuss this further with the ELC.

Limits and Cap types. ELC: For some caps, there are no alternatives today (e.g. Halogen low voltage caps). CFL lamps replacing lighter lamps would fall out from some standard sockets installed vertically, this doesn't meet IEC standards. Fittings and luminaries are in households already, and the ELC only provides products for those installed sockets.

The ELC raised the issue of the double ended halogen lamps used in uplighters, which they propose to leave out of scope because there is no energy efficient replacement to those lamps that would fit into the existing sockets. The way to go is to first ban the luminaires using such lamps. Environmental NGOs added that they are actually proposing to ban such luminaires in their position paper.

The Chairman asked for feedback on the suggestion to lower the scope from 150 to 100 lumens and for opinions on how this would affect special purpose lamps. ELC replied that they would not be in favour of this because lowering the target would affect many special applications like in refrigerators or ovens, for which no alternatives are available today and which use very low wattages.

Performance Requirements

MR Toth presented a slide on performance requirements. These are the performance requirements set out in Annex III.6 of the possible EcoDesign requirements.

Mr Toth mentioned that there were questions on switching cycles, warm-up time, lumen maintenance and other issues relating to CFL quality. Sweden noted that if the number of CFLs increases in the home, then switching cycles gets shorter.

ANEC/BEUC mentioned that lumen maintenance for the entire life of the lamp is important and advocated that short switching cycles be taken as a base for the determination of the maximum switching cycles per lamp life as this isn't adequately addressed in the study or standard. Also, warm up time should be shorter – at least 80% in 60 seconds.

ELC would like to see a reference to the Eco Profile developed by the industry and proposed to the Commission rather than have specific quality requirements in the IM. The innovation rate is high in CFLs and industry would prefer to innovate faster which will be reflected in faster updates of the Eco Profile, rather than wait for a review of legislation every 5-10 years. Of course, the Eco Profile needs to become mandatory in this case.

The Chairman suggested looking at this in the IM and improving further, if necessary, in one and a half years at the same time as the second IM on domestic lighting.

The UK supports performance requirements in the IM.

Denmark commented that you cannot base EU legal initiatives on a reference to a voluntary charter but that it might be possible to incorporate some elements of the charter into the IM.

Poland cautioned that halogen performance needs to be discussed carefully in terms of heating, quality etc.

CELMA advocated including performance requirements for halogens as none exist yet although there is no need for CFL requirements due to the quality charter.

UK has recently implemented Version 6 of the Energy Saving Trust specification which includes halogen and maybe we can learn from that to write some basic halogen implementation measures.

ELC queried whether performance requirements for halogen needed to be in the IM. The Commission replied that some quality requirements that cover halogen lamps are already there and that it will be looked at in more detail.

Belgium asked about the power factor but Vito believes that there is no need to raise the bar on this as there is a good level on the market already.

The Commission concluded by recognising that proposed requirements on dimmers are controversial as dimmers able to operate any CFL can only dim the lamps to 40%.

Annex VIII
Structure of the methodology used for establishing the technical, environmental and economic analysis

Following the "Methodology Study Eco-design of Energy Using Products" ("MEEuP"), the tasks listed below are carried out for developing the technical, environmental and economic analysis referred to in Annex II of the Ecodesign Directive:

Task 1: Product definition, existing standards and legislation

Task 2: Economics and market analysis

Task3: Analysis of consumer behaviour and local infrastructure

Task 4: Technical analysis of existing products

Task 5: Definition of base case ("average" model) and related environmental impact

Task 6: Technical analysis of best available technology

Task 7: Improvement potential

Task 8: Policy, impact and sensitivity analysis