

Phasing out incandescent bulbs in the EU

Technical briefing

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A case for more energy efficient lighting in households

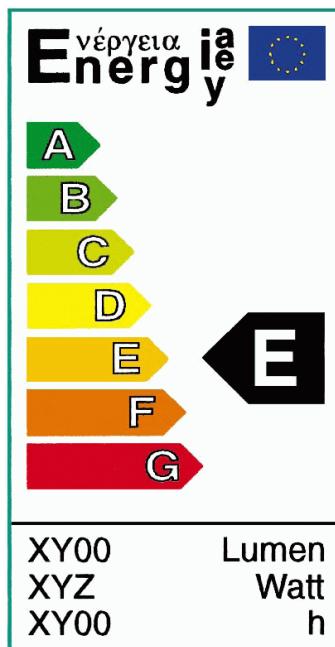
Lighting may represent up to a fifth of a household's electricity consumption. There is a four to five-fold difference between the energy consumption of the least efficient and the most efficient lighting technologies available on the market. This means that upgrading the lamps could reduce a household's total electricity consumption by up to 10-15% and save easily 50€ / year (taking into account the purchasing cost of lamps).¹

In the context of the commitment of European leaders to reduce primary energy consumption by 20% compared to projections for 2020, the Spring European Council 2007 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.

In October 2008, the Council of energy ministers expressed hope that "*in particular [...] the sale of the worst-performing domestic lighting products will be prohibited from 2010, where alternatives exist, whilst avoiding any risk of disruption of supply to the internal market or loss of functionality from the user perspective and respecting all ecodesign review parameters including cost effectiveness*". "*In line with these requirements and to that effect [...]*" it invited the Commission to "*[...] submit in 2008 a draft Regulation that will launch a gradual process of phasing out until incandescent lamps and all the worst-performing lights are banned.*"

¹ Assuming 20 lamps in the household, which are initially all incandescent lamps and changed to compact fluorescent lamps of equivalent light output.

Today, the most energy efficient bulbs are compact fluorescent lamps. They achieve Class A according to the EU energy label on household lamps, while incandescent bulbs are class E or worst (Directive 1998/11/EC).



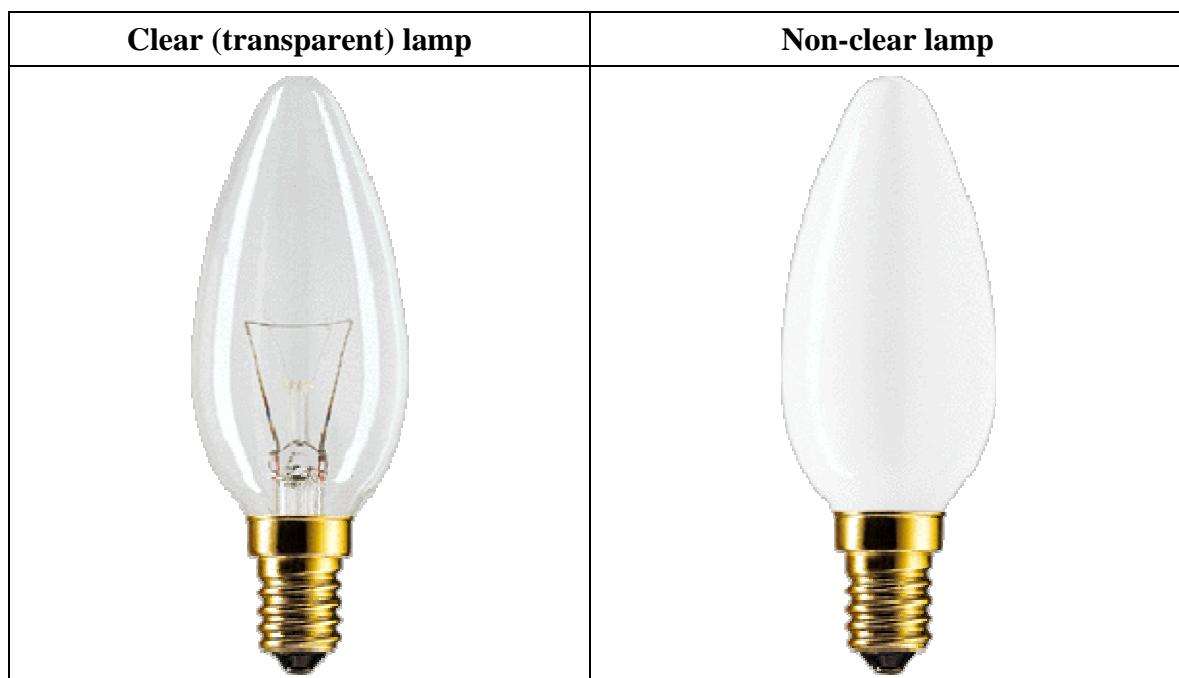
The Ecodesign Directive provides a framework for the Commission, assisted by a committee of experts from the Member States, to adopt performance requirements that products need to meet for being placed on the EU market.

When setting the energy efficiency requirements for household lamps, the Commission has also to take into account other aspects, such as the functionalities of the product from the consumer's perspective, health and safety of the users, or the competitiveness of industry. Such measures have to be preceded by extensive stakeholder consultation and be accompanied by an assessment of the impacts on the lamp industry and on consumers (affordability, aesthetic and quality of lighting). Before adopting a measure, the Commission asks the opinion of a committee of Member States experts who vote (with the same number of votes as in the Council).

Other aspects to be considered concerning household lamps

Functionalities of lamps from the consumer's perspective

- lamp start and warm-up times (after it is switched on, how long it takes the lamp to start and reach its full light output)
- lifetime
- dimmability (some lamp types cannot be dimmed on conventional dimmers)
- size for compatibility with luminaires (some lamps contain auxiliary electronics which could make them too large to fit in certain luminaires)
- colour rendering (the capacity of the lamp's light to render the colours of the objects lit)
- aesthetics (bright point light sources are possible only with transparent (clear) glass lamps and are needed in certain lighting installations)



Mercury content and ultraviolet light emissions

Compact Fluorescent Lamps (CFLs) contain small quantities of mercury and emit ultraviolet light which can, under certain circumstances, have a negative impact on people suffering from diseases accompanied by light sensitivity. However analysis shows that these two factors do not present a risk to the general public in normal use. Indeed the decrease of mercury emissions resulting from energy savings (electricity generation in power plants has its own mercury emissions) outweighs the need for mercury in the lamps. It remains that CFL lamps should be disposed properly. The impact of both elements can be further reduced by using CFLs with an outer non-breakable lamp envelope.

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. Halogens are produced locally and imported in more or less equal proportions. Therefore, a shift towards lamps with integrated electronics is likely to cause a shift of production away from the EU. The total number of workforce assigned to incandescent lamp production for European sales is in the order of 8000 people in total out of the 50.000 people producing lamps in the EU. However, the shift in production has already taken place to a large extent. It should be noted that some halogen lamps (class C) can be made on the production lines of incandescent lamps, which would mitigate further the loss of jobs resulting from a ban of incandescent bulbs. Overall, at most 2-3000 jobs are estimated to become redundant after the incandescent lamp phase-out. This is to be looked at with the 5 to 10bn€ saved from energy bills which can be reinvested every year in other economic activities that generate employment.

Global CFL production capacity

If the phasing out of incandescent lamps would happen too fast, it could lead to global production capacity shortages of quality alternative lamps (mainly compact fluorescent lamps). Therefore the Commission has consulted the industry to design a phasing out scheme that does not risk leading to empty shelves in shops.

Affordability to the consumer

The increase in purchase price is significant but affordable (an economic bulb can cost as little as a pack of cigarettes) 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). All the alternatives to incandescent lamps bring substantial savings over the life cycle of the product and they also live much longer.

Lamp types and their pros & cons

I. Incandescent lamp (GLS)

This lamp type was first commercialised in 1879 by Thomas Edison and reached the limits of further efficiency improvement in its current form already towards the middle of the last century. The light is produced by a threadlike conductor surrounded by inert gas or vacuum and heated to incandescence by the electric current passing through it.



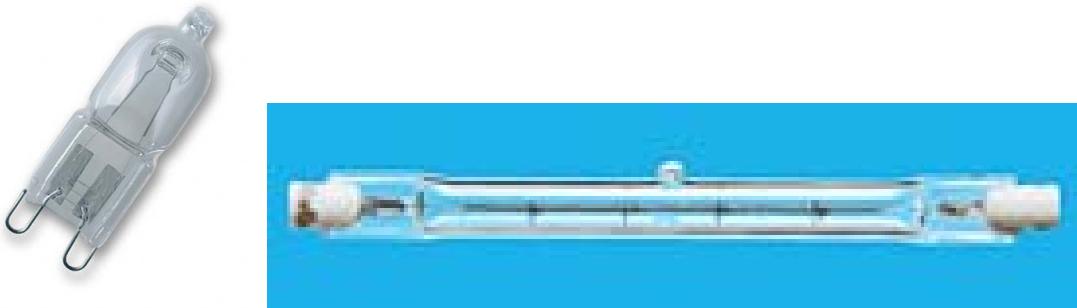
Standard incandescent lamp

Advantages	Disadvantages
Bright point light source (if transparent glass)	Energy-guzzler - very low efficiency (E, F or G-class)
Full compatibility with existing luminaires	Risks due to high operating temperature
Fully dimmable on any dimmer	Short lifetime (1000 hours)
Good quality and performance	

II. Halogen lamps

Improved incandescent lamp technology, first commercialised in the 1980's. Much smaller lamp size, equal or slightly higher efficacy than incandescents due to the replacement of the inert gas by gas containing halogens or halogen compounds. 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).

1.) Conventional halogen lamps



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	Risks due to high operating temperature
Fully dimmable on any dimmer	Relatively short lifetime (1000 - 3000 hours)
Good quality and performance	

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 the best incandescents, even at mains voltage. There exist two versions of this halogen lamp:

a.) 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 .

b.) 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”).



C-class pear-shaped retrofit halogen lamp

Advantages	Disadvantages
Bright point light source	25% energy savings (C class) compared to the best incandescent lamps
Full compatibility with existing luminaires	Risks due to high operating temperature
Fully dimmable on any dimmer	Relatively short lifetime (2000 - 3000 hours)
Good quality and performance	

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 the best incandescents. 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 special 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 retrofit 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 the best incandescent lamps
Good quality and performance	Too large for some luminaires
Fully dimmable on any dimmer	No equivalent yet to GLS > 60W
	Only one producer currently for GLS retrofit
	Relatively short lifetime (3000 hours)
	Risks due to high 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. It was first commercialised in the 1980's. 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. It sometimes comes with an external envelope which hides the tubes and makes it even more similar to light bulbs (though decreasing its efficiency). The envelope also shields off any unwanted ultraviolet radiations and risks connected to incorrect disposal.



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
Money-saver	Often not dimmable
Environmentally-friendly	Suboptimal colour rendering
Long lifetime (6 times longer compared to incandescent lamps)	Relatively low starting and warm up time
Available with warm or cool light	Safety issues (can be avoided with proper coating)
	Too large for some luminaires

Light-emitting diodes (LEDs) are a fast emerging technology, whose efficacy competes with that of CFLs. However, LEDs for room illumination are today only in the first phases of commercialisation, and rare are those that fulfil all the expectations of the consumers in terms of light output and other functionalities. They are likely to become true alternatives to CFLs very rapidly.

Efficiency of lamp technologies compared with incandescent lamps (E-class)

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

Content of the draft regulation on household lamps

The draft regulation on household lamps submitted to the opinion of the Member States experts today addresses the following issues:

1. Calendar for the phasing-out of incandescent bulbs and of less efficient halogen lamps.
2. Requirements on the functionalities of the lamps taking care of the users' expectations.
3. Requirements on product information to allow consumers to make informed choices.

Scope

The draft regulation only covers the so-called "non-directional" lamps. These emit light equally in all directions, as opposed to directional lamps (such as reflector lamps/spots) where the light is directed by a reflector in a given angle. Directional lamps will be covered by another regulation to be tabled in 2009. An update of the lamp energy label (Directive 1998/11/EC) is also planned in 2009 in order to redistribute the energy classes after the phasing out of classes D, E, F, G and also to integrate low voltage lamps and reflector lamps, which are currently not covered by the label.

Non-directional halogen lamp	Directional halogen lamp (reflector lamp)
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Halogen lamps with special lamp caps (like the ones shown in the table above or the linear lamp shown in section II.1) do not exist with energy classes better than C. They are needed on the market as there are luminaires that can only take such lamps (for example the 150W or 300W floor-standing uplighters). Therefore further improvements can only be achieved by imposing requirements on the luminaires themselves, which the Commission is planning to do in a measure currently under preparation and to be tabled in 2009.

Special purpose incandescent lamps (e.g. those used in household appliances such as ovens or fridges, traffic lights, infrared lamps etc.) are meant to be exempt from the measure, as they cannot fulfil the efficiency requirements and most of the time there is no alternative lamp technology.

Next steps

In case a qualified majority of the Member States in the committee vote in favour of the draft regulation, it is sent to the European Parliament and to the Council for a scrutiny period of three months. During this period, the two Institutions verify that the the draft regulation is in line with the provisions of the Ecodesign Framework Directive. If no objection is raised by the end of the scrutiny period, the Commission can adopt the measure which is then applicable to all products put on the market as from the date set out in the regulation. The regulation will enter into force 20 days after its publication in the Official Journal of the European Communities, and the first stage requirements will be applicable after an initial transition period. Products already on the market may continue to be sold.

Regulation as endorsed by the Member States' committee meeting of 8 December 2008

The draft regulation applies to non-directional lamps. Directional (reflector) lamps such as spots will be covered by a dedicated measure at the end of 2009 or in 2010.

Incandescent lamps will be phased out from the EU market starting in 2009 and finishing in 2012.

Non-clear (= non-transparent) lamps

All non-clear incandescent lamps will be phased out as from September 2009. Non-clear lamps will be required to be A-class (or slightly less efficient for certain lamps such as those with external envelope). In practice, considering currently available technologies, this means that non-clear lamps will have to be compact fluorescent lamps which save about 80% energy compared with incandescent lamps. Consumers who for various reasons (aesthetics, size, shape etc.) would prefer another lamp technology can buy clear (transparent) lamps.

Clear (transparent) lamps

The less efficient clear lamps will also be phased out progressively, starting with the brightest lamps (100W incandescent bulbs and above, and equivalent lamps) in 2009.

- From September 2009, lamps equivalent in light output to 100W incandescent bulbs and above will have to be C class (phasing out all 100W incandescent bulbs). At the same time, all lower wattage incandescent lamps of the F and G class will be phased out, so that only E-class incandescent lamps will remain.
- By the end of 2012, the level will be made progressively stricter (to class C) for the other wattages too, completely phasing-out clear incandescent bulbs. Halogen clear lamps (xenon-filled) which reach class C will remain on the market until 2016. Unless new technologies would emerge, clear lamps will be low voltage halogen lamps with integrated or non-integrated transformer from 2016, reaching class B.

The more promising emerging technology are LEDs which are covered by the energy efficiency requirements in the measure and are A-class lamps.

Under conditions, special purpose incandescent lamps (e.g. those used in household appliances such as ovens or fridges, traffic lights, infrared lamps) are exempted from the requirements of the regulation..

The table on the following page shows the details of the implementation of the different stages of the regulation.

In addition to the minimum efficiency requirements, the measure also contains requirements explained earlier concerning lamp functionality and product information.

Detailed timing (including review):

Wattage categories indicated in the table 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).

CFL = compact fluorescent lamp

For the descriptions of the different lamp categories in the table, please refer to the first part of the technical memo.

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

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.