Replacement of GLS Lamps with Compact Fluorescent Lamps

The Government are seeking to reduce carbon emissions by looking at the efficiency of different energy consuming products. The current proposals review eleven different areas including domestic, commercial, and street lighting. A major part of the proposals for reducing the use of electrical energy for domestic lighting involves the replacement of the standard GLS lamp (commonly referred to as a bulb) with a compact fluorescent lamp (CFL). CFL's come in many different shapes, forms, and wattages and with either integral or separate control gear. This note looks at the benefits and disadvantages of this proposal and is limited to integral control gear lamps designed to be a direct plug-in replacement for the existing GLS lamp.

Do CFL's provide the same level of lighting as GLS lamps?

Most GLS lamps provide approximately 11/13 lumens of light per watt of energy consumed thus a 60W GLS lamp will produce approximately 700 lumens of light and a 100W GLS lamp produces approximately 1,300 lumens. In comparison the equivalent CFL's,
11W produces approximately 600 lumens and a 20W produces approximately 1,200 lumens so the light output can be considered as being comparable when new. Unfortunately as CFL's age their light output reduces and by the time they have burnt half of their life their output will be considerably lower at about 70% of their new output. This reduction in light output will continue as the lamp ages and should be considered when deciding upon the wattage and output of CFL to use.

Do CFL's provide the same quality of light as the GLS lamp?

A GLS lamp has a correlated colour temperature (CCT) of 2,800K and a colour rendering index (CRI) of 100. The higher the colour temperature the colder the appearance of the light produced. The closer the CRI is to 100 the better the colour rendering of the light source. It can be seen that the GLS lamp has a warm CCT and very good colour rendering properties. Whilst CFL's come in a number of colour temperatures those generally used in domestic situations are classified as Warm White with a CCT of 2,700K and a CRI of 82. In this example the colour temperatures is very similar to that of the
GLS lamp and little difference will be noticed. However, as the GLS lamp has a better CRI it will reproduces most colours accurately whereas a CFL will distort some colours due to the non-continuous wavelengths of the light produced.

Do CFL's use less energy?

A GLS lamp will use approximately six times the energy used by an equivalent CF. Therefore a CFL shows a considerable reduction in the energy consumed and metered at the domestic premises.
However, CFL's have a very poor power factor and the actual current taken from the power supply is approximately twice that actually paid for by the consumer, resulting in a doubling of the energy generated, transmitted and distributed. Now the consumer may not be worried about this as they only pay for the energy they consume whilst the remainder is classified as losses by the energy suppliers. Unfortunately energy suppliers are not benevolent organisations but are there to make a profit and so the cost of generating, transmitting and distributing this lost energy are added to the basic cost of the energy and the domestic consumer pays for it indirectly. The electronic circuitry in CFL's can cause high levels of distortion to the electricity supply which can have adverse effects on other electrical equipment. Fortunately the electrical load from CFL's in a domestic situation is small in comparison to the remainder of the electrical load and so these effects are substantially reduced and should not cause problems. In installations with large quantities of CFL's it is possible that this distortion may affect other equipment and care may be needed.

Do CFL's take a long time to reach full brightness?

GLS lamps provide almost instantaneous light when switched on whereas CFL's do not start instantaneously requiring a short time to strike and then up to 2 minutes to reach their rated output. Whilst this may be a short time it can cause problems in some domestic installations where light is required instantly. For example if you want to go up or down the stairs and require a light to do so, or look in to a cupboard or storage area you want the light there and then and to have to wait for the light to switch on or run up to full brightness.

Are CFL's subsidised?

Many CFL's are subsidised by the electricity companies to help reduce the need to invest in new generating, transmission and distribution systems similarly other environmentally aware organisations also subsidise these lamps to help protect the environment. Both strategies are to be welcomed and applauded however will these subsidies remain once a high percentage of users have committed themselves to the use of CFL's and GLS lamp production has been substantially reduced if not ceased?

Do CFL's have any adverse health risks?

A number of organisations dealing with specific medical conditions have concerns over the quality and consistency of the light output from CFL's.

The majority of these complaints are concerned with:-

- the quality of the light i.e. the colour rendering and the colour reproduction of the light, both of which can be varied in production to suit different requirements, albeit at a cost,
- the effect from flickering of the light output, this is a long standing criticism with fluorescent and discharge lamps but has potentially been overcome by the use of high frequency control gear which moves the frequency of the flickering to well above those limits normally considered to cause problems to humans,
- The intensity of the light, CFL's especially the exposed tube type have a higher surface brightness than comparable output GLS lamps, however, this can be offset to a large extent by the use of lamps with an external outer frosted envelope which gives the lamp an appearance similar to conventional GLS lamps.

Do CFL's last longer?

GLS lamps have an average rated life of 1,000 hours compared to the average rated life of a CFL of 8,000 hours. However, the use pattern of a CFL in a domestic property will vary considerably from the profile used during laboratory testing to determine the average life of the lamp. In practice a CFL in a domestic property will be switched more frequently than under laboratory tests and therefore the average life of the lamp may be shortened by up to 50% i.e. 4,000 hours. A light in one of the principle family rooms such as a living room or kitchen will be used for approximately 1,000 to 2,000 hours per annum. Frequent switching on and off of a CFL will reduce its life and it is recommended that CFL's should be run for a minimum of 15minutes each time they are switched on to minimise the effect of switching on and off the lamp.

Are CFL more economic?

Approximately 98% of the energy consumed by a GLS lamp is produced as heat which is often classified as "waste" heat i.e. 58 watts of the energy consumed by a 60w GLS lamp or 98 watts of the energy consumed by a 100W GLS lamp is produced as heat not light. In an average UK domestic property this heat will heat the room in which the light is being produced reducing the actual level of heating required. The only time this heat will be a nuisance is on very hot summer's night or where the property is so well insulated that it needs air conditioning to maintain a comfortable temperature. In most other domestic situations this heat is not wasted but used to offset the heating supplied by the central heating system.

Are there any disposal problems with CFL's?

Modern GLS lamps can safely be recycled or disposed of as there are very few dangerous materials used in their manufacture. Older GLS lamps used lead in the solder but this has now been replaced with other materials. CFL's do use some potentially dangerous materials in their manufacture such as mercury. The quantities of mercury in each lamp are very small being less than the size of a pin head but with increased use of CFL's across the country, there will be a cumulative increase in the mercury released into the environment. This would not occur if CFL's were disposed of by recycling to recover the mercury, phosphors, and other materials used in their manufacture. Unfortunately whilst this is now a requirement of the WEEE Regulations for commercial users it is impractical to readily apply it to the domestic situation and discarded GLS and CFL lamps will still be placed in domestic waste.
The consumer should have no problems from the disposal of old lamps provided they are not broken. Where CFL's are broken there is a very small possibility of ingesting the phosphors and mercury but this can be minimised by sensible precautions such as not breathing in any of the powders from the broken lamp. Care should be taken when dealing with either a broken GLS lamp or CFL not to cut oneself on the glass or resulting sharp edges.

Will CFL's fit my existing light fittings?

Many CFL's are larger than comparable GLS lamps and therefore may not be able to fit in to fully enclosed light fittings or may protrude out of the light fitting as seen in many retro fit installations. However, manufacturers are taking account of this and new shapes of lamps are available mimicking existing GLS lamps such as candle lamps and golf ball lamps. Unfortunately such lamps generally do not have a subsidy or discount and are only available at full retail price making them expensive in comparison with GLS lamps and subsidised CFL's. Often such lamps are only available in one wattage.

Can I dim a CFL?

GLS lamps can be varied from 0 to 100% using simple devices in place of the actual wall switch. This high degree of variability allows the level of lighting for the specific task to be readily set and for the ambience of the room to be varied and changed to suit the mood of the occupants. The level of light produced by a GLS lamp is proportionate to the energy consumed and paid for. CFL's cannot be readily varied and need to have specialist control units fitted or need to be of a special design. The energy consumption of a CFL when dimmed down is not directly proportionate to the energy consumed; for instance when varied down to 50% light output the energy consumption will be approximately 60% of the maximum. So you will be paying more for each lumen of light produced.

Can I use CFL's with electronic timers or electronic sensors?

Many of us have got used to having lights on electronic sensors or time switches to switch on or off at predetermined times or lighting levels or to detect intruders and to switch on as a warning.
Unfortunately many of these control systems are not compatible with standard CFL's and may be destroyed by the switch on current from the lamp. As the sales of CFL's increases so suitable equipment is becoming available, however, care should be taken to ensure that permanent damage or fire cannot be caused due to retro fitting CFL's in to GLS lighting systems controlled by electronic equipment.
Effect of age on lamp characteristics GLS lamps tend to fail just before the reduction in light output through life is noticed. As CFL's approach old age the light output drops significantly, the run-up time to full output becomes extended and the presence of flicker become more noticeable. These effects can last for considerable periods before the lamp fails.

Are there any other energy efficient replacements for GLS Lamps?

The pressure to reduce energy consumption has increased the development of alternative light sources and it is anticipated that within two to three years alternative light sources such as LED's and halogen lamps will be available to replace GLS lamps. Some of these lamps may have advantages over the CFL's currently available, however it is believed that the development of CFL's will continue to reduce many of the adverse features of these lamps.

Source: Institute of Lighting Engineers