# *Bringing lighting out of the policy darkness*

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## ABSTRACT

To reduce electricity consumption in the lighting sector provides a particular - and interesting - challenge for policy makers.

The complexity for policy results from the need to focus on both bulbs and fixtures, if the savings are to be irreversible. In the short term the objective is to get consumers used to compact fluorescent lamps (CFLs), but in the long term there needs to be a switch to dedicated fixtures, that will not take an incandescent bulb. This involves two groups each of manufacturers and retailers, all four of whom have very different organisational structures and selling policies. In addition, for consumers, the move to low-energy light bulbs, particularly in dedicated fixtures, implies changing from a minor purchase with a short life to one that could be lasting as long as 40 years.

The challenges - and opportunities - provided by low-energy lighting scenarios require an innovative approach to imaginative design of fixtures, manufacturer actions on the average bulb efficiency, retailer education and displays, and consumer awareness. The different cultures and lighting infrastructures across Europe add to the task, for instance policy should encompass regulations for new buildings in some countries. The lessons learnt from past policy interventions, particularly those involving electricity utilities, will be combined with a discussion of future options. The optimal choice and sequence for policy can be identified through a strategic market transformation approach.

## INTRODUCTION

The lighting sector provides substantial opportunities for reducing energy use and carbon dioxide emissions. The focus on lighting supports the targets agreed in the Kyoto Protocol as these need to be guaranteed. Light bulbs are bought routinely, by every household in Europe, so that transforming the purchase in favour of more efficient bulbs does result in definite savings, quickly.

## INDUSTRY STRUCTURE

Lighting is a particularly complicated sector for policy, because there are both bulbs and fixtures. These two technologies have different manufacturing industries and are sold through separate retailing structures, making a total of four groups of companies (Table 1). These four groups have not co-operated traditionally, but collaboration will be important if the potential savings are to be realised.

**Table 1: Main constituents of domestic lighting manufacturing and retailing markets**

| | **Manufacturers** | **Retailers** |
|---|---|---|
| **Bulbs** | Three large multi-national companies | Supermarkets |
| **Fixtures** | Numerous, small, often country-specific | Specialist shops, department and DIY stores |

*Source: DELight*

### 1.1. Light bulbs

Across Europe, the majority of light bulbs for both residential and commercial use are produced by three major light source manufacturers: Philips, Osram (Siemens) and GE Lighting (Tungsram, Mazda). These companies each account for around 30% of residential light bulb sales in Europe. There may be slight variations in the wattage or type of bulb sold in each country, but, on the whole, products do not differ significantly between countries. The UK and Ireland represent an exception because of the requirement for bayonet based bulbs in the residential sector.

Most people buy their replacement bulbs in supermarkets, where fixtures are not available. This does not give people the opportunity to look at how the bulb and fixture interact. While this is not an issue when purchasing incandescent bulbs, it becomes more important with CFLs, for fixtures that were not specifically designed for CFLs.

When householders are shown the full range of CFLs currently on the market, they are surprised, as it is far greater than that found in most retail outlets. Choosing the right low-energy bulb for an existing fitting, that is at home, is a lottery with the present system. This highlights the benefit of expert advice and demonstrations in encouraging the appropriate use of CFLs.

### 1.2. Light fixtures

The crucial difference between the bulb and fixture manufacturing industries is that there are hundreds of relatively small fixture manufacturers, generally specific to each country, rather than a few multi-national organisations. The top 50 companies in this sector represent only 27% of production, illustrating the small scale of companies (CSIL 1996).

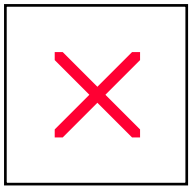
Influencing the fixture industry in a coherent strategy is potentially difficult, therefore. The current market is still dominated by fixtures produced within Europe, but competition from the Far East is increasing. Levels of production and export from the Eastern European countries are increasing due to direct investment by Western European companies. The luminaire retailers have potentially the most significant role in transforming domestic lighting. The absence of a trade perspective - there are few large chains of lighting shops - may inhibit this development and indicates the benefit of external schemes, such as accreditation. Households within the EU are thought to purchase an additional or replacement fixture each year, representing an opportunity to introduce dedicated fixtures into peoples' homes.

## POTENTIAL SAVINGS

In the DELight study, a survey was undertaken of 72 households, equally from Germany, Sweden and the UK. All the fittings in each house were assessed, both by a lighting expert and by the occupant, for their suitability for conversion to low-energy bulbs. A successful conversion would be where the CFL can be installed in the existing fitting, with no additional expenditure, and gives a satisfactory light output. There is a similar proportion of luminaires suitable for immediate conversion in each country, ranging from 42-46% (Figure1). In some cases, these fittings already have a CFL installed by the householder.

Assuming one bulb per luminaire, the 'successful conversion' category indicates that, in each household, at least seven bulbs in Germany, nine bulbs in Sweden and eight bulbs in the UK could be changed to CFLs immediately. Also, by simply replacing the shade, requiring minimal investment on the part of the householder, the 'successful conversion' category could be almost doubled in Germany and the UK. However, the 'successful conversion' category will never reach 100% of luminaires since there will always be some fixtures where CFLs are not appropriate, either for technical, economic or aesthetic reasons.

Some luminaire types were more suited to the installation of CFLs than others: ceiling pendant fixtures were particularly suitable for conversion in the UK, while ceiling surface and recessed luminaires were more successful in Sweden. In luminaires where the bulb was visible, globe CFLs were effective and often represented an improvement on GLS bulbs, because glare was reduced.



*Note: The figures are from the 72 households surveyed and may not be nationally representative*

***Figure 1**: Technical potential for installing CFLs into existing fixtures in Germany, Sweden and the UK*

## SIZE OF SAVINGS

Data were collected from most European states on the level of electricity consumption in domestic lighting[2]. Where detailed modelling was undertaken (UK and Germany) the level of consumption was doubled from previous estimates. There are still several anomolies and unexplained variations in national figures (Figure 2).

***Figure 2**. Annual electricity consumption for domestic lighting across Europe*

An estimate of lighting electricity consumption for the EU has been made based on the detailed modelling for Germany, Sweden and the UK. The figures for all three scenarios have been extrapolated on the basis of the number of households in the EU and corrected to match the present national consumption figures, adding up to 86 TWh across the whole of the EU. Electricity consumption is projected to rise to 102 TWh by 2020 under the Reference Case scenario, with a conservative estimate for potential savings of 44 TWh (43%) achievable by 2020 across the EU (Figure 3).

The ETP scenario defines the envelope of savings that could be accessed through policy, with the FITP scenario an illustration of one way in which this could be achieved. The FITP scenario is based on the finding from the technical survey that it is technically and aesthetically feasible to install CFLs in at least 40% of fixtures currently using incandescents, equivalent to around eight CFLs per house. Given the natural rate of turnover of bulbs, this is realistically achievable within five years. Following on from this, it is assumed that all fixtures purchased, either new or replacement in the natural turnover of the stock, are dedicated to CFLs. Therefore, by 2020, 80% of all bulbs in the household are CFLs. The largest savings will come from installing CFLs in the highest used locations - the technical survey demonstrated that by replacing only four bulbs in the highest use locations which are suitable for CFLs, annual savings of 200 kWh per house can be achieved. These need to be targeted first. The only barrier to achieving this potential, given sufficient availability of CFLs, lies in persuading the householders to make the change.

*Figure 3: Estimated EU lighting electricity consumption under RC, FITP and ETP scenarios, 1970-2020*

*Source: DELight*

There are further complexities specific to lighting, in addition to those found with all other domestic appliances where market transformation is now the accepted policy strategy. Lighting policy options have to recognise that:

- there is multiple ownership of light fixtures in the home, requiring multiple interventions, over a long time period;
- lighting is used by different people for a variety of tasks and attitudes to 'acceptable' light vary in households and across countries;
- each fixture has a different usage pattern which implies differing levels of cost-effectiveness when replacing with more energy-efficient alternatives;
- ownership of fixtures varies across Europe, from being personal possessions in some countries to part of the fabric of the house in others;
- the replacement rate of bulbs is rapid, but turnover is slower for fixtures.

## POLICY FOCUS

A market transformation strategy for lighting, including both incentives and standards, is a relatively new concept. Any programme developed will be more complex than that required for other domestic appliance markets since lighting represents two distinct but inter-dependent technologies and their associated industries - light sources and light fixtures. The synergies available from a strategic policy approach are greater in lighting than with other appliance groups. There are two main policy phases, in parallel:

- **to get the first CFL into those households that have none as soon as possible**. Throughout Europe, those households that have a CFL have an average of three or four. However, there are still around 70% of households that currently have no CFLs. The non-users are either unaware that CFLs exist or uncertain about their attributes. The owners, however, are generally positive about the quality of light and other benefits of CFLs, which can explain why they have several in the house (Figure 4). The practical experience of using a CFL seems to be vital if people are to be converted from doubters into happy users.

*Figure 4 Perception of light from CFLs, according to ownership*

- **to ensure that the majority of fixtures in households are dedicated to CFLs in the longer term**. The ultimate focus of any strategy must be a move towards dedicated fixtures, so that the savings are certain and there can be no reversal to incandescent bulbs and higher consumption. This has to be a long term goal, partly because there are few attractive dedicated fixtures available at present and also because of the slower turnover of fixtures in the home. The European Commission is co-ordinating a competition, which will result in good, new designs on the market by May 2000. Once appropriate luminaires are designed and as people become used to CFLs in the home, then the adoption of dedicated fixtures will be both acceptable and natural.

The focus on integral ballast CFLs in the short term is, therefore, a necessary precursor and provides the opportunity for policies targeted at fixtures to be developed. This is necessary, partly because the technological development of the bulbs has progressed more rapidly that the support from the fixtures - the two markets are, initially, at different stages of market transformation. The combination of these two phases and their eventual synchrony requires a coherent strategy, as in market transformation, to ensure that the savings are achievable and at a reasonable rate. The details behind policy formulation for Europe is given through an example developed for domestic lighting in the UK.

## A CASE STUDY OF THE UK

The DECADE team developed a detailed market transformation strategy for domestic lighting in the UK, using a mixture of national and EU policies [3], which is summarised here to demonstrate the way in which policies could

interact. It is not proposed that this is the appropriate scenario for Europe, but it provides a useful exemplar. For the UK, one of the main objectives was to achieve the ETP level by 2020 in an equitable way - low-income households should clearly benefit from the strategy.

The aim, as in Europe, is to promote integral ballast CFLs in the short term combined with building the market for dedicated fixtures as the long term goal. This scenario is constructed on the basis that there are 24 million households with an average of 20 bulbs per household in 2000. The ETP level at 2020 is equivalent to 85% of all bulbs being CFLs, which requires the market to be built up to and maintained at an annual sales volume of around 24 million CFLs. This is equivalent to one new CFL per household per year, not including replacement bulbs. The contribution of various policies towards achieving this target is illustrated in Figure 5.

*Figure 5: Transformation of the UK domestic lighting market to 2020*
*Source: DECADE 1997*

Current market building polices at the national level are continued, such as programmes run by the Energy Saving Trust (EST) to distribute or subsidise CFLs, so that by 2003 every household has two integral electronic ballast CFLs. In addition, the EST is developing a scheme to promote dedicated fixtures and it is assumed that successful designs are manufactured and subsidised until 2005. As the average household purchases a fixture each year, whether new or replacement, the aim is for an increasing proportion of these purchases to be dedicated, so that by 2005, each home has two dedicated fixtures. Hence, in the four years from 2001, the average home will have acquired four CFLs (two of which are in dedicated fixtures). The implication is that from 2000 onwards, 50% of fittings sold are dedicated.

The market is further developed through a retrofit programme, over fifteen years, to install dedicated luminaires in 8 million households; mainly low-income. This policy serves the function of both confirming the market for dedicated fixtures and making sure that low-income households benefit from the energy savings at an early stage. Further support comes from the specification of dedicated fixtures in the UK Building Regulations - further consultation on this is expected in Autumn 1999. In the UK, the majority of light fixtures are considered part of the building fabric. This would affect 200 000 new homes per annum, guaranteeing future markets. These last two policies - tailored to the UK situation - complete the market building stage. In other countries, alternative national policies may be needed.

These national policies achieve 35% of all the savings. This is a substantial proportion, because of the need to ensure that both CFLs and dedicated fixtures are firmly established. With lighting, it will not be possible to regulate and prevent the sale of the less efficient technologies, such as incandescent bulbs, in the way that inefficient refrigerators or washing machines can be banned. This is because the householder will continue, for many years, to own fixtures that are designed for GLS bulbs and they should be free to purchase these traditional bulbs. The interaction between bulbs and fixtures and the substantial number of luminaires per house requires particularly careful policy design.

The consolidation of the market implies co-operation across Europe to achieve the remaining 65% of savings. The form of this collaboration will depend upon the speed with which electricity savings are required. In this UK example, the aim is that by 2020, CFL sales will account for half of all bulb sales and around 80% of burning hours in the average household. The target could not be reached earlier, because of the large number of fixtures and bulbs involved per household. These remaining savings would be achieved through the agreement with the bulb manufacturers of an EU Corporate Average Bulb Efficiency (CABE).

The proposal for CABE is an agreement, negotiated with the light source manufacturers, which would set a target level of efficiency for the average bulb sold, that improves annually. CABE allows flexibility in shifting from a majority of incandescent sales to a majority of more energy-efficient bulbs, while recognising that there will always be a certain level of incandescent and halogen sales. This approach has the scope to incorporate other efficient technologies which may emerge in the future. In conjunction with a decision to phase out all integral ballast CFLs, this agreement would support the change to CFL dedicated fixtures. Collaboration between the bulb and fixture

industries would enable bulb manufacturers to confirm that the appropriate dedicated fixtures are available in order that they may reach the targets set for CABE. A voluntary agreement by the lighting industries is the only way that has been identified to achieve the target set under the ETP scenario in a timescale that will contribute to the Kyoto commitments.

The CABE is designed to achieve several objectives:

- to give a framework to the long-term structure of domestic lighting in Europe, with clearly defined targets. These provide the boundaries (maximum and minimum, depending on where the bulbs are installed) for future savings, as guidance for government in climate change negotiations;
- to provide a focus for the manufacturers of both bulbs and fixtures for new designs and production capacity;
- to establish a basis for discussions on a negotiated directive, rather than a voluntary agreement, if the role of imports are to be included;
- to provide wide flexibility and continuing customer choice over the types of bulbs on the market, even in 2020.

CABE is only an example for discussion. The opportunity exists to identify the contribution that the lighting industry can make to the reduction of carbon dioxide emissions. This is both a substantial challenge and a new perspective.

### 1.3. Other member states

The design of a similar strategy for other EU member states will depend on factors specific to each country at the market building stage. At the national or local government level, the importance given to lighting and to electricity will be affected by the country's target for $CO_2$ emissions in 2010 and whether electricity is a major source of these emissions. Other factors, such as the importance of domestic lighting as a component of peak electricity will determine whether the utilities will be potential collaborators. However, the role of common and co-ordinated policies, like CABE, would be the same for the whole EU.

### 1.4. Existing policies

Both within the EU and within individual member states, a variety of initiatives are already underway which are contributing towards the transformation of the market for both light bulbs and fittings.

#### *1.4.1. EU Energy Label for light bulbs*

The Energy Label for electrical household bulbs is due to be implemented on 1.1.2000, but there is an interim period before it is completely mandatory from 1.1.2001. The label gives each bulb a rating on a scale of A to G, similar to the cold and wet Energy Labels, with A representing the most efficient light source and G being the least efficient (Figure 6). The rating is calculated on the basis of the wattage and light output of the bulb, giving the following classifications of current technologies[4]:

A - tri-phosphor fluorescent lights (linear strips and pin-based CFLs) and integral electronic ballast CFLs
B - halo-phosphor fluorescent lights (linear strips and pin-based CFLs) and integral magnetic ballast CFLs
C - efficient halogen bulbs
D - other halogen bulbs
E/F - standard GLS bulbs
G - very poor incandescent bulbs

The only other new information to be included, in addition to the information normally given on the packaging, is the luminous flux of the bulb (a measure of light output). The average life of the bulb (in hours) will be included on the label only if the packaging already shows information on bulb life. As the label has to be printed onto the box there will be fewer problems with compliance - no bulbs can be sold after 1.1.2001 without the label and the whole of the year 2000 is provided as the period during which the transition occurs and old, unlabelled stock are sold off.

It is hoped that the label will provide greater confidence in the benefits of CFLs and help ensure the quality of these bulbs. It will also raise awareness of the label in general since light bulbs are a frequent purchase. The Energy Label is a major step towards enabling consumers in the EU to make an informed choice about the bulbs they buy and

provides the basis for market transformation of the light source market.

## A LABEL FOR FIXTURES

There are discussions about a label on fixtures mainly emanating from the Dutch. At the moment, there is no easy way for a consumer, when buying a fixture, to identify if it is suitable for use with integral ballast CFLs and which type of CFL would work best. Such information could be provided by a fixture label, corresponding to information given with the bulbs as to the type of fixtures they are suitable for. Thus, the fixture could be identified as suitable for, say, certain types of A rated bulbs. The criteria to qualify for the label should be simple and easy to apply. This process would encourage collaboration between the bulb and fixture industries, stimulating designs of incandescent fixtures suitable for integral ballast CFLs, with a natural progression towards dedicated luminaires.

### 1.5. Procurement

The IEA procurement initiative on the 'future bulb' has been overtaken by events: the CFL market has developed so rapidly that there is no longer such a clear gap between the incandescents and the low-energy bulbs. The IEA procurement has therefore been terminated.

There have only been a few schemes focusing on dedicated fixtures. In addition to the UK's scheme (mentioned above), Sweden and Poland have run design competitions on dedicated fixtures in the past and STEM (Swedish National Energy Administration) is currently running a procurement programme for energy-efficient fixtures in conjunction with Ljuskultur (Swedish National Lighting Trade Organisation). The EU is organising an international competition to design attractive, domestic dedicated fixtures. The results in the summer of 2000 will be promoted by several member states.

### 1.6. Lighting campaigns

Another EU initiative is in conjunction with Eurelectric, the European Federation of Electricity Utilities. This aims to improve the likelihood of every household in Europe having a CFL. The launch is in October 1999 and may or may not include the distribution of free or subsidised bulbs, depending upon the individual utility. Lessons learnt from previous national campaigns were discussed in DELight.

### 1.7. Phasing out magnetic ballasts/ Voluntary agreements

The Commission has prepared a proposal for an EU directive, introducing a minimum efficiency requirement for ballasts [?]. An energy efficiency index for bulb-ballast systems was recently agreed by the European ballast manufacturers, represented by CELMA (Committee of European Lighting Manufacturers). This provides the basis for the proposed minimum standard by progressively removing low efficiency ballasts from the market, such as the early magnetic ballast CFLs. This will be undertaken in three stages from 2002 and completed by 2008. One effect of this will the removal of magnetic ballast CFLs from the market since high efficiency magnetic ballasts are too bulky for use with CFLs. This useful precedent demonstrates that the manufacturers recognise the benefits of concentrating the market on the more efficient CFLs.

### 1.8. Summary of present policies

Policies are already in place to ensure that householders are encouraged to use more efficient bulbs, particularly CFLs, in their homes. The market transformation process is underway, though the separate policy components are not yet part of a clear, structured and targeted strategy. The two immediate priorities are to provide consumer education on CFLs.

## THE ROLE OF EDUCATION - BUILDING A POSITIVE IMAGE

The campaigns to promote free or heavily subsidised CFLs have not always incorporated guidance to the householder on how to use the bulb effectively in the existing fixtures. Without awareness of some of the technical characteristics of both CFLs and fixtures - and the way they interact - there is a danger that people will have placed CFLs in inappropriate fixtures, resulting in poor light output and uncertainty about the technology. An efficient bulb is devalued if used in an unsuitable fixture. As outlined earlier, there is already confusion surrounding CFLs. The

negative views of CFLs will increase if people continue to obtain bulbs without guidance on how to use them properly.

An early development should be the production of clear leaflets to be given out with each CFL, so that they can be used effectively in people's existing fixtures.

This would enable another obstacle to be overcome: advice is not available at the point of purchase of a bulb since the majority of replacement bulbs are bought in supermarkets and retail staff there are unlikely to be well-informed about lighting issues. In addition, people are not used to, and possibly not aware of the need to ask for advice when purchasing light bulbs. A leaflet at the point of sale would help all consumers obtain a better understanding of the interaction between the bulb and the fixture, whether in their existing fixtures or in new purchases.

At the moment, it is not easy for householders to obtain a CFL on a trial basis and impossible to get expert advice in the home, where the fixtures are. Many German utilities have 'CFL test suitcases' which allow customers to try out a range of CFL types for free. An alternative approach to enable experimentation would be for retail outlets to offer 'no-questions' refunds if the bulbs were returned within a certain time period, encouraging people to try out the bulbs. A reliability 'quality list' for CFLs, as used in Denmark and Sweden, would also help provide consumers with confidence in the products.

### 1.9. The retail environment

Across the EU, 70% of households - over 100 million families - do not have a single CFL in the house. Those households that do have CFLs are having to teach themselves, by trial and error, how to identify which fixtures are most appropriate. At the same time, there are few articles in the media and magazines to inform the public on the lighting characteristics of different bulbs. It is not surprising that there is ignorance and confusion.

The difficult task is to see how such advice can be provided for householders. It may never be possible to provide detailed information to consumers when they purchase their low-energy bulbs in supermarkets. Educating householders will have to be achieved through other means. The obvious channel is through luminaire retailers, though the assistants may not be well-informed at present. The recommendation is that:

**The retail environment for luminaires is transformed into a showcase for low energy lighting.**

This will require several policy initiatives, explained in more detail below, if consumers are to be provided with good quality advice:

- a label on a fixture to identify which bulbs can be used in it;
- a fully trained workforce, with incentives to understand and promote low-energy lighting;
- displays of fixtures that are suitable for CFLs.

#### *1.9.1. Retail staff training and consumer support*

The provision of labels on bulbs and fixtures is important for further policies, but the impact of the labels themselves depends upon the support provided in retail outlets. This is particularly true for lighting, where the efficiency of the system as a whole depends upon the efficiency of both the fixture and the bulb. The role of retail staff is particularly important in the promotion of dedicated fixtures, requiring an awareness of the additional benefits of these fixtures. The provision of training courses for the retail staff could be undertaken in conjunction with the light bulb manufacturers. A national accreditation scheme would make it possible to identify those shops where the staff are trained to a specified standard with regard to energy-efficient lighting.

#### *1.9.2. Retail displays*

One way of tackling several issues simultaneously would be for retail outlets with lighting showrooms to fit all - or the majority - of the fixtures on display with integral ballast CFLs. Ideally, this would be done in conjunction with a fixture label indicating suitability for CFLs and would serve several functions:

1) It would demonstrate to consumers that CFLs can work well in the similar fixtures they have at home, producing an appropriate light, thus bridging the gap between knowledge and experience. It would also guide them to the most suitable type of bulb to use with a particular fixture.
2) The retail staff would have practical examples to demonstrate the types of CFLs available and be more

aware of the issues to consider when using them in fixtures originally designed for incandescent bulbs.

3) The retail outlets could make substantial savings in electricity as well as air conditioning, since the heat generated would be far less with CFLs.
4) Dedicated luminaires will gradually replace the incandescent fixtures currently on show as the range available increases.

This suite of policies demonstrate ways in which the industries and policy makers could collaborate to ensure that people have access to good advice, particularly on how to use integral ballast CFLs in both fixtures in the home and new purchases.

## RECOMMENDATIONS

The objective is to ensure that every household has at least one CFL. Three particularly successful methods employed in the past have been:

- when a CFL is purchased, giving another for free;
- giving the CFL for free;
- purchasing the CFL through the electricity bill.

An early development should be the production of clear leaflets to be given out with each CFL, so that they can be used effectively in people's existing fixtures.

Establishing a 'quality list' for CFLs that have been tested for reliability.

The retail environment in specialist lighting shops is transformed into a showcase for low energy lighting, requiring several policy initiatives if consumers are to be provided with good quality advice:

- a label on a fixture to identify which bulbs can be used in it;
- a fully trained workforce, with incentives to understand and promote low-energy lighting;
- displays of fixtures that are suitable for CFLs.

Procurement of well-designed, dedicated fixtures, as is being promoted by the EU competition, is needed as soon as possible. The resultants designs should be widely publicised in the media and provided with rebates initially. The rebate could be the inclusion of the appropriate bulb, for free.

Clear targets agreed with industry, for instance in the form of a Corporate Average Bulb Efficiency, to establish the direction for design and manufacturing capacity and confirm the electricity savings.

These opportunities are both less and greater than previously recognised. Through an assessment of the fittings in the home, it is possible to estimate the number of incandescent bulbs that could be replaced by low-energy lamps - and it is about half. This number will increase as the CFLs become smaller and fit into more of the existing fittings. However, by modelling sales of light bulbs in individual countries and establishing how often the average bulb is used, electricity consumption in lighting can be quantified more accurately - and it can be twice as much as previously estimated.

The lighting market is in the process of being transformed and this revolution will involve all the players: manufacturers, retailers and all 150 million households in the EU. The savings could be accessed rapidly, contributing to the demanding targets for carbon dioxide reductions in both 2005 and 2010 and long after. These savings would not be realised by the market alone and require positive policy intervention. All EU countries face a considerable challenge, as agreed at Kyoto, and want to set a positive example in future climate change negotiations. The opportunities exist to bring lighting out of the policy darkness.

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## ENDNOTES

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[2] Given in full detail in Vol 2, Delight.

[3] Decade 1997 - 2Mtc

[4] Borg 1997