The untapped potential of energy efficient lighting technologies

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Abstract
This paper demonstrates the potential for new energy efficient lighting technologies to reduce energy, and ideas for speeding up the adoption rate.

Introduction
In October 2006 the EU published its Action Plan for energy efficiency with its 20 % target for energy savings by 2020. Today a new generation of energy efficient lighting technologies have the potential to make a significant contribution to achieving these targets and this paper will consider both this savings potential and the remaining issues around their adoption.

Before starting this however we should consider the background to Lighting and its energy use. After all why is lighting highly relevant? The answer is simply that it uses a lot of electricity. The International Energy Agency for example has calculated that worldwide – electrical lighting uses 19 % of all electricity produced.

There are two fundamental points to make when considering lighting in Europe. Firstly, about two thirds of all lighting currently installed in Europe is based on older, less energy efficient technology – developed before the 1970's – a figure based on Philips analysis of sales figures and existing lighting installations. Electrical lighting was developed in the latter part of the nineteenth century and it developed at an ever faster pace during the 20th century. Incandescent lamps were augmented by low pressure sodium lighting and fluorescent lighting in the 1930's. In the 1950's Halogen lamps were developed before the 1960's and 70's saw a quickening of the pace of development. The main point however was that the older technologies were never replaced but remained in being. For example large numbers of incandescent and halogen lamps are still manufactured today even though there are many more energy efficient alternatives. Research by Philips of both consumers and buyers in the business to busines sector suggests this is due to people looking only to intial cost rather than the true cost over the products lifetime.

The second point is that during the last decade there has been a revolution in lighting technology, especially in energy efficient solutions. These developments, well documented by trade media during the past decade or so cover all key areas of lighting such as light sources, control gear and luminaire optics as well as lighting control sensors and LEDs.

An examination of the figures makes this even clearer. Philips – the worlds leading lighting supplier has analysed the potential savings. Assuming a very conservative 20 % saving in lighting energy consumption, there would be running cost savings - or a business potential - worth 14 billion euros per year. This is the equivalent of 59 million tons of CO_2, or the output of 67 power stations. But the saving potential of modern lighting is more than 20 % – more like 30-40 % on average which means lighting can contribute more than the average in savings. And new lighting technologies not only offer energy savings, they also provide a higher quality of light.

These calculations are intended as a snapshot of the energy savings potential of what is in reality a moving target influenced by fluctuations in energy prices, market sizes, assumptions on CO_2 p/kw/h and indeed the number of member states in the EU. The assumptions adopted here are an average of 0.42 kg CO_2 p/

kw/h in the EU which is the average adopted by the european lighting industry federation (ELC). This is an average which takes into account regional and country differences – for example the fact that France generates most of its energy from Nuclear power. In addition the cost of electricty has been calculated at an average of 0.1 euro/kWh and the Philips central market intelligence unit is the source for the size and value of the european lighting market.

The main point is that the potential savings are very significant and our strategy therefore logically should be to encourage and indeed speed up the switch over from this "older lighting technology" to the "latest technology" available on the market today. The term speed up is very important. Current changeover and refurbishment rates can be measured quite acurately for e.g. street lighting or office lighting based on sales figures and lamp and control gear lifetimes. These currently indicate a slow change over rate of about 3% per year in Street lighting to 5 to 7 % per year in office lighting. These changes over rates demonstrate an important part of the issue. Even if a new energy saving technology is developed it takes almost a generation for it to be fully adopted, and by then something better has been developed in its turn. Nor will the original technology disappear as it will be discounted at a lower intial price.

By defining lighting into old and new categories we can simplify the issue but this does require some further explaining. In broad terms a number of criteria are used. If the technology was developed before 1975 it will be on average 30 %-80 % less energy efficient than technology developed after this time. Examples of this rule apply to all the product families and major segments where lighting is used. For example in residential lighting where compact fluorescent lamps save 80 % compared to incandescent lamps, or in office lighting where electronic ballasts with lighting controls can make fluoresent lighting systems up to 70 % more efficient. This is also true in for example road, shop, industrial and flood lighting. Nor is this improvement confined to energy efficiency. The quality of light has also improved considerably over this timeframe for all commercial lighting applications. For example in street lighting Ceramic metal halide technology now has colour rendering levels of 60-70 compared to 25-45 with the older high pressure sodium (SON) and high pressure mercury (HPL) technologies.

The reality of the potential savings becomes more real and meaningful when some examples are taken of the main areas where lighting is used. Take for instance Office lighting. The Philips market intelligence unit has analysed this market and concluded that more than 75 % of all Europe's office lighting is based on old lighting technology, originally developed during the 1950's. Primarily this consists of standard fluorescent lamps with electromagnetic control gear. This is wasting more than 2 billion euros per year in unnecessary energy consumption and does not comply with current quality norms, which also raises productivity and well-being issues (EN12464).

One issue that needs addressing in this context is that very often companies do not own the premises they are working from and do not make decisions on what lighting their employees work under. This split budget incentive would suggest it is harder for companies renting their properties to act although still needs further quantification.

The new energy-efficient lighting technologies include the use of lighting controls, which turn the lights off automatically when nobody is present and adjust light levels in the office when natural daylight is present. We all know about these technologies but they are no longer the complex technical solutions they used to be. Today simple plug-and-play systems are available which can easily save up to 75 % of energy consumed. It is a sobering fact that today only about 1 % of our offices or schools use lighting controls of any sort.

A similar picture can be found in Road & Street lighting. A good deal of Europe's Street lighting systems and poles date from the 1960's and need replacing and at least a third of all street lighting is very energy inefficient. The potential for third party financing is there with an energy savings potential of more than 1 billion euros per year in the EU.

Today European Municipality's have the opportunity to tackle this issue collectively by replacing the older less efficient technology with the latest energy efficient lighting technologies. This offers a quick win and indeed we are already seeing lots of Cities and Regions across Europe acting on this. One example here is the new road lighting scheme in the Northern German City of Vechta which has upgraded its street lighting from the older less energy efficient mercury lamps to a state of the art CosmoPolis system. The verified savings amount to a 50 % energy saving whilst the quality of light has increased enormously.

The same is valid for Home lighting – for more than 100 years we have been using the ordinary household light bulb. This uses 4 times more energy than existing compact fluorescent alternatives. Yet today in the EU we still install 2 billion of these incandescent lamps per year, bulbs which in fact are little more than heating devices, as 95 % of the energy consumed is wasted in heat. The collective cost to Europe in terms of energy and costs is huge.

In December 2006 Philips announced it was calling for the replacement of incandescent light bulbs within ten years.

We believe the mechanism and forum to achieve this switchover within the EU is already in place, namely the combination of the Eco Design directive for Energy Using Products and the Energy Services Directive.

This switch will not happen overnight. It will take a number of years for the supply chain to change from incandescent bulbs to alternative solutions in the quantities needed.

However at a personal level it also makes sense. At today's energy prices each energy saving light bulb – compared to an incandescent bulb – can save you up to 12 euros per year on your electricity bill, or 72 euros during a six year lifetime. In addition, due to its longer lifetime, you won't need to buy 5 replacement incandescent light bulbs during this period.

The above examples only mention a few areas in which lighting is used. However the same kind of energy efficiency story for example can be told for Retail, Industrial, and Hotel lighting amongst others.

The point is that the technology exists today to make a major difference – We simply need to switch over to it. And for those who help finance it this is indeed a huge business opportunity.

The same kind of energy efficiency story can also be told for retail, industrial, and hotel lighting amongst others.

Area of lighting	Energy saving	CO2 savings per lamp per year
Road lighting	 HPL 57%  CosmoPolis	109 kg CO_2
Shop Lighting	 Halo 80%  CDM	115 kg CO_2
Office & Industrial Lighting	 TL8 61%  TL5	77 kg CO_2
Home Lighting	 GLS 85%  CFLi	34 kg CO_2
LEDs	 GLS 82%  LED	34 kg CO_2

Examples of energy savings which can be achieved with new lamp technologies

The point is that the technology exists today to create a "win, win, win" situation: saving cost, energy, and the environment. We simply need to switch over to it. And for those who help finance the initial investment costs, it is indeed a huge business opportunity.

During the next few years we expect to be able to announce more technology breakthroughs. LED technology will also have a big future impact in the home. Already we have decorative LED light bulbs for the home, which can replace incandescent light bulbs where only a decorative effect is required both indoor and outdoor. These don't just use less energy, they slot into existing light fittings and also provide the consumer with a new lighting experience, using colours. I should stress however that the light output of these current LED light bulbs is not yet comparable to an incandescent lamp. Philips is investing heavily in this area too. Not only in in-organic LEDs produced by Lumileds. We started Lumileds as a JV with HP and we now acquired full ownership. But also in Organic LEDs we are active. We formed a research consortium, under our initial leadership, together with companies like BASF, and OSRAM, and we aim for a European lead in this field as well.

The issue is clear, the solution is simple – just switch – why is it not happening faster? I would like to summarize this article by looking at some barriers and possible solutions

To start with we believe the EU's Action plan for energy efficiency promises to address the remaining key road blocks. The development of new financing incentives and energy pricing initiatives offers the potential to remove one of the largest barriers – that of higher initial investment costs - and I hope I have illustrated the business opportunity for financial institutions or ESCO's to repay investments out of energy savings.

The introduction of new minimum energy performance standards is a very good measure. This should be supported by the development of tax incentives to encourage new technologies or discourage older less efficient technologies.

And finally we note the willingness by the Commission and the other EU institutions to demonstrate new energy efficient technologies in their own buildings.

New lighting technology offers a triple win - consumers and end users, the environment and business: all will gain and benefit. However these gains also require a triple effort. The lighting industry has to replace old by new technologies, consumers and users should be aware of the benefits of newer technologies, and the financial sector needs to offer more products to support this switch-over. And from a political perspective it will help to have fast and successful implementations of new legislation for example the Eco design Directive and the setting of ambitious mandatory energy efficiency targets.

This article started by referring to our support for the new EU action plan for energy efficiency.

This plan calls for a 20 % reduction in energy consumption by 2020. We conclude that there are even more opportunities than that. The Kyoto targets for lighting could easily be achieved! It just needs action and it needs action now, so let us take on that responsibility and act.