



# Factors Effecting the Success of Large Scale Lighting Schemes



This document is intended to help executives and managers understand the potential benefits of implementing large scale low energy lighting schemes. It will help you understand how to maximise financial value and avoid pitfalls.

For companies subject to carbon reduction regulation lighting is one of the few areas that can have a significant impact on carbon reduction that is easy to implement, without affecting the operation of the business while paying for itself.

- Reduce Energy Costs
- Address Carbon Reduction Targets
- Avoid the Pitfalls
- Maximise the Financial Benefits

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**Confidential:**

## Introduction

Evolving Government legislation and new lighting technologies offers companies the opportunity to make considerable savings and gain market advantage. If you have good advisers and are well informed, it is possible to avoid pitfalls, generate significant savings and profit from changes in new environmental impact laws. This can be achieved by the use of proven technologies applied to large-scale lighting schemes. Easy to capture benefits can be gained with minimum disruption to the business. Moreover, carbon reduction from lighting schemes is easily and objectively measured. Consequently, organisations should consider lighting as a first-call activity to meet regulatory targets.

Savenergi has been designing, installing and maintaining efficient lighting schemes since 2003. We bring to bear considerable experience with our comprehensive Business Feasibility and Design Study to help businesses and public sector organisations identify and implement successful schemes. This paper outlines some of the issues that should be considered to minimise implementation and maintenance costs and achieve the highest possible financial returns. It is intended as pre-reading for key stakeholders in advance of the study.

## What's Driving Change?

From the 1992 Earth Summit in Rio to the 1997 Kyoto Protocol, the subsequent launch of the European Climate Change Programme (ECCP) in 2000 and then Copenhagen in 2009, the message from Governments is clear...

*Behaviour towards our environment is undergoing change. Whether we like it or not the UK is leading the way, through an aggressive legislative programmes, over which we have little choice.*

At the time of writing the UK is the only country in the World that has legally committed to carbon reduction targets. In order to meet them, the Government is enforcing change by passing laws that affect all UK organisations. A 'carrot and stick' approach is being used with the carrots being grants, interest free loans and tax relief. For larger organisations the 'stick' is being wielded to drive action down through their supply chains. This is fast becoming stressful for private industry and public bodies alike, as deadlines approach and punitive sanctions for non-compliance become real.

## Incentives and Sanctions

Instead of leaving the matter of climate change and carbon reduction as a social conscience, marketing or corporate governance issue, the Government has decided to drive change via monetisation of the problem. This means that if you meet or exceed your obligations you will be financially rewarded. Conversely, if you do not meet your targets you will be publically identified as such with a consequent impact on reputation. You will also be liable to pay extra within carbon trading schemes and possibly fined. This has raised the profile of taking action to Board level in major organisations and placed the matter firmly in the lap of company Chairpersons, Managing Directors and Financial Directors.

## **What are the new laws and when do they apply?**

The freshly-renamed “CRC Energy Efficiency Scheme” (CRC = Carbon Reduction Commitment) forces many organisations to comply with the new Government policy on carbon reduction by next year. CRC registration needs to take place from 2010 onwards, with full reporting from 2011 and actual compliance thereafter. Failure to comply can result in civil and criminal sanctions being taken against the responsible officers. Even if your company falls outside direct regulation, your business clients might not and they have an obligation to get their suppliers (possibly you) to play ball. Many major consumer brands and retailers are already starting to demand that suppliers demonstrate a responsible attitude to carbon reduction.

The “UK Low Carbon Industrial Strategy” published in July 2009 describes how UK Government policy will achieve carbon reduction. Compared with 1990 levels, the UK needs to achieve 22% reduction by 2012, a 33% by 2020 and 80% by 2050. These challenging targets are now enshrined in the Climate Change Act 2008.

CRC is a key component of the Climate Change Act, requiring organisations with annual energy consumption of over 6,000 MWh per annum, or £500k annual spend on energy, to report their energy-related carbon emissions. Approximately 5,000 organisations within the CRC scheme will have to purchase allowances to cover their emissions, with all payments recycled among participating organisations according to their place in a performance league table. It is expected that a further 15,000 smaller organisations will need to report into the CRC scheme, but will not have to trade allowances.

## **Key issues to consider... What’s Driving Change?**

The first and most important issue to consider is what level of engagement you will have with the Government’s push for change. Are you part of the upper tier of high energy consumers captured in the EU Emissions Trading System (EU ETS), or the next tier of organisations to be caught in the CRC net? Or are you an SME being encouraged to act by taking advantage of economic incentives on offer or pressure from you business clients?

Whatever level you are at, as soon as possible you must start understanding what your current carbon emissions are and be able to quantify how you will reduce your carbon footprint. What contribution are you making to meet the legislative targets and is it possible to reap any financial reward for compliance? Don’t leave action until the eleventh hour. The market for external resources required to put carbon reduction initiative in place will quickly dry up as energy tariffs rise and the dates for regulatory compliance come closer.

Savenergi constantly monitors the development of Government policy and how companies respond to it. We are ideally positioned to advise our clients on the best ways to manage the ever-changing policy landscape.

## **Finance & Funding**

In the current economic climate there are massive pressures on companies’ margins and an imperative to cut costs to maintain profitability. Changing lighting schemes is one of the few activities that can meet carbon targets at the same time as delivering a positive financial return.

Government sponsored and specialist private finance schemes are ever-changing and hard to navigate. Government incentives are on offer for qualifying organisations via the Carbon Trust, in the form of Interest-Free Loans and Enhanced Capital Allowances. There are numerous private finance initiatives, with many different characteristics that companies can benefit from and various Public Sector funding options.

### Key issues to consider... Finance and Funding

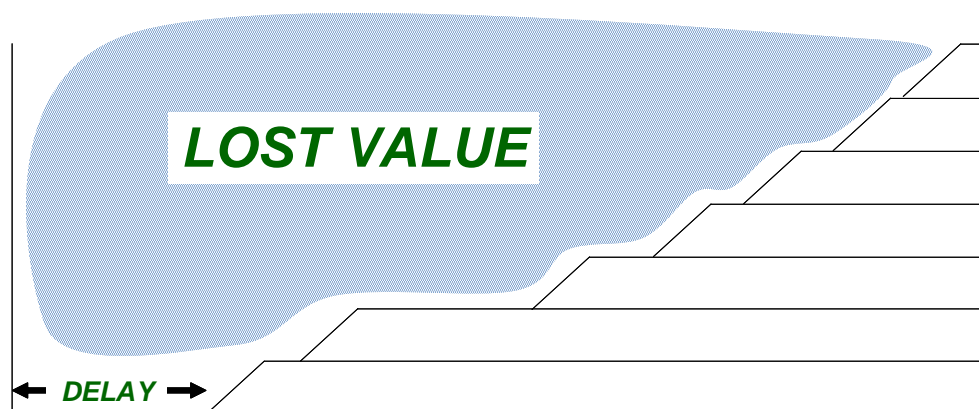
How do you deliver the financial savings available as a consequence of reductions in energy consumption? What are the various sources of grants, interest-free loans and preferential term loans that you could obtain? In order for a project to have enough interest to get financial approval, it will have to meet a decent return on investment criteria and/or a significant level of carbon reduction, so the correct and most appropriate project configuration will have to be used.

Savenergi can help you find the best financing options. We understand how to present to funding bodies to maximise the chances of getting funding. With Savenergi's expert guidance, you will be able to increase your stakeholder value as the result of running an efficient business.

### Project Management

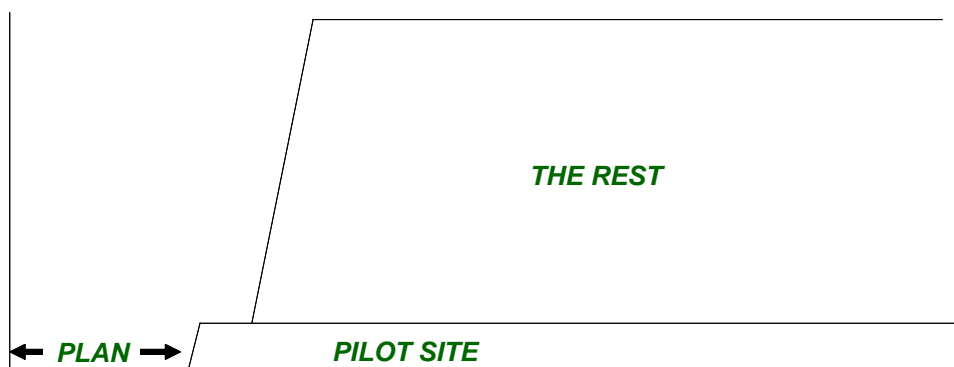
Due to poor project definition and management 9 out of 10 companies throw away more than the first year's worth of value from value of the implementation of energy efficient lighting schemes. The most common pitfalls leading to this loss are:

1. Unnecessary internal staffing costs employed in evaluating solution due to a poorly defined or non-existent procurement process. On average companies spend 54 full man days deciding on what project to implement. With proper advice the same result should be possible with less than 10 man days.
2. Adopting a piecemeal approach to implementation across multiple sites leading to loss of early stage benefits.



Typical Mistake... The graph above typifies the piecemeal approach taken by many large companies. Time to initial benefit is delayed, project execution is inefficient with little learning from project to project. Full implementation often takes years to complete when it could take only a few weeks **MONTHS**.

Best Practice... The following graph shows the ideal approach. A plan for the complete asset based is drawn up to minimise the time to get all the potential benefit. A pilot site is chosen in which a scheme is implemented and proven before being rapidly rolled out across the rest of the organisation. This avoids potential issues outlined in point 3 below.



3. Not involving key stakeholder in decisions leading to ineffective solutions that need rework or that reduce operational efficiency. We have seen some interesting human factors come into play when companies have tried to introduce new lighting. These are some of the comments from workforces

“You can’t replace that lighting, mate. You’ve got to fix this area first. It’s a death trap”.

“The energy savings are irrelevant. The production staff don’t like the colour”.

“The current circuits are ‘shot’ and the wiring runs are in the wrong place for the new technology. We have to invest in getting the basics right first”.

“It’s all very well spending money on saving energy, but we don’t pay the energy bill directly. It’s included in the overall contract we’ve negotiated with the site owner”.

“This new lighting is too directional. We can’t see into the corners of the warehouse now”.

All these problems can be address, but discovering them after you have installed a scheme may negate the benefits of expensive projects or stopped their implementation completely.

### **Key issues to consider... Project Management**

Very simply, have to got a programme plan and was that plan drawn up qualified and experienced people.

### **Energy Tariffs and Technical Skills**

Almost universally organisations baulk at implementation of solutions because their energy tariffs are currently low. The capital cost of implementation occurs as an event before the financial returns are delivered over time. Making an investment decision based on current tariffs a dangerously flawed approach.

Energy prices are set to soar just at the time when Government regulation starts to mandate action. At that point in time the market for qualified contractors capable of implementing schemes will become swamped with work. Project costs will soar. The skills required to do this kind of work take 3 years to develop and it is a legal requirement to use qualified personnel, so it's not easy for the market to ramp up capacity quickly.

Power companies are currently generating electricity with gas (or equivalent) at around 25p per therm. Savenergi have talked in depth to the major generators. They are forward buying gas at between 50p and 100p per Therm, so unless you have a low tariff locked in for the next 5 years your tariffs are going to rise.

### **Key issues to consider... Energy Tariffs and Technical Skills**

Don't make the mistake of making your investment decision based on current energy prices unless you have your low price locked in. Act sooner rather than latter to get the installation contractors ahead of the rest of the market. Use a financial model that takes into account all the sources of benefit, the cost of money and risk weighting.

### **When does implementing a new lighting make sense?**

Savenergi has put together many investment cases. From our considerable experience project justification on pure energy saving often makes no sense. Up front project costs, the cost of capital and competing candidates for investment conspire to counteract the financial benefits achieved over time from direct energy savings. However, regulation means companies must act and, as we have already discussed lighting is one of the few opportunities that deliver objective returns without impacting business operations. These are some of the situations that we have experienced where financial benefit has been better than average and projects have been justified on energy savings alone.

**Large Multi-Site Properties:** Large, multi-site production or warehousing facilities where lighting is required 24 hours a day, 7 days a week usually make excellent returns. Small spaces where lights are regularly turned off deliver marginal returns.

**Cold Stores and Air Conditioned Spaces:** In areas, such as cold stores, cooled offices and workspace, old lights cause heat rise and the consequent need for increased refrigeration or air conditioning. New lighting technologies reduce heat input reducing the combined running costs of cooling and lighting by up to 80%. It also significantly reduces the capital cost of refrigeration and air-conditioning equipment required in new installations.

**Small Spaces:** Many small spaces installed on a piecemeal basis rarely produce a good return, but building them into a single programme will capitalise on economies of scale, considerably reducing installation and maintenance costs.

**Car Parks and Security Lighting:** The external nature of this type of lighting, using old style technology is inherently wasteful. Using modern directional lighting and various control technologies can reduce energy consumption, increase security and reduce maintenance

The next section discusses situations where additional benefits can greatly increase the viability of projects.

### **Additional Sources of Value**

As we've said above pure energy savings are often not enough to justify a programme. But through the many programmes Savenergi has done we have discovered many additional sources of value. In many cases the value of the additional benefits far out way the direct financial benefit of energy savings. These include:

**Reduced Maintenance Overhead:** Often discounted in the calculation of savings lower maintenance overhead is a factor in all installations. The failure rates of new technologies is typically more than 5 times less than with old technology. The benefits are particularly good in situations where lights are difficult to get at and extra safety precautions must be taken. Also, longer life means that inventory and procurement costs are considerably less. Combining these two sources of value should result in, at least a 50% saving on maintenance costs.

**Reducing Light Pollution:** In a number of key areas in the country, particularly around large warehousing parks planning permission for expansion is difficult to get. When interviewed local residents cite light pollution as the single biggest reason for objection. The latest technology solves this problem allowing expansion to go ahead without this major stumbling block.

**Obsolete Infrastructure & Capacity Constraints:** Older sites tend to have old and obsolete wiring schemes, sometimes no longer compliant with the latest standards. These situations can lead to poor equipment performance, inefficiency of operation and safety issues. On occasion, production or operational capabilities may be constrained by the incoming site electrical supply being run at capacity, thereby restricting further growth.

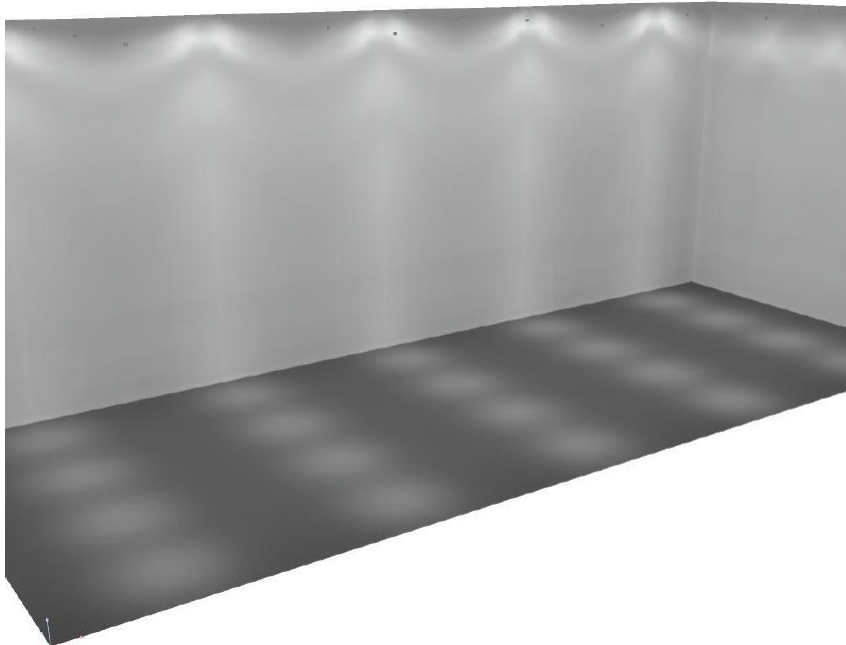
With new technology, power consumption is reduced releasing capacity to expand production or warehouse capacity. Also, the restructuring of your power requirements often offers you the opportunity to renegotiate your tariffs with your power supplier or site operator. For example, the reduction in peak electricity consumption can lead to a lower 'supply availability charge'.

**Increased Productivity and Staff Retention:** For many years industrial psychologists have understood the impact of appropriate lighting on worker performance. Implementing the right scheme can deliver significant productivity benefits. However, as we discuss elsewhere in this paper care must be taken to get it right otherwise productivity may suffer.

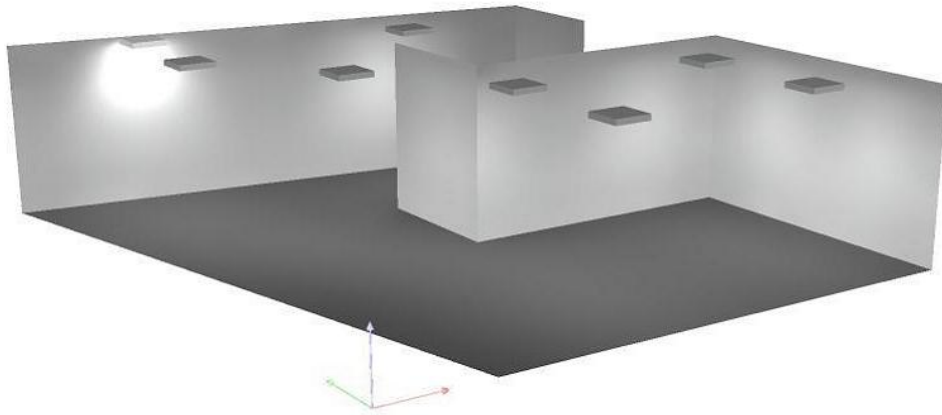
## Choosing the Right Technologies

The recent advent of reliable, cost effective fluorescent and LED technologies has driven demand for energy reducing lighting schemes, but these are not the only or even ideal technologies. Achieving the best results requires a portfolio of products and considerable solution design skills. Here are some of the options and the issues you should be aware of:

**LED:** Unlike old style lighting new LED arrays are highly directional. This is part of the reason they are so efficient. You cannot replace existing lights with LEDs on a like for like basis otherwise you get unacceptable patchy coverage. This is particularly true of high level lighting in warehouses and large manufacturing spaces. The correct array design must be specified and the layout carefully planned by an experienced designer. LED lighting in office environments poses an additional challenge. Currently, the products available for this application vary in quality. We strongly recommend seeking the advice of an experienced and independent consultant before you make any significant investment in relighting office space.



*The rendering above shows the result of a poor LED lighting design. Due to the highly directional nature of LED coverage is patchy. The picture below shows good coverage in a complex space, illustrating the need for experienced design skills.*



Major improvements -

- reliability of the control gear (ballast)
- improved efficiency of control gear
- dimmable
- auto switch off of the cathodes after startup
- auto sense/shutdown on tube failure
- improved operational life from 8,000 to 35,000
- easy maintenance

**Occupancy and Daylight Detection:** Many organisations fail to spot these technologies as low cost, easy to implement sources of savings. They simply turn lights off when they are not needed. However, to make them work they must be operated properly. Someone should be made responsible for monitoring their use.

**Voltage Optimisation:** This is a highly cost effective solution for selected applications. It reduces the voltage and therefore power consumption without reducing light output. It also works on any circuits, not just lighting. In many cases, in a suppliers haste to sell a product and the buyers desire to maximise savings voltage optimisation has been poorly specified. This results in lower levels of light output, often requiring a complete refit. Make sure you fully understand the implications of employing this technology.



***This picture shows a typical Voltage Optimisation system. These are easy to install, but require careful selection to ensure light levels are not compromised.***

### **Commercial Issues and Market Perception**

Regulation make decisions for public sector organisations and larger companies relatively simple, but smaller companies have more options to consider.

It is the Governments intention to create a business environment where it is advantageous for companies to demonstrate their green credentials. It is now proven that companies that show commitment in this area get positive consumer response and increased business volume. In Business to Business supply chains clients are requiring change in their suppliers. Government policy is being trickled down through supply chains in the form of new contract terms and supplier registration processes. There has been a recent increase in Invitations To Tender demanding statements on carbon reduction. Suppliers that cannot demonstrate a commitment to action are no longer being short-listed.

So, knowing that the market demand for carbon-related behavioural change is there, organisations can intelligently exploit this demand by marketing their positive contribution to the environment.

Savenergi can help companies deliver projects that create a positive perception of the business with a wide range of stake holders including consumers, shareholders, employees, suppliers, local residents and Government.

### **Human Factors and the Workforce**

It is not easy to predetermine the impact a poor lighting implementation on employees. Getting it wrong means they may become de-motivated and more easily disaffected in their job. It is often difficult to put the problem right requiring a costly redesign and refit.

“Bad lighting” is lighting that is inappropriate for the tasks being performed. Illumination may be too low or too high, excessive direct or reflected glare may be present, the colour rendering of artificial light sources may be inadequate, or the distribution of light may be inappropriate. Poor lighting has been associated with a variety of problems including low productivity, high human error rates, eyestrain, headache and a reduction in mental alertness.

Each of these problems can have a significant negative economic impact on any business. It is therefore important to seek expert advice to understand the quality and type of light required in any new implementation.

### **Savenergi... A Reliable Path to Maximising Your Benefits**

Projects that are managed without a clear understanding of the key objectives will certainly miss all the value to be had in undergoing a business enhancement programme concerning energy efficiency. A full understanding of modern technology is required, e.g. Voltage Optimisation, LED lights, occupancy controls, etc. in order to maximise their effectiveness. Incorrect choice of technology or incorrect installation will lead to poor performance and disrupted operations and ultimately, a wasted investment.

An organised and proper methodology is required to specify and deliver the full value from a project, whilst also allowing for a full appraisal of the results.

A Business Feasibility and Technical Design Study should be conducted involving key stakeholders and sources of knowledge about all the relevant business issue. This will determine the options and arrive at the recommended solution to deliver all the benefits and avoid the risks. It is important that the key stakeholders have an opportunity to contribute to, and consequently feel ownership of the eventual proposal.

Pilot sites can be useful to prove the lighting concepts, allowing proper design adjustment where necessary before a full roll out.

Savenergi offers a Business Feasibility and Technical Design Study to assure its clients' success and avoid the many costly mistakes that we have seen people make. Through this process we bring to bear a wealth of experience gained with many large and demanding organisations such as Unipart, Tesco, Molson Coors, Corus, the MOD and the Home Office.