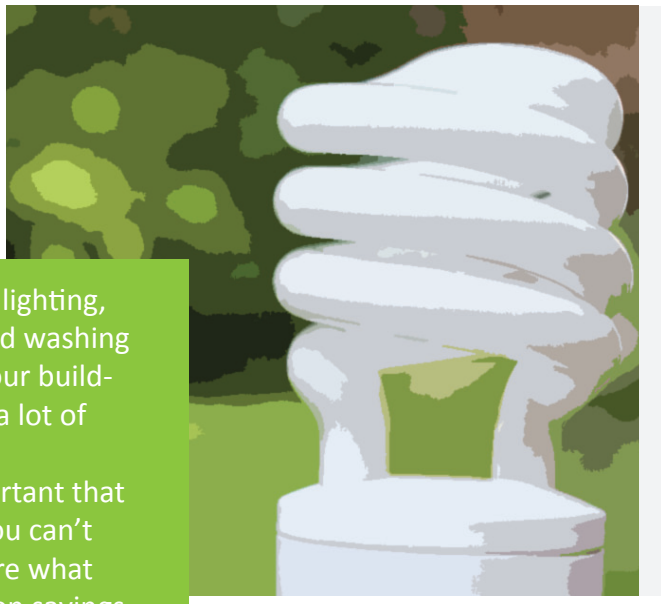
APPENDIX 7:
Electricity



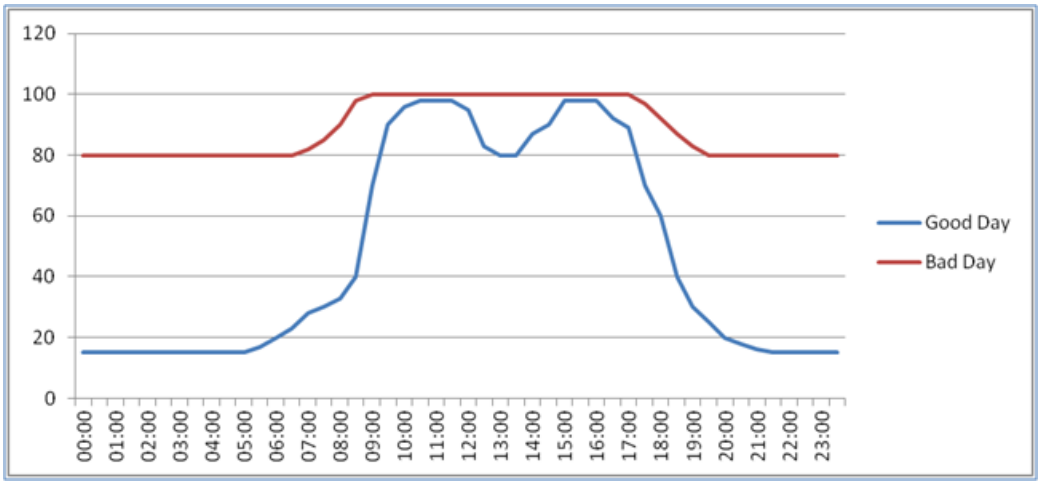
Electricity can be used to power all of the appliances, lighting, heating, ventilation, cooling, cooking, refrigeration and washing in your building. Anything that consumes energy in your building could be powered by electricity, so it is likely that a lot of electricity is used in your building.
Since a lot of electricity is likely to be in use, it is important that this is managed properly. Good metering is vital, as you can't manage what you don't measure! If you don't measure what electricity you are using, you won't be able to tell when savings can be made.
Traditional meters will give you some indication of usage, but more advanced metering can be truly beneficial, particularly in large buildings.

SMART METERS

A smart meter is an intelligent electricity meter that enables two way communications between your business and your energy supplier. Using electronic communications technology, like the SIM card in your mobile phone, it is able to send accurate meter readings and electricity usage details to your energy supplier.

This communication capability allows data to be read remotely and displayed on a device within the home, or transmitted securely externally. The meter can also receive information remotely, e.g. to update tariff information or switch from credit to prepayment mode.

Automatic meter readings can be enabled with some smart meters. This allows you, or the person that does your energy management, to view half hourly meter readings. This can be a great benefit when monitoring energy use and looking for problems and opportunities in the building. The graph below shows office energy use for a well managed day and a badly managed day.



On the good day, it is easy to see what time people came in to work, and even when most people went out for lunch. At night, only the servers and security systems were left on, so less than 20% of the maximum load was being used.

On the bad day, very little is turned off at night, and no-one turns their monitors or lights off at lunch. The overnight usage is closer to 80% of the maximum load.

Half hourly energy data allows energy managers to observe the trends shown in this graph, and implement appropriate actions to save energy where it is being wasted. Without a smart meter and half hourly data, we may not have realised how much energy was being wasted over night on the bad day.

The Government has stipulated that all properties in the UK must have a smart meter. The timeframe for this will be between 2014 and 2019. But the sooner you have your new smart meter installed, the sooner your business can start benefitting, so it makes sense for us to install it now whilst the engineers of your supplier in your area.

The UK Government is keen that the rollout of smart metering begins around 2012 / 13, with an estimated completion in 2020.

WILL THE METER CHANGE AFFECT MY BILLS?

The price you pay for your electricity will not change. However, your bills will be more regular and accurate after fitting the new meter. When the engineers install the smart meter, they will simply record the final reading on your old meter and take an opening reading from the new meter. There will be a smooth transition because your next bill will show two sets of readings.

Also, you will be free to move energy supplier at any time and receiving the benefits of smart metering. Understanding when and where energy is used is the first and most important step in reducing energy consumption. We cannot manage what we do not measure. Good metering is a powerful tool in effective energy management. Metering has been used by utility companies to measure and bill for the quantity or volume of that utility being delivered to a site. Some sites monitor their own consumption from their bills or directly from their meters to monitor their consumption.

Knowing and understanding consumption enables organisations to manage their energy usage and expenditure effectively and enables consumers to accurately monitor their energy consumption, which is likely to encourage a reduction in both fuel bills and carbon emissions by identifying opportunities for energy efficiency improvements.

Find more information about the implementation and advantages of AMR technology.

APPLIANCES

When purchasing appliances, such as washing machines, fridges or anything else with a plug, it is important to make an efficient choice. Large items, like fridges, come with an environment rating. Buying the slightly more expensive A-rated model will save you money over time compared with the slightly cheaper B or C-rated model.

TIMER PLUGS

The easiest way to save some of the energy used by your appliances is to fit them with timer plugs. These can be bought for £5 or less from DIY stores, and will ensure that your appliances are switched off at the wall when they are not in use. This is particularly useful for items such as games machines and televisions in front of house areas or bars.

LIGHTING

Lighting is responsible for much of an office's electricity use, and occupancy sensors can provide significant energy savings by only lighting where and when it is needed.

To fulfil the requirements about comfort and energy efficiency, building managers have implemented programs to reduce lighting energy requirements by installing more efficient light sources and luminaries. However, this is not sufficient. Lighting energy management has to provide the optimal lighting level for the tasks being performed using the most efficient light source suitable for the application, and providing light only when and where it is needed. This can be achieved by using lighting control strategies and lighting control systems. The main purpose of these systems is to reduce energy consumption while providing a productive visual environment.

This includes:

- Providing the right amount of light
- Providing that light where it is needed
- Providing that light when it is needed

Due to the increase of environmental concerns, lighting control systems will play an important role in the reduction of energy consumption of lighting without impeding comfort goals.

SENSORS

A sensor is a device that measures or detects a real-world condition, such as motion or light levels. It then converts the condition into an analogue or digital representation, so that building services can respond. For example, a light sensor may detect that it is getting dark, and send a signal to turn on the lights.

The sensor specifications include performance factors (range, accuracy, repeatability, sensitivity, drift, linearity and response time) and, practical and economical considerations (costs, maintenance, compatibility with other component and standards, environment and sensitivity to noise).

The sensors we recommend to you are as follows:

- Presence/ Occupancy sensory
  Presence sensors detect the presence of occupants by detecting their movements. The most common sensors used in the building sector are passive infrared (PIR) sensors that react to variations of infrared radiations due to movement of people.

- Photo sensor control

Photo sensor control contains an advanced, energy-saving occupancy sensor designed with an integrated photocell that automatically turns lights off when the room is unoccupied or dims them when enough daylight is present. This unique indoor link-and-go system is perfect for retrofits and new installations in commercial applications. With a battery engineered for an estimated 10-year life and a 2-year limited product warranty.

Today, the most common form of control (the standard wall switch) is being replaced by automatic systems which are based on occupancy or daylight harvesting. Most common examples are occupancy sensors which turn the lights off when the area is unoccupied, time-based controls and the dimmer plus photocell combination. All are more effective than the standard switches in saving energy. Potential gains vary from 10% with simple clock to more than 60%.

BENEFITS

- Lighting energy savings potential with Presence Sensors:

Application	Potential Energy Cost Savings (%)
Offices (private)	25-50
Offices (open areas)	25-50
Toilets	35-75
Hallways	30-40
Storage Areas	45-65
Meeting Rooms	45-65
Conference Rooms	45-65
Warehouses	45-65

- Sensors with photocells provide additional savings in areas with sufficient natural light by turning off lights whenever possible, as is the case of the offices, the hall and hallways.
- On the other hand, toilets are typically occupied less than 50% of the day, and lights are often left on while no one is present. Significant savings can be achieved by systematically turning lights off when possible using the presence sensors, here is not needed the photo sensor control because usually toilets are not very luminous.
- Potential annual savings achieved by installing presence detection (for a 400m2 floor area) are:
    - £664
    - 8,736kWh
    - 3.8 tonnes CO_2

Advanced occupancy sensing technology helps to enhance performance while optimising energy savings.
If the lights are not needed, they should not be on!

REPLACING INEFFICIENT LIGHTS WITH EFFICIENT ONES

There are different types of bulbs, each with a different efficiency and lighting capacity. New bulbs and tubes are much more efficient than older models and therefore, in many cases it is highly recommended to replace them in order to make electricity savings.

Please, find bellow a comparison of some of them (considering an operating time of 10 Hours per day, 5 days a week and 52 weeks per year), with their different features, working time, replacing costs and Pay-Back:

- Replacing standard T8 Fluorescent with T8 LED Tubes and T5 Fluorescent tubes.

	Fluorescent Bulb T8 (5ft 1500mm)	T8 LED TUBES (5ft 1500mm)
Power Consumption	58W	22W
Hours in use per year	10 Hours per day, 5 days a week, 52 weeks per year = 2600 hr.	
Kilowatt hours per year (watts / 1000*	150.8 kWh	57.2 kWh
Cost per year/bulb (at 13p per kWh)	19.604 kWh	7.436 kWh
REPLACING COST	£40	
PAYBACK	3 - 4 years	
WORKING TIME	10,000 hours (4 years)	50,000 hours (20 years)

LEDs (Light Emitting Diodes) are much more efficient than older T8 and compact fluorescent lights, while having almost the same lighting characteristics.

	Fluorescent Bulb T8 (5ft 1500mm)	Fluorescent Bulb T5 (5ft 1500mm)
Power Consumption (inc. ballast)	58W	35W
Hours in use per year	10 Hours per day, 5 days a week, 52 weeks per year = 2600 hr.	
Kilowatt hours per year (watts / 1000*	150.8 kWh	91 kWh
Cost per year/bulb (at 13p per kWh)	£19.604	£11.83
REPLACING COST	£40	
PAYBACK	2 - 3 years	
WORKING TIME	10,000 hours (4 years)	20,000 hours (8years)

- Replacing standard T12 Fluorescent with T5 Fluorescent tubes.

	Fluorescent Bulb T8 (5ft 1500mm)	Fluorescent Bulb T5 (5ft 1500mm)
Power Consumption (inc. ballast)	70W	35W
Hours in use per year	10 Hours per day, 5 days a week, 52 weeks per year = 2600 hr.	
Kilowatt hours per year (watts / 1000*	182.2 kWh	91 kWh
Cost per year/bulb (at 13p per kWh)	£23.686	£11.83
REPLACING COST	£21 = 3+ (£18 ballast)	
PAYBACK	2 - 3 years	
WORKING TIME	10,000 hours (4 years)	20,000 hours (8 years)

- Replacing Standard 50-60W Incandescent bulbs with 5W LED bulbs.

	Standard Incandescent Bulb	LED BULB
Power Consumption	50 / 60W	5W
Hours in use per year	10 Hours per day, 5 days a week, 52 weeks per year = 2600 hr.	
Kilowatt hours per year (watts / 1000*	130 - 156 kWh	13 kWh
Cost per year/bulb (at 13p per kWh)	£16.90 / £20.28	£1.70
REPLACING COST	£8 - 13	
PAYBACK	0 - 1 years	
WORKING TIME	1000 hours	50,000 hours (20 years)

- Replacing Standard 50-60W Incandescent bulbs with 11W Compact Fluorescent Lamps (CFL).

	Standard Incandescent Bulb	CFL
Power Consumption	50 / 60W	11W
Hours in use per year	10 Hours per day, 5 days a week, 52 weeks per year = 2600 hr.	
Kilowatt hours per year (watts / 1000*	130 - 156 kWh	28.6 kWh
Cost per year/bulb (at 13p per kWh)	£16.9 / £20.28	£3.72
REPLACING COST	£5 - £9	
PAYBACK	0 - 1 years	
WORKING TIME	1,000 (< 1 year)	6,000 hours (3 - 4 years)

- Replacing Standard 50-60W Incandescent bulbs with 5W LED bulbs and 11W Compact Fluorescent Lamps (CFL).

	Standard Halogen Bulb	LED BULB
Power Consumption (inc. ballast)	50 - 60W	5 W
Hours in use per year	10 Hours per day, 5 days a week, 52 weeks per year = 2600 hr.	
Kilowatt hours per year (watts / 1000*	130 - 156 kWh	13 kWh
Cost per year/bulb (at 13p per kWh)	£16.90 / £20.28	£1.70
REPLACING COST	£8 - £13	
PAYBACK	0 - 1 years	
WORKING TIME	2500-5000 hours (1-2 years)	50,000 hours (20 years)

IN CONCLUSION

Replacing old lighting with LED technology:

LEDs (Light Emitting Diodes) are much more efficient than older T8 and Compact Fluorescent Lights, whilst having almost the same lighting characteristics, and they are considerably more efficient than halogen spots. There are also smaller savings to be made versus T5 lights.

Although LED lighting is a bit more expensive, it lasts much longer (30,000 hours more than T5's) and thus it has lower maintenance and lifecycle costs, which leads to less replacements and a better final cost.

Other benefits are:

- They are easily dimmable using occupancy and daylight sensors, resulting in additional energy savings.
- There are not breakable glass or filaments and thus, they are highly resistant to shock and vibration.
- They are designed to fit most existing light fittings for an easy retrofit.
- No need for ballast or starters.
- They have an instant strike and have no warm up period so you have light when you want it.

For all these reasons and because there is no need for ballast or starters, we recommend the use of LED technology rather than T5 Fluorescent lamps or CFL's.

There are some costs and benefits which are difficult to include in this calculation. These are as follows:

- Cost of installation / replacing bulbs. Although they last 10 times as long than T5 and therefore need less labour to replace over the long term.
- Reduced heat from operation – might require less air conditioning in summer months.

Replacing T12 and T8 with T5 Fluorescent:

The T5 Tubular Fluorescent Lamps (TFLs) are relatively thinner than most tube-lights and considered to be more energy efficient and offer a higher intensity of light output than even its previous version T8 lamps and T12 lamps.

There are many advantages with the replacement, such us:

- More efficient lighting with instant start up (no flicker startup), no startup noise.
- T5 tube life is double that of conventional T8 or T12 tubes, halving the frequency and cost of re-lamping.
- At their respective rated operating temperatures, on equally good control gear, T5s produce more lumens per watt (i.e. more light for the same electrical power) than T8s.
- Greater light output unless you choose for a lamp wattage reduction.
- T5 tubes are a non-flicker light due to the usage of a high frequency ballast which can reduce worker fatigue. T8 or T12 tubes have a 50hz mains frequency flicker.
- Environmentally friendly with less energy use and less waste

Replacing Incandescent bulbs with Compact Fluorescent Lamps(CFL):

CFLs can provide energy savings of up to 75% when replacing incandescent lamps while providing equivalent lighting levels. Increased lamp life also reduces maintenance costs significantly in many common applications formerly dominated by incandescent bulbs.

In this case we recommend the use of CFLs, as there is no need to change the fitting, which would increase the final price.