Ultimate Utility Brokers Ltd

Energy Audit and Survey Report

XYZ Site

ABC Client

Client LOGO here

Version Control

Author	Reviewer	Date	Version
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1. Executive Summary

An energy survey of XYZ Site was undertaken by Inspired Efficiency Ltd to support the drive to reduce energy consumption across the organisation (ABC Client). This energy audit has been prepared in line with BS EN 16247-1:2012 standards

The XYZ Site is a campus style site which provides full head office functions, training, control room and centralised support serviced for police and police staff. Alongside the training centre there are ten residential blocks. The site is occupied and in use 24 hours per day, 7 days per week. However, many of the office areas have reduced occupancy and are occupied for weekday periods between 8am and 5pm. There is both mains gas and electricity supplied to the site in addition to this there are 3 packaged biomass heating systems installed.

Our key findings and recommendations have been summarised in the table below (sorted by payback) and are described within the body of this report. Inspired Efficiency would be pleased to support the implementation of any or all of these measures.

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	% Energy Reduction	Estimated capital cost (£)	Simple Payback (years)	CO_2 savings (tCO_2e/yr)
Adjust energy star settings on copiers and printers	3,337	£296	0.04%	Nil	Immediate	1.37
Remove water coolers	1,205	£107	0.02%	Nil	Immediate	0.50
Install low loss air filters	27,444	£2,438	0.36%	£1,260	0.52	11.31
Fit EcoButtons to workstations to computers	9,898	£879	0.13%	£510	0.58	4.08
Optimise control settings	154,136	£3,121	2.04%	£2,940	0.94	28.36
Remove blinds and install solar reflective film to server room windows	17,520	£1,557	0.23%	£2,100	1.35	7.22
Install Variable Speed Drives (VSD) to fan motor / pumps	135,762	£12,062	1.80%	£21,856	1.81	55.94
Fit flow regulators onto existing taps	44,937	£910	0.59%	£2,363	2.60	8.27
Install SavaWatt devices on fridges and freezers	7,860	£698	0.10%	£2,573	3.68	3.24
Relocate External AC condensing units to S&A plant room to outside	4,047	£360	0.05%	£1,523	4.23	1.67
Install Endotherm advanced heating fluid into heating system(s)	254,641	£5,156	3.37%	£22,418	4.35	46.85
Install PIR motion sensors on selected lighting circuits / Adjust settings on existing PIRs	48,528	£4,312	0.64%	£19,359	4.49	20.00
Change existing lighting for low energy lamps/fittings	290,672	£25,826	3.84%	£139,437	5.40	119.77
Replace sectional burners on boilers	509,283	£10,312	6.73%	£63,000	6.11	93.71

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	% Energy Reduction	Estimated capital cost (£)	Simple Payback (years)	CO_2 savings (tCO_2e/yr)
Insulate exposed pipework and fittings in plantrooms	29,958	£607	0.40%	£4,200	6.92	5.51
Install timer switches to hot water heaters	1,120	£100	0.01%	£698	7.02	0.46
Replace boilers in residential blocks	89,873	£1,820	1.19%	£42,000	23.08	16.54

Based on current contracted prices (including CCL) of 8.89 /kWh and 2.02 p/kWh for electricity and mains gas respectively.

2. Introduction

This report is provided to ABC Client as part of a series of energy audits to identify the energy saving opportunities available to the client across their entire estate.

ABC Client consists of 41 properties, four of which are run under a PFI agreement, and the estate is currently undergoing rationalisation. The organisation uses over 30 million kWh per annum at an estimated cost of £1.93m.

An energy survey of the XYZ Site, <Site Address> was completed over two days on the 3rd and 23rd March 2017 by David Legge and Matt Fulford. David is an experienced energy auditor with over 10 years' experience in sustainability and energy matters in the built environment. David is a fully qualified ESOS lead assessor with CIBSE and a CIBSE Low Carbon Consultant, a fully qualified ISO50001 lead auditor, as well as being a Practitioner Member of IEMA. Matt is a highly-experienced energy auditor with over 15 years' experience in sustainability and energy matters in the built environment. He is a chartered surveyor with RICS, a Certified Measurement and Verification Professional (CMVP) for energy savings measures and a member of the Energy Institute. He has audited hundreds of buildings of varying types.

The Force HQ is a purpose-built campus style site located ……. It provides all the centralised support functions for the Force including the main control centre, training school, stores, armoury and all the head office admin functions. The site consists of multiple buildings which were mainly constructed from 1995. The buildings are mainly for a masonry construction between one and three storeys. The site is open 24/7 and has a number of full time operational functions although large areas are only used for office hours. It has ten residential blocks for police trainees which are in constant occupation.

Building Ownership	Owned
Location	Rural
Gross Internal Floor Area	23,186 m^2
Listed Status	Unlisted
Sustainability Certification	DEC Rating – D78 (Admin Building)

The majority of the building is open and operated for the following times during the week

Monday to Friday	7am to 5pm
Saturday	Closed
Sunday	Closed

The above timings apply to major blocks such as Admin, Training, etc. The operations building, force technology and other areas are operational 24 hours a day. These additional hours have not been included in any savings calculations.

3. Energy Procurement Review

Energy bills for gas and electricity have been supplied by ABC Client for the site and have been reviewed.

The current electricity rates are:

Blended Rate	8.326 p/kWh	Below current market rates
Standing Charge	TRIAD charging	In line with current market rates

The current gas rates are:

Single / Blended Rate	1.8298 p/kWh	Below current market rates
Standing Charge	£51.12/day	In line with current market rates

The above review has highlighted that the current rates being paid are in line or below current market levels and the organisation can be confident it is receiving good rates and should continue with their current procurement practices.

A review has also been carried out of the taxation and other levies which are being applied to the bills. These are:

VAT	20%	The correct VAT rate is being applied.
CCL	100% charged	The correct CCL rate is being applied.

The above review confirmed that the correct taxation and levy rates are being charged.

Note that due to the closing of the Carbon Reduction Commitment (CRC) the CCL rates are increasing with substantial increased planned from 1st April 2019 as follows:

	CCL Rate from 1/4/16	**CCL Rate from 1/4/17**	**CCL Rate from 1/4/18**	**CCL Rate from 1/4/19**
Electricity (p/kWh)	0.559	0.568 (+1.6%)	0.583 (+4.3%)	0.847 (+51.5%)
Gas (p/kWh)	0.195	0.198 (+1.5%)	0.203 (+4.1%)	0.339 (+73.8%)

4. Energy Compliance Check

There are a number of energy related areas where organisations have a statutory duty to comply with various regulations. As part of this audit we have checked the compliance on a number of these areas as follows.

Compliance Area	When does it apply?	Does is apply to you?	Do you comply?	Potential enforcement penalties
Energy Saving Opportunities Scheme (ESOS)	To organisations with over 250 employees (PT or FT) or with over certain turnover and asset holding.	No	Not Applicable	A fine of up to £5,000 per day and £500 per working day until breach is remedied (to a max of £40,000)
Display Energy Certification	To buildings which are over 250m^2 and are occupied by a public authority and can be visited by the public.	Yes	In part (Some DECs displayed are out of date and not at A3 size)	£500 fine for failing to display a DEC and £1,000 for failing to have a DEC/Advisory Report.
Air Conditioning Inspection (TM44)	To buildings where the total rated output of the air conditioning systems is over 12kW	Yes	No	Penalty for not having the required certificate is fixed at £300.
Heat Network Regulations	Buildings which have centralised heating, hot water and/or chilled water system serving more than one final customer	No	Not Applicable (assuming there is not charge for residential accommodation)	A fine of up to £5,000 or criminal prosecution
Energy Performance Certificate (EPC) / Minimum Energy Efficiency Standards	An EPC is required on all new buildings and buildings when they are let or sold. From 1st April 2018 commercial property with an F or G rating cannot be let.	No	Not Applicable	The maximum fine is 20% of the rateable value with minimum £10,000 and maximum of £150,000

From the review and a check on the Non-Domestic Energy Performance Register, it has been found that ABC Client is currently non-compliant with Air Conditioning Inspections (TM44) and not fully compliant the Display Energy Certificate requirements. While an in date DEC for the Admin building is available there is an out of date version being display and it is only at A4 size. From the review on site we would also suggest that the S&A and Training buildings may also fall into the 'frequently visited' category and it would be prudent to have a DEC for those areas. The Stores may also require one due

to the Bumblebee Auctions usage. It should take urgent action to remedy this in order to avoid the potential penalties outlined. E3 Sustainability is able to provide compliance services to help you meet all your energy related statutory requirements.

Further information on these requirements is available on the following links.

Air Conditioning Inspections

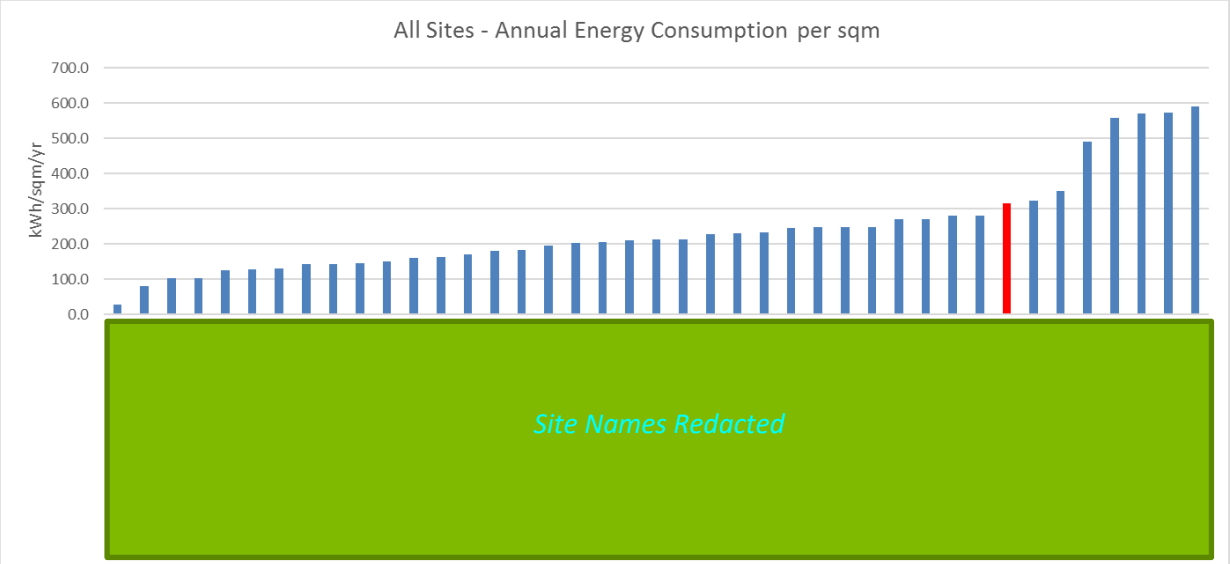
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/51121/A_guide_to_air_conditioning_inspections_for_buildings.pdf

DEC's

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/452481/DEC_Guidance__rev_July_2015_.pdf

5. Energy Usage Details

XYZ Site uses 4,567,081 kWh/year of electricity, costing the organisation in the region of £405,785 per year, and 2,702,214 kWh/year of gas, costing £54,714 per year. The site also uses biomass and used 293,568 kWh/year of biomass pellet fuel. This site is the eighth most energy intensive site of the estate, using 314 kWh/sqm/yr, whilst also consuming 23.92% of total annual energy across the ASC estate, by far the largest total energy consuming site.



The electricity data has been taken from the half hourly electricity and gas data which has been provided by the Constabulary for the period 1/2/16 to 31/1/17. XYZ Site has one main connected electricity meter MPAN 12345678901234567. There is one gas meter serving the site, MPRN 123456789. The biomass consumption has been taken from the annual costs and invoice values to calculate tonnage and this has then been converted to kWh.

Utility	Meter Reference	Type	Pulsed output	Location
Electricity	12345678901234567	HV 1,100 KVA	Yes	Not located
Gas	123456789	n/a	Yes	Not located

All the meters are AMR connected and as such energy profile for the entire energy usage is possible. Half hour meter data has been provided for both the gas and electricity meter for the purpose of this report and this has been used to verify the annual consumption data.

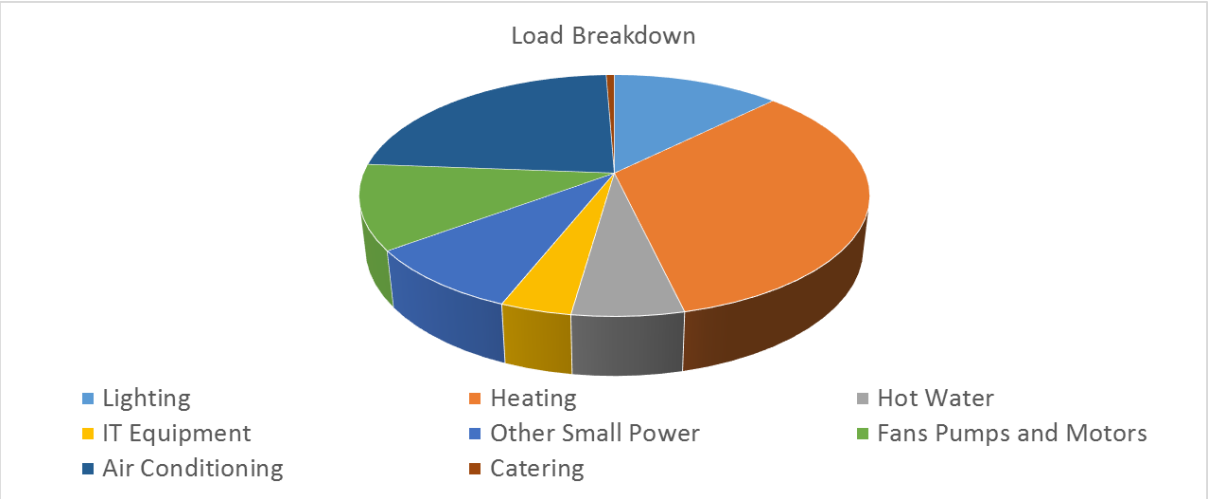
5.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	Predominantly T8 tube, PLL and 2D fluorescent lighting with some areas have been replaced for T5 and LED lighting with PIRs more recently.	13%
Heating	Mainly gas fired boilers located to each major area with biomass serving 3 sizeable blocks with associated thermal stores.	34%
Hot Water	Mainly centralised gas fired calorifier either direct or indirect. Some electrical point of use water heaters.	6%
IT Equipment	A large amount of workstations, printers and copiers in all buildings.	4%
Other Small Power	Regional server room for control centre. Staff kitchenettes AV equipment, battery chargers and the like.	9%
Fans, Pumps and Motors	Ventilation and air handling units to major buildings. Large heating and hot water circulation pumps.	11%
Air Conditioning	Cooling provided by two large chillers and numerous packaged air conditioning systems around the site.	23%
Catering	Full catering kitchen serving a busy staff restaurant facility catering predominantly for lunchtime only.	1%

5.2 Significant Energy Loads

Based on the loads that were observed on site, it is estimated that the load breakdown for XYZ Site described above can be considered as:

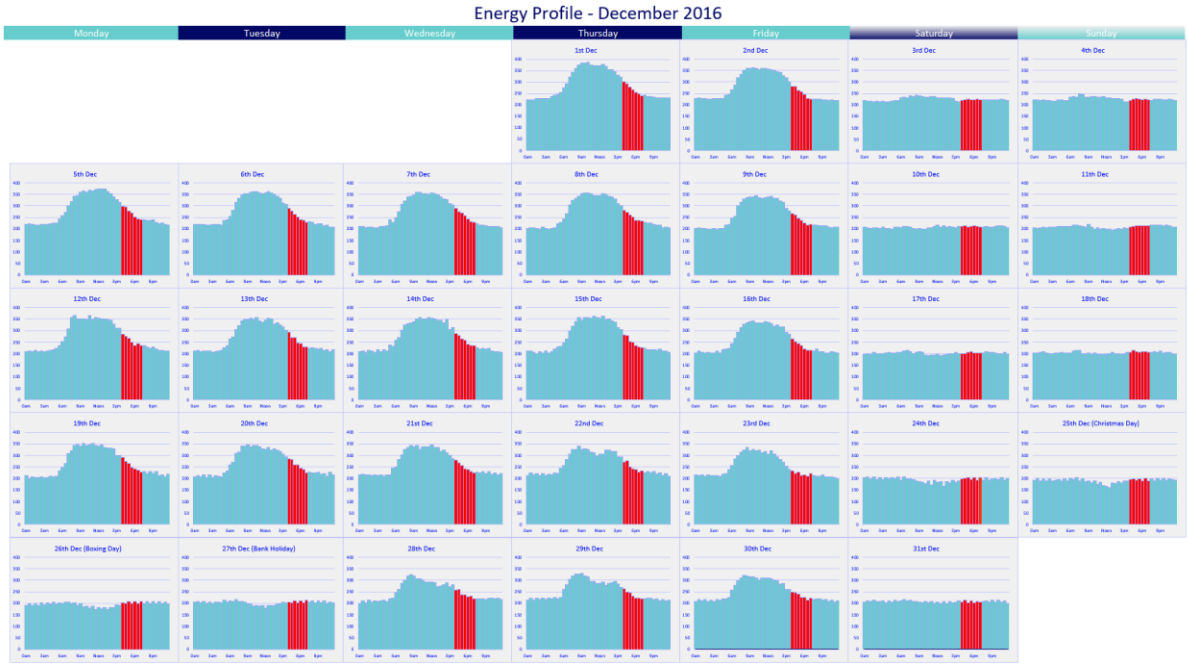


As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The significant electrical loads include air conditioning and lighting.

5.3 Energy Usage Profiles

The automatic meter reading devices on the site allow for detailed energy profiling.

The electricity usage has been reviewed for the period of December 2016. This shows a relatively uniform electrical consumption with a base load of around 200kW per hour at evenings and weekends alike as well as bank holidays. The daytime increase in usage tends to start around 6am and drop back to baseload levels by 7pm and peaks around 400kW per half hour. This profile would tend to suggest that savings would be best focused on the baseload and reducing those electrical items which are 'always on' or reducing the amount of equipment that is left running constantly as much of the site does not operate 24/7.

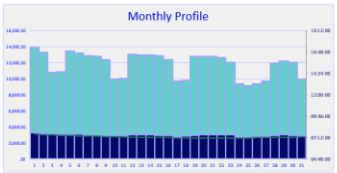


Site:	Force HQ Electricity
Meter:	Main Incomer
Period:	December 2016

Baseload Week	418.9 kWh
Baseload Weekend	401.7 kWh

Max Demand	815 kVA
MD + 20%	978 kVA

This Year		
Total kWh	364,082	kWh
Total Night	92,006	kWh
Total Day	272,076	kWh
% Night Consumption	25%	
Total Peak	44,106	kWh
% Peak Period	12%	



Note: The red bars on the daily profiles show consumption in the peak period, reducing consumption in this period has a greater impact on costs and carbon reduction. The line on the daily graphs represent last years consumption levels.

The gas usage has also been reviewed for the period of December 2016. The profile shows gas usage occurring at all times of the day and night and given that there is also biomass usage to some of the plant rooms the usage profile does not follow any typical profile.

Site:	Force HQ Gas
Meter:	Main Incomer
Period:	December 2016
Baseload Week	220.3 kWh
Baseload Weekend	181.2 kWh

	This Year	
Total kWh	289,610	kWh
Total Night	59,522	kWh
Total Day	230,087	kWh
% Night Consumption	21%	

Note: The line on the monthly chart illustrates degree days and is a measure of how cold each day is.

There is a peak around 8am in the morning, which is to be expected, as the main daytime systems start to run. There is then a relatively consistent load through the rest of the day. There is some correlation to the weather (outside air temperature) but it is not well aligned. This would seem to suggest that there are systems remaining on constantly regardless of occupation or weather and further sub metering of the main blocks would be required to analyse the usage further.

One theory to be tested is that the biomass unit serving the Administration building is poorly configured and as the heating is left on for the security desk this creates (excessive) gas consumption overnight. Using local electric or far infrared heaters to heat the reception/security desk overnight and reverting to gas heating for the buildings heating source may be useful solutions but would be subject to further investigations.

5.4 Energy Benchmarking

The annual energy usage has been examined against the industry benchmark for Emergency Services from CIBSE TM46:2008. It should be noted that these benchmarks make use of data from 2004 and

that the parameters the benchmarks are based upon, such as occupancy hours, could provide wide ranging variations.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
XYZ Site (elec)	23,186	4,567,081	196.98	70.00	181%
XYZ Site (thermal)	23,186	2,995,782[1]	129.21	390.00	-66.87%
TOTAL	23,186	7,562,863	326.18	460.00	-29%

The benchmark is based on:

Usage times:	Normally continuous
Building features:	Provision of a variety of services that would be separate categories in other parts of the non-domestic stock (e.g. accommodation, offices and vehicle garaging)
Services included:	Heating, lighting, cooling, food services, office and training equipment

The XYZ Site has an average energy use of 326.18 kWh/m^2/yr.

The usage against the benchmark is very mixed, with electricity well over what is expected against the benchmark (CIBSE TM46). It uses 181% over what it should, but the gas and biomass usage performs much better, 67% under the benchmark. As a combined energy benchmark, it consumes 29% more than would be expected

The gas and biomass consumption levels appear to be very efficient but it is the electrical consumption which is driving the high cost and energy inefficiencies at the site. As the profiles show, the control does not appear to be setting back many of the systems in periods of low use and this report recommends a number of other measures which can be implemented to achieve energy consumption and associated cost savings.

[1] kWh includes gas and biomass consumption

6. Costing and Paybacks of Saving Recommendations

The costs, savings and simple paybacks for each recommendation have been detailed within the executive summary (section 1) of this report.

Please note that all capital cost figures provided are estimates and have been provided based on previous prices for similar projects, market testing or budgets from suppliers direct. They do not include for any main contractor overheads if bundled together in such a way, project management internally or externally, or VAT and the like.

All operational energy savings are estimated using the current energy consumption data over a 12-month period as detailed in section 5.4. Any changes outside of the scope of this report may impact the estimated savings.

Savings cannot be assumed to be cumulative.

7. Saving Recommendations (Electrical)

7.1 Lighting (fittings)

The lighting makes up a significant proportion of the electrical load across the site, and most areas are lit by a mixture of relatively efficient T5 fluorescent tubes, 2D fittings and some LED fittings as well as less efficient T8 fluorescent tube and PLL fittings.

It is recommended that the fittings scheduled in Appendix 1 are all changed for LED. This would be an especially valuable action for the areas which are occupied 24/7, even those that have been relatively recently re-fitted with the twin PLL light units.

If all the lights were changed the total capital cost (supplied and fitted) would be £139,437. The annual cost saving would be £25,826 resulting in a payback of 5.40.

7.2 Lighting (control for internal lights)

There are many lights around the site which currently remain on all the time that the building is open. Some of these areas are only used occasionally and for a short amount of time and as such the light does not need to remain on constantly. There are also spaces which benefit from a good amount of natural daylight coming in through the windows where artificial lighting is not required for much of the year during the day.

It is recommended that a photocell motion sensor is installed on specific lighting circuits so that the lights come on only when movement is detected in the space and turn off approximately two to five minutes after the last movement has been detected (note that LED lights are much more suited to being switched off after only a short duration than some fluorescent lights). These movement sensors (commonly called PIRs) also have light sensors integrated into them as well so they can additionally be used to make sure that the light does not come on if there is already sufficient daylight in the space.

Your existing electrician or any NICEIC registered electrical contractor can install PIR sensors onto existing lighting circuits. This can be carried out without significant disruption to the use of the space.

Additionally, many of the lighting circuits within the building already have motion sensors installed on them. However, it was noted during the audit that these sensors are not currently set up to work to their full potential.

It is recommended that the existing lighting sensors installed within the building are reviewed and optimised so that the time lag before they turn off the lights, and the light level at which they allow the artificial light to be turned on is adjusted so that it is suitable for the space. Depending on the type of light fitting installed it is normally recommended that areas such as store rooms and cleaners' cupboards switch off after just 1 minute, corridors and stair lobbies after 2 minutes and WCs after 5 minutes. Generally lighting levels should be around 300lux but it is highly dependent on the use of the space.

The careful optimisation of the existing lighting controls can be undertaken by Inspired Efficiency (contact matt@inspiredefficiency.co.uk, 07971 787363) without any disruption to the use of the building.

7.3 Refrigeration Controls

Across the site there are various domestic refrigeration units such as fridges within the staff kitchenettes for storage of milk and staff food and large commercial kitchen fridges and freezers within the restaurant kitchen. These units run 24/7 and contribute to the baseload electrical consumption of the building.

To reduce the electrical consumption of these appliances it is recommended that they are all fitted with a SavaWatt unit. These units work by automatically detecting the load of the compressor and turning down the power when it is not in full load. This reduces the energy consumption of the refrigeration unit by around 18% while maintaining the cooling of the appliance. It does this by reducing the voltage delivered to the unit when it is idling but allowing the full energy to the unit when it is required.

Supply and installation for commercial units and further details can only be undertaken by SavaWatt directly http://savawatt.com/. The installation does not cause any significant disruption to operations and can be undertaken during normal operating times.

7.4 Power Saving Settings on Appliances

Within the building there are printers and photocopiers all of which have power saving features (typically indicated by an 'Energy Star' label) available. These power saving features automatically put the unit into a sleep mode when it is not being used.

During the audit, it was noted that the maximum power saving features had not been fully enabled on all the units. It is therefore recommended that all printers and photocopiers in the building are checked and the maximum power saving settings are enabled.

This can usually be carried out by the person who looks after your IT, or anyone with a good level of IT knowledge.

7.5 Computer Workstation

The PCs and computer work stations are used by the staff within the building but it was noted during the audit that some of these were being left on when the staff member was not actually at their desk and using the computer.

All computers can be shut down or put into a hibernate mode but this is rarely done by users during the day and tends to be limited to an end of day shut down only. This tends to be due to the multi-function process that is required to do this. It is therefore recommended that all computer workstations are fitted with an EcoButton (https://www.ecobutton.com/). These simple devices are a one press button that sits on the desk and puts the computer into a hibernate mode when pressed. As it is not fully shut down any documents that are currently being worked on and other programmes will remain running. On returning to the workstation the computer will need to be 'woken' up by pressing a key and then normally the password entered. This not only saves power from the machine running but also increased data protection and security as computers are not left open and unattended.

These eco-buttons can be purchased and self-fitted by using the above link.

7.6 Water Coolers

During the audit, it was noted that the building has water coolers within the kitchen areas. These have typically been installed to provide filtered / chilled water to the staff. These water coolers consume energy due to their refrigeration element and tend to be left on 24/7.

The water quality within the cold tap is extremely high and often UK tap water is of superior quality to bottled water which has been subject to varying temperatures and light as well as been contaminated by the plastic bottle itself.

Given the proximity of high quality drinking water in the cold tap it is recommended that the water coolers are removed. This will save energy as well as maintenance/leasing costs of the units.

7.7 Variable Speed Drives

The existing heating and AHU motors and pumps within the building are, in the majority, fixed speed units meaning that they are either running at full power or they are off. In the training building these are VSD pumps running as a fixed 50Hz spend. In varying conditions the pumps and fan motors will only need to operate at part power and can consume less energy in doing so.

It is recommended that the pumps and fan motors have variable speed drive units add to them or where they already have VSD installed then it is fully enable to that the pump/motor can automatically vary the power they use depending on the conditions at that particular moment in time, for example, how much heat is required into the heating system or how much air is required into the building based on factors such as CO_2 levels.

Given the age of the Air Handling Units (AHUs) rather than adding a variable speed drive to the existing fan motors it may be more prudent to consider the replacement of the entire fan deck for a new EC/plug fan. While this would involve greater capital expenditure than the costs highlighted in this report it would give a more robust solution which would provide longer term maintenance savings in addition to the energy savings.

The installation of variable speed units will require the removal of the existing fan motor / pump and the installation of a new unit with integration back into the controls system. As such this should be carried out by a competent mechanical engineer.

7.8 Low Loss Air Filters

It is important to note that the use of low loss filters will only provide energy savings if VSDs are installed to fan motors.

Filters in the supply air duct are necessary in order to remove any contaminants from the air being drawn into the building but they increase the resistance of the air flow and therefore increase the power used by VSD fan motors. The current filters are standard pleat and bag filters and are changed on a planned maintenance programme every 6 to 12 months.

It is recommended that the specification of all bag air filters is changed so that they are low loss filters which maintain or enhance the level of filtration but reduce the pressure loss through across the filter. Such low loss filters are REVO filters available from Vokes air. http://www.vokesair.com/products/bag-filters-0/revo-ii

The change in specification should be advised and requested from whoever maintains the air handling units and changes the filters. These filters often last longer and therefore the replacement frequencies should also be reviewed alongside the change in specification.

7.9 Timeclocks on point-of-use hot water heaters

There are various electric hot water heaters and water boilers (for tea making and the like) located around the site. These only need to heat the water to the required temperature when the building is in occupation but at the moment these heaters are directly wired in without any form of time control and therefore maintain their set temperature 24/7.

It is recommended that the heaters are fitted with a 24 hour/7-day timeclock to replace the fused spur switch. An example of such a unit would be a TimeGuard FST77. They should be set up with times to match the times that the building is occupied and this will prevent the standing losses from the unit wasting energy during periods when the building is not occupied.

Such units can be purchased at any electrical wholesaler and fitted by your existing electrician or any NICEIC registered electrical contractor.

7.10 Server Room Windows

Within the main central computer server room located in the operations building, there are racks of servers cooled by CRAC units. These units were found to be generally efficient and effective. However, the server room was clearly not originally designed to be an IT server room, and as such has a large glazed area to one external wall. The windows are fitted with standard internal window blinds, which were found to be in poor condition. The windows are allowing significant heat build-up from the sun and warming the room by increasing the solar gain.

It is recommended that the blinds are removed and the windows are covered in a highly reflective solar window film which will reflect the light and associated heat back out.

The installation of solar window film can be carried out by a number of specialist companies such as St Gobain or Solarshield http://solarshield.co.uk/window-film/solar-control-and-energy-reduction

7.11 Relocate External Air Condition Units to Outside

Within the Sports and Amenities (S&A) plant room there are number of split air conditioning units which are cooling sub server rooms and the UPS room. The external heat rejection elements of these systems have been located internally within the plant room which is itself a warm space and as these units are trying to reject heat they are having to work harder and consume more energy.

In one case the heat rejection unit is actually pointing towards the room that is being cooled and therefore is pushing heat back into the room, contributing to higher space temperatures and continual recirculation of air.

It is recommended that the condenser units (designed for external use) are relocated to the outside environment so that they are in cooler external air conditions and can reject waste heat to atmosphere. This would appear to be relatively straightforward as they just need to be moved to the external face of the wall on which they are already positioned. This work should be able to be carried out by any air conditioning engineer. ACRIB can help with locating a qualified engineer http://www.acrib.org.uk/help-and-advice/find-a-contractor

7.12 Chiller Replacement

There are two large chiller units located near the force service centre. It has been reported that these are at end of life and due for replacement in the near future. Such a replacement present opportunities for energy savings. Given the high cooling load on site it is recommended that high efficiency chillers are installed. In particular a free cooling system, which utilises the cooler ambient external air to cool internal spaces and which can adapt to the changing loads would be a worthwhile consideration.

http://www.airedale.com/web/Products/Free-Cooling.htm

7.13 Back-Up Generator Replacement

It has been advised that there are currently plans to replace the existing back-up fuel oil generators on site.

A holistic review of this would be recommended with the potential for a generator installation to be designed and installed which not only provides back-up generation in the event of a power failure but also provides for electrical generation within the peak (red) period. Electricity generators using mains gas or bio-diesel are all readily available and provide greater efficiencies and/or lower carbon emissions. Using a generator in the peak 'red period' hours can have major cost savings and attract additional income from the Electrical Demand Reduction (EDR) scheme (which focuses on the period between 4pm and 8pm on weekdays) and the like.

We understand that the generator replacement project is already in planning and therefore the widening of its scope of consider all viable opportunities should be considered promptly.

8. Saving Recommendations (Heating and Hot Water)

8.1 Endotherm Advanced Heating Fluid

In order to improve the efficiency of the heating system further it is recommended that an advanced heating fluid (http://www.endotherm.co.uk/) is added to the heating system.

This fluid in in addition to, and complements any existing inhibitors in the heating system and is added in a similar way. The fluid works to improve the ability of the boiler to transfer heat into the heating system and for the radiators and other heating elements to give out their heat into the rooms. It does this by reducing the surface tension of the water and increasing its capacity to transfer and hold heat. Case studies have demonstrated that the addition of this fluid into heating systems reduces heating energy consumptions by over 10% as well as helping the building heat up quicker.

Endotherm can be supplied and self-installed or supplied and installed by Inspired Efficiency (contact matt@inspiredefficiency.co.uk, 07971 787363)

8.2 Insulation of Pipework and Fittings

The pipework within the plant room has the majority of its straight lengths insulated but some of the more complex shaped pipework fittings, such as valves, have been left uninsulated in the residential blocks and the purchasing and stores plant rooms. These exposed areas of pipework contribute to wasted heat loss from the system and make the plant room unnecessarily warm. The exposed hot surfaces also represent a health and safety risk of burns for those working in the area.

It is recommended that these areas of expose pipework and fittings are insulated with bespoke made flexible insulation jackets. These wrap around the various elements but can be removed and then replaced for any servicing activities.

A free survey and quotation for the supply and installation of insulation of pipework fittings can be arranged through Sustain Ltd (contact Mark Griffin, 0117 403 2689, mark.griffin@sustain.co.uk) or ESOS Energy Ltd (contact Adrian Newton 0117 930 9689, adrian@esos-energy.com).

8.3 Controls

The buildings main heating, hot water and ventilation plant is controlled by a centralised building management system (BMS). This is controlled by a head end computer located in the facilities office.

A high-level review of the settings within this control system highlighted a number of areas where the way in which it operates the building can be optimised to both reduce energy consumption and improve comfort.

For example:

- The Ops building hot water set point is 65°C whereas 60°C would be sufficient for legionella protection
- The summer hold off temperature is 18°C and it was noted that some areas were overheating and windows were open when the heating was on. It is recommended that the summer hold off temperature is reduced to 16°C.
- In Tech Services, all 16 ground floor fan coil units (FCUs) are being left on 24/7 although there is only a skeleton staff operating overnight. The location of these staff should be defined and only the FCU's in the immediate vicinity of these overnight staff should be enabled, or local individual heating units used instead.
- The force as a cooling policy of only cooling down to 24°C for comfort however there are numerous area where cooling was set to lower than this (Tech Services ground floor at 22°C and first floor at 18°C)
- There are occurrences of both the heating and cooling running together with the potential of the systems 'fighting' one another
- The BMS shows that there are humidifiers running on the Force Service Centre which may not be required (or they may have been isolated locally in which case the BMS requires updating)

It is likely that a more detailed forensic review of the control system settings and strategy will yield further opportunities for improvement.

It was advised that there are separate companies for the maintenance of the software (ControlCo) and the Hardware (Matrix) and it is evident from the headline review that the coordination between these two companies is not perfect. There may be advantages to be gained by having the maintenance of the BMS run by a single company.

In addition, the control of the Administration building and its dedicated biomass boiler raised a number of points of concern, most notably:

- The biomass boiler appears to be back feeding the gas boilers due to the lack of actuated valves from the boilers into the common header.

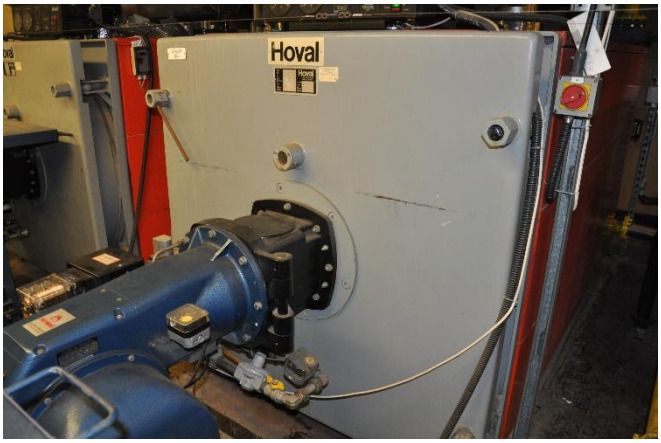
- The Administration building controls set up is running 24/7 which appears to be for the ground floor security desk only and this is having consequences on the operational strategy of the biomass.

A more detailed review of this operation and strategy is recommended and further commentary on this has been provide in the section below.

It is therefore recommended that a detailed control optimisation process is conducted, this can be run alongside and with the full support of any existing controls maintenance company that may be used, or as a separate independent exercise. This can be arranged and undertaken by Inspired Efficiency (contact matt@inspiredefficiency.co.uk, 07971 787363)

8.4 Burner Replacement

The boilers in a number of the plant rooms are modern, efficient condensing boilers and do not require any action.



The boilers within both the S&A plant room and the Operations plant room are of a type which has a sectional burner unit. This sits on the front of the boiler and can be replaced independently of the boiler itself. The boiler casing and internal parts remain serviceable but the burner element where the combustion takes place is now inefficient and poorly controlled.

Due to the type of the existing burner, the combustion settings are relatively static and are tuned only during the boiler servicing.

It is recommended that a new sectional burner with fully modulating controls is installed to replace the existing burner, but retaining the boiler itself. Such upgrades can be carried out with a Limpsfield Burner with Autoflame controls and Autoflame will undertake the installation and can be contacted on 01959 578821 or at http://www.autoflame.com/.

8.5 Boiler Replacement to Residential Blocks

The ten residential blocks each utilise a Strebel Geneva c51 60kW standard gas boiler installed to provide heating and hot water. These are currently running at around 85% efficiency. The boiler units also appear to be approaching the end of their serviceable life and it is recommended that they are considered for replacement to a modern gas condensing boiler which will have higher overall efficiencies and provide long term maintenance savings. The installation of replacement gas condensing boilers can be carried out by your normal mechanical services contractor.

8.6 Admin Building - Biomass Boiler

There are three biomass boiler installations around the site. The installations within the Purchasing and Stores block and within the Operations Training block have raised no concerns and appear to be operating efficiently and effectively.

The biomass installation to the Administration building has raised a number of points of concern regarding operational set up.

The Administration building is largely an 'office hours only' operation with the notable exception of the security/reception desk at the ground floor entrance. At present the heating is scheduled to run 24/7, running outside of core office hours to serve this small area exclusively. It would therefore be recommended that either the out of hours security operation is relocated to run from an existing 24/7 area or that local electric heating (such as a far infrared heater, https://www.herschel-infrared.com/product/pulsar/) is installed to provide local heat to the security desk out of hours and the heating in the rest of the block can then be disabled.

Further to changing the heating strategy and time schedules, the original design strategy for the biomass should be investigated in detail with regard to its sizing and operation as it is currently maintaining heat within both the building and the buffer tank constantly which does not appear to be needed if the security heating provision can be provided from a more efficient means. One possibility is that were the Administration building heating times to be reduced to office hours only then the biomass installation may become unsuitable for this operation and more efficient heating would be possible from the existing gas boiler installation.

Finally, the use of biomass where mains gas is readily available makes little economic sense unless biomass fuel is being provided from on-site supplies or at significantly less than current market rates. Mains gas is considerably cheaper than wood pellets (not only at unit rate but also due to increased maintenance costs associated with biomass) and switching all biomass plant to mains gas would save £3,479 per year at this site.

It is recommended that a further project into undertaking a review of the original design and reviewing this against specific energy logging and analysis of the actual heating within this building is considered.

9. Saving Recommendations (Water)

9.1 Tap Flow Regulators

The taps to the wash hand basins within the building have been checked as part of the audit and the average flow rate within these has been measured to be 10l/min for hot taps and 20l/min for cold taps. The recommended flow rate for hand washing is 4.8l/min and therefore the taps are providing around two to four times the amount of water that is necessary. The flow rate in the residential blocks was found to be highly excessive.

The over provision of water for hand washing is not only a source of excessive water use, but in the case of hot water, it is also a source of wasted energy in the heating that has to go into providing the hot water.

The flow rate of the taps can be easily regulated by fitting flow regulators within the taps. It is recommended that flow regulators such as those manufactured by neoperl (http://www.neoperl.net/en/) are fitted into all the viable hand wash basin taps to save on both water and heating of the hot water.

Flow regulators can be supplied and installed by Inspired Efficiency (contact matt@inspiredefficiency.co.uk, 07971 787363)

10. Renewable Energy Potential

The potential for the generation of renewable energy on site has been reviewed and the viability noted.

Renewable Energy Type	Viable
Solar PV	Yes (some already installed and further installation viable)
Battery Storage	Yes (possibilities to link into UPS systems)
Wind	Yes (extensive grounds)
Micro-Hydro	No
Solar Thermal	Yes
Ground Source Heat Pump	No
Air Source Heat Pump	No
Biomass	Already installed

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Training Entrance	11	5ft Single LED	£112.11	£1,193.16	10.64
Corridor 06	13	5ft Single LED	£173.58	£1,410.10	8.12
Reception	3	5ft Single LED	£30.58	£325.41	10.64
Room 03	4	5ft Single LED	£40.77	£433.88	10.64
Room 03	2	4ft Single LED	£20.65	£166.93	8.08
Room 05	1	5ft Single LED	£15.94	£108.47	6.80
Kitchen	1	4ft Single LED	£5.32	£83.46	15.68
Room 8	2	4ft Single LED	£10.64	£166.93	15.68
Class 9	6	5ft Single LED	£80.11	£650.82	8.12
Class 10	6	5ft Single LED	£80.11	£650.82	8.12
Store	1	5ft Single LED	£10.19	£108.47	10.64
Lecture	*18*	*NO CHANGE*	*£-*	*£-*	-
Class 1-5 Corridor	5	5ft Single LED	£50.96	£542.35	10.64
Class 5	4	5ft Single LED	£53.41	£433.88	8.12
Class 4	2	5ft Single LED	£26.70	£216.94	8.12
Class 4	4	4ft Single LED	£41.30	£333.86	8.08
Class 3	2	5ft Single LED	£26.70	£216.94	8.12
Class 3	4	4ft Single LED	£41.30	£333.86	8.08
Class 2	4	5ft Single LED	£53.41	£433.88	8.12
Class 1	8	5ft Single LED	£106.82	£867.76	8.12
Class 6-8 Corridor	4	4ft Double LED	£4.66	£400.54	86.00
Class 8	2	5ft Single LED	£26.70	£216.94	8.12
Class 7	4	4ft Single LED	£41.30	£333.86	8.08
Class 6a	2	5ft Single LED	£26.70	£216.94	8.12
Class 6	6	5ft Single LED	£95.64	£650.82	6.80
Corridor 0/15	2	CorePro 6.5W	£10.69	£32.69	3.06
Multimedia	3	5ft Single LED	£30.58	£325.41	10.64
Interview room	8	600 x 600 30W Panel	£62.54	£336.17	5.38
Learning Tech	4	5ft Double LED	£20.44	£595.02	29.11
Learning Tech	2	4ft Single LED	£20.65	£166.93	8.08
Rear WCs	4	2D LED	£15.63	£278.29	17.80
1st Floor Mezz Uplights	15	CorePro 6.5W	£80.18	£245.18	3.06
1st Floor Mezz	19	5ft Single LED	£253.70	£2,060.92	8.12
Ladies and Gents WC	8	2D LED	£31.27	£556.59	17.80
Ladies and Gents WC	14	5ft Single LED	£142.69	£1,518.57	10.64
Library	8	5ft Single LED	£35.19	£867.76	24.66
Room 1/1	55	5ft Single LED	£734.38	£5,965.82	8.12
Room 1/10	2	5ft Single LED	£26.70	£216.94	8.12
Room 1/11	2	5ft Single LED	£26.70	£216.94	8.12
Room 1/12	3	5ft Single LED	£40.06	£325.41	8.12
Room 1/10	3	600 x 600 40W Panel	£15.73	£434.98	27.65
Room 1/2 and 1/1	4	5ft Single LED	£53.41	£433.88	8.12

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Driver Training	9	5ft Single LED	£120.17	£976.23	8.12
Room 1/6	3	5ft Single LED	£40.06	£325.41	8.12
Room 1/7	4	5ft Single LED	£53.41	£433.88	8.12
Room 1/8	3	5ft Single LED	£40.06	£325.41	8.12
Classroom, Syndicate	8	5ft Single LED	£45.09	£867.76	19.24
End Room	1	5ft Single LED	£13.35	£108.47	8.12
Room 1/25 and Computer Training 19 and 1/24	16	5ft Single LED	£213.64	£1,735.51	8.12
Learning Support	4	5ft Single LED	£53.41	£433.88	8.12
Classrooms 1/20 to 24	18	5ft Single LED	£240.34	£1,952.45	8.12
Sports corridor	9	2D LED	£44.49	£704.61	15.84
Multi Gym	15	600 x 600 30W Panel	£117.26	£630.33	5.38
Sports Hall	9	5ft Single LED	£91.73	£976.23	10.64
Corridor	3	5ft Single LED	£76.40	£325.41	4.26
PT Dept Office	3	600 x 600 30W Panel	£12.39	£126.07	10.17
Gym	*11*	*NO CHANGE*	*£-*	*£-*	-
Changing Rooms	18	600 x 600 40W Panel	£355.11	£1,950.02	5.49
Changing Rooms	20	2D LED	£78.17	£1,391.47	17.80
Disabled WC	1	2D LED	£3.91	£69.57	17.80
Café	41	CorePro 6.5W	£398.37	£2,010.52	5.05
Café	4	2D LED	£15.63	£278.29	17.80
Café Corridor	5	2D LED	£19.54	£400.17	20.48
Café Corridor	*44*	*NO CHANGE*	*£-*	*£-*	-
Redacted	41	CorePro 6.5W	£398.37	£2,010.52	5.05
Redacted	2	2D LED	£7.82	£139.15	17.80
Coffee Shop	*38*	*NO CHANGE*	*£-*	*£-*	-
Kitchen	29	600 x 600 40W Panel	£572.12	£2,610.15	4.56
Kitchen	2	5ft Single LED	£24.67	£216.94	8.79
Kitchen	8	5ft Double LED	£197.37	£1,190.04	6.03
Redacted	13	CorePro 6.5W	£138.98	£424.99	3.06
Redacted	17	CorePro 6.5W	£181.75	£555.75	3.06
Redacted	8	600 x 600 40W Panel	£157.83	£720.04	4.56
Vetting	4	600 x 600 40W Panel	£22.03	£360.02	16.34
Vetting	20	600 x 600 40W Panel	£394.57	£2,020.06	5.12
Vetting	11	CorePro 6.5W	£138.74	£359.60	2.59
Redacted	6	600 x 600 40W Panel	£118.37	£650.01	5.49
Redacted	9	CorePro 6.5W	£7.82	£147.11	18.82
Redacted	6	5ft Double LED	£122.31	£892.53	7.30
Kitchenette	1	CorePro 9W	£9.54	£33.15	3.48

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Force Tech	3	PLL LED	£232.10	£121.55	0.52
Strategic digital services	*36*	*NO CHANGE*	*£-*	*£-*	-
Quiet Room	4	600 x 600 40W Panel	£72.84	£360.02	4.94
Force Technology Corridor	9	CorePro 9W	£79.22	£298.39	3.77
Force Technology Main GF Room	95	600 x 600 40W Panel	£7,615.92	£9,210.35	1.21
Port Oyns	20	600 x 600 40W Panel	£364.21	£1,910.08	5.24
Male WC	15	PLL LED	£476.91	£607.75	1.27
Redacted	4	600 x 600 40W Panel	£72.84	£415.01	5.70
Tech Room	4	600 x 600 40W Panel	£72.84	£415.01	5.70
Staff Room	10	600 x 600 40W Panel	£664.69	£1,065.02	1.60
Admin Block Reception and Corridor	10	CorePro 6.5W	£64.78	£326.91	5.05
Reception Desk	6	CorePro 6.5W	£108.06	£98.07	0.91
Display Cabinets	7	4ft Single LED	£156.91	£584.25	3.72
Admin Block WC's	6	2D LED	£29.66	£417.44	14.07
Male WC	2	5ft Single LED	£24.67	£216.94	8.79
Post Room	8	600 x 600 40W Panel	£157.83	£720.04	4.56
Maintenance team	2	5ft Double LED	£71.32	£370.15	5.19
Corridor	12	2D LED	£199.87	£913.33	4.57
007 Store	2	5ft Double LED	£40.77	£297.51	7.30
Office	*4*	*NO CHANGE*	*£-*	*£-*	-
Corridor 2 Rooms (x 9)	*396*	*NO CHANGE*	*£-*	*£-*	-
Corridor (x 9)	108	2D LED	£533.91	£7,592.36	14.22
Amoury entrance	*2*	*NO CHANGE*	*£-*	*£-*	-
Amoury entrance	7	2D LED	£34.61	£487.01	14.07
Opps training classroom	8	5ft Double LED	£197.37	£1,190.04	6.03
Opps training office	12	5ft Double LED	£296.06	£1,785.06	6.03
Estates	*0*	*NO CHANGE*	*£-*	*£-*	-
Estates	8	600 x 600 40W Panel	£157.83	£720.04	4.56
Estates	*18*	*NO CHANGE*	*£-*	*£-*	-
Estates	4	2D LED	£19.77	£330.59	16.72
Estates	6	5ft Double LED	£122.31	£892.53	7.30
Estates	23	5ft Single LED	£283.73	£2,494.80	8.79
Stores	4	5ft Double LED	£98.69	£595.02	6.03
Stores	*44*	*NO CHANGE*	*£-*	*£-*	-
Stores	*10*	*NO CHANGE*	*£-*	*£-*	-
Stores	*22*	*NO CHANGE*	*£-*	*£-*	-
Stores	*3*	*NO CHANGE*	*£-*	*£-*	-

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Stores	5	600 x 1200 72W Panel	£133.06	£814.68	6.12
Stores	15	2D LED	£74.15	£1,043.60	14.07
Stores	2	CorePro 6.5W	£10.69	£32.69	3.06
Stores	4	600 x 1200 72W Panel	£106.45	£651.74	6.12
Design	8	600 x 1200 72W Panel	£212.90	£1,303.49	6.12
Kitchen	4	CorePro 9W	£38.14	£132.62	3.48
Stores	*54*	*NO CHANGE*	*£-*	*£-*	-
Top Stores	*11*	*NO CHANGE*	*£-*	*£-*	-
Top Stores	*36*	*NO CHANGE*	*£-*	*£-*	-
Armoury	*8*	*NO CHANGE*	*£-*	*£-*	-
Armoury	*6*	*NO CHANGE*	*£-*	*£-*	-
Armoury	2	5ft Single LED	£20.38	£216.94	10.64
Armoury	4	5ft Double LED	£81.54	£595.02	7.30
Opps Building 2nd Floor	20	CorePro 6.5W	£360.21	£326.91	0.91
Opps Building 2nd Floor	113	600 x 600 40W Panel	£1,996.48	£10,170.60	5.09
Opps Building 2nd Floor	*23*	*NO CHANGE*	*£-*	*£-*	-
Stairs	4	2D LED	£52.68	£278.29	5.28
Opps Building 1st Floor	*112*	*NO CHANGE*	*£-*	*£-*	-
Meeting Rooms	20	600 x 600 40W Panel	£394.57	£1,800.11	4.56
Ground Floor	*120*	*NO CHANGE*	*£-*	*£-*	-
Ground Floor	24	600 x 600 40W Panel	£473.48	£2,160.13	4.56
Resi Block - Entrance Lobby	50	4ft Single LED	£266.12	£4,173.24	15.68
Rooms	180	2D LED	£889.85	£12,523.19	14.07
Kitchenette	20	2D LED	£98.87	£1,417.62	14.34
Corridors	90	2D LED	£769.26	£6,287.74	8.17
TV Room	10	2D LED	£49.44	£695.73	14.07
WC/Shower	50	2D LED	£247.18	£3,478.66	14.07