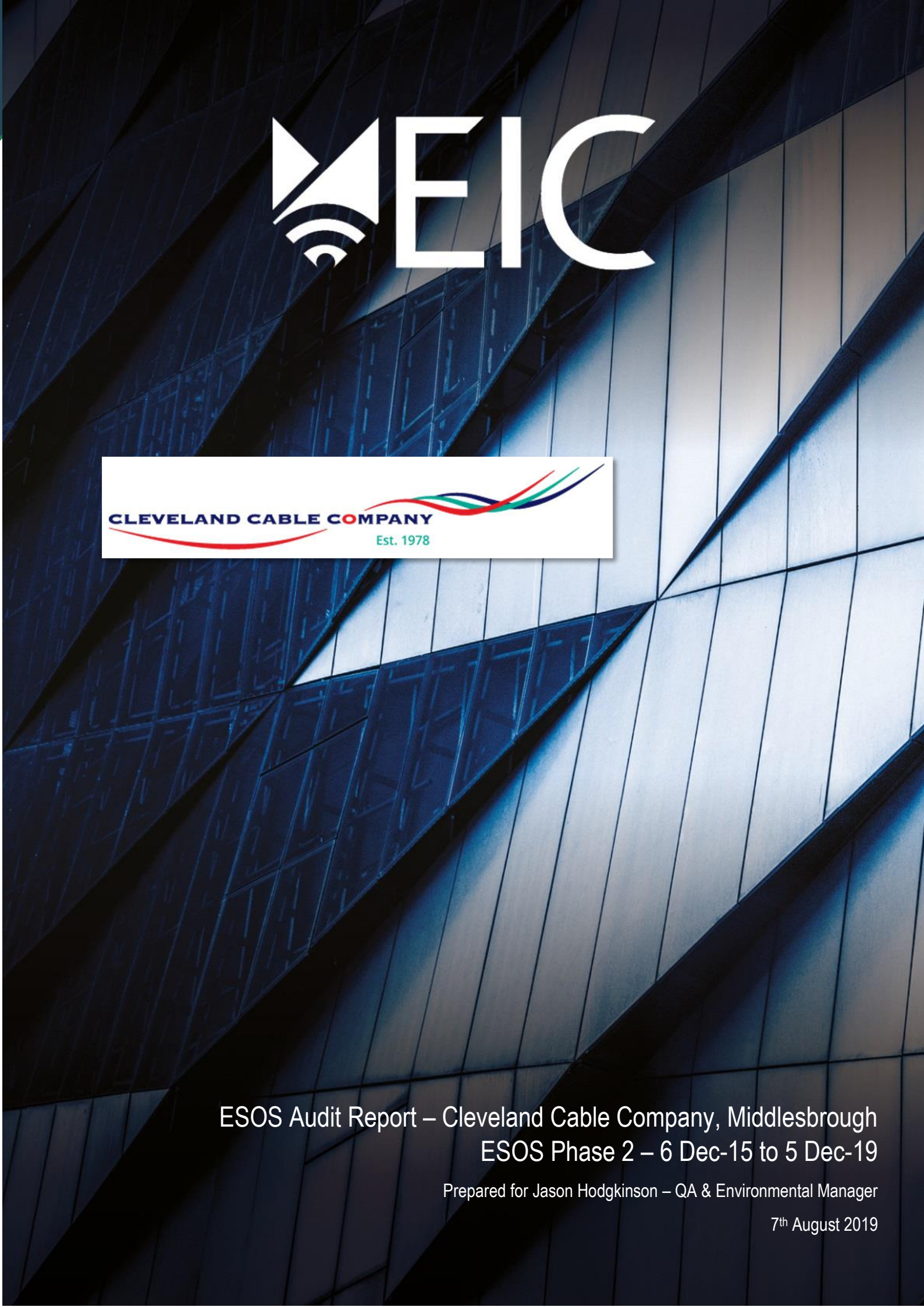

ESOS Audit Report – Cleveland Cable Company, Middlesbrough
ESOS Phase 2 – 6 Dec-15 to 5 Dec-19

Prepared for Jason Hodgkinson – QA & Environmental Manager

7th August 2019

Contents

Status	Name	Date
Initial Draft	Nicholas Anderson	07/08/2019
Technical Review	Paul Buckley	14/08/2019
Lead Assessor Review	Stephanie Monk	05/12/2019

Executive Summary

This Executive Summary provides the key audit findings and we recommend that these are read in conjunction with the full audit report. This report presents the results of an Energy Audit for Cleveland Cable Company carried out by EIC on 7th February 2019. This report can be used as part of your compliance for the Energy Savings Opportunity Scheme (ESOS), a mandatory energy assessment and energy saving identification scheme for large organisations in the UK.

This site energy audit report has been completed in line with the BS:EN16247 standard for energy auditing.

Site discussions were held with Jason Hodgkinson, QA & Environmental Manager, during the survey. The client requested that savings be based upon simple paybacks, with life cycle costs for qualifying equipment (please see Summary Action Plan notes).

Names used by client and locally by site may differ and to prevent any potential confusion, the table below identifies which building/site is discussed within this report.

Site Name & Address	
Site Name Provided by Client	Cleveland Cable Company, Middlesbrough
Site Name (If Different to Above)	
Address Line 1	Riverside Park Road
Address Line 2	Middlesbrough
Post Code	TS2 1QW

Table 1 - Site and or Building Discussed Within this Report

Cleveland Cable Company store and distribute a wide range of electrical cabling from a site in Middlesbrough, which comprises six high-bay warehouses (sheds). The largest of these has adjoining offices and staff amenities, which include the head-office facilities of this international company. The buildings were constructed in the early 1990s and they have a combined internal floor area of approximately 17,000m². 280 staff are employed at the site.

Utility	Energy Consumption		Fiscal Cost		Carbon Emissions	Specific Energy Consumption
	(kWh/Year)	(%)	(£)	(%)	(tCO_2)	(kWh/m²)
Electricity	909,353	44%	£118,971	65%	277.2	53
Natural Gas	173,401	8%	£5,090	3%	31.8	10
Other Fossil Fuels	999,575	48%	£59,975	33%	253.5	59
Total Energy	**2,082,329**	**-**	**£184,036**	**-**	**562.5**	**122**

Table 2 - Site Energy Consumption Data 01/01/2018 to 31/12/2018

The core energy consumption relates to the diesel driven forklift trucks, lighting systems, HVAC systems and miscellaneous electrical equipment, which includes electrically powered forklift trucks and cable winding machines. Although the buildings have not been recently refurbished, the client has installed energy efficient LED lighting in the majority of the offices and some warehouse spaces and is gradually extending the LED lighting to other areas as and when the existing fittings fail.

A summary of the Action Plan is presented in the table on page 4. The aggregated savings from the measures identified represent a 41% reduction in energy consumption and a 56% reduction in cost. This equates to £102,252 of direct cost savings and gives a combined payback of 7.7 years for an investment of £784,678. Reductions in carbon emissions equate to approximately 247.6tCO2 per year.

Risks and Uncertainties

The energy savings and implementation costs for the various recommendations are all estimates based on the limited information available for the assessment. Fluctuating costs of energy should be taken into account when reviewing the recommendations at any future point in time. The implementation of strategic energy management practices will assist greatly in the sustainable strategy for energy efficiency.

There is no sub-metering on site. Therefore, the breakdown of energy loads shown within this report has been carried out using sound engineering practices, experience, information gained during the site survey and historical monitoring data provided by the client. Please see Appendix A for a breakdown of equipment loads, operating hours and utilisation factors used in the audit. Before any individual investment measures are carried out it is recommended that, an assessment of the actual consumption for each recommendation be undertaken and that savings be recalculated with more accurate consumption data for each piece of equipment. The introduction of sub-metering and an aM&T (automatic monitoring and targeting) system would improve the accuracy of this work.

It must also be noted that there may be some minor discrepancies found within some areas of the report in regard to the invoiced electrical and gas consumption data and the actual profiled energy consumption of the installed equipment due to minor changes between the current operating parameters and the original 2018 operating control profiles. Where possible the energy profile of the site is accurately matched to suit the invoiced consumption data supplied by the client.

Whilst there may be a degree of double counting in this action plan, it should assist in identifying other opportunities and quantifying the savings of the other actions identified within this report. In the other actions, the effect of implementing one has been considered in the calculations for others, based on implementing the most advantageous action in the first instance.

Recommendations have been calculated using sound engineering techniques, where sub-meter data is not available, utilising information regarding equipment rating, hours of operation and utilisation. Further details of this information can be found within Appendix A of this report.

Summary Action Plan

The audit has identified the following core recommendations and these have been prioritised according to their payback period, and the objectives of Cleveland Cable Company.

Priority	Action Ref.	Recommendations	Estimated Savings per Annum			Capital Investment (£)	Payback Period (Years)	Payback Method
			Energy (kWh)	Fiscal (£)	Carbon (tCO_2)			
1	EMM-01	Improve energy monitoring and general levels of energy awareness.	21,655	£2,481	6.2	£8,483	3.4	SPP
2	BM-07	Reset current heating profile to suit occupancy times.	25,996	£763	4.8	£100	0.1	SPP
3	AC-07	Consideration should be given to the savings that can be made by linking the space conditioning systems to movement sensors to prevent systems operating when areas are not occupied.	14,190	£1,856	4.3	£1,850	1.0	SPP
4	BM-06	Improve pipework insulation and fit quick release insulation jackets to exposed valves, flanges and pump bodies.	19,425	£570	3.6	£936	1.6	SPP
5	LM-02	Replace the dated light fittings with new fittings/lamp upgrades and include additional lighting controls.	28,454	£3,723	8.7	£6,147	1.7	SPP
6	LM-01	Replace the dated light fittings with new fittings/lamp upgrades.	57,546	£7,529	17.5	£24,979	3.3	SPP
7	BM-01	Replace the dated heating boilers with modern modular condensing boilers.	32,108	£942	5.9	£7,000	7.4	SPP
8	RNM-01	The site has a large expanse of roof area, this should be considered for onsite generation utilising solar photovoltaic systems.	645,023	£84,388	196.6	£735,182	10.0	LCCA
		Total	**844,397**	**£102,252**	**247.6**	**£784,678**	**7.7**	

Table 3 - Site Action Plan

Payback methodology relates to either LCCA (Life Cycle Cost Analysis) or SPP (Simple Payback Period), with projects being >£10,000 considered as viable for a LCCA calculation, unless otherwise specified.

Lighting recommendations have been based upon SPP methodology, due to the varying maintenance, run hours and technologies in-situ.

Where life cycle cost analysis has been carried out, the payback period has been adjusted to a life cycle payback period (LCPP). Full details of LCCA for relevant recommendations, can be found in Appendix C of this report.

1.Introduction

This ESOS compliant energy audit report serves as a means to compliance for Cleveland Cable Company. This survey was carried out by EIC Ltd.

This site energy audit report has been completed in line with the BS:EN 16247 standard for energy auditing.

Objectives for the Visit

The objectives for the audit are:

- To serve as a compliance route to meet the ESOS requirements of Cleveland Cable Company.
- To identify, quantify and prioritise energy efficiency opportunities for future implementation by the client.
- To apply applicable recommendations across the portfolio of similar sites.

Cleveland Cable Company are a forward thinking organisation that have already invested in energy saving measures, in particular with the introduction of LED lighting in parts of the warehouses and offices.

Site Details

Cleveland Cable Company store and distribute a wide range of electrical cabling from a site in Middlesbrough, which comprises six high-bay warehouses (sheds). The largest of these has adjoining offices and staff amenities, which include the head-office facilities of this international company. The buildings were constructed in the early 1990s and they have a combined internal floor area of approximately 17,000m². 280 staff are employed at the site.

The core energy consumption relates to the diesel driven forklift trucks, lighting systems, HVAC systems and miscellaneous electrical equipment, which includes electrically powered forklift trucks and cable winding machines.

The main offices which adjoin shed 1 are heated via 1 Stelrad Ideal Concord CXi gas fired boiler with a maximum heat input of 85kW. This boiler feeds a wet radiator system, is over 30 years old and is now considered to be dated technology. The goods-in area of shed 1 is heated via 1 Baxi Solo gas fired boiler with a maximum heat input of 30kW. This boiler is less than 15 years old and appears to be in good condition. It was noted that the heating pipework fed from these boilers is un-insulated.

The engineering workshop within shed 2 is heated via 1 kerosene fired warm air heater with a heat input of 30kW. The heater appeared in reasonable condition and no reasons for concern were noted.

A number of electric panel heaters were noted in offices and staff amenities throughout the site. However, the main warehouse spaces are un-heated.

Hot water is supplied to the washrooms and toilets in shed 1 by 1 Heatrae Sadia Megaflo hot water storage cylinder fitted with a 3kW electric immersion heater. The cylinder is well insulated, of modern construction and operates on a 24 hour basis to suit the working hours of the site. There are also a small number of electric point-of-use hot water boilers over sinks in the kitchenettes of shed 1.

The offices adjoining shed 1 and those in the assembly shed are served by refrigerant based split air conditioning systems. These are generally less than 10 years old and are manufactured by Mitsubishi Electric. The split AC systems have a combined cooling capacity of around 250kW. They are controlled by programmable controllers in the conditioned spaces and generally appeared in good condition. However, the systems appear to be operating outside normal office hours. A TM44 air conditioning inspection should be carried out, if not already completed, to comply with Energy Performance of Buildings Regulations.

The majority of the lighting on site consists of energy efficient LED fittings. However, there are a significant number of inefficient high-bay luminaires in the warehouses and less efficient T8 fluorescent tube fittings in offices and the warehouse stores. Some inefficient halogen spot lights were noted in the warehouse stores, main office reception and corridors. There are also compact

fluorescent fittings in corridors and WCs. The majority of the lighting is manually controlled with much of the warehouse lighting burning continuously during the working week. However, occupancy (PIR) sensors control the lighting on the mezzanine level of the warehouse stores. It is advised that the less efficient fittings be upgraded to LED equivalents, which will also provide longer lamp life. When replacing lighting in intermittently occupied spaces such as the warehouse stores, locker rooms, tray warehouse and WCs, integrated PIR controls could be installed to switch off the new fittings when spaces are unoccupied.

Please refer to Appendix A for a complete breakdown of the audited equipment and estimated operating profiles.

Day of Week	Site Operating Hours	Office Hours
Mon. – Fri.	Continuous from 06:00hrs on Mon. to 24:00hrs on Fri.	07:30hrs - 17:00hrs
Sat.	00:00hrs - 12:00hrs	-

Table 4 - Site Opening Hours

The site has mains electricity and mains gas supplied, as well as deliveries of red diesel (gas oil) and LPG. The site has 2 half-hourly (HH) electricity meters for which HH data was made available for this audit. There is 1 non-HH gas meter on site. It is recommended that all utility meters are fitted with loggers and connected back to an aM&T system with monthly reports scheduled for the directors/managers.

2.Site Energy Profile

In compiling this report the consumption for the 12-months from January to December 2018 has been used as a basis for annual consumption.

Utility	Energy Consumption		Fiscal Cost		Carbon Emissions	Specific Energy Consumption	Average Unit Cost
	(kWh/Year)	(%)	(£)	(%)	(tCO_2)	(kWh/m²)	(£/kWh)
Electricity	909,353	44%	£118,971	65%	277.2	53	0.131
Natural Gas	173,401	8%	£5,090	3%	31.8	10	0.029
Other Fossil Fuels	999,575	48%	£59,975	33%	253.5	59	-
Total Energy	**2,082,329**	**-**	**£184,036**	**-**	**562.5**	**122**	-

Table 5 - Profiled Site Energy Consumption Data 01/01/2018 to 31/12/2018

All energy values and associated calculations are given in terms of delivered energy.

Looking at forward prices for 12-months from now; if prices were to rise by an average of 5%; assuming the same consumption, costs will rise by approximately £9,202. If these revised prices are factored in, then savings from the recommendations within this report will rise from £102,252 to £107,365.

Annual Energy Consumption Profile

Based upon the data gathered during the survey the following chart illustrates the split of energy across the site, some high level assumptions have had to be made due to the lack of sub-metering.

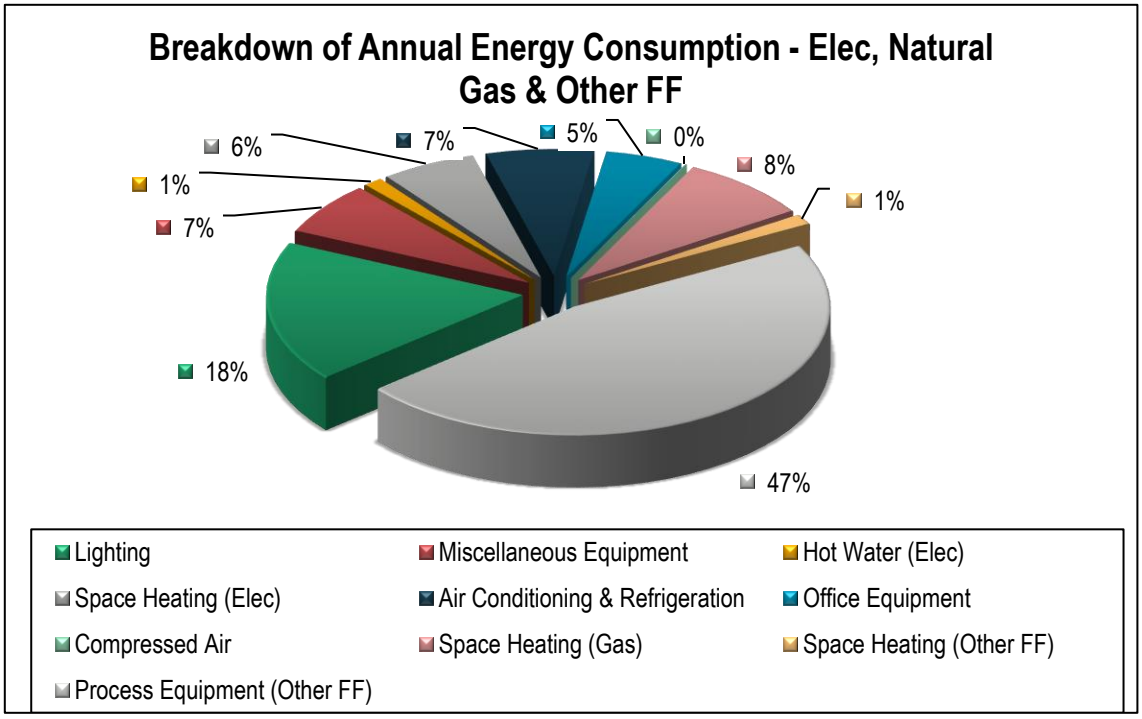

Figure 1 – Site Estimated Annual Energy Breakdown

The chart above highlights that of the total audited energy consumption process equipment (other ff) is the largest overall energy consumer (47% - 972,182kWh) followed by lighting (18% - 370,407kWh) and heating (gas) (8% - 173,306kWh). It should be noted that process equipment (other ff) consists entirely of diesel consumption by forklift trucks, whereas miscellaneous equipment includes the electrical consumption of forklift trucks and cable winding machines.

Benchmark

Due to the specialist nature of the activities on site, benchmarking data is not currently available for this industry sector, and therefore a comparison between similar sites taking into account building occupancy, size, activities, location and weather (degree days), could not be carried out.

Benchmark data is normally obtained from the CIBSE Guide F – Energy Efficiency in Buildings, based upon a Building Maintenance Information (BMI) special report dated 1999. Energy performance indicators give a measure of activity based energy use, which can be compared with equivalent benchmarks. Energy consumption benchmarks are published in Good Practice Guides for different buildings and some processes. For a particular site, the performance indices are modified to take into account building occupancy, size, activities, location and weather (degree days). The 'Good' value indicates best practice.

The client has a number of similar sites throughout the UK, it is recommended that bespoke group benchmarks are created and this data is used to improve overall energy management across the group and at local level via the introduction of site specific energy targets and monthly reports. The inclusion of additional periodic benchmarking charts for the sites showing their position will also engage staff at a local level to continue along the path of energy and environmental efficiency improvements. This data could also be utilised at a corporate level to gain a greater understanding of poorly performing sites so that additional resources can then be targeted for improvements.

3.Energy Management

The status of the company's current energy management practices are reflected in the following comments. The matrix is ranked in levels from 0 to 4, with 4 being the highest level of achievement.

The site is relatively new to energy management and has little previous experience in this field apart from good engineering practice; as such the scores reflect this.

Level	Policy	Organising	Training	Performance Management	Communicating	Investment
4	Energy policy, Action Plan and regular review have active commitment of top management	Fully integrated into management structure with clear accountability for energy consumption	Appropriate and comprehensive staff training tailored to identified needs, with evaluation	Comprehensive performance measurement against targets with effective management reporting	Extensive communication of energy issues within and outside of organisation	Resources routinely committed to energy efficiency in support of business objectives
3	Formal policy but no active commitment from top management	Clear line management accountability for consumption and responsibility for improvement	Energy training targeted at major users following training needs analysis	Weekly performance measurement for each process, unit, or building	Regular staff briefings, performance reporting and energy promotion	Same appraisal criteria used as for other cost reduction projects
2	Un-adopted Policy	Some delegation of responsibility but line management and authority unclear	Ad-Hoc internal training for selected people as required	Monthly monitoring by fuel type	Some use of company communication mechanisms to promote energy efficiency	Low or medium cost measures considered if short payback period
1	An unwritten set of guidelines	Informal, mostly focused on energy supply	Technical staff occasionally attend specialist courses	Invoice checking only	Ad-Hoc informal contacts used to promote energy efficiency	Only low or no cost measures taken
0	No explicit energy Policy	No delegation of responsibility for managing energy	No energy related staff training provided	No measurement of energy costs or consumptions	No communication or promotion of energy issues	No investment in improving energy efficiency

Policy

No energy policy is in place. It is recommended that an energy policy is developed and that it is committed to by the senior management team. The policy should state commitment, set targets, enforce effective monitoring and targeting and state the Company's future commitment to energy efficiency in the maintenance, operation and procurement of plant and equipment. This should be displayed in a central location so that all staff can review the policy and additional feedback added from ongoing projects to reduce energy consumption and plans for any future energy saving programme of works.

Organising

At present the responsibility for energy management is carried out on an ad-hoc basis with no formal job role description created. It is recommended that a specific job role of energy manager is written into the duties of a suitable manager and additional time is allocated to enable them to develop action plans and report back periodically to top level management on energy savings. It is also recommended that regular updates for an "Energy Management Notice Board" are undertaken along with additional communications to disseminate the new information across the site.

Training

No specific training is provided to the staff, it is assumed that common sense will prevail. It is recommended that a full training analysis of staff is carried out and documented. Targeted energy awareness/training should be provided to all staff, with the programmes designed to provide an adequate level of information depending upon the specific job role/undertakings as informed by the training analysis.

Performance Measurement

Monthly meter readings are collated and used to monitor changes in monthly energy consumption against invoices, which is an excellent start. It is recommended that this process is expanded to include monitoring of additional external drivers for energy use and that these are reported on a monthly basis. Energy usage information should be disseminated to staff to increase their understanding of consumption patterns and to develop energy awareness across the site.

Communicating

Some staff information has been provided regarding energy awareness but this has been ad-hoc with no formal structure. From other sites visited the energy teams have created dedicated staff energy/environmental notice boards as a central location to display information about energy usage across the site and ongoing internal projects. They have also used this as a forum for staff suggestions with a list of suggestions received and the evaluation of the suggestion listing any future actions/projected that are to be undertaken. The board has also been used to communicate energy saving measures that staff can adopt at home. It is recommended that a similar tailored approach is adopted at this site. Positive feedback should also be provided in order to continually drive the staff awareness process.

Investment

Based upon the findings of internal/external reports all measures are reviewed based upon their merits. It is recommended that future measures are assessed using life cycle cost analysis. The benefits of tax breaks such as the Enhanced Capital Allowance Scheme and government grants/incentives should also be explored.

4.Energy Reduction Opportunities

The sections below describe the main energy intensive areas at the site and detail possible actions to reduce energy consumption.

Priority No: 1	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	21,655	2,481	6.2	8,483	3.4
Recommendation	Improve energy monitoring and general levels of energy awareness.				
Detail:	There is currently no sub-metering of electrical loads or major electrical plant items on site. It is advised that sub-metering of major plant/distribution boards is installed with some staff time set aside to analyse the data, consider where energy waste can be reduced, and put energy saving measures in place following this appraisal. It is recommended that: 1. A basic site specific Energy Policy is written which sets performance standards for reducing energy consumption. 2. The client implements a structured approach to energy management, with clear and concise goals and objectives within the policy, to drive the site forward. 3. The energy data gathered for this survey is built upon moving forward as a stage one approach to managing energy. 4. The client conduct an out of hours survey to establish what equipment forms part of the baseload then challenge staff to reduce this by improving shutdown/set back procedures. 5. The energy data is analysed and issues highlighted through the improved Monitoring & Targeting (M&T) techniques are used to target specific known waste areas. 6. Actual energy costs of specific areas or plant is disseminated to staff to highlight waste issues further. 7. All savings realised are disseminated to staff – it is important to give positive feedback when received to ensure ongoing motivation and commitment.				
Rationale:	To manage energy effectively it is essential that the correct data is available. "You cannot manage what you do not measure" is a popular adage used across most management sectors. The importance of aM&T cannot be stressed enough. Examples of the benefits of improvements to aM&T are: • Invoicing errors can be quickly identified and rectified. • Eradication of estimated billing and account reconciliation. • The identification and monitoring of exceptional usage patterns. • More accurate forecasting and setting up of energy budgets. • Rapid identification and implementation of opportunities to save energy and water. • Standard progress reports can be generated regarding the progress made towards achieving the energy consumption reduction target. Installation of Automatic Meter Readers (AMR) with relevant energy monitoring software have the following benefits: • Automatic monitoring and targeting of consumptions. • Validated and verified billing. • Tailored forecasting, budgeting and future procurement optimisation. • Timely reporting allowing clients to identify waste. Adoption of a formal energy policy will be vital to ensure that the necessary resources are allocated and that energy management is given the priority it deserves. Commitment from the				

Priority No: 1	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	21,655	2,481	6.2	8,483	3.4
	senior management is of paramount importance when attempting to seriously improve energy performance and reduce energy costs. Raising awareness of energy and environmental issues is a cost effective way of reducing energy use and should be tackled at all levels. As well as transferring essential information relating to the control of plant in each area, training and awareness will also: • Build a greater understanding of the importance of energy efficiency. • Facilitate the dissemination of technical information. • Improve awareness of the need for energy efficiency to be continually maintained. • Engage staff into appraising energy waste.				
Costs & Savings:	Typical savings for improvements in M&T have shown that savings of between 5% and 20% of the total energy bill have been achieved when applied to businesses with no previous experience. Due to the size of the site and the level of staff influence on energy the savings here have been estimated at 1.0% of the overall energy consumption, broken down into 2.0% electrical savings & 2.0% natural gas savings and 0% fossil fuel savings. Estimated costs of £8,483 are based on electrical meter upgrades/sub-metering of £6,450 and gas meter upgrades of £2,033.				

Priority No: 2	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	25,996	763	4.8	100	0.1
Recommendation	Reset current heating profile to suit occupancy times.				
Detail:	The boilers serving the main offices and the goods-in area of shed 1 are currently set to operate continuously. By setting a time schedule on the heating controls to suit the occupied hours of the heated spaces, the boiler operating hours will be significantly reduced which will reduce the gas consumption of the boilers. It is recommended that: 1. All time schedules are optimised to ensure areas are not being heated out of hours. 2. Different time settings should be trialled to find the most suitable for each building/area. 3. Temperature set-points should be set corresponding to the requirements of the space. This may require fine-tuning. 4. Frost stats are set at 5°C. 5. A Building Log Book is created to store details of ideal set-points for the various seasons. 6. Periodic checks are undertaken to ensure that set-points have not been adjusted.				
Rationale:	Optimising the settings on space heating controls can greatly improve the efficient operation of buildings. Operating heating plant out of hours when areas are not in use is a waste of energy, but care should be taken to ensure that adequate time is allowed to bring spaces up to temperature prior to staff arriving for work, the use of smart building controls automates this process. The savings highlighted within this report show the importance of ensuring correct time and temperature settings are in place and that regular checks are undertaken to ensure that temporary changes don't become permanent changes. During planned building closedowns over weekends/bank holidays or company holidays heating should be setback or operating in building protection only mode.				
Costs & Savings:	The cost savings have been based upon reducing the annual heating energy consumption by 15% from optimising the heating time profiles/settings. The cost for carrying out this work should be minimal, a report overall cost of £100 has been allowed.				

Priority No: 3	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	14,190	1,856	4.3	1,850	1.0
Recommendation	Consideration should be given to the savings that can be made by linking the space conditioning systems to movement sensors to prevent systems operating when areas are not occupied.				
Detail:	The split air conditioning systems serving office spaces throughout the site may be operating at night and at weekends when the majority of the offices are unoccupied. Fitting occupancy (PIR) sensors linked to the AC system controls in each space will help to reduce the operating hours and hence the energy consumption of these systems. It is recommended that the client: 1. Installs Passive Infra-Red (PIR) movement sensors in intermittently occupied spaces and links these to the air conditioning system controls so that systems switch off once the spaces become unoccupied. 2. Considers linking the PIR sensors to the lighting in each room.				
Rationale:	A PIR sensor is a motion detector which detects the heat (infra-red) emitted naturally by humans. When a person in the field of vision of the sensor moves, the sensor detects a sudden change in infra-red energy and the sensor is activated. Enhancing the current overall occupancy time controls with additional PIR sensors can reduce energy consumption in areas with intermittent use by over 30%. If the lighting as well as the air conditioning systems in a space are PIR controlled, further energy savings can be achieved during the summer cooling season because the cooling load on the air conditioning systems will be reduced by switching off the lights. The latest low energy split type air conditioning systems and some of the large central variable refrigerant flow systems now incorporate inbuilt PIRs as part of local controls for the internal units with options to first set-back space temperatures before isolating the local internal unit.				
Costs & Savings:	The cost savings have been based upon reducing annual overall energy consumption for the comfort cooling space conditioning plant by 10%, these savings are from isolating systems when rooms are not occupied. The investment required to implement this recommendation has been based upon installing 37 PIRs interfaced with the internal AC units, with an estimated installed total cost of £1850.				

Priority No: 4	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	19,425	570	3.6	936	1.6
Recommendation	Improve pipework insulation and fit quick release insulation jackets to exposed valves, flanges and pump bodies.				
Detail:	Both the heating boiler serving the main offices and the boiler serving the goods-in area of shed 1 have un-insulated distribution pipework. Installing insulation to pipes and valves in unheated spaces such as plant rooms will reduce heat losses from the heating systems and thereby reduce the gas consumption of the heating boilers. It is recommended that: 1. All un-insulated hot distribution pipework is insulated. 2. All valves and flanges are insulated. 3. The Enhanced Capital Allowance Scheme's Energy Technology list is checked when purchasing insulation as tax incentives may be available.				
Rationale:	Heat losses from pipes can be reduced by over 70% by fitting insulation. Significant heat is lost from valves (equivalent to the heat lost from 1m of uninsulated pipework) and flanges (equivalent of 0.5m of uninsulated pipework). Undertaking a thermal imaging survey will enable the building occupier to identify all the weaknesses in the heating and cooling networks as well as the building envelope.				
Costs & Savings:	Savings have been based upon reducing heat lost from the uninsulated pipework/valves of 11% by fitting insulation jackets/replacing missing pipework insulation in the plant rooms. Costs have been based upon fitting 32m of pipework insulation & 14 valve/pump jacket(s with an overall installed cost of £936.				

Priority No: 5	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	28,454	3,723	8.7	6,147	1.7
Recommendation	Replace the dated light fittings with new fittings/lamp upgrades and include additional lighting controls.				
Detail:	The majority of the lighting on site is manually controlled. It is advised that when replacing lighting in the warehouse stores, locker rooms, tray warehouse and WCs, integrated PIR controls are installed to switch off the new fittings when spaces are unoccupied. It is recommended that the client: 1. Reviews the lighting across the site. 2. Adopts a programme to replace all the older style fittings with new low energy fittings. 3. Includes additional costs for a lighting design review to ensure that the light levels comply with the current Society of Light and Lighting (SLL) codes. 4. Investigates further the option of installing additional manual switches in areas that have excess natural day light during the normal working day. Alternatively trial dual PIR/Photocell sensors in areas with excessive light levels.				
Rationale:	Lighting manufacturers are constantly releasing improved light output fittings with reduced energy input to meet the growing demands to reduce energy consumption related to artificial lighting. Over the past 3 years LEDs developments have seen the introduction of new slim line LED panel light fittings that can provide an improved quality of light with a reduced power input. A quality LED fitting also has an additional advantage of an extend lamp life with the majority of manufacturers guaranteeing at least 5 years of operation (with lamp lives of up to 50,000hrs), reducing ongoing maintenance costs. Switching off lighting when it is not required can achieve savings of up to 90% in rarely used areas such as basements and plant rooms. In areas that are occupied for part of the day, savings will be reduced but still significant. The addition of modern integrated lighting controls for new fittings will increase the projected savings by automatically switching off fittings in areas that are no longer in use. For areas with high levels of natural light options for photocell controls will enable the luminaire to reduce the light output, but will ensure that minimum light lux levels are maintained.				
Costs & Savings:	The overall energy savings have been based upon reducing the energy consumption of the various light fittings (91) identified during the survey by 66%. The operational data has been based upon the information taken from site regarding the specific operating hours for the various rooms. Estimated costs of £6,147, based upon the following breakdown of grouped existing technologies to be replaced with LED equivalents: 71 x T8 (HF) @ £5,675; 20 x G10 Spots @ £350. Additional costs have been included for controls. These relate to the following areas of the site: Goods-In Store, Cabin Office & Stores, Stores, Shed 1 - Lockers, Shed 1 - IF Store, Tray W'hse & Mezzanine, Main Office – WCs.				

Priority No: 6	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	57,546	7,529	17.5	24,979	3.3
Recommendation	Replace the dated light fittings with new fittings/lamp upgrades.				
Detail:	The majority of the lighting on site consists of energy efficient LED fittings. However, there are a significant number of inefficient high-bay luminaires in the warehouses and less efficient T8 fluorescent tube fittings in offices and the warehouse stores. Some inefficient halogen spot lights were noted in the warehouse stores, main office reception and corridors. There are also compact fluorescent fittings in corridors and WCs. The majority of the lighting is manually controlled with much of the warehouse lighting burning continuously during the working week. However, occupancy (PIR) sensors control the lighting on the mezzanine level of the warehouse stores. It is advised that the less efficient fittings be upgraded to LED equivalents, which will also provide longer lamp life. It is recommended that the client: 1. Reviews the lighting across the site. 2. Adopts a programme to replace all the older style fittings with new low energy fittings. 3. Includes additional costs for a lighting design review to ensure that the light levels comply with the current Society of Light and Lighting (SLL) codes.				
Rationale:	Lighting manufacturers are constantly releasing improved light output fittings with reduced energy input to meet the growing demands to reduce energy consumption related to artificial lighting. Over the past 3 years LED developments have seen the introduction of new slim line LED panel light fittings that can provide an improved quality of light with a reduced power input. A quality LED fitting also has an additional advantage of an extend lamp life with the majority of manufacturers guaranteeing at least 5 years of operation (with lamp lives of up to 50,000hrs), reducing ongoing maintenance costs.				
Costs & Savings:	The overall energy savings have been based upon reducing the energy consumption of the various light fittings (343) identified during the survey by 47%. The operational data has been based upon the information taken from site regarding the specific operating hours for the various rooms. Estimated costs of £24,979, based upon the following breakdown of grouped existing technologies to be replaced with LED equivalents: 62 x Metal Halide @ £11,470; 166 x T8 (HF) @ £10,963; 38 x CFL @ £1,558; 48 x G10 Spots @ £480; 24 x GU5 Spots (12V) @ £240. These relate to the following areas of the site: Security, External Lights (hi-energy), Stores & Mezzanine, Shed 1 - Corridor & Stairwell, Shed 1 - Office, Shed 3 - Office, Shed 3 - High Bay (hi-energy), Sheds 4 & 2 - Offices, Main Office - Super Lec, Main Office - Corridors, Main Office - Reception, Main Office - Corridors & WCs, Main Office - Small Office, Post Room, Fire Escape, Corridors, Wages, HR, IT.				

Priority No: 7	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	32,108	942	5.9	7,000	7.4
Recommendation	Replace the dated heating boilers with modern modular condensing boilers.				
Detail:	The floor standing gas fired heating boiler serving the main offices is at least 30 years old and is likely to be operating at low efficiency. Replacing the boiler with modern condensing plant will help to reduce gas consumption for heating the offices. It is recommended that: 1. The boilers are replaced with high efficiency modular condensing boilers. 2. The energy loan scheme and the Enhanced Capital Allowance scheme are investigated prior to purchase of new plant.				
Rationale:	Condensing boilers are the most efficient boilers on the market as they recover as much of the heat as is practically possible from the flue gases. They are particularly suited to low temperature or possible part load applications. The latest modular design of boilers offers excellent turndown modulation controls to match system demands and improve overall seasonal energy efficiency ratios. Since 1997 high efficiency boilers have been required as standard for new and refurbished buildings. The latest Building Regulation Part 2B has seen additional increases in the minimum efficiency levels and types of controllers installed as part of retrofit programmes. The minimum effective heat generating seasonal efficiency (% gross calorific value) for replacement boilers is 84% for natural gas, the controls must include the following for boilers less than 100kW: • Timing and temperature demand control, zone specific for floor areas greater than 150m². • Weather compensation (except where a constant temperature supply is required). Tax incentives are available when purchasing energy efficient boilers and other equipment such as controls via the enhanced capital allowance scheme. The latest Energy related Products (ErP) Directive sets minimum seasonal energy efficiencies of 92.5% for boilers between 70kW and 400kW, these are beyond that required under the current Building Regulation. This directive only applies to boilers of 400kW or less.				
Costs & Savings:	The cost savings have been based upon reducing the annual energy consumption by 25% by replacing the existing boiler with new modular condensing boiler system. The investment required to implement this recommendation has been based upon installing 1 high efficiency modular boiler system, with a typical overall installed cost of £7,000.				

Priority No: 8	Estimated Savings per Annum			Investment	
	Energy (kWh)	Fiscal (£)	Carbon (tCO_2)	Capital Investment (£)	Payback (Years)
	645,023	84,388	196.6	735,182	10.0
Recommendation	The site has a large expanse of roof area, this should be considered for onsite generation utilising solar photovoltaic systems.				
Detail:	The large south-west facing pitched roof areas of sheds 1, 2, 4 and the tray warehouse could potentially be used for the installation of solar photo-voltaic (PV) panels in order to generate electricity for use on site. It is recommended that: 1. A detail feasibility study is undertaken to determine the suitability of the site's infrastructure to take a solar PV system. 2. All quotes obtained should include submitting the required paperwork to the DNO (dependant on array size). 3. Additional checks are undertaken with the local Distribution Network Operator (DNO) to ensure that should energy be exported that the local network is able to take this energy.				
Rationale:	PV panels or cells convert sunlight into electricity. Photovoltaic materials are usually solid-state semiconductors which generate electric current when exposed to light. Panels are available in a variety of glass-based packages, including traditional aluminium-framed panels, plain cladding, solar roof tiles and custom built glazing with integral PV cells. PV cells are most effective in bright sunlight but are still able to produce some power in the UK on cloudy days. A PV system will not meet the entire electricity needs of a business, but could provide a significant percentage. PV cells can be positioned in an unshaded southerly (between south east and south west) direction and can be tilted at an appropriate angle (between 30° - 40° to the vertical, on average, is optimum in the UK, taking into account winter and summer irradiance).				
Costs & Savings:	The cost savings have been based upon reducing the annual grid electrical energy consumption by 91.8% from the installation of onsite PV energy generation. The fiscal savings also include additional export revenue: Grid Offset 645,023kWh x 13.08p/kWh ÷ 100 = £84,388 The investment required to implement this recommendation has been based on installing a budget cost of £735,182 for a 717kWp/3,020m² site PV system, but a detailed survey will be required to obtain accurate complete project costs. The value of offset grid electricity is expected to rise dramatically with increases in the cost of grid electricity. With an inbuilt average energy unit cost escalator of 5%, array efficiency decay of 0.25% (year 2 onwards) and the above adjustments the overall potential fiscal savings for the 20 year period could equate to £2,714.2k, reducing the payback period down to 8.5 years.				

Further Recommendations

Number	Recommendations
1	To assist with future energy saving surveys and site operation consider introducing a Building Log Book these are designed to give the facilities team a single document that covers the general operation of the HVAC plant at design/commissioning stage with information to enable the team to optimise the system controls to ensure that the internal environmental conditions meet the requirements of the building users whilst optimising the operations to ensure that energy consumption is minimised.
2	Ensure that a TM44 AC report is held in a central folder alongside the F-Gas Log Book data. In order to comply with Energy Performance of Buildings Regulations, an air conditioning inspection is required in any air conditioned building with a combined installed cooling capacity of at least 12kW.

Table 6 – Further Recommendations

5.What Next?

Project Implementation: Following the recommendations highlighted within your ESOS compliance, EIC can assist with the implementation of energy efficient projects which will reduce your carbon footprint. Our projects team have a full catalogue of products to suit your requirements, from installation of renewable technologies, energy generation to building/process control strategies. Your dedicated Account Director will be in touch to discuss energy solution opportunities following receipt of this report.

Streamline Energy and Carbon Reporting (SECR): From 1 April 2019, large organisations in the UK will need to comply with the proposed Streamlined Energy and Carbon Reporting (SECR) regulations. The new scheme - which is currently pending approval - is part of the government's reform package. Its aim is to reduce administrative burden and "streamline" energy and carbon reporting, as well as raise awareness of energy efficiency and reduce energy bills and carbon emissions. The scheme follows a similar data collection technique as ESOS, resulting in EIC being best placed to assist you with compliance of the scheme.

For further information on your carbon compliance and reduction needs, please contact EIC on For further information on your carbon compliance and reduction needs, please contact EIC on **01527 511 700 or by email SECR@eic.co.uk.**

Appendix A - Assumptions

The table below illustrates how the site energy consuming plant has been modelled prior to energy savings being applied. Due to the lack of active sub-metering the breakdown of energy loads shown within this report have been carried out using sound engineering practices and experience as well as a review of the site controls and energy data profile.

Technology	Plant/Area Served	Manufacturer	Model Number	Fuel	Energy Input (kW)	Number Off	Hours Per Year	Utilisation Factor	Estimated Annual Energy (kWh)	% of Fuel	% of Technology
Elec Hot Water	Immersion cylinder (Shed 1)	Heatrae Sadia	Megaflo	Elec	3.0	1	8,400	0.3	7,560	0.8%	30.0%
Elec Hot Water	Point-of-Use Water Boiler (Main Offices - 2 x Kitchens)	Not Known	Not Known	Elec	2.0	2	8,400	0.3	10,080	1.1%	40.0%
Elec Hot Water	Point-of-Use Water Boiler (New Offices)	Not Known	Not Known	Elec	3.0	1	8,400	0.3	7,560	0.8%	30.0%
Miscellaneous	Lift (Goods-In)	Not Known	Not Known	Elec	10	1	8,400	0.13	10,920	1.2%	8.0%
Miscellaneous	Forklift Truck Chargers (Sheds 1, 3, 4, Tray W'hse & Assembly Shed)	Not Known	Not Known	Elec	5.99	7	8,400	0.13	45,755	5%	33.4%
Miscellaneous	Cable Winding Machines (Sheds 1, 3 & 4)	Not Known	Not Known	Elec	2.2	26	8,400	0.13	62,462	7%	45.6%
Miscellaneous	Jet Wash Machine (Shed 4)	Not Known	Not Known	Elec	2.81	1	8,400	0.2	4,717	0.5%	3.4%
Miscellaneous	10 Tonne Cranes (Shed 2)	Not Known	Not Known	Elec	0.5	2	8,400	0.25	2,100	0.2%	1.5%
Miscellaneous	Cardboard Baler (Assembly Shed)	Not Known	Not Known	Elec	2.2	1	8,400	0.1	1,925	0.2%	1.4%
Miscellaneous	Cardboard Cutter (Assembly Shed)	Not Known	Not Known	Elec	0.75	1	8,400	0.1	656	0.1%	0.5%
Miscellaneous	Gym Treadmills (Assembly Shed)	Not Known	Not Known	Elec	2.5	3	8,400	0.13	8,190	0.9%	6.0%
Miscellaneous	Gym Cross-Trainers (Assembly Shed)	Not Known	Not Known	Elec	0.07	5	8,400	0.1	273	0.0%	0.2%
Elec Heating	Security	Not Known	Not Known	Elec	3.0	1	5,037	0.6	9,066	1.0%	7.2%
Elec Heating	Cabin Office	Not Known	Not Known	Elec	2.0	2	5,037	0.6	12,088	1.3%	9.6%
Elec Heating	Shed 1 - Lockers & WCs	Not Known	Not Known	Elec	3.0	4	5,037	0.5	30,219	3.3%	24.0%

Technology	Plant/Area Served	Manufacturer	Model Number	Fuel	Energy Input (kW)	Number Off	Hours Per Year	Utilisation Factor	Estimated Annual Energy (kWh)	% of Fuel	% of Technology
Elec Heating	Shed 1 - Office	Not Known	Not Known	Elec	2.0	2	5,037	0.5	10,073	1.1%	8.0%
Elec Heating	Shed 1 - Canteen	Not Known	Not Known	Elec	2.0	3	5,037	0.5	15,110	1.7%	12.0%
Elec Heating	Shed 3 - Office	Not Known	Not Known	Elec	2.0	2	5,037	0.5	10,073	1.1%	8.0%
Elec Heating	Tray Warehouse - Shipping Container	Not Known	Not Known	Elec	3.0	1	5,037	0.5	7,555	0.8%	6.0%
Elec Heating	Shed 4 - Office	Not Known	Not Known	Elec	3.0	1	5,037	0.5	7,555	0.8%	6.0%
Elec Heating	Shed 2 - Eng. Workshop	Not Known	Not Known	Elec	2.0	1	5,037	0.5	5,037	0.6%	4.0%
Elec Heating	Shed 2 - Eng. Office	Not Known	Not Known	Elec	2.0	1	5,037	0.5	5,037	0.6%	4.0%
Elec Heating	New Offices - Corridor	Not Known	Not Known	Elec	1.5	1	5,037	0.5	3,777	0.4%	3.0%
Elec Heating	New Offices - IF	Not Known	Not Known	Elec	2.0	2	5,037	0.5	10,073	1.1%	8.0%
Gas Heating	Wall Hung Boiler (Shed 1 - Goods in)	Baxi	Solo	Gas	30	1	5,037	0.30	44,875	26%	25.9%
Gas Heating	Floor Standing Boiler (Main Offices)	Stelrad Ideal	Concord Cxi	Gas	85	1	5,037	0.30	128,431	74%	74.1%
Other FF Heating	Warm Air Heater (Shed 2 - Eng. Workshop)	Not Known	Not Known	Other FF	30	1	3,598	0.25	26,981	2.7%	100.0%
Office Equipment	-	-	PCs	Elec	0.06	140	-	-	18,127	2.0%	17.8%
Office Equipment	-	-	Flat Screen LED Monitors	Elec	0.02	160	-	-	5,886	0.7%	5.8%
Office Equipment	-	-	Photocopiers	Elec	1.0	2	-	-	1,118	0.1%	1.1%
Office Equipment	-	-	Laser Printers	Elec	0.11	54	-	-	6,458	0.7%	6.4%
Office Equipment	-	-	Server	Elec	0.2	20	-	-	24,752	2.7%	24.4%
Office Equipment	-	-	CCTV	Elec	0.35	1	-	-	1,977	0.2%	1.9%

Technology	Plant/Area Served	Manufacturer	Model Number	Fuel	Energy Input (kW)	Number Off	Hours Per Year	Utilisation Factor	Estimated Annual Energy (kWh)	% of Fuel	% of Technology
Office Equipment	-	-	Microwave	Elec	0.8	12	-	-	5,335	0.6%	5.3%
Office Equipment	-	-	Domestic Refrigerators	Elec	0.22	14	-	-	17,734	2.0%	17.5%
AC & Refrigeration	Split Heat Pumps (Main Offices)	Mitsubishi Electric	Various	Elec	2.0	10	2,375	0.4	19,000	2.1%	13.4%
AC & Refrigeration	Split Heat Pumps (Main Offices)	Mitsubishi Electric	Various	Elec	3.0	10	2,375	0.4	28,500	3.2%	20.1%
AC & Refrigeration	Split Heat Pumps (Main Offices)	Mitsubishi Electric	Various	Elec	1.5	4	2,375	0.4	5,700	0.6%	4.0%
AC & Refrigeration	Split Heat Pumps (New Offices)	Mitsubishi Electric	Various	Elec	2.0	8	2,375	0.4	15,200	1.7%	10.7%
AC & Refrigeration	Split Heat Pumps (Assembly Shed)	Mitsubishi Electric	PUHZ-RP140	Elec	5.0	5	8,400	0.35	73,500	8%	51.8%
Lighting	Security	-	T8-6ft-S-HF	Elec	0.08	2	6,600	1	1,016	0.1%	0.3%
Lighting	Security	-	T8-2ft-Q-HF	Elec	0.08	4	6,600	1	2,112	0.2%	0.6%
Lighting	Security	-	LED 5W	Elec	0.01	4	6,600	1	132	0.0%	0.0%
Lighting	External Lights (hi-energy)	-	MH-250W	Elec	0.25	56	4,200	1	58,800	7%	15.9%
Lighting	External Lights (LED)	-	LED 100W	Elec	0.1	14	4,200	1	5,880	0.7%	1.6%
Lighting	Goods-In	-	LED 40W	Elec	0.04	4	6,600	1	1,056	0.1%	0.3%
Lighting	Goods-In Store	-	LED 25W	Elec	0.03	4	6,600	1	660	0.1%	0.2%
Lighting	Goods-In Store	-	T8-5ft-S-HF	Elec	0.06	2	6,600	1	845	0.1%	0.2%
Lighting	Cabin Office & Stores	-	T8-5ft-S-HF	Elec	0.06	10	6,600	1	4,224	0.5%	1.1%
Lighting	Stores & Mezzanine	-	T8-5ft-S-HF	Elec	0.06	60	6,600	0.8	20,275	2.2%	5.5%
Lighting	Stores	-	LED 25W	Elec	0.03	24	6,600	1	3,960	0.4%	1.1%
Lighting	Stores	-	GU10-50	Elec	0.05	20	6,600	1	6,600	0.7%	1.8%

Technology	Plant/Area Served	Manufacturer	Model Number	Fuel	Energy Input (kW)	Number Off	Hours Per Year	Utilisation Factor	Estimated Annual Energy (kWh)	% of Fuel	% of Technology
Lighting	Stores	-	T8-4ft-D-HF	Elec	0.08	14	6,600	1	7,392	0.8%	2.0%
Lighting	Stores	-	LED 10W	Elec	0.01	14	6,600	1	924	0.1%	0.2%
Lighting	Sheds 1 & 3 - High Bay LED	-	LED 100W	Elec	0.1	100	6,600	1	66,000	7%	17.8%
Lighting	Shed 1 - Lockers	-	T8-5ft-D-HF	Elec	0.13	10	6,600	1	8,448	0.9%	2.3%
Lighting	Shed 1 - Lockers	-	LED 40W	Elec	0.04	7	6,600	1	1,848	0.2%	0.5%
Lighting	Shed 1 - IF Store	-	T8-2ft-Q-HF	Elec	0.08	8	6,600	1	4,224	0.5%	1.1%
Lighting	Shed 1 - Corridor & Stairwell	-	CFL-18	Elec	0.02	14	6,600	1	1,663	0.2%	0.4%
Lighting	Shed 1 - Office	-	T8-2ft-Q-HF	Elec	0.08	4	2,500	1	800	0.1%	0.2%
Lighting	Shed 1 - Canteen	-	LED 40W	Elec	0.04	10	6,600	1	2,640	0.3%	0.7%
Lighting	Shed 3 - Office	-	T8-4ft-D-HF	Elec	0.08	4	2,500	1	800	0.1%	0.2%
Lighting	Shed 3 - Office	-	T8-6ft-S-HF	Elec	0.08	2	2,500	1	385	0.0%	0.1%
Lighting	Shed 3 - Office	-	LED 80W	Elec	0.08	64	2,500	1	12,800	1.4%	3.5%
Lighting	Shed 3 - High Bay (hi-energy)	-	MH-250W	Elec	0.25	6	6,600	1	9,900	1.1%	2.7%
Lighting	Tray W'hse, Sheds 4 & 2	-	LED 80W	Elec	0.08	100	6,600	1	52,800	6%	14.3%
Lighting	Tray W'hse & Mezzanine	-	T8-5ft-S-HF	Elec	0.06	24	6,600	1	10,138	1.1%	2.7%
Lighting	Sheds 4 & 2 - Offices	-	T8-5ft-S-HF	Elec	0.06	3	2,500	1	480	0.1%	0.1%
Lighting	Assembly Shed	-	LED 40W	Elec	0.04	40	6,600	1	10,560	1.2%	2.9%
Lighting	Main Office - Super Lec	-	T8-4ft-D-HF	Elec	0.08	34	2,500	1	6,800	0.8%	1.8%
Lighting	Main Office - Corridors	-	GU10-50	Elec	0.05	48	2,500	1	6,000	0.7%	1.6%

Technology	Plant/Area Served	Manufacturer	Model Number	Fuel	Energy Input (kW)	Number Off	Hours Per Year	Utilisation Factor	Estimated Annual Energy (kWh)	% of Fuel	% of Technology
Lighting	Main Office - Kitchen	-	LED 5W	Elec	0.01	20	2,500	1	250	0.0%	0.1%
Lighting	Main Office - Purchasing, Sales, MD, Transport, Import&Export, Accounts	-	LED 40W	Elec	0.04	400	2,500	1	40,000	4.4%	10.8%
Lighting	Main Office - Reception	-	LED 5W	Elec	0.01	14	2,500	1	175	0.0%	0.0%
Lighting	Main Office - Reception	-	GU5-20	Elec	0.02	24	2,500	1	1,200	0.1%	0.3%
Lighting	Main Office - Corridors & WCs	-	CFL-18	Elec	0.02	26	2,500	1	1,170	0.1%	0.3%
Lighting	Main Office - WCs	-	T8-2ft-Q-HF	Elec	0.08	5	2,500	1	1,000	0.1%	0.3%
Lighting	Main Office - Small Kitchen	-	LED 40W	Elec	0.04	2	2,500	1	200	0.0%	0.1%
Lighting	Main Office - Small Office, Post Room, Fire Escape, Corridors, Wages, HR, IT	-	T8-2ft-Q-HF	Elec	0.08	56	2,500	1	11,200	1.2%	3.0%
Lighting	Main Office - Boardroom	-	LED 5W	Elec	0.01	22	2,500	1	275	0.0%	0.1%
Lighting	New Offices - Corridor & Stairwell	-	LED 5W	Elec	0.01	38	2,500	1	475	0.1%	0.1%
Lighting	New Offices - Offices, Meeting Room & IF	-	LED 40W	Elec	0.04	38	2,500	1	3,800	0.4%	1.0%
Lighting	New Offices - Canteen	-	LED 40W	Elec	0.04	4	2,500	1	400	0.0%	0.1%
Lighting	New Offices - WCs	-	LED 10W	Elec	0.01	4	2,500	1	100	0.0%	0.0%
Process (Other FF)	Forklift Trucks (diesel driven)	Not Known	Not Known	Other FF	20	46	8,400	0.1258	972,182	97%	100.0%
Compressed Air	Air Compressor (Shed 2)	Sylbo	Not Known	Elec	0.85	1	8,400	0	1,071	0.1%	100.0%

Table 7 – Site Energy Model

Appendix B – Data Analysis

The following charts illustrate the monthly fiscal energy profile (electricity and natural gas only) based upon the data provided by the client.

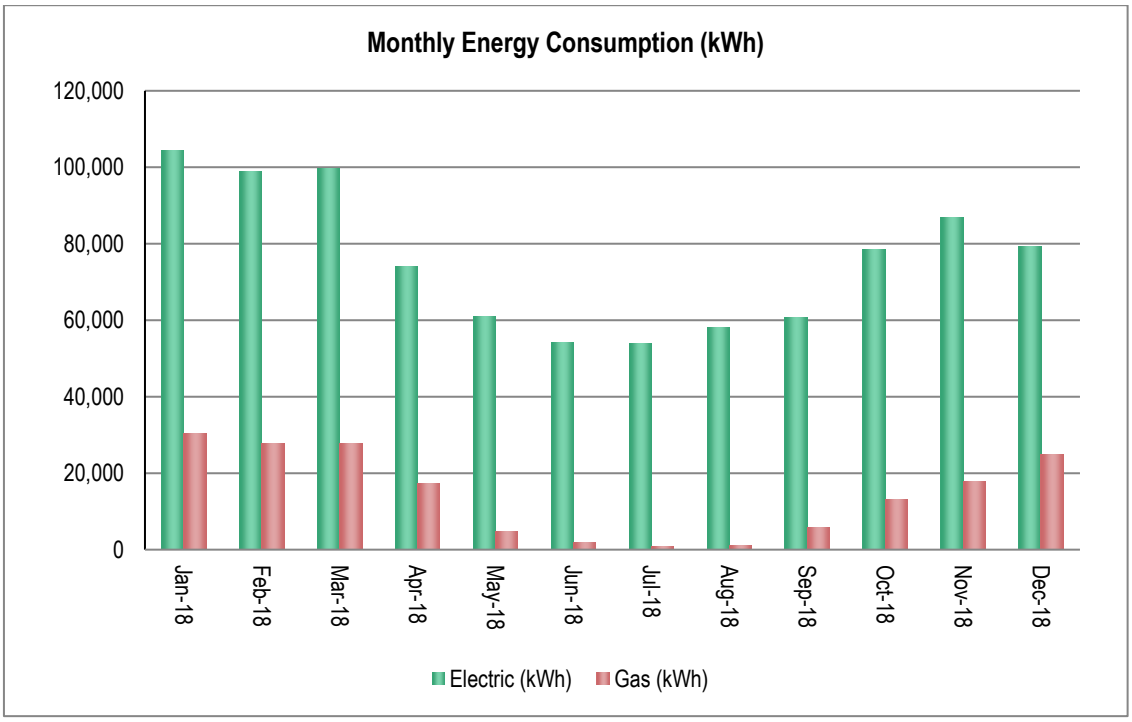

Figure 2 – Site Energy Monthly Profile

The electricity profile shows a significant drop in consumption during the summer months. This may be partly explained by a reduction in electric heating and lighting demand during the summer. However, other factors such as seasonal variations in business activity may also be relevant here.

The gas profile exhibits a clear seasonal variation with high consumption in winter and low consumption in summer. This can be explained by the fact that space heating equipment is the main consumer of gas.

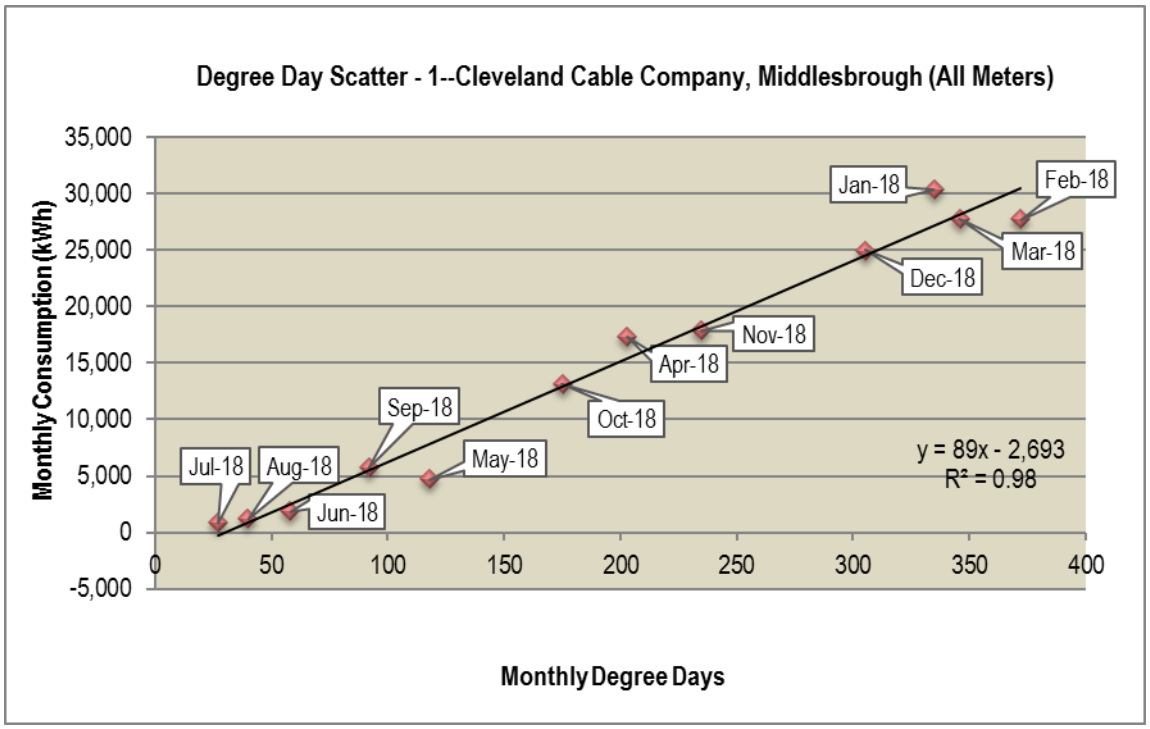

Figure 3 – Monthly Degree Day Profile

Degree days are a tool used to assess the weather dependent energy use in buildings. The intercept on the vertical axis represents the site's gas base-load or the non-weather dependent gas consumption. Since gas is only used for space heating (gas fired boilers serving the main offices and goods-in area), the existence of a summer base-load would suggest the boilers are firing unnecessarily in summer. This could be reduced or eliminated by setting time schedules on the heating controls or by isolating the boilers during the summer. The trend line's slope is a measure of how much extra fuel is consumed for an increase in Degree Days.

The R^2 factor is derived from regression analysis and it indicates how well the heating systems are controlled. The higher the value of R^2 the better ($0<R<1$). An R^2 value above 0.7 indicates that the heating system is well controlled.

The R^2 value of 0.98 shows that the control strategy of gas consuming equipment is fairly well managed. Further analysis can be found in Figure 4 below.

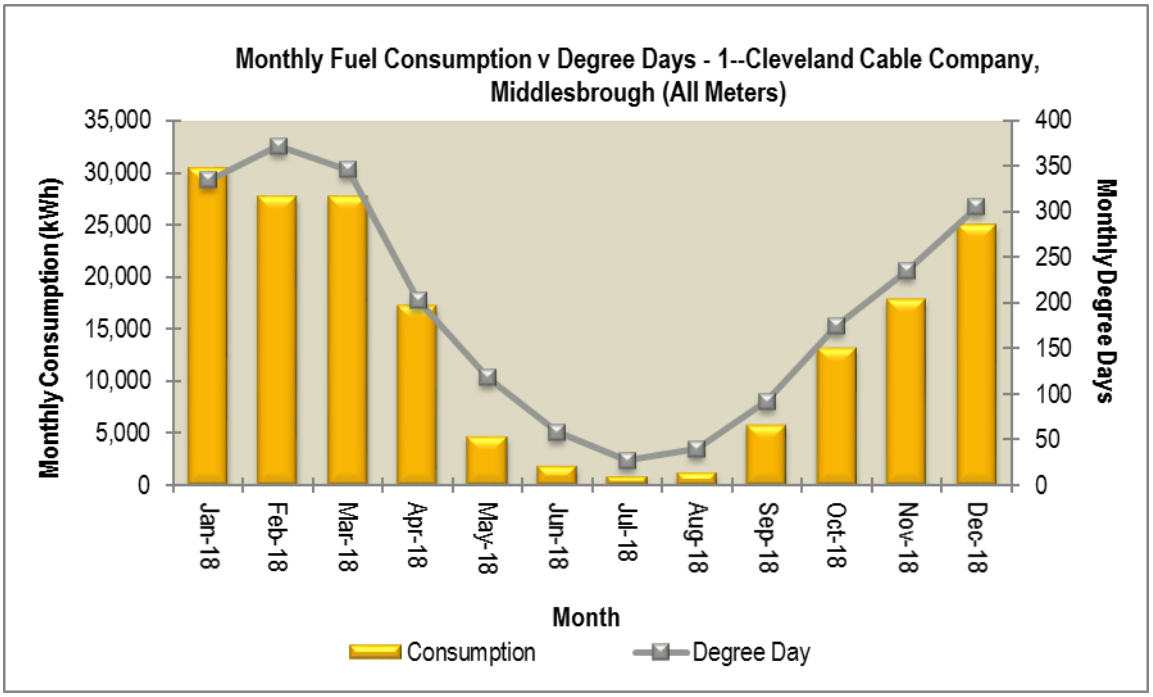

Figure 4 – Natural Gas Consumption v Degree Day Profile

The degree day profile shows a good correlation between ambient air temperature and gas consumption, which shows the heating systems have effective thermostatic controls as discussed above and reflected in the R^2 value.

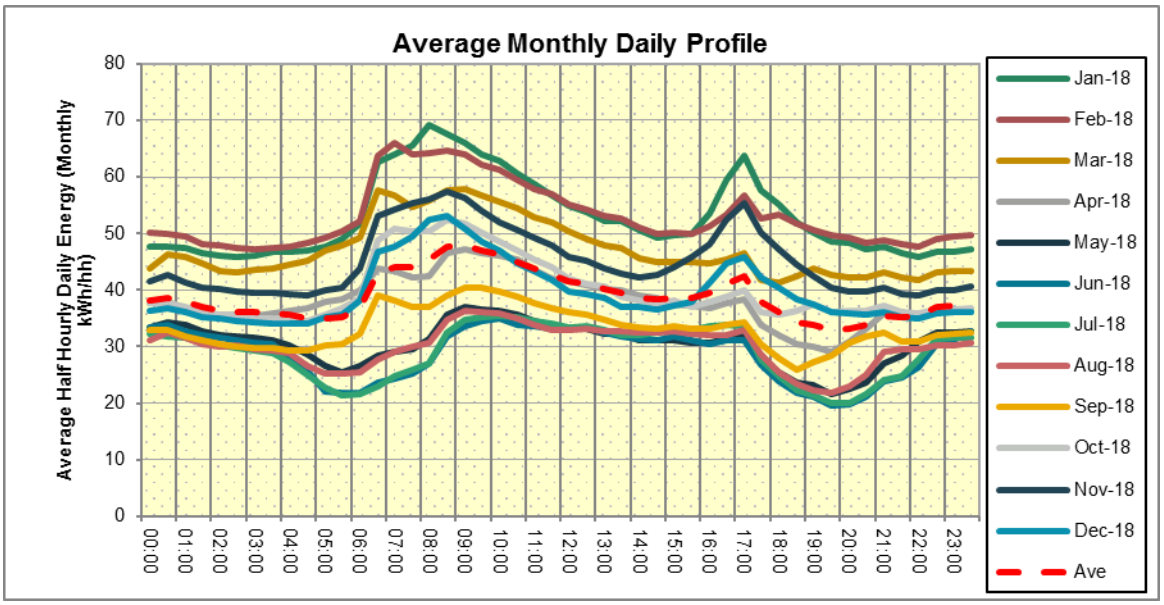

Figure 5 – Site Electricity Monthly Profile

The chart above profiles the average daily half-hourly electricity consumption, month by month during 2018. It is included to show the variation in consumption during a 24 hour period.

The profile shows equipment being energised from around 6am after the night-time or weekend lull in activity. The rise in consumption after 4pm, particularly during the winter months, probably reflects an increase in demand for lighting as night falls. The high base-load of around 30kWh/HH reflects the fact that the site is in 24 hour operation. Upgrading the lighting with more efficient LED fittings will help to reduce this.

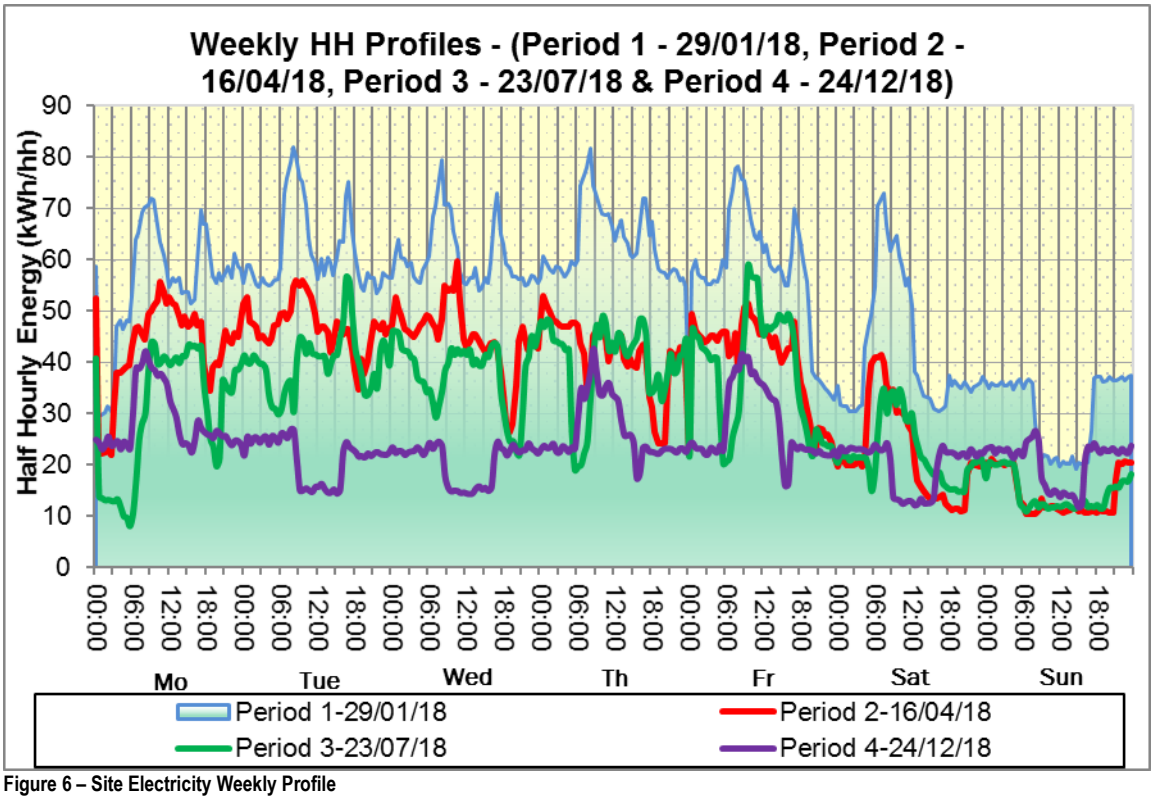

Figure 6 – Site Electricity Weekly Profile

The chart above profiles four periods of weekly half-hourly electricity consumption and is included to show the seasonal influence on electricity consumption. The profile for period 1 shows consistently higher consumption during mid-winter when demand for lighting and electric heating is highest. The relatively low consumption during period 4 reflects the Christmas holidays. However, there is a constant base-load, even during the weekends of around 10kWh/HH, which should be investigated further.

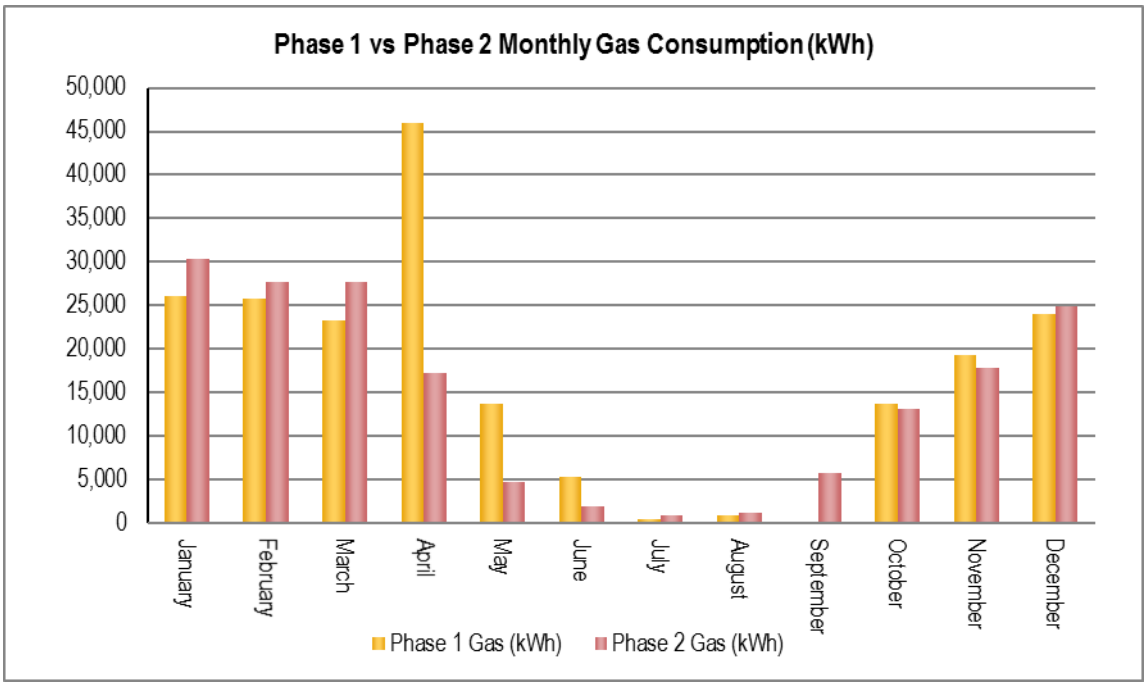

Figure 7 – Phase 1 Vs Phase 2 Gas Consumption Profiles

The above chart shows that gas consumption is broadly similar on a month by month basis between the 2 ESOS phases. The phase 1 value for April is clearly an anomaly, which should be investigated further.

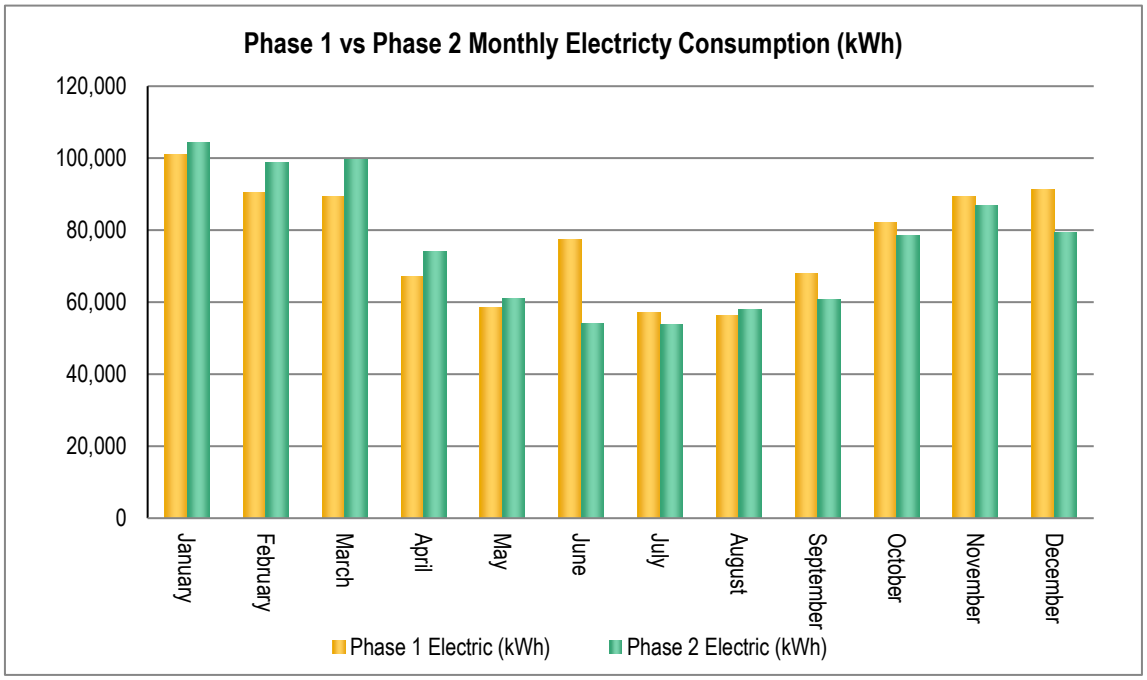

Figure 8 – Phase 1 Vs Phase 2 Electricity Consumption Profiles

The above chart shows a slight fall in electricity consumption during phase 2 when compared with phase 1. The replacement of some of the fluorescent lighting with more efficient LED lighting, as recommended in the phase 1 report, is likely to have helped in reducing the electricity consumption overall. Replacement of the remaining older light fittings with LEDs, as recommended in this report, will help to reduce consumption further in successive years.

Appendix C – Life Cycle Cost Analysis

Recommendation:	The site has a large expanse of roof area, this should be considered for onsite generation utilising solar photovoltaic systems.															
Years	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CAPITAL COST																
Capital Investment	£735,182															
Ancillary equipment	£2,000															
Installation	£8,500															
Other	£0															
Total capital cost	**£745,682**															
UTILISATION COST	Uplift															
Fuel cost	5.00%	£91,947	£96,545	£101,372	£106,440	£111,762	£117,351	£123,218	£129,379	£135,848	£142,640	£149,772	£157,261	£165,124	£173,380	£182,049
CCL		£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605	£53,605
Other		£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
Total utilisation cost		**£145,552**	**£150,150**	**£154,977**	**£160,046**	**£165,368**	**£170,956**	**£176,823**	**£182,984**	**£189,453**	**£196,246**	**£203,378**	**£210,866**	**£218,729**	**£226,985**	**£235,654**
MAINTENANCE/OTHER COSTS	Uplift															
Maintenance	2.00%	£2,000	£2,040	£2,081	£2,122	£2,165	£2,208	£2,252	£2,297	£2,343	£2,390	£2,438	£2,487	£2,536	£2,587	£2,639
Other		£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
Total maintenance/other costs		**£2,000**	**£2,040**	**£2,081**	**£2,122**	**£2,165**	**£2,208**	**£2,252**	**£2,297**	**£2,343**	**£2,390**	**£2,438**	**£2,487**	**£2,536**	**£2,587**	**£2,639**
COUNTER FACTUAL COSTS	Uplift															
Fuel cost	12.00%	£102,981	£115,339	£129,179	£144,681	£162,042	£181,488	£203,266	£227,658	£254,977	£285,574	£319,843	£358,224	£401,211	£449,356	£503,279
CCL		£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038	£60,038
Maintenance	2.00%	£2,000	£2,040	£2,081	£2,122	£2,165	£2,208	£2,252	£2,297	£2,343	£2,390	£2,438	£2,487	£2,536	£2,587	£2,639
Other		£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
Total counter factual cost		**£165,019**	**£177,416**	**£191,298**	**£206,841**	**£224,245**	**£243,734**	**£265,556**	**£289,993**	**£317,358**	**£348,002**	**£382,319**	**£420,749**	**£463,785**	**£511,981**	**£565,956**
NET CASH FLOW	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Net benefit/(cost)	-£745,682	£17,466	£25,227	£34,240	£44,673	£56,713	£70,570	£86,481	£104,712	£125,562	£149,366	£176,503	£207,396	£242,520	£282,409	
Cumulative cash flow (out)/in	-£745,682	-£728,216	-£702,989	-£668,749	-£624,076	-£567,363	-£496,794	-£410,313	-£305,602	-£180,040	-£30,674	£145,830	£353,225	£595,745	£878,154	£1,205,817
LCPP (Break Even)	**11**															

Appendix D – Site Photos

	
Photo 1 – Split AC Units Outside Assembly Shed	**Photo 2 – Dated Main Office Boiler**
	
Photo 3 – Un-insulated Heating Pipework (Main Offices)	**Photo 4 – Goods-In Boiler with Un-insulated Pipework**
	
Photo 5 – Well-Insulated Hot Water Storage Cylinder (Shed 1 Toilets)	**Photo 6 – Small Air Compressor (Shed 2)**

Conclusions

The recommendations within this report highlight areas by which the company can reduce its energy consumption and carbon footprint, by working more efficiently and installing equipment where necessary.

Although ESOS does not require businesses to act upon the findings highlighted from their ESOS compliance, it is advised that the recommendations are considered at the relevant site level and where possible and relevant, rolled out to similar buildings within the portfolio.

By becoming more energy efficient, the company will “future proof” the business from energy price increases, aid their CSR and company image, and in some cases reduce maintenance costs.

Implementing a number of the recommendations will also support future UK carbon reduction legislation schemes, which are due to come into force.

Our Locations

Newcastle

Cobalt Business Exchange
Cobalt Park Way
Wallsend
NE28 9NZ

t: 0330 303 0233
f: 0870 626 0589

Redditch

Ravens Court
Ravensbank Business Park
Redditch
B98 9EY

t: 01527 511 700
f: 01527 512 712

Bury St Edmunds

Linden Square
Kings Road
Bury St Edmunds
IP33 3DJ

t: 01284 718 111
f: 01284 718 188

www.eic.co.uk
info@eic.co.uk