RESOURCE EFFICIENCY REPORT

Old Buckenham Hall School

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On behalf of Suffolk County Council

Contents

Old Buckenham Hall School 0

BACKGROUND 2

PRIORITY ACTIONS 3

CARBON FOOTPRINT 4

CARBON FOOTPRINT BREAKDOWN 5

EMISSIONS BY BUSINESS SIZE 5

RESOURCE USE BY COST 6

IMPACT AREAS FOR PRIORITY ACTION 7

ADDITIONAL RECOMMENDATIONS 12

ACTIONS REQUIRED TO GAIN THE SUFFOLK CARBON CHARTER 13

SUGGESTED TARGETS 13

SIGNPOSTING TO FUNDING INFORMATION 14

SUPPORT PLAN AND NEXT STEPS 15

Background

The Suffolk Carbon Leaders programme assists medium sized businesses (50-250 employees) to understand the wide ranging carbon and resource hotspots within their business and take focused, practical action to improve efficiency in these areas. The benefits of becoming a low impact business through this programme are numerous including:

- Reduced carbon emissions
- Reduced resource use e.g. energy, water, materials
- Lower associated costs
- Improved reputation / resilience
- Ability to engage and influence suppliers and customers
- Contribution to the Greenest County agenda in Suffolk- visit www.greensuffolk.org for more information

Old Buckenham Hall School (OBH) is a day and boarding preparatory school for boys and girls in the village of Brettenham. Founded in 1862, OBH currently accommodates about 190 boys and girls between the ages of 2 and 13 years. OBH's 5,500 square metres of buildings house a staff of 93 full time equivalent employees within a 75 acre site. The central Brettenham Hall was built in the early 19th century. The school moved there in the 1950s, and have added buildings in most decades since then, resulting in a diverse building stock.

OBH do not have any environmental accreditations or certifications, but are keen to act where financial and environmental considerations coincide, and they are members of the Independent Schools Energy Group which assists the school with its energy management and demonstrates the school's ongoing commitment to reducing its energy consumption.

An opportunities assessment survey report was undertaken by Energy Management Solutions Ltd (funded by the Carbon Trust) in 2008. Since then they have made significant improvements to the efficiency of their internal lighting – with many high frequency T5 strip light fittings now in place.

OBH are also in the process of installing a biomass boiler to replace their current oil-fired system, which will substantially reduce their carbon emissions; a bold approach to reducing their energy consumption. For this reason, Carbon Smart were asked not to focus on heating oil consumption when considering opportunities onsite, as the financial drivers for action are currently in flux. Therefore, we have not undertaken full calculations for oil-saving opportunities, but we have logged some of them in the additional recommendations section.

Priority actions

Detailed below are the recommended actions listed in order of priority based on a number of factors including: carbon and cost savings, investment required, feasibility, visibility and resource required.

	Actions in order of priority	Potential savings (£/year)	Carbon Savings (tCO_2e/year)	Estimated capital cost (£)	Payback (years)
1	Enable remote shut down of PCs	£2,400	14	£300	0.1
2	Convert high intensity lighting to LEDs	£1,700	8	£2,300	1.3
3	Roll out a simple automated electricity monitoring and targeting system	£3,300	20	£5,200	1.6
4	PIRs and timers on the lighting in the dormitories	£1,600	7	£8,700	5.6
5	Solar panels in the grounds	£31,800	103	£482,100	15.2
	Total	**£40,800**	**152**	**£498,600**	

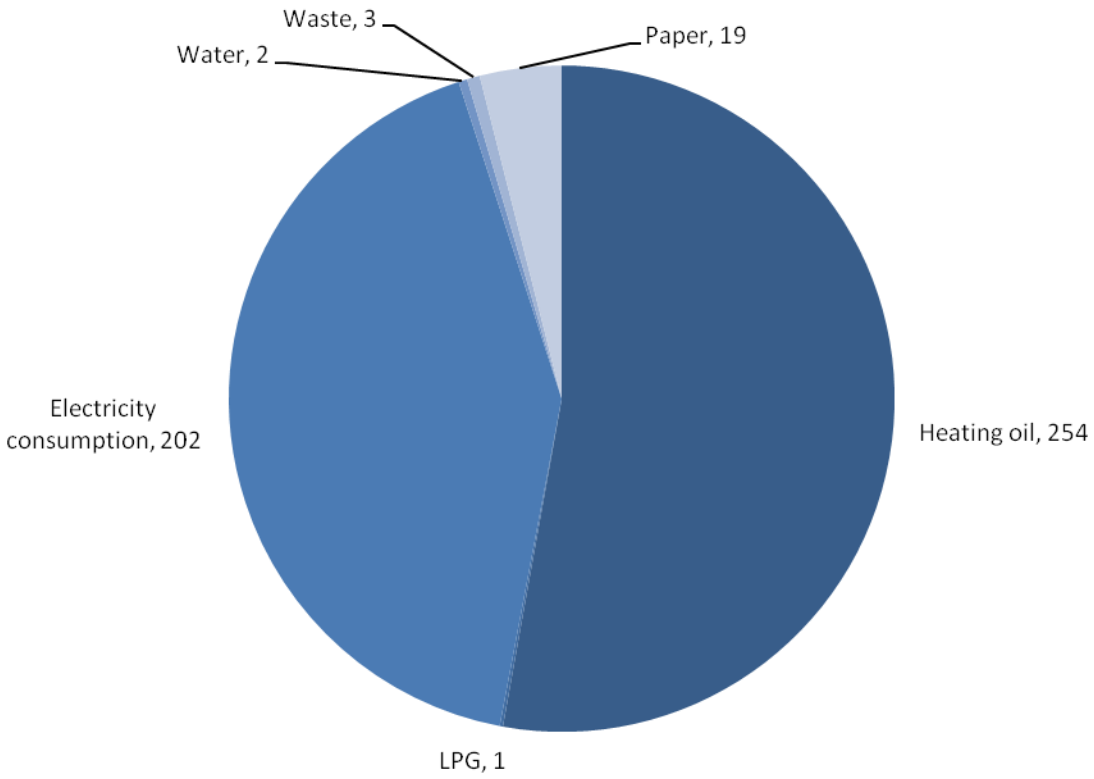
Carbon footprint

Old Buckenham Hall School's carbon footprint has been calculated covering the reporting period 01/01/2013 to 31/12/2013. Their quantified carbon emissions for this period are:

	Resource area	Raw data	Units	Cost	tCO_2e
Scope 1	Heating oil	100,000	Litres	£98,000	254
	LPG	269	kg	£1,610	1
Scope 2	Electricity consumption[1]	417,234	kWh	£39,610	202
Scope 3	Water	1,923,077	Litres	£5,000	2
	Waste	10,309	kg	£2,577	3
	Paper	2,179	kg	£9,594	19
	Grand total	**N/A**	**N/A**	**£156,391**	**481**

[1] This includes both electricity generation which is a scope 2 emission and electricity transmission and distribution which is a scope 3 emission

Carbon footprint breakdown

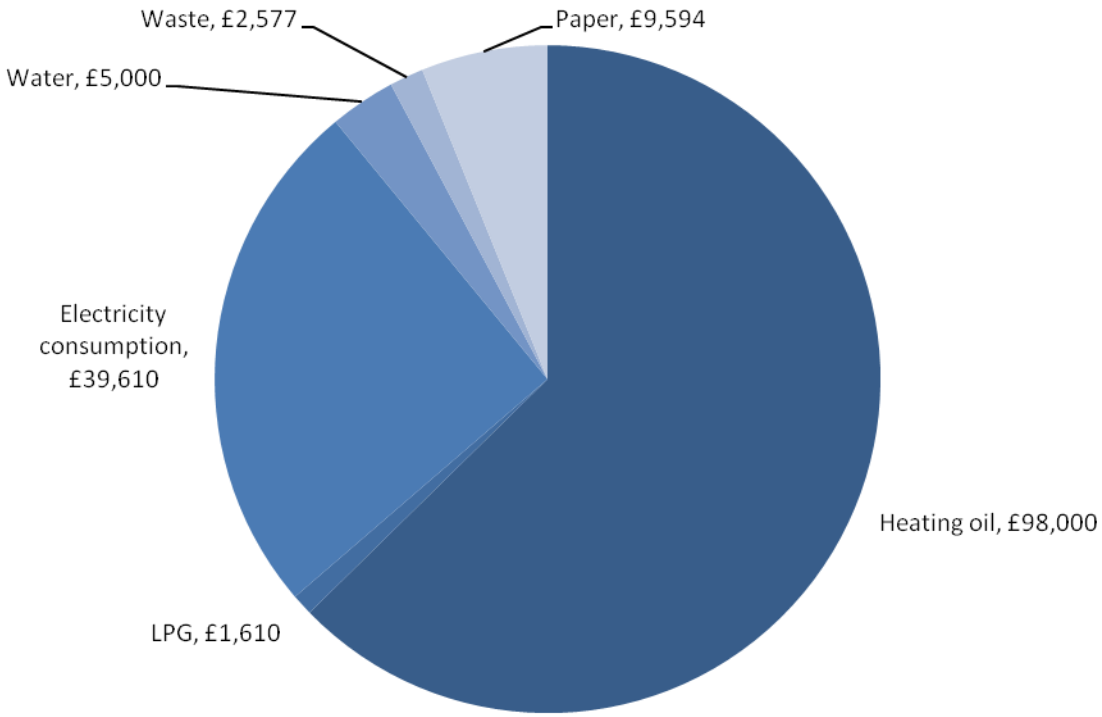


Emissions by business size

Using metrics such as these will allow Old Buckenham Hall School to monitor its resource consumption taking into account the impact that future changes will have on emissions.

	Tonnes CO_2e *per employee*	Tonnes CO_2e *per unit floor area* (m^2)
2013	5.2	0.09

Resource use by cost



NB: Where actual spend data was not available figures have been extrapolated using average costs per unit.

Impact areas for priority action

Resource area 1

Action 1	Enable remote power management of desktop computers			
Cost savings (£/yr)	**CO_2e savings (tCO_2e/yr)**	**Resource savings (kWh/yr)**	**Cost of implementation (£)**	**Estimated payback (Years)**
£2,600	14	28,000	£500	0.2
Observations	There are 58 PCs for staff and pupil use at the school, all with liquid-crystal display flat panel displays. Despite the fact that very few people were onsite (due to Easter Holidays), those PCs that were investigated (approximately 20%) were found to be in 'sleep mode' – i.e., when the mouse or keyboard was touched, the screen lit up and was on the login page – rather than being shut down.			
Details of recommendation	Power management software allows remote shutdown and start up of PCs. This software is a well established and inexpensive product. Central management of PCs on the local network allows control of one or multiple PCs remotely, as well as other power management operations. The power management actions can be scheduled to take place automatically. Remote operations are customisable; for example when a remote shutdown is initiated local users can be allowed to cancel the shutdown if they wish to continue using the computer.			
Assumptions	• Suitable software is available for under £100 • £400 has been allowed to cover staff time to set up the power management system • In 'sleep', an average PC with LCD screen draws 75W, in 'off', this is 4W • The 58 PCs are currently in 'sleep' 24/7/365 • This can be reduced to 8 hrs per day, 240 days per year • OBH pay £0.1027 per kWh of day electricity including VAT and the Climate Change Levy			
Next steps	1. Research different options for where to buy the power management system, possibly speaking to the IT department in other schools 2. Explore procurement options such as a free trial 3. Test the software on a limited number of PCs 4. When a suitable option is identified, roll this out across the PCs onsite 5. Communicate the system to all PC users			

Resource area 2

Action 2	Convert high intensity lighting to LEDs			
Cost savings (£/yr)	**CO_2e savings (tCO_2e/yr)**	**Resource savings (kWh/yr)**	**Cost of implementation (£)**	**Estimated payback (Years)**
£1,700	8	17,000	£2,300	1.3
Observations	Much of OBH's corridor and classroom lighting has been upgraded to energy efficient fittings. However, in terms of high intensity lighting (internal or external floodlights), there are more energy efficient options than those currently in place. LEDs not only provide more lumens per watt, they also last longer, reducing the amount of staff time needed, and the risks and costs of working at height.			
Details of recommendation	Metal halide floodlights are in place throughout the school. It is recommended that these are changed to LED fittings. This will require replacement of the whole light fitting (not just the bulb). These fittings are in use in many areas of the school, including the hockey pitch and tennis courts. However, changing the lighting on the sports floodlighting is not recommended because the lighting in these areas is not used for long periods of time - typically two or three times a week for up to three hours per time. This means that the payback period to recoup the cost of the LEDs is prohibitively long. However, the lighting in the drama studio and the external security lighting are in use for much longer periods. Lighting upgrades of this type can be eligible for the Enhanced Capital Allowance tax relief which will financially support for the project. If the fittings are purchased in bulk as a large upgrade a significant proportion of the capital costs (around 20%) could be recouped by this tax break. There may also be opportunities to access grants or loans to part fund the initiative.			
Assumptions	• Lighting in the drama studio: – Eight 400W metal halide light fittings replaced with eight 50W LEDs – The lights are on 10 hrs per day, 7 days per week, 45 weeks per year • External floodlights: – Eight 400W metal halide light fittings replaced with eight 50W LEDs – Five 100W metal halide light fittings replaced with five 20W LEDs – The lights are on from sunset to midnight and from 5am to sunrise • The new LED fittings cost £80 per fitting and the labour cost of each fitting is £30 • OBH pay £0.1027 per kWh of day electricity including VAT and the Climate Change Levy • Any upgrade specified should comply with CIBSE guidelines and light level recommendations			
Next steps	1. Identify a suitable replacement lighting unit that meets light level requirements 2. Obtain quotes on the cost of purchase and installation 3. Apply for available funding and finance to part fund the upgrade			

Resource area 3

Action 3	Roll out an automated electricity monitoring and targeting system			
Cost savings (£/yr)	**CO_2e savings (tCO_2e/yr)**	**Resource savings (kWh/yr)**	**Cost of implementation (£)**	**Estimated payback (Years)**
£3,300	20	42,000	£5,200	1.6
Observations	The site visit took place during non-term time, when most of the buildings were unoccupied, however on three occasions during the site visit plug-in electric heaters were found to have been left on in rooms that hadn't been occupied for a number of days. This presents a significant fire risk, as well as energy wastage.			
Details of recommendation	An automated electricity monitoring and targeting system can be installed inexpensively. This will allow remote monitoring of electricity usage from a website on a PC or mobile device. For example, one or two days into the holidays, the load profiles of the buildings could be checked to see whether there is any unexpectedly high energy usage – if there is, then this can be investigated and the offending equipment switched off. The facilities team at OBH are active in identifying and cutting energy wastage, but the heterogeneous and disperse nature of the buildings makes this challenging and means that an automated system would save significant staff time. We would recommend starting with a minimum number of metering points – around seven – just to pick up the main building areas. A system is going to be installed anyway to capture data from the heat meters across the site on the biomass system. This should serve to reduce the cost of installing the metering points discussed herein. The full costs and practicalities of this system will depend on the configuration of the existing electricity distribution boards – which will require investigation by an electrician.			
Assumptions	• 7 metering points • £1,000 distribution board survey cost • £600 per meter capital and installation costs • OBH spend £39,600 per year on electricity, of which it has been assumed that 10% could be saved through the wastage identified through this system (the Carbon Trust [2] estimate that between 5% and 15% of electricity usage can be saved in this way) • The following ongoing costs have been subtracted from the annual saving: – Accessing the data will cost £2.50 per month per point – Software licence is £25 per month – A sim card will be needed, costing £120 per year			

[2] http://www.carbontrust.com/media/13187/ctg054_energy_management.pdf

Next steps	1. Undertake, or commission the undertaking of a survey of the distribution boards by a qualified electrician to establish the suitable locations for meters in order to achieve a good picture of energy use onsite 2. Invite quotes from multiple providers for purchase and installation 3. Apply for available funding and finance to part fund the rollout

Resource area 4

Action 4	Movement sensors and timers on the lighting in the dormitories			
Cost savings (£/yr)	**CO_2e savings (tCO_2e/yr)**	**Resource savings (kWh/yr)**	**Cost of implementation (£)**	**Estimated payback (Years)**
£1,600	7	15,000	£8,700	5.6
Observations	OBH has over 2,300m^2 of dormitories, spread across 58 rooms, which, with one or two exceptions, are lit by one 11w compact fluorescent bulb per 2m^2 (as well as individual lights above each bed). During the school week, the dormitories are generally empty between 9 (when the children leave for classes following breakfast) and 12, and from 1pm and 4pm, with children only occasionally returning to the room. However, the facilities management staff confirm that the overhead lights are generally left on all day, with people only going into the rooms sporadically. The consultant was not able to confirm this as the site visit was outside of term time.			
Details of recommendation	We recommend installing timer and sensors to control the lights. After 9am, the timers should automatically switch the lights in the dormitories to being controlled by movement sensors. This will mean that between 9am and 4pm, for the light to come on, the main light switch must be in the on position, *and* there must be a movement detected in the room. Between 4pm and 9am, the lights would be controlled as normal, to avoid the lights coming on when not wanted, such as when someone gets up in the night to go to the toilet. There are also various corridors in the boarding areas in which PIR controls of the lighting would generate significant savings – particularly around the girls' boarding rooms.			
Assumptions	• The lights are on unnecessarily for an average of 4 hrs per day, 300 days per year • 58 rooms • Estimated capital and installation cost per room: £150 • OBH pay £0.1027 per kWh of day electricity including VAT and the Climate Change Levy • Any upgrade specified should comply with CIBSE guidelines and light level recommendations			

Next steps	1. Invite contractors to set up trials of systems in some rooms 2. Leave the controls in place for some weeks 3. Gather feedback 4. Invite quotes from multiple providers for purchase and installation of the preferred system 5. Apply for available funding and finance to part fund the rollout

Resource area 5

Action 5	Solar panels in the grounds			
Cost savings (£/yr)	**CO_2e savings (tCO_2e/yr)**	**Resource savings (kWh/yr)**	**Cost of implementation (£)**	**Estimated payback (Years)**
£31,800	103	212,000	£482,100	15.2
Observations	OBH spend around £40,000 per year on electricity and are situated in a 75 acre grounds. Much of the grounds is flat grassland, that is rarely used, particularly towards the north of the site. Therefore there is significant space available in the grounds for solar panels, and facilities staff onsite supported the idea of a ground-mounted solar array in this area. Situating solar panels in the grounds is preferable to on the roof due to the listed status of much of the buildings and the fact that the school does not have significant south-facing unobstructed roof space.			
Details of recommendation	Install a ground-mounted array of 1,000 250 watt-peak panels towards the north of the site, suitably distant from trees and other areas that could potentially shade the panels. This will require an area of approximately 1 acre and should save the school around £15,000 per year in electricity spend. A further £14,000 should be generated each year from the feed-in tariff and £2,500 from exporting energy to the grid. In terms of financing, the payback could be significantly shortened by pursuing a leasing arrangement whereby the installer fronts the capital costs of the installation and the loan is then paid off via the income generated from the solar array. If this payment system were selected there could be low/no upfront capital costs for OBH and once the initial loan had been paid off, for the remainder of the PV array's life it would be profitable. Alternatively, the land could simply be rented to a solar operator organisation on the basis that OBH will buy electricity from them at a reduced cost.			
Assumptions	• 1,000 250 watt-peak panels measuring $2m^2$ each • Spacing between the panels will be $2m^2$ to avoid overshading • Assuming the 6.61 p/kWh is received for generation and 4.77 p/kWh is received for energy sold back to the grid • Feasibility will be governed by the capacity of the district network, the local District			

	Network Operator should be consulted as a first step • OBH pay £0.1027 per kWh of day electricity including VAT and the Climate Change Levy
Next steps	1. Obtain quotes from three installers for the installation including a payment plan as one of the criteria. 2. Apply for available funding to part finance the installation. 3. Register on the feed in tariff scheme.

Additional recommendations

Recommendation	Observations	Details of recommendation
T8 strip lamps	Many high frequency T5 strip light fittings have been installed around the school, however, approximately 150 T8 strip lamps are still dotted around (particularly in the drama studio, music block, pre-prep and nursery)	Replace the remaining t8 strip lamps fittings with t5 fittings.
Incandescent candle bulbs	In the drawing room there are light fittings with 12 incandescent bulbs in them – there are attractive low energy alternatives available.	Replace the 12 40W incandescents in the drawing room with LED candle bulbs
Roof insulation in the old block	It is understood that the old block has minimal roof insulation and that slates are due to be changed in the coming 5 years.	Ensure that when the roof is refurbished, the thermal insulation is brought up to best practice standards.

Actions required to gain the Suffolk Carbon Charter

	Actions required	Comments
1	**Write an environmental policy**	Use the guidance provided by Suffolk Carbon Leaders to write a strong environmental policy.
2	**Recording and monitoring key performance indicators**	Begin to use the data monitoring tool provided by Suffolk Carbon Leaders to track resource consumption and monitor savings.

Suggested targets

Target	Timescale	Measure of success
Reduce the school's total carbon footprint by 10%	3 years	Continue to monitor the carbon footprint of the OBH annually to enable the tracking of progress. By implementing the measures planned this target should be achievable.
Reduce electricity consumption by 5%	1 year	Monitor electricity consumption before and after implementing energy saving initiatives. If light bulbs are replaced and sensors installed this should be more than achievable.

Signposting to funding information

Funding options for the recommendations suggested in this report are summarized in the table below. Conditions do apply, for example, some funding streams can only be accessed once by the same company, while others are not compatible with one another and cannot be used in combination. The specific requirements of the options available can be discussed further and explored as part of the implementation phase of the Suffolk Carbon Leaders engagement.

Fund/Finance	Source and information	Summary	Eligible technologies
EDF Green Fund	EDF Energy http://www.edfenergy.com/products-services/for-your-home/our-services/green-energy-fund.shtml?redirect=greenfund/#	The EDF Energy Green Fund exists to help develop micro-generation technology through funding of schemes in organisations with a social purpose such as charities and schools.	• Solar PV
Feed In Tariff (FITs)	Government https://www.gov.uk/feed-in-tariffs/overview	Feed-In Tariffs (FITs) provides a tariff (payment) for every unit of electricity generated by a renewable system. Electricity not used by the company can then be sold back to the grid for an additional export tariff.	• Solar PV
Carbon Trust & Siemens Energy Efficiency Finance	Carbon Trust and Siemens http://finance.siemens.com/financialservices/uk/products_solutions/equipment-finance-leasing/energy-efficiency-financing/	Provides unlimited loans which are paid back over a 10 year period. The savings generated by the installation should cover the repayments meaning no direct capital expenditure is required. Any technologies are support provided they meet the 'golden rule' that estimated savings must be equal to or greater than repayments. This will be assessed during the Carbon Trust assessment.	• Lighting

Support plan and next steps

A number of recommendations have been presented in this report and Old Buckenham Hall School will now make a decision as to which projects they wish to take forward as a priority, and how the Suffolk Carbon Leaders programme can support this process. The table below offers an outline plan for the two day implantation phase of the project, however the support can be tailored to your organisation's requirements.

	Actions	Next step	Start date	Time-scale	Responsibility
1	Obtain quotes for chosen technology measures	1. Obtain three quotes for the purchase and installation of the chosen technologies: these could be lighting upgrades, refrigeration process upgrades, solar PV.	Implementation visit date TBC	1 day	Suffolk Carbon Leaders Team with support from the Engineering Manager
2	Apply for financing to cover part of the costs of installation	1. Identify eligible funding and/or finance streams. 2. Submit applications based on the quotes obtained.	Implementation visit date TBC	1 day	Suffolk Carbon Leaders Team with support from the Engineering Manager

To arrange your implementation support or if you have any questions about the contents of this report, please contact your consultant with the details below. If you would like to go beyond the two days implementation support provided by the Suffolk Carbon Leaders programme further support can be provided at a day rate of £400.

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