Brodie Plant Goddard
Energy Consultation

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WPI

Mole Valley District Council

1. Introduction

The purpose of this energy consultation was to discover potential areas of energy reduction and savings within Brodie Plant Goddard building in Dorking. This consultation was conducted using a questionnaire and check list during a walk-through, with supplementary data on past gas and electric usage. BPG is an architecture firm, whose Dorking office building is part of a bigger building with separate electrical and gas billing. BPG has recently updated their heating system in an attempt to make the temperature uniform throughout the office in order to increase employee comfort.

The energy consultation, analysis, and report were completed by four American university students, for a project requirement for Worcester Polytechnic Institute. These students are working with the Mole Valley District Council to help reduce the carbon emissions of small and medium enterprises in the Mole Valley.

Notice: While there has been an effort made to ensure that the information contained in this report is accurate, it should be taken into consideration that some of the information may be incomplete, inaccurate, or become out of date. Therefore, Mole Valley District Council, Worcester Polytechnic Institute, and all associated persons do not provide any guarantees on the information provided in the following report.

2. Action Plan

The recommendations listed below are prioritized by payback period and estimated costs. Further explanations of each recommendation are provided.

Priority	Recommendations	Estimated Annual Savings			Estimated Costs (£)	Payback Periods (years)
		(£)	CO_2 (Kg)	(kWh)		
1	Behavioral Changes	---	---	---	---	---
2	Envelope and Door Insulation	140	1,485	5,690	460	2.9
3	Lighting Control	69	373	690	600*	8.7
4	LED Lighting	709	3,868	7,093	6,233	8.8
Total		918	5,726	13,473	7,293	7.9

* I guess that it would take an electrician about five days at £100 a day to zone the lights, this is while he is rewiring the fixtures for LEDs. It will be around £500 a day if he were to do it on its own.

3. Energy Savings

a. Priority 1: Behavioral Changes, No Cost Solutions

Make sure that all radiators are unobstructed and kept on appropriate settings. Obstructed radiators are forced to work harder to heat a room resulting in higher energy usage. Also a radiator that is left on its maximum setting will never turn off and over heat a room. Keeping radiators unobstructed and at a setting of 3 to 4 you will save energy and money.

Site Specific Examples:

- Many of the radiators in the building were obstructed by furniture or other items and should be moved accordingly if at all possible. See Figure 1 and Figure 2 below for some examples.

Figure 1: Desk in front of a radiator

Figure 2: Desk in front of a radiator

- Ensure that the TRV's are at a level of 3-4 unless otherwise needed.
    - If the radiator is in a place where it is blocked, ensure that it is turned off.
    - There is a frequently vacated office with the TRV set on high. When the office is not in use, make sure the TRV is on a frost setting.
    - The main lobby has one radiator installed to heat a whole room with many leaky windows. Consider either turning the radiator off completely because the staircase is

blocking the heat, which makes it never actually reach the upstairs portion of the office. This renders the heater obsolete.

- Most employees turn radiators down when heat during the winter becomes too hot, however some employees claim to open windows during the winter when heating gets too intense. Try to stress temporarily turning on a fan and turning down the radiator valve. However this is not possible for employees near the edges of the building with floor radiators.
- Desks located near the edge of the building are not properly positioned as to take advantage of use. When talking to the two employees on the right side of the office, the side where the main conference room is located, they said that they didn't think the floor heating system worked at all and complained of being very cold in the winter. However, the employees on the side of the office with the printing room said they were very hot and had to open windows during the winter.

  The first set of employees had their desks positioned in such a way that the cubicle wall was consuming all of the heat being distributed by the floor unit. Consider rotating the desks on that side of the office by 180 degrees so that the person sitting at the desk has their back facing the heater.

  Make sure that the employees on the other side of the building have their cubicles either facing the heater or move them to a more centralized position in the office so that they do not consume heat. If reorganizing desks created a large disturbance, consider creating an office model in CAD and freely postulate repositioning employee desks without bothering anyone.

Turn off lighting and electrical equipment when it is unnecessary. Ensure that computers and lights are turned off when office is closed and when rooms are not in use.

Site Specific Examples:

- The kitchen light was left on all day when we went through the building. Consider imposing "light off hours" outside of lunch hours. Possibly, turn off lights after use during the hours of 11.00-14.00 to ensure that the fluorescent bulb life is not drastically reduced and excess energy is not being used.

b. Priority 2: Building Envelope

Instead of purchasing new windows, make the old ones work in a more efficient manner. Also ensure that doors are sealed to prevent cold air from infiltrating the inside of the building.

Site Specific Examples:

- The windows that surround the building can be more efficient with the aid of window insulation film. Specifically convection control film which cuts down the amount of heat lost from the inside of the building. It can also prevent window condensation, another reason for heat lost.

Installation Costs	Savings Per Year	kWh Saved per year	kg CO2 saved per year	Payback Period (years)
400	99	4320	800	4

- Some of the rubber seals on the windows were getting disconnected from the window pane. These require regular maintencance to ensure that cold air from the outside does not infiltrate.

Figure 3: A window that had a seal falling off it. This is possibly an area for improvement.

- The emergency exit door leading to the secondary fire escape has a large gap between the bottom of the door and the floor. Consider filling in the gap with a door skirt or resizing the door. Also, the front door to reception could also use a door skirt to keep the cold air from the lobby from penetrating into the office.

Figure 4: Rear fire escape door gap

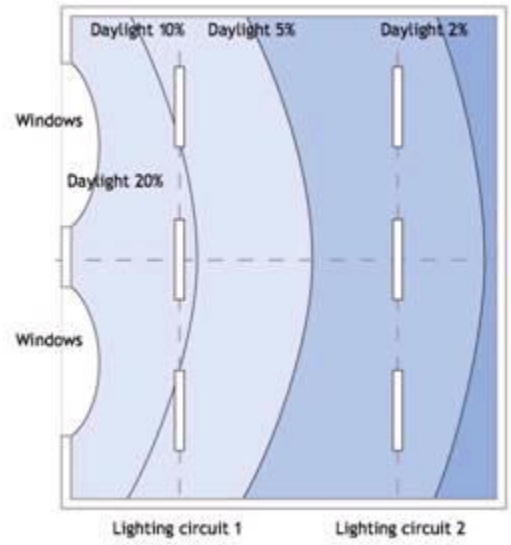
Item	Quantity Units	Est. Cost of Each Item £	Annual Saving £	Total Investment £	kWh saved per year kWh	kg C02 saved per year	Payback Period years
Front and Rear Doors	2	30	41	60	1370	685	1.5

c. Priority 3: Lighting Control

Lights that are on when they are not needed consume extra energy. There are different situations which can result in lights being on, though they not needed. Timed lights, lights in often though not continuously used areas, or incorrectly zoned lights are some examples of why more lights may be in use than are needed.

Site Specific Examples:

- The lights in the open office areas of the building are zoned in square sections. These lights should be zoned such that the line of lights closest to the windows are one zone with subsequent zones moving further from the windows. Lights in offices should also have separate switches so that they can be turned off when not in use. If they are zoned in this manner, the lights closest to the windows can be turned off when the sun provides sufficient lighting, therefore saving energy. This means, with sufficient sunlight, approximately one eight to one quarter of a large room's energy consumption can be cut, and one half of a small office can be cut.



Total Number of Bulbs in Zoning Area	Total Current kWh per Year	kWh saved if 1/8-1/4 of Lights are Turned Off	Money Saved per Year (£)	CO_2 Savings (kg of CO_2)
50	4104	513-1,026	51-102	277-554

*This is if the lights are off for half a day on average throughout the year

- Toilettes are frequently used areas, where the lights are left on when no one is in the room. All the toilettes in the building should have motion sensors installed on the lights. This will save energy by turning off the lights when the room is not being used, while adding the convenience of having the lights turn on when someone enters the area. For added employee convenience with motion sensors, check to see if it has a timer.

Location	**Total Number of Bulbs in Zoning Area**	**Watt of Bulb**	**Total Current kWh per Year**	**New Consumption with Technology**	**Money Saved per Year (£)**	**CO2 Savings (kg of CO2)**	**Cost of Appropriate Sensor (£) (£50 ea.)**	**Payback Period (Years)**
Toilet	8	14	242	61	18	98	100	5.6

d. Priority 4: LED Lighting

Replace existing lights in the facility with newer lights. Many old lighting elements have become inefficient over the years. Replacing the existing elements with LED equivalents allows you to save significant amounts of money on your energy bill. If LED bulbs are not a viable option at the current time then CFL and fluorescent tubes can be used but make sure that the most efficient ones are in use i.e. T8 or T5's for fluorescent tubes and bulbs with high energy ratings of A or B should be used. The table below breaks down the recommended areas where lighting should be replaced with all the correlating information about payback periods and costs.

Site Specific Examples:

- All halogen spotlights can be replaced with lower wattage LED lighting where possible.
- When installing LED lighting, labor must be performed to bypass the ballast. A price of £4 per bulb has been added to the total costs to factor this in.

New Bulb	New Wattage*	Total Costs*	Savings per year	Kwh saved per year	kg CO2 saved per year	Payback (years)
1200mm LED	15.00	5,345.00	596.00	5,961.00	3,250.00	8.17
590mm LED	8.00	832.00	76.00	760.00	415.00	9.26
GU-10 LED	7.00	56.00	37.00	372.00	203.00	1.08
		6,233.00	709.00	7,093.00	3,868.00	8.79

*All calculations are based off pricing and wattage from Halers Lighting 2011 Catalogue

**This is based off an electricity rate of 10p per kWh

4. Additional Considerations

These are items that should be considered to help increase energy savings.

Site Specific Examples:

- It is possible that the extract fans are on after hours, it was not clear whether or not the building management system controls this.
- The LTHW boiler seemed to be oversized. It may have used to heat water for the two showers on the ground floor, however those showers have inline water heaters in them. The boiler is only heating water for four WC faucets and two kitchen faucets. These kitchen faucets do not need an excessive amount of hot water because only small plastic containers, plates, and cups are being washed and at most one at a time. Reducing the size of this boiler will help the heating system use less energy.
- The heating scenario in the lobby is difficult. Experiment with turning the heater completely off and see if employees walking to the WC and kitchen notice. If they do notice the heater off then consider adding thin film insulation to the two-story set of windows in the lobby area.
- Consider adding zoning to the lighting fixtures when the rewiring needs to be done for the LED additions. This way labor costs will be reduced and payback period for these suggestions will be lessened.

5. Brief Summary

In summary it can be seen that while this building is already doing very well in energy efficiency, there are still areas which can be improved to help reduce energy usage. Many of these steps are of a higher cost or more difficulty, but will be worth the change due to the amount saved on energy bills. Some savings opportunities in this report have not been quantified due to the large amount of variables present in the calculation. Carefully read over the report and take advantage of the most useful suggestions first. We recommend that you seek the opinion of another expert to check our numbers and suggestions. Good luck and happy savings!

Appendix A

Enhanced Capital Allowance (ECA)

ECA allows for companies who are investing in energy saving technologies to receive a tax relief on their profits for the year based on the amount they spent on the energy saving technologies. This provide companies to have additional capital to be able to put energy saving equipment in that would normally be too expensive so that both the environment and the company are able to benefit quicker from their investments.

There are currently many energy saving technologies out there for the many different sectors of a business from lighting, to HVAC, to pipe insulation, to motors, etc. The technologies for these sectors can often provide great energy savings but can cost more than a business is willing to spend. The ECA then provides a company with additional capital so that they can benefit from the savings of the energy efficient technology.

About ECA: This link provides more information on why the ECA was started and some of the key features that it has.

http://www.eca.gov.uk/etl/about/

How ECA works: This link breaks down how exactly the ECA works and how much money a person may see from claiming an ECA.

http://www.eca.gov.uk/etl/about/How+does+the+ECA+scheme+work.htm

Benefits of ECA: This link provides more information how claiming an ECA can benefit a business from cash-flow boost and lower energy costs.

http://www.eca.gov.uk/etl/about/Value+and+Benefit.htm

Finding Eligible Technologies: This link provides the information on the various technologies that are currently out there that an ECA can be claimed for. http://www.eca.gov.uk/etl/find/

There are a few technologies that are not listed as they are very variable or to numerous in type. More information on how to check if the technology is eligible for a company to claim an ECA is provided in the link below. In many cases if a contractor is hired to complete the work they should be able to provide information on whether or not an ECA can be claimed.

http://www.eca.gov.uk/etl/claim/non-listed.htm

Claiming an ECA: This link provides information on how and where to claim an ECA.

http://www.eca.gov.uk/etl/claim/