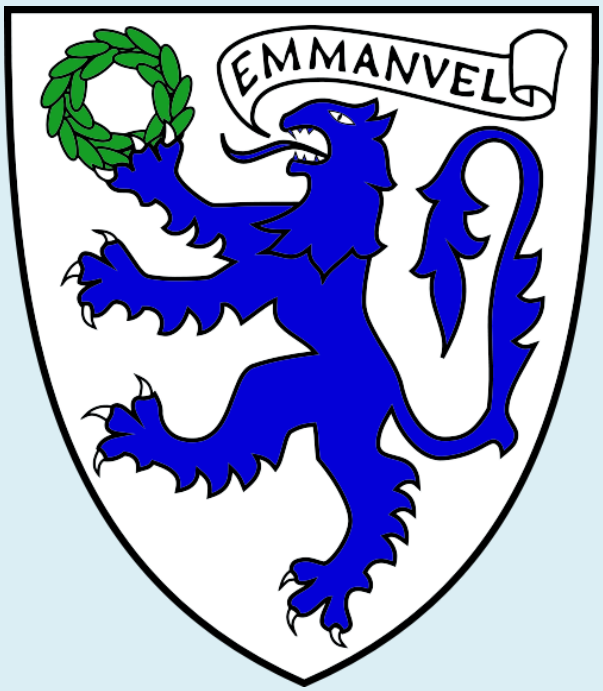
CU ECS

Emmanuel
Green League Table Report

Academic Year 2013 - 2014



Sponsored by IBM

Compiled by Paul Cohen

Aims

The Green League Table is run by the Cambridge University Environmental Consulting Society (CUECS). Its principle aims are to promote sustainable practice and environmental concerns through the provision of analysis and constructive feedback. The grading system allows assessment of environmental performance both at a college and university wide level.

Contents

Executive Summary

This is the second year that Emmanuel has participated in the Green League Table, and there have been a few improvements in areas such as recycling and electricity usage. However, its main downfalls remain the same: overall energy consumption, specific education and policy, and water usage. All of the population data was submitted, meaning a good analysis could be done, although construction and service data was not entered so a more in-depth reading of the data was not possible.

1. Technical Analysis

Quantitative graphical analysis is conducted on four areas of Emmanuel's operations:

- Management
- Energy
- Water
- Recycling

Data is collected from our online survey, alongside central collection from the TEAM Database and Cambridge Water. Please be aware, energy and water data are for the reporting period April 2012-2013 as April 2013-2014 are not yet available.

Focus lies on understanding the college's consumption of energy, water and waste, with consideration of the management systems put in place to address such usage.

1.1 Management

Data on managerial components of environmental strategy employed by Emmanuel are assessed on three components:

1. Current sustainability **practice**:
   Infrastructure and managerial systems currently in place
2. Environmental **policy**:
   Long term plans for environmental issues
3. **Education** initiatives:
   Programmes to inform staff, students and fellows about environmental awareness with the motive of promoting sustainable behaviour

Management data is displayed through a Spider Plot which shows a direct comparison between Emmanuel's current performance, 2013 performance and the average performance across Cambridge Colleges.

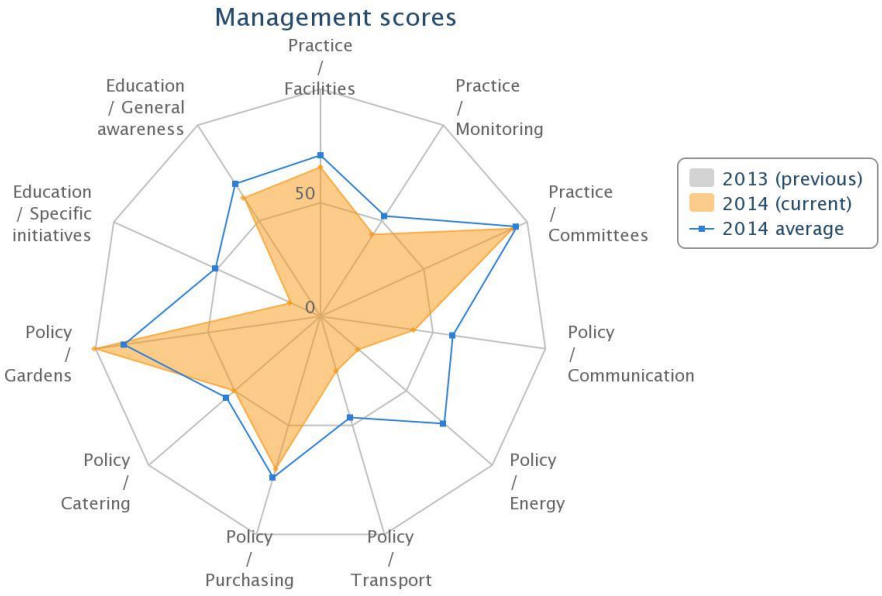


FIGURE M- 1: MANAGEMENT ACROSS CORE MANAGEMENT AREAS

Emmanuel performed on par with the University average for a number of criteria, with a comprehensive gardening policy as well as the presence environmental committee meaning it performs well in these areas. However, it also falls significantly below the average in a few areas, notably for energy, transport and communication policy, as well as lacking specific education initiatives.

This dip below the average across most of the policy areas indicates an obvious area for improvement. A more defined policy could help the college reduce its environmental impact, by creating targets to work towards and giving members of the college an idea of what things should be reported as breaches of such a policy, allowing changes to be made much more rapidly. Consequently, this is something that should be prioritised for next year.

Last year's management data was in a different form with fewer categories so has not been overlaid here, but showed a similar trend in performance. The college still has a good general awareness score, due to leaflets explaining recycling in student's rooms and some posters encouraging people to recycle, but a rise in the University average this year has meant the comparative score is lower. Making a wider range of information more accessible would help improve this, such as displaying the sourcing of food in the canteen, or targeting electricity and water usage By putting up signs in laundry rooms to encourage washing at lower temperatures.

1.2 Energy

1.2.1Overview

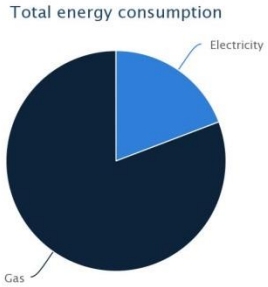


FIGURE E- 1: TOTAL ENERGY CONSUMPTION

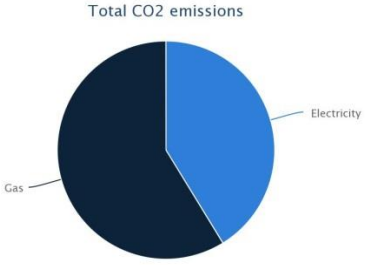


FIGURE E- 2: TOTAL ENERGY CONSUMPTION DIVIDED BY CO_2 EMISSIONS

Figure E-1 shows the distribution of energy consumption between energy sources within Emmanuel properties.

With over 80% of energy being supplied by gas, Emmanuel is in a promising position in terms of CO_2 emissions. It can produce significantly less CO_2 than colleges that have a higher electricity usage, due to the amount of CO_2 produced per unit of energy being almost 3 times as much for electricity as for gas. Due to this large emission weighting on electricity, it is advisable to replace the use of electricity with gas wherever possible, and reduce the overall electricity consumption where it is irreplaceable.

Between 1st of April 2012 and 31st of March 2013, the college used a total of 8453 MWh, a large increase from 6780 MWh for the previous year. The consumption of electricity did go down this year (from 1763 MWh to 1606MWh), but was accompanied by an increase in gas consumption of 1830 MWh (35%). The difference in the equivalent CO_2 factor between electricity and gas leads to a much less severe change in total CO_2 emissions, but there was still an increase from 1875 tonnes to 2132 tonnes.

Type	CO_2 Emissions [Tonnes/MWh]
Electricity	0.541
Gas	0.1836

TABLE E- 1: CO_2 EMISSIONS FROM ENERGY USAGE

1.2.2 Electricity

1.2.2.1 Per Capita Electricity Consumption

Figure E-3 shows the per capita electricity consumption of Emmanuel properties. Properties satisfy different usage categories: residential, mixed, other and unknown. This

allows distinction between purely residential properties and those that may share potentially higher usage due to less reflective per capita usage figures. Unknown indicates that the usage of the property has not been specified within the survey, with it possible to update this information in the next survey submission.

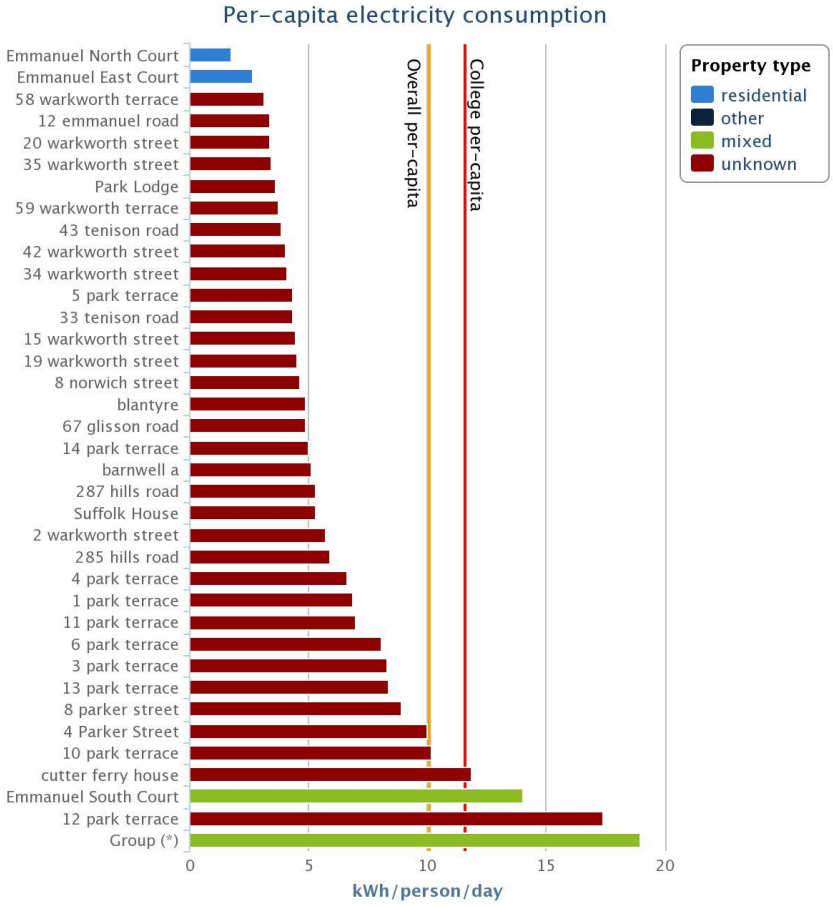


FIGURE E- 3: PER CAPITA ELECTRICITY CONSUMPTION

The UK average per capita electricity consumption is approximately 5.7kWh per person per day.

The college's average electricity usage is 11.6 kWh/person/day, a decrease from 15.2 kWh/person/day last year. This is an impressive result, as the defined population increased from 546 to 616 this year and total electricity consumption actually declined slightly as well. However, while being below the University average, it is still considerably greater than the UK per capita average. This is mainly due to the college being not only being occupied during the evening like a normal UK household, but also has a large proportion of students and staff being in college throughout the day. The low electricity usage this year is also accompanied by a large increase in gas consumption, a correlation which will be evaluated later.

The majority of the electricity is used by the main site, and goes through three half-hourly meters: "Emmanuel Hostel Block", "Emmanuel Kitchen Boiler House" and "Emmanuel Queens Building" (**Group(*)** on the graph), the three of which represent about half of the

total consumption. These properties include communal facilities such as the kitchen, the Porter's lodge and the lecture theatre, meaning the per capita consumption is much higher than most of the other properties.

The next highest consuming properties are **12 Park Terrace** and **South Court**, both above the college average. The Park Terrace house only has a defined population of 4, but it is unclear whether it serves other functions. This should be investigated, as there are potentially large savings to be made here if the cause for the high consumption is identified.

South Court displays a more troubling consumption, as it houses over 100 people for 27 weeks of the year and is second in total consumption only to the communal main site buildings. It is mainly residential, but does also house the college bar which will be responsible for some of its large usage. On inspection of the property, another cause has been identified:

- Hallway, staircase and bathroom lights are not on a timer and cannot be switched off. Although they use energy efficient fluorescent lighting, this is still responsible for a large amount of unnecessary wasted electricity.

The lowest consuming property is **North Court**, which is entirely residential. At just 1.7 kWh per person per day, it is far below the national average, which seems to imply a very economical use of energy. However, as will be seen later, the gas consumption must be taken into account to get an overall picture of a property's energy efficiency.

1.2.2.2 Daily Electricity Consumption

Half hourly electricity consumption over the reporting period April 2012 – 2013 is available for the main site.

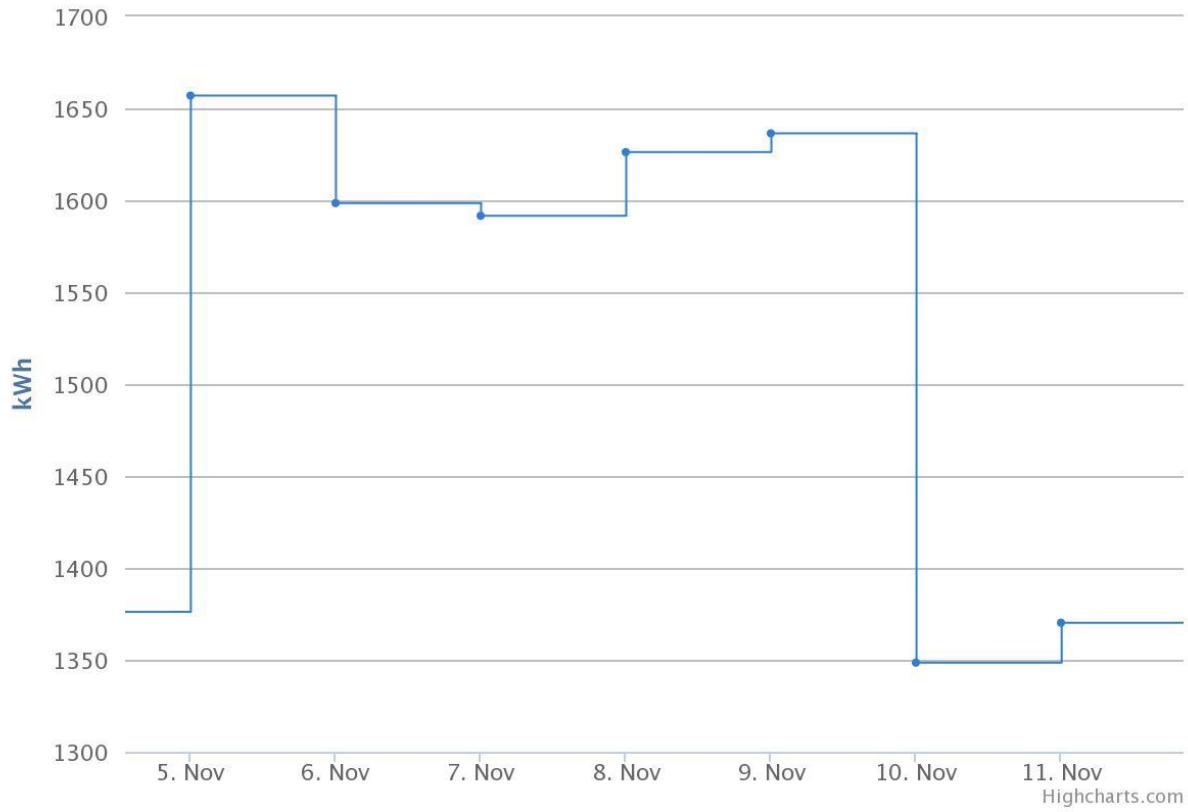
Figure E-5 shows the variation in electricity consumption over the year at the resolution of each day. This gives an indication of the fluctuations in electricity consumption over the year, taking into account the influence of weekend/weekday and seasons.

FIGURE E- 4 – ANNUAL DAILY ELECTRICITY CONSUMPTION ('EMMANUEL KITCHEN BOILER HOUSE' METER)

From the variation within Figure E-5 it is possible to make some estimation of energy usage for some activities within the college:

Weekday and Weekend Variance

The weekly variance of the usage can be seen in the annual graph, but is clearer if zoomed in on a particular week (in this case, around week 5 in Michaelmas term). This shows the lull in electricity use at the weekend, which is mainly due to the absence of office staff.



Term Time Variance

The main drops in usage (aside from an anomalous month in May) coincide with the holidays, when the college is mostly empty. A good base load can be taken from around Christmas day, when the college is almost entirely empty. This is around 480 kWh for the "Kitchen Boiler House" meter, a considerable amount considering that there are almost no residents. This base load is due to lights and appliances that are left on unnecessarily, as well as some essential services.

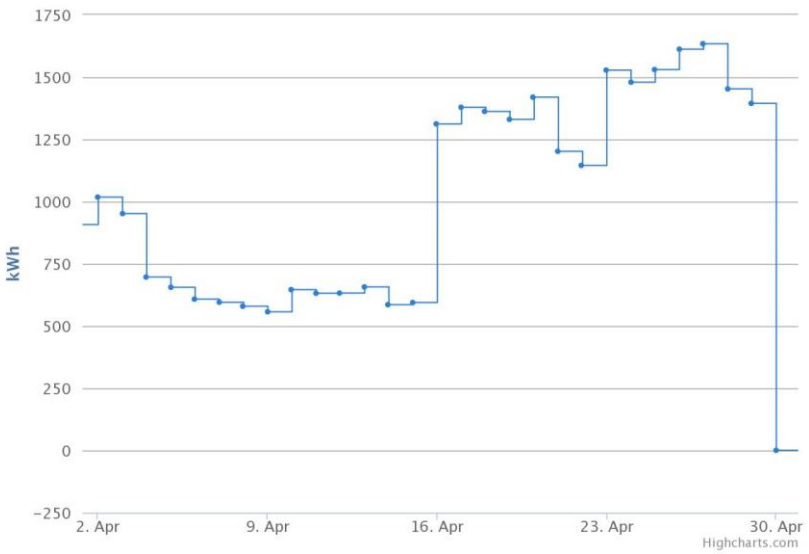
Seasonal Variance

There is an obvious and easily explained difference between the usage in the summer and the winter (during term time). During the winter, with shorter hours of sunlight, lighting is used for longer periods during the day (fig. E-7). If any heating is supplied by electrical sources, the colder temperatures can mean this also increases consumption, but as electric heaters are not allowed in Emmanuel student rooms this is unlikely to contribute.

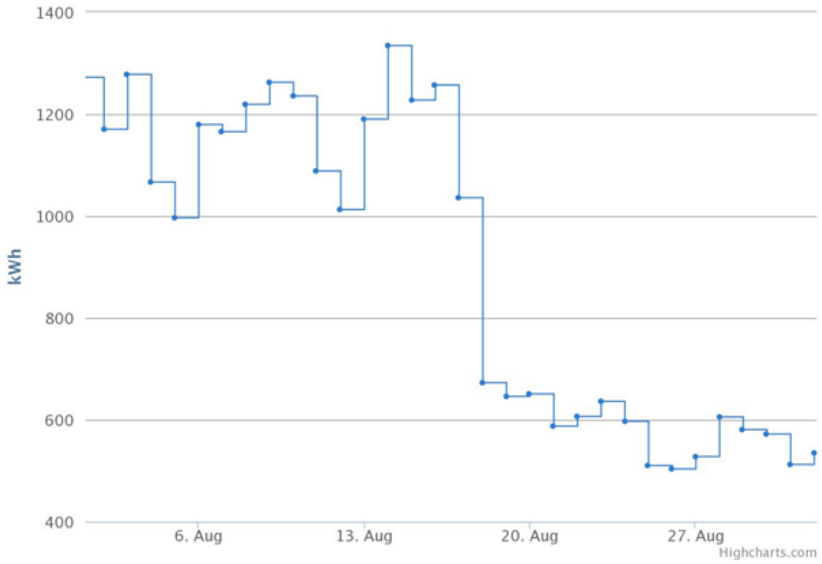
Electriciy Consumption over the course of a day

Half hourly data can also be used to analyse energy use of the course of the day.

- In the middle of the night, the electricity usage is understandably at its lowest.
- Between 6am and 8am, when the kitchens start working and people wake up, the usage rises rapidly, staying high over lunch when lots of people are in college.
- After a lull in the afternoon, the consumption reaches a maximum at about 6pm, when students are mainly either in hall or in their rooms. It then drops off rapidly as the kitchens close down at around 7pm.



April 2012


1400
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kWh
6. Aug
13. Aug
20. Aug
27. Aug
Highcharts.com

August 2012

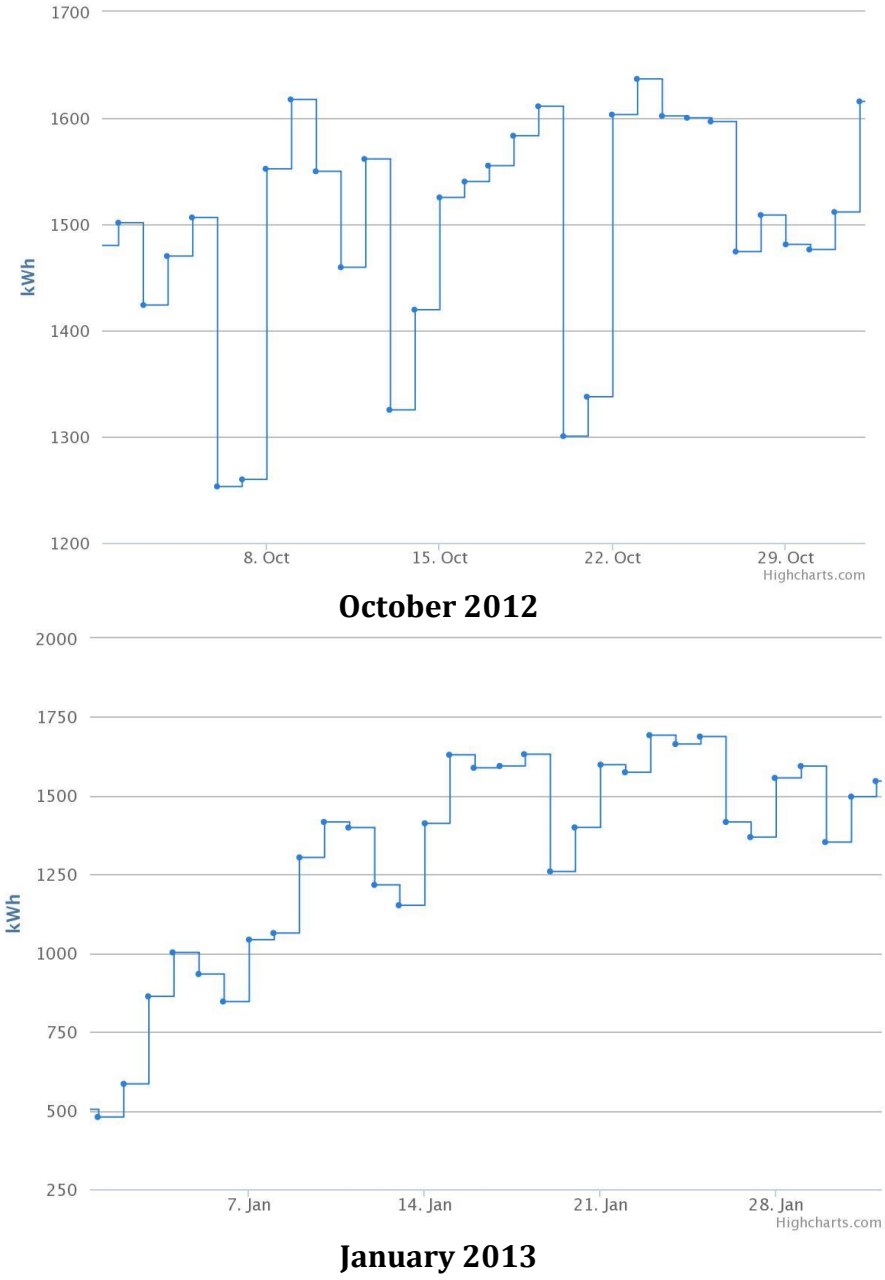

FIGURE E- 5: ELECTRICITY USAGE THROUGHOUT THE DAY COMPARED BY SEASON

1.1.1 Gas

1.1.1.1 Per Capita Gas Consumption

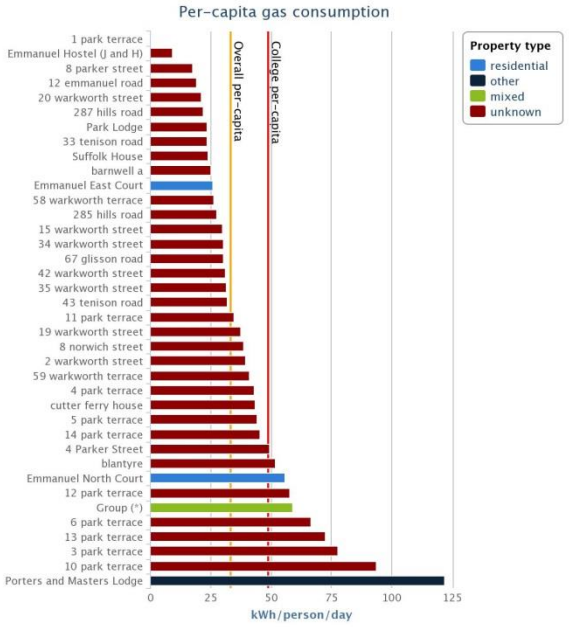

Figure G-1 – Per Capita Gas Consumption

Figure G-1 shows the per capita gas consumption of Emmanuel properties.

This graph shows the impact of the college's large gas consumption on its position relative to the university average. It had per capita usage of 48.7 kWh for this period, an increase on last year's average of 43.8 kWh. This difference could have been due to the slightly milder winter experienced in 2011-12 than 2012-13, but this seems unlikely when it is seen that the University average actually decreased from 46 kWh to 33 kWh.

No single property appears to be responsible for this large jump, with all of the greatest consuming buildings exhibiting a similar increase in usage. It is therefore unclear what could have caused this large change.

The lowest electricity usage award went to **North Court**, a residential building that used only 1.7 kWh per capita. As expected, this has been compensated for by having a gas usage above the college average, though this still means that, overall, it is responsible for less CO2 emissions than other properties (again, due to the large CO_2 factor for electricity).

Park Terrace houses **6**, **13**, **3** and **10** show a worryingly elevated consumption, considering they were also some of the greatest consuming properties for electricity. This could be due to their population data being incorrect, and is something that should be investigated.

South Court, identified as a high consuming property with regard to electricity, does not have unique gas data to be compared as it is part of the bar marked Group(*). However,

on inspection of the property some probable causes for inefficiency were highlighted by residents:

- Rooms do not have individual thermostats, though temperatures vary drastically between rooms: some are kept at around 17°C, while others are as high as 23°C. This means people open there windows while the heating is on to cool the room down, which represents an obvious source of waste.

- External doors are not draught proofed, and shutters also have little or no draught proofing.

- Each room has a large (2.4m^2) single glazed window. This accounts for a significant proportion of the external surface of the buildings, and offers very little insulation compared to insulated walls or double/triple glazing.

1.2 Water

The UK average per capita water consumption is approximately 150 litres/person/day.

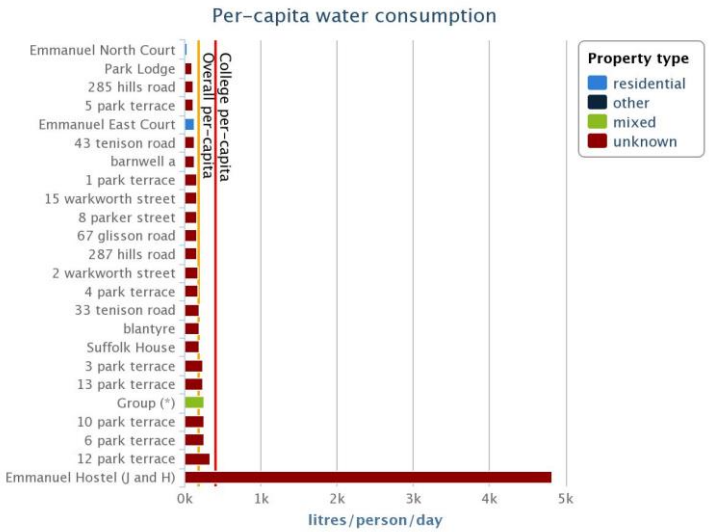

FIGURE W- 1: ANNUAL WATER PER CAPITA

The majority of properties sit close to the University average in terms of water use, but **Emmanuel Hostel** immediately stands out as a property to be inspected more closely.

Emmanuel Hostel's huge per capita water usage is down to the College laundry being situated in its basement, which washes around 200 bags of laundry a week. Assuming that residents of Emmanuel Hostel use a similar amount of water per day as 12 Park Terrace (the second largest per capita consumer), They would only account for around

2250m^3 of water use per annum, so the laundry can be said to be responsible for using 27 600m^3 of water per annum. This would correspond to 2600l *per bag of laundry.* Considering that a normal washing machine only uses 40l per wash, there is clearly something wrong with this analysis.

Looking at the raw data for the meter, the actual water usage of the meter appears to be around 3000m^3 per annum. Again assuming an above average water usage by the residents, this now leaves around 750m^3 being used by the laundry. The number of bags washed per day is not known exactly, but using last year's figure of 200 per week and assuming this figure is true for around 30 weeks of the year, this gives a value of 125l per bag of washing. Compared to 40l per wash, this still appears to be rather high, but this could be down to the large uncertainty in the actual water consumption. More regular metering would solve this problem, as well as providing a warning system for potential leaks that could easily go unnoticed due to the large total consumption.

1.3 Recycling

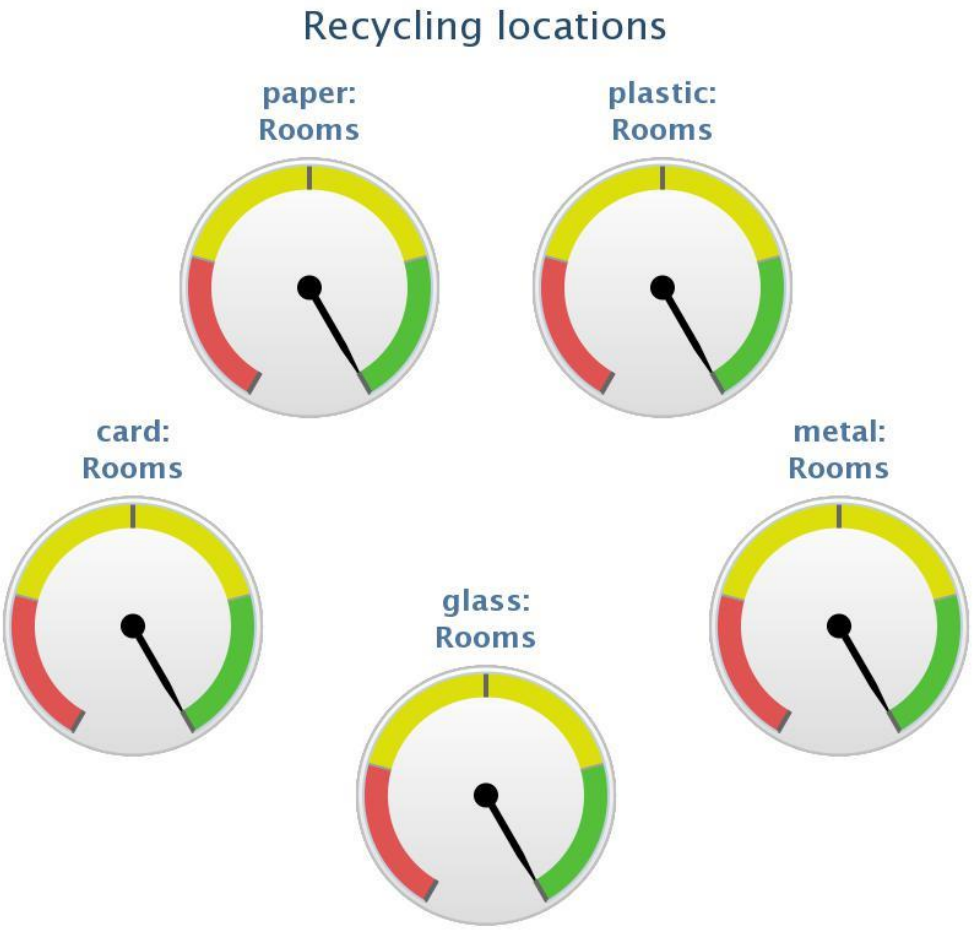

FIGURE R- 1: ACCESSIBILITY OF WASTE DISPOSAL FACILITIES

Emmanuel has a very good recycling access, with two bins in each student's room: one for mixed recycling, the other for waste. This greatly increases the chance of students recycling, by making it as easy as possible for them to do so.

Unfortunately, as no waste quantity data has been submitted it is difficult to assess to success of this scheme. Including this data in next year's report would make this possible, allowing the college to build on this promising policy.

2. Recommendations

2.1 Management

The spider plot for Emmanuel's management score highlights environmental policy as one of the key areas for improvement. The college has a good long term policy for the efficiency of its buildings, using energy saving technologies such as increased glazing and insulation when building renovations are undertaken. However, in terms of short term policy and environmental awareness education, the college performs well below average.

The college does have an environmental policy, but this policy is not published online and members of the college have not been made aware of it. Without clear aims and objectives set out, it is difficult for environmentally conscious students and staff to encourage others to act in an environmentally responsible way. The key aims for Emmanuel should therefore be:

- To form a college-wide environmental policy **as soon as possible**, with the help of the college student union's Green Committee. This can be supplemented by more specific policies for different areas of the college, such as the Bar, the Kitchen, and the computer suites.

- To make sure short term measures are being taken in conjunction with long term ones, by making use of low cost intermediary solutions (eg. Installing low flow shower heads, draft proofing doors, secondary glazing).

- To encourage the creation of specific education initiatives (eg. Themed events, guest speaker talks).

The College Best Practice team also highlights a few measures that have been successful in other colleges:

- Having environmental issues as a standing agenda item for college committees has proved successful at King's college. It would mean that issues are brought to the attention of relevant college members (such as the Bursar, Butler, Housekeeper etc.) much more readily. An active, dedicated Environmental committee that represents all members of the college would also have a great effect on the speed that solutions are implemented.

- Increased metering for water and gas data would allow individual problem properties to be pinpointed more accurately, and also give a quantifiable result to be used in comparisons, such as evaluating the success of a new scheme.

- Creating 'environmental warden' as a position for a member each staircase would help the broad policies take effect on a smaller scale. They would be responsible for reporting faults that have an environmental impact, such as leaky taps and draughts, and also encourage the other residents to act in an environmentally conscious fashion.

2.2 Energy

The analysis of Emmanuel's energy usage highlights a few properties as causes for concern:

- **Park Terrace houses -** more services information for these properties would allow their high gas and electricity consumptions to be explained, and construction data for the buildings themselves would give a better understanding of where energy is being wasted.

- **South Court –** installation of infrared sensors with timer switches on hallway and bathroom lights would reduce the overall electricity consumption, and therefore have a large impact on CO_2 emissions. This applies to any communal lighting, not just in South Court. Draught proofing on external doors can cost as little as £20 per door in materials[1] and secondary glazing starts at £30 per frame[2], both of which are good short term insulation solutions and can be implemented quickly and easily. With secondary glazing reducing heat losses by up to 58%[4], they ensure reduced energy consumption while long term solutions are being planned (eg. during whole building renovations).

A few more general recommendations:

- An investigation into the large increase in gas usage for this period is recommended, as there is not enough data submitted to identify the root cause of the jump in consumption.

- Turning off most of the computers, printers and photocopiers at night when they are not being used can save £17 per year per computer, or £21 for laser printers and £42 for photocopiers[3]. Having someone responsible for doing this each night could be a solution, or computer suites can be programmed to do this automatically.

2.3 Water

Most properties are unmetered and thus not possible to assess. Water use in those buildings is instead paid in relation to a Rateable Value (RV) assigned by Cambridge Water. However, Cambridge Water does provide meters to buildings that request installation of them. It may be suggested that payment for water be based on meter readings than from RV, both for clarity of actual use and for ease of comparison with other already-metered buildings.

This is also relevant for **Emmanuel Hostel**, which *is* metered but is also attributed with over half of the entire college's water use. More regular readings of this meter, as well as a specific investigation into the laundry's actual water usage are key points of action.

2.4 Recycling

With almost all types of waste being recycled in and collected from students' rooms, this is a very strong area of Emmanuel's environmental action. It can be built on by providing figures for how much total waste is created, and how much is recycled. There should also be a focus on educating students as to what can go in each bin and of the risks of contamination (non-recyclable material in the recycling bin). Well labelled bins and a continual assessment of awareness through questionnaires is the best approach, as well as making sure these points are re-communicated each year.

1. http://www.carbontrust.com/media/19465/ctl063_how_to_implement_draught_proofing.pdf
2. http://www.servicemagic.co.uk/resources/cost-guides/secondary-double-glazing-prices/
3. Warwickshire county council Switch It Off campaign
4. http://www.climatechangeandyourhome.org.uk/live/content_pdfs/579.pdf

3. Appendix

3.1. Unassigned Electricity Meters

Supply Number	Meter Name
1012801382783	22 PARKSIDE/GARAGE
1012801469264	5 PARKER STREET
1012801523080	55 ST ANDREWS STREET
1012801472258	CAMDEN HOUSE
1012801383012	22 PARKSIDE/GARAGE

3.2. Unassigned Gas Meters

Supply Number	Meter Name
70844006	285-287 HILLS ROAD
17227306	22 PARKSIDE/GARAGE
3087415801	5 PARKER STREET
3087417805	CAMDEN HOUSE

3.3. Unassigned Water Meters

Meter Number	Meter Name
P0403910050 (supply number)	5 PARKER STREET CAMBRIDGE CB1 1JL
99T023729	CAMDEN HOUSE PARK TERRACE CAMBRIDGE CB1 1JH
82602035	JANUS HOUSE 46 ST. ANDREWS STREET CAMBRIDGE CB2 3AH
99T038284	22 PARKSIDE CAMBRIDGE CB1 1JE
86052164	EMMANUEL COLLEGE BC CAMSIDE CAMBRIDGE CB4 1PQ