HSBC Sustainability Audit Report

Keith Tovey: MA PhD, CEng, MICE, CEnv

HSBC Director of Low Carbon Innovation

Simon Gerrard:

CRed Programme Manager

Mike Harris:

EABEC Project Development Manager

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Carbon Reduction (CRed) Programme
School of Environmental Sciences
University of East Anglia
Norwich
NR4 &TJ

CRed
carbon reduction

Full Report

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Executive Summary

In December 2005 the Carbon Reduction (CRed) Programme at UEA was invited by HSBC Group to undertake energy, waste and water audits at five sites in East Anglia. CRed at UEA is part of the HSBC Partnership in Environmental Innovation (jointly with Newcastle University) launched in 2004. The CRed team at UEA have particular expertise in carbon reduction and are contributing expertise to HSBC's transition to carbon neutrality. At the request of HSBC, this report has been produced in two formats. The first includes information on all sites visited together with a section comparing the sites. The second format contains the information to the individual sites.

HSBC operates from over 10,000 sites worldwide and achieving carbon neutrality will require considerable attention to carbon emissions from these sites over time. As a precursor to a more complete study site audits were conducted five representative premises including the Cambridge Area Office and four branches in Norwich (London Street); Norwich (UEA); Great Yarmouth and King's Lynn during February and March 2006.

The five sites showed a significant variation both in terms of size but also the nature of the premises whether owned by HSBC or rented, and the general awareness of staff towards environmental concerns etc.

It was apparent that despite the corporate objective to ensure that HSBC is carbon neutral this message was not always appreciate among the staff suggesting that the message should be raised effectively in training sessions.

In general, most of the lighting was of low energy either as compact fluorescent bulbs or T* fluorescent tubes. However, there were a few spot lights which were unnecessary. Those for display purposes should be replaced by the new CFL spot light equivalents. Many of the overhead lighting units had several tubes in each, and a strategy should be implemented for rewiring to allow restricted numbers of such tubes to be used at any one time. The majority of workstation monitors are of the CRT type and these use considerably more energy than their flat screen equivalents. The programme of replacement should be accelerated. This reduction in energy use will also have the added benefit of a lower requirement for air-conditioning in summer thereby saving more energy and consequential emissions.

In terms of overall electricity consumption as measured on a unit floor area, the Kings Lynn and Great Yarmouth Branches have consumptions levels which fall within the range noted in Local Authority Offices, however, in the Norwich Branch the consumption level is 60% above the average level of such offices and may relate to noted malfunctions in the air-conditioning and supplementary heating plant.

Several specific issues were identified and some warrant urgent attention. Not only are some actions at the branch level wasting energy, but there is a lack of awareness of the impact each employee may be having. It was noticed, for instance, that the average electricity consumption per employee over a year in the branches studied was as much electricity as the total electricity consumption in a typical home over the same period, despite the time spent in the premises being significantly less than in the home.

It is understood that energy and utility meter readings are undertaken by Mowlem, but the quality of the data available needs to be improved if the move towards carbon neutrality is to be verified. Some specific issues in this area may be identified as:

- The information about meter readings did not identify which were estimated and which were actual readings. It is important that this issue is addressed urgently as any analysis will be of limited value unless this is known.
- The date of the month on which each meter reading was taken should be evident so that data can be normalised to a standard month.
- At least one branch had remotely read electricity data. This provision should be made more widespread and should include gas and water meters. The cost of provision of such remote metering has reduced substantially all utilities can be linked through a single modem. The benefits from acquiring accurate data and the opportunities for identifying possible cost reductions and energy conservation measures will make such a strategy very cost effective in many cases. It is recommended that a role out policy towards remote metering in most branches over the next 5 – 10 years should be a priority.

While good quality data is essential, steps are needed to ensure that proper analysis is undertaken so that deviations from normal consumption can be identified at an early stage. The analysis should include compensation for weather where relevant and set upper and lower target bands which would trigger a reporting incident to identify the cause of such a deviation. An unexpectedly high consumption might provide early warning of a malfunction as was noticed in one branch. Equally a particularly low consumption also warrants attentions as it might arise from good practice which could be implemented subsequently not only in that branch but elsewhere. It is important to ensure that this is effective and likely to succeed so that reporting incidents are not too frequent and bandwidths should be set accordingly. If initial bandwidths are too narrow and trigger too many reporting incidents, then it will be difficult to ensure full cooperation of the personnel involved. It is suggested that the bands should initially be drawn to ensure that reporting incidents do not occur more than twice a year in any one branch.

A centrally based team needs to be established to regularly review performance and also the width of the individual targets bands in each branch. Ideally the band width should be reduced in width as time progresses and low carbon strategies are adopted routinely through out the HSBC network.

There was a general lack of commitment to energy and environmental issues as there needs to be a “Green Champion” at each site who can promote good practice. In larger premises, there will be the need for a “Green Team”. One function of such “Green Teams” would be to ensure that company policy is actually implemented: for instance though there is a laudable objective that all workstations should be switched off at night, (leaving only the servers on), it is clear that this is not always happening. Equally there was evidence that lights and in some cases room air-conditioners were being left on unnecessarily when no one was using the room.

At one branch there was clearly one person who was conscientious about energy use, and it was noteworthy that that particular branch had no rooms which were unoccupied (e.g. store rooms, conference room, kitchen / rest room) with lights on. This is a practice that needs to be promoted more widely.

At one site, a social survey was done over a period of one week of 25% of the staff to ascertain their reaction to the thermal and visual environment. This approach is helpful as the staff can see that they are being involved in any strategy and a similar approach should be considered at other sites, particularly when changes are planned.

There are some technical solutions which will reduce the carbon footprint of HSBC such as a move towards flat screen workstations, however, equal if not greater reductions can be achieved by motivating the staff through awareness campaigns. Training sessions for staff should thus include elements of environmental awareness at regular intervals.

Only three of the five sites visited had energy data available. However, from these three the total carbon emissions amount to 360 tonnes per annum which have an equivalent volume of 180 hot air balloons. The CRed Team has found that a visual connection with a volume of an object with which everyone is familiar is particularly helpful in conveying the message about the need to reduce carbon emissions.

1. Introduction and Background

In December 2005 the Carbon Reduction (CRed) Programme at UEA was invited by HSBC Group to undertake energy, waste and water audits at five sites in East Anglia. CRed at UEA is part of the HSBC Partnership in Environmental Innovation (jointly with Newcastle University) launched in 2004. The CRed team at UEA have particular expertise in carbon reduction and are contributing expertise to HSBC's transition to carbon neutrality. On the basis of the audit experience the team at UEA was asked also to design a sustainability checklist for use more widely at other HSBC sites.

HSBC operates from over 10,000 sites worldwide. Achieving carbon neutrality will require considerable attention to carbon emissions from these sites over time. No specific standards were set to audit against but the focus was placed on energy, waste and water consumption. Details of the sites to be studied were received from HSBC in early February 2006, and work commenced shortly thereafter. Site audits were conducted at the Cambridge Area Office and four branches in Norwich (London Street); Norwich (UEA); Great Yarmouth and King's Lynn during February and March.

This report details the findings from those audits and sets out a checklist toolkit that could be used to assess other HSBC sites within the overall portfolio of branches and offices worldwide.

Prior to the audit the team at UEA received some background information on site size and population, waste generation and energy use for the previous three years. This information was not wholly complete but provided some basis for assessing the sites. The quality of the information was difficult to assess. For example, the waste information provided appeared static for the three years, which was surprising as one would have expected some variation over time. The information provided on site area did not correlate with the site visits. The HSBC branch at the University of East Anglia (UEA) was the smallest site by far and yet was rated the second largest in area terms according to the site summary data.

The site audits were conducted in a single visit with the exception of the Norwich London Street branch where two visits were made. The length of the audit was dependent on the size of the site. The UEA branch was the shortest (50 minutes); others took between two and four hours.

1.1 Format of this Report

This report is being produced in two formats. The first is a Full Report covering all sections and including specific sections on all the five sites. The second format includes the initial three sections and the final two general sections, but includes specific information for only a single branch or office. In this second version, the section comparing one site with another is not included. There are thus five separate versions of this second format, one for each of the five sites.

2. General Information and background theory

It was apparent that none of the sites were aware of their energy consumption and in some cases there was little direct control over heating. In the case of lighting most branches had all lights on throughout the working day irrespective of whether these were actually required. In some cases the lighting was time switched.

To assess the likely overall consumption the number and type of lights were noted and these provided an approximate estimate of the total energy consumption during a typical day. Other major sources of electricity consumption included computers and associated IT peripherals, coffee machines, kitchen appliances e.g. refrigerators etc. In summer air-conditioning would feature as an added demand on electricity.

Heating at all sites was supplied (directly or indirectly) by gas boilers sometimes supplemented by ceiling mounted air handling units providing both heating and cooling. At the UEA sub-branch heating was provided by the district heating system of the University which itself is supplied from gas driven Combined Heat and Power (CHP) plant in a central boiler house. At the Norwich Branch there were supplementary fixed fan heaters and in addition a few free standing 2 kW convector heaters. Control of heating units was confusing in some cases and few of the staff were fully clear on how they work.

Without detailed plans it was not possible in this audit to cover a full heat loss assessment, however, data relating to thermal comfort was taken at three branches (Norwich, Kings Lynn and Cambridge) and this was supplemented by a short questionnaire at the Cambridge branch which ran for a few days.

Data about energy consumption was provided by HSBC who have contracted Mowlems to obtain such information. However, though monthly readings were usually available (except at Cambridge where there were no readings, and UEA which is a special case), many of the readings were declared as potentially being estimates. However, there was no indication as to which were estimates and which were genuine readings making detailed analysis difficult. In addition it is not clear on which days of the month the reading relate to. Had this information been available then normalisation of data to a standard month would have been possible.

Waste management focused primarily on two waste streams – confidential waste collected and managed (recycled) by a national waste contractor; and commercial or trade waste generated as part of everyday office operation. The distinction between the two waste streams was occasionally blurred, particularly for promotional material. At some sites all of this was treated as confidential and sent for shredding. At other sites this material was partially destroyed (ripped up) to make it safe and then treated as trade waste. Additional waste streams included cardboard packaging, which was recycled in most cases. Waste from office refurbishment was not considered but is likely to be a significant waste stream when aggregated across the whole portfolio of sites.

2.1 General Data about the Sites

The following background information (Table 2.1) about the five sites was available during the study. It is clear that the area for the UEA sub branch is erroneous, as this is very much smaller than the next largest branch and yet Table 2.1 indicates it is the second largest and over twice the size of Kings Lynn. . It is believed that the figure quoted might be in error by a factor of 10. This error does question the reliability of other data in this table.

Table 2.1 Basic data about the sites

Property Name	Property Type	Business Use	FTE	m2
Cambridge, Area Office	OFFICE	AREA OFFICE	48	639
Norwich, London Street	BANK	BRANCH	99	1306
Kings Lynn, High Street	BANK	BRANCH	21	484
Great Yarmouth	BANK	BRANCH	19	712
University of East Anglia	BANK	SUB BRANCH	No	995

2.2 Background Energy and Related Data

Background data relating to the site, waste arising, and energy use were provided by HSBC. However, some of the data are estimates, and it is not clear which meter readings are actual ones and which are estimates. In addition, there are limited data from UEA and none at all from the Cambridge Office. The relevant data for each site are included in the description of that site. Providing metrics for ongoing performance measurement are important. Typically this is measured per capita (waste generation and water) or per square metre (energy). The area measurements given in the pre-audit data were questionable so these metrics are difficult to derive with confidence.

2.3 Carbon Emission Calculations

The emission factors for electricity and gas were taken as 0.186 kg/kWh for gas and 0.520 kg/kWh for electricity. These figures are derived from modelling developed at the University of East Anglia. The emission factor for gas is close to that defined in the DEFRA website. However, the value for electricity differs slightly. The figure used above more correctly allows for transmission losses and relates to the mix of electricity generating stations in the UK in 2005. It is likely that this factor of 0.520 kg/kWh will increase over the next few years as the Magnox nuclear power stations are closed. There is a continuing shift towards more coal generation as gas prices have risen significantly and these are likely to do so further for the foreseeable future. This fuel switch will also see a rise in this emission factor. Consequently any emission figures quoted in this report are likely to be underestimates of actual emissions up to 2010.

2.4 Lighting and Electricity use

There is much evidence of low energy lighting or more efficient fluorescent lighting in the branches. There were some spot lights used for display purposes, although there were some which were largely redundant (e.g. two spot lights in the ceiling at the Kings Lynn branch). Estimates of electricity use were obtained by counting the number of lights that were on and assuming a typical number of hours of use. The same was done for workstations. Basic estimates of the use of other appliances, such as fridges etc. were made used to ascertain the overall electricity consumption and an estimate of the associated carbon emissions. Such estimates will be only very approximate but can be compared with actual data where this is available. However, it is clear that a high degree of correlation is not expected because:

i) It is not clear on which day of the month the meter readings were taken
ii) It is not clear which readings are estimates and which are actual readings.

iii) Electricity will be used in fan in the ventilation system, supplementary heaters (e.g. at Norwich), and any air-conditioning. It is difficult to assess the contribution of these, but such use could be significant.

At the Norwich Branch, the electricity meter is read remotely so it is presumed that the data for this branch are accurate, although, once again, the date of each reading is unknown.

The electricity consumption data as provided is shown below in Table 2.2. There are no data for the Cambridge site, as this office is in new premises and hopefully data will become available for any future study. The UEA data refer only to one twelve month period. As far as can be ascertained, these data are an allocation of electricity use rather than a specific metering of electricity used.

Table 2.2 Electricity Consumption Data

		Electricity Consumption (kWh)												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UEA	2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,145	1,108	1,145	993	1,026	5,417
	2005	1,026	981	1,086	1,051	1,102	1,067	1,102	1,181	1,143	1,181	n/a	n/a	10,920
	average	1,026	981	1,086	1,051	1,102	1,067	1,102	1,163	1,126	1,163	993	1,026	12,886*
Cambridge	2003	No Data Available												
	2004													
	2005													
	average													
Kings Lynn	2003	7,084	7,172	6,909	5,422	5,030	4,381	5,944	5,440	5,309	5,540	5,850	3,918	67,999
	2004	9,289	5,592	5,644	4,747	4,846	4,437	4,987	5,310	4,960	5,418	5,244	6,033	66,507
	2005	6,218	6,296	6,513	6,049	5,541	5,232	6,630	5,139	5,744	4,128	6,070	5,185	68,745
	average	7530	6353	6355	5406	5139	4683	5854	5296	5338	5029	5721	5045	67750
Norwich	2003	36,675	32,183	31,980	29,924	29,745	30,214	32,445	32,066	30,794	31,605	30,499	32,658	380,788
	2004	32,963	28,388	32,265	28,487	31,864	39,096	33,857	30,425	28,340	27,436	26,729	24,821	364,671
	2005	24,266	22,207	21,812	23,243	22,398	31,862	42,693	42,237	41,291	38,474	37,657	40,079	388,219
	average	313013	27592	28685	27218	28002	33724	36331	34909	33475	32505	31628	32519	377892
Great Yarmouth	2003	6674	5969	6608	6395	6871	6443	6658	5192	5025	7302	6329	6540	76006
	2004	7,198	8,277	8,848	8,492	5,174	5,007	5,620	6,906	6,684	17,807	10,087	9,896	99,996
	2005	9,663	7,634	8,452	7,955	6,714	6,498	6,730	6,953	6,729	5,608	8,648	10,038	91,622
	average	7845	7293	7969	7614	6253	5982	6336	6350	6146	10239	8354	8824	89208

* equivalent annual figure based on a complete 12 month period

2.5 Gas Consumption Data

The gas consumption data is less robust than the electricity data. No data is available for either the UEA site or the Cambridge Site. Furthermore it is clear that there is much more data which is estimated, and even several negative values (arising from overestimates one month and compensated by corrections in the following month). The data provided is displayed in Table 2.3.

Table 2.3 Gas Consumption data

		Gas Consumption (kWh)												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UEA and Cambridge		No Data Available												
Kings Lynn	2003	16,203	13,236	14,578	9,637	6,468	3,626	3,012	-10,072	2,707	4,305	7,477	12,874	84,051
	2004	23,989	785	15,188	9,920	1,365	1,033	1,068	1,068	1,034	4,232	7,477	12,873	80,032
	2005	23,989	11,863	13,541	8,512	4,333	134	-1	-1	2,974	4,300	7,364	12,866	89,874
	average	21394	8628	14436	9356	4055	1598	1360	-3002	2238	4279	7439	12871	84652
Norwich	2003	41,058	39,930	32,839	28,702	23,450	13,620	393	5,393	11,317	21,605	27,567	23,864	269,738
	2004	43,231	36,856	40,255	28,545	25,329	19,338	4,328	5,393	2,224	23,636	29,948	36,609	295,692
	2005	36,001	30,805	35,301	23,699	12,003	2,469	n/a	n/a	n/a	23,622	29,923	36,605	230,428
	average	40,097	35,864	36,132	26,982	20,261	11,809	2,361	5,393	6,771	22,954	29,146	32,359	265,286
Great Yarmouth	2003	14,529	13,898	13,823	10,139	6,782	3,815	3,170	-7,454	2,941	4,537	7,825	13,510	87,515
	2004	25,145	823	13,396	11,087	4,624	386	261	261	655	4,413	7,820	13,481	82,352
	2005	25,143	13,564	14,629	8,914	4,545	2,776	1,168	1,198	7,970	4,697	7,683	13,452	105,739
	average	21,606	9,428	13,949	10,047	5,317	2,326	1,533	-1,998	3,855	4,549	7,776	13,481	91,869

Gas consumption data relates primarily to space heating and this can vary from month to month and from year to year. If the data above were consistent (i.e. no estimated readings, and taken on same day of each month), then it is possible to normalise the data according to the Degree Data information. The demand for heating a building should be highly correlated with external temperature provided there is adequate control and Degree Day information provides a surrogate measure of external temperature to allow analysis.

An approach is thus to plot the monthly consumption data for heating against the relevant number of Degree Days. The result should be a straight line with some scatter, but if data is reliable and there is reasonable control of the system, the coefficient of correlation of a linear regression on the data should be high. If a high coefficient of correlation is achieved (i.e. > 0.8) this would indicate that the data itself must also be reliable. While the focus of this suggested analysis is on external temperature, However, If the coefficient of correlation is low then this indicates that some of the data are probably suspect and should be treated with caution.

Other factors such as wind speed, rainfall etc also affect heating requirements, but these are normally account for 10% or less of any variation.

The Degree Data for East Anglia are shown in Table 2.4.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	354	327	247	191	118	35	20	23	71	199	212	324
2004	336	297	281	183	128	51	42	19	56	136	244	327
2005	307	334	280	189	144	61	30	44	47	68	281	363

2.6 Water Consumption Data

The water consumption data are shown in Table 2.4. Once again there is no information for either the UEA or Cambridge Sites.

Table 2.4 Water Consumption data

		Water Consumption (m^3)												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
UEA and Cambridge		No Data Available												
Kings Lynn	2003	1	14	16	16	16	16	15	14	13	14	13	14	162
	2004	11	6	6	6	6	6	7	10	9	10	9	10	96
	2005	10	11	12	11	12	11	10	9	9	9	9	9	122
	average	7	10	11	11	11	11	11	11	10	11	10	11	127
Norwich	2003	139	126	145	141	146	141	146	146	134	135	131	135	1,665
	2004	135	127	109	102	106	102	106	106	105	111	107	111	1,327
	2005	111	100	112	110	113	110	113	106	119	135	130	135	1,394
	average	128	118	122	118	122	118	122	119	119	127	123	127	1462
Great Yarmouth	2003	0	13	17	16	17	16	19	21	20	21	20	21	201
	2004	21	10	9	8	9	8	9	9	8	9	8	9	117
	2005	9	8	9	9	9	9	8	No data					61
	average	10	10	12	11	12	11	12	10	9	10	9	10	126

2.7 Data on Waste Generation

Table 2.5 presents the available data of waste arising at the branches. It is very surprising that these figures are identical to two decimal places for each of the three years for all three reporting sites. Some question must be levelled at the quality of such data.

Table 2.5 Waste arisings at the sites

Property Name	Weight for 2003 in tonnes	Weight for 2004 in tonnes	Weight for 2005 in tonnes	Total weight in tonnes
UEA and Cambridge		No information		
Kings Lynn, High Street	2.91	2.91	2.91	**8.74**
Norwich, London Street	15.6	15.6	15.60	**46.8**
Great Yarmouth, Hall Quay	4.37	4.37	4.37	**13.10**
	22.88	**22.88**	**22.88**	**68.64**

2.8 Thermal Comfort

Thermal Comfort of the workforce is important to ensure optimum conditions for productivity. Areas which are too cold will result in complaints, while performance starts to fall when the perception of comfort rises towards the hot end. Thermal comfort is measured on the ASHRAE scale ranging from +3 (far too hot) to -3 (far too cold with 0 (zero) being optimum.

Six factors affect perception including the air-temperature, humidity, mean radiant temperature, wind speed, activity level and clothing. No two individuals will react the same in a particular environment and research shows that even in an ideal environment where the mean ASHRAE vote is close to zero, there will still be 2.5% of people voting +2 or more and 2.5% voting -2.0 or lower. Normally these individuals will respond by wearing thinner clothing (in the first case), or warmer clothing (in the second case).

In an office setting, the wind speed will be negligible except perhaps near vents from air handling units and can be ignored. Typical activity levels of staff are likely to be in the order of 60 kcal/m^2/hr – i.e. seated with occasional walking around. Observations of most staff at the time of the visit to the Cambridge Office suggested that the average clothing level is around 0.8 clo. [The clo unit is a measure of clothing level ranging from, 0 for the nude body to 2 or more for thick outdoor clothing – a typical business is standardised at 1.0]. Physical readings of temperatures were observed at three sites (Cambridge, Norwich and Kings Lynn), and the information used to assess what the predicted level of comfort would be. This was achieved using specifically written software following the method outlined by Fanger (1970).

A trial thermal comfort analysis using a questionnaire (see Appendix 1) was circulated to select staff at the Cambridge Office. The intention was to ascertain whether there were periods of the day when staff felt particularly warm or cold.

3. Methods to analyse data and present results.

3.1 Introduction

The use of energy is essential to every day life and the effective development of businesses. Though energy prices are little different, in real terms, from what they were 20 years ago, despite the recent substantive rises, the prospect for the future is not good, and significant further energy price rises are likely. Wholesale prices have increased by over 250% in the last 2 – 3 years, but only around one third of these increases have so far been felt by the consumer. It makes financial sense to reduce the impact of future energy costs rises by conservation methods which will have the added benefit of reducing carbon dioxide emissions and thus helping to minimise the worst effects of global warming.

While technical solutions to energy conservation are an important first step, they are by themselves not sufficient and comparable, if not greater savings can be made by effective management and promoting awareness by the user. Effective management at UEA, for instance, has shown that it is possible to half the energy consumption in buildings. This has been achieved by good record keeping and appropriate analysis to ensure that the buildings are performing to their optimum levels.

3.2 Analysis of Heating Energy Use

As discussed in section 2.5, energy requirements for heating should be closely related to external temperature and in particular Degree Days. Fig. 1 shows an example of such a plot.

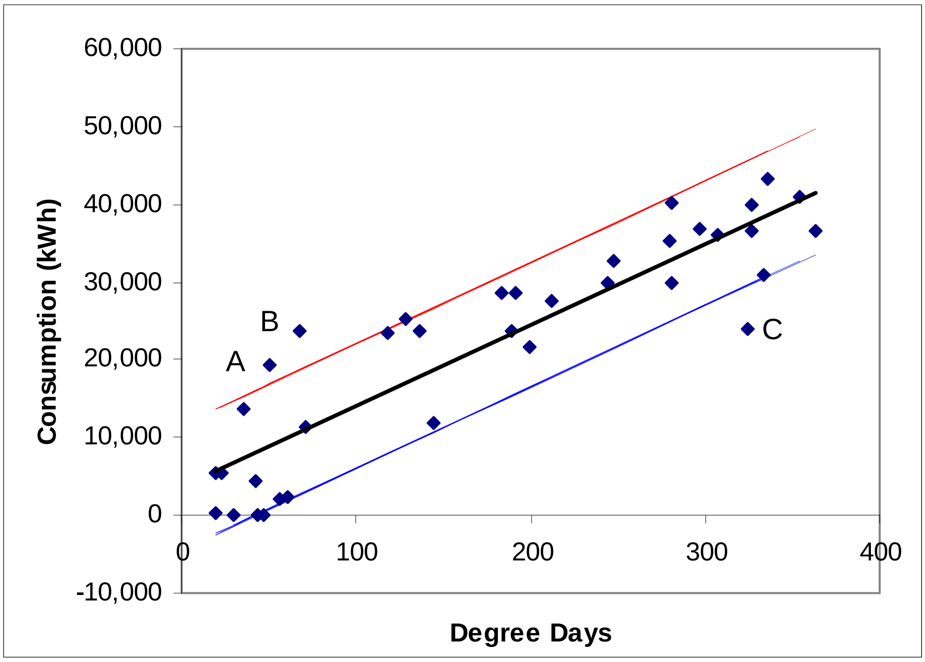


Fig. 1 A typical plot of gas consumption data against Degree Days.

The data shown in Fig. 1 were read remotely and thus likely to be more reliable than most data sets. There is evidence of scatter, part of which will be associated with other weather effects such as wind. The trend line is shown in black. Nevertheless the data have a high degree of correlation with degree days, and a plot such as this may be used to monitor future performance. If improvements to insulation or the main heating appliance are made, then it would be expected that the trend line would have a lower gradient with more significant savings being made during the colder months of the year. If changes are made to fixed energy use – e.g. the fitting of low spray taps, then the trend line would be expected to have the same gradient, but shift vertically downwards on the axis.

At the time of compiling this report, there had been little or no previous analysis of this nature, but it is important to use such a visual means to identify at an early stage when energy consumption rises unexpectedly. This might be due to a malfunction of the heating system or the associated control equipment and can thus be rectified at an early date. Conversely, some data points may lie well below the trend line. In these cases there has been a saving and it is just as important to identify the cause of this as this might point to particularly effective management or awareness which might be something to replicate in future months or indeed in other premises.

In Fig. 1, two tentative band lines have been drawn. The red (upper) line was chosen so that the number of points lying above was small and amounted to less than one per year on average. These are data points (e.g. A and B) where, for some reason, the energy consumption was above that expected. It is important to identify why this is the case. Possible causes could be:

i) Incorrect setting of, or malfunction of a thermostat and/or control system
ii) Malfunction of heating/cooling plant
iii) User actions – e.g. windows left open
iv) Special circumstances – e.g. additional staff/personnel in the premises than normal

As important are the data points which fall below the line (e.g. C). The reasons for this reduction might be because of unusual circumstance (e.g. fewer staff), but could be as a result of particular effective management.

The upper and lower bands were drawn in this example so that the majority of points lay within the band. If an effective policy were in place, then it would be expected that each branch would be required to identify the reasons why data lay outside the bands so that lessons could be learnt in the future. Such action would be triggered on about one occasion per year for each branch which should not be an arduous task. However as greater awareness is promoted, the chances of point lying outside the band will diminish and regular reviews of the actual trend line and the banding should be in place to ensure good practice is encouraged and technical faults etc causing increases in consumption are identified at an early stage.

3.3 Analysis of Electricity Use

Electricity will be used for four main functions:
i) Computer and IT applications
ii) Lighting
iii) General Appliance use – e.g. kettles/coffee machines etc.
iv) Air-conditioning/supplementary heating.

Space heating using electricity is a particularly inefficient means of heating. Not only is it more costly, but typically at least twice as much energy is consumed to generate the electricity as using a fossil fuel like gas directly. In addition the emissions of carbon dioxide are at least twice a high if electric heating is used. Wherever possible, supplementary space heating using electricity should be avoided.

In an office which is not heated electrically and in which there is natural day light, it would be expected that the electricity consumption would rise in winter and fall in summer as show schematically in Fig. 2.

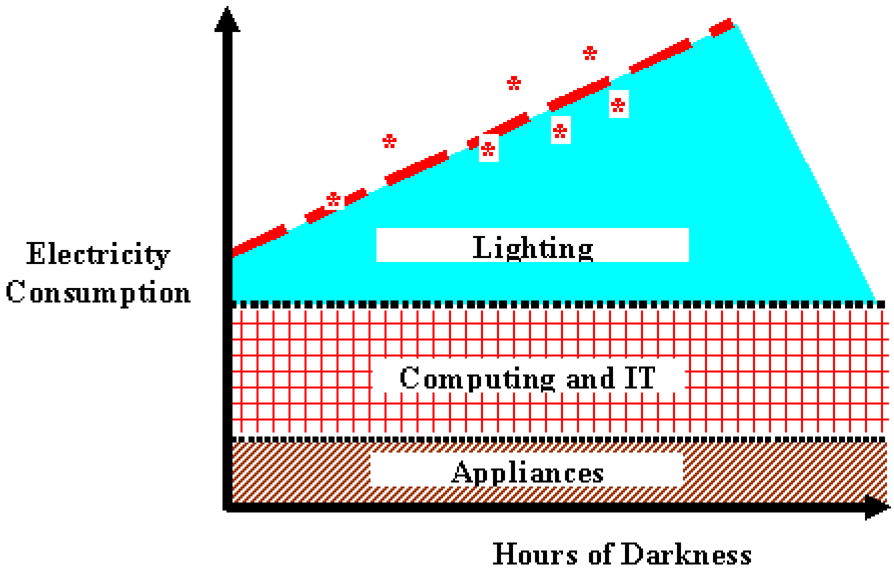


Fig. 2 Schematic illustration of electricity consumption in an office lit primarily by natural daylight.

In Fig. 2, it would be expected that both Computing and IT and appliance use would be approximately constant throughout the year, but that lighting would vary with hours of darkness. In this way a similar trend line to that for heating could be defined and appropriate bands drawn in a similar manner to that described in section 3.2. However, in many offices, the amount of natural daylight is often small and reliance is made on artificial light which is likely to be constant throughout the year. In such cases the trend line will be almost horizontal as shown in Fig. 3.

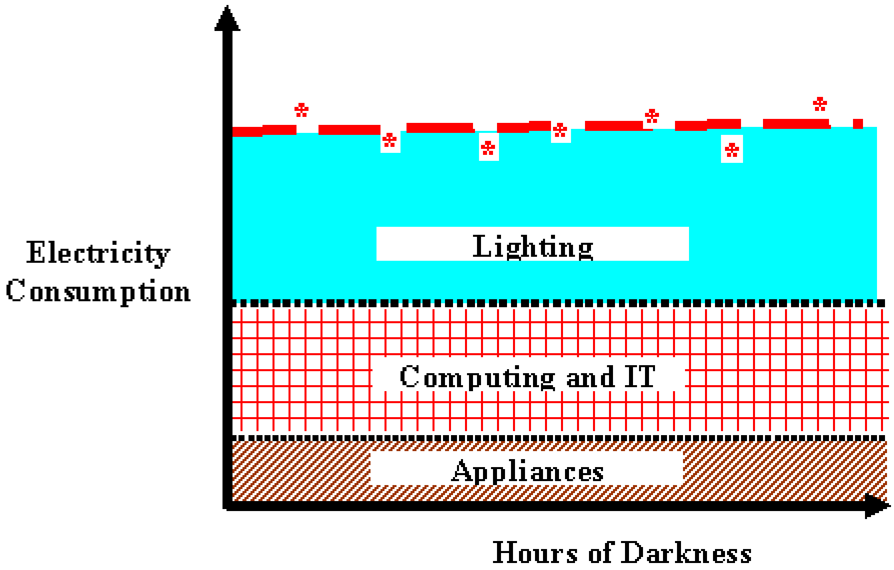


Fig. 3 Schematic representation of electricity use in an office with limited natural daylight

Whether the trend line is like that in Fig. 2 or that in Fig. 3, bands can be drawn to monitor performance. Most HSBC branches appear to follow a trend closer to Fig. 3. There are some points to note:

If no change is consumption is taking place then the data points will all plot close to the trend line. If a specific action occurs e.g. replacement of computer screens with the flat screen variety then there should be step downward jump in consumption which should be maintained thereafter. If there is a progressive replacement of such items or the installation say of low energy lighting over a period of months then the electricity consumption data should show a steady and constant decline from one month to another. If there is a sudden increase in consumption which is then maintained this will normally be associated with some malfunction of equipment or a significant change in activity requiring new machinery etc. An example of such a plot is shown in Fig. 4

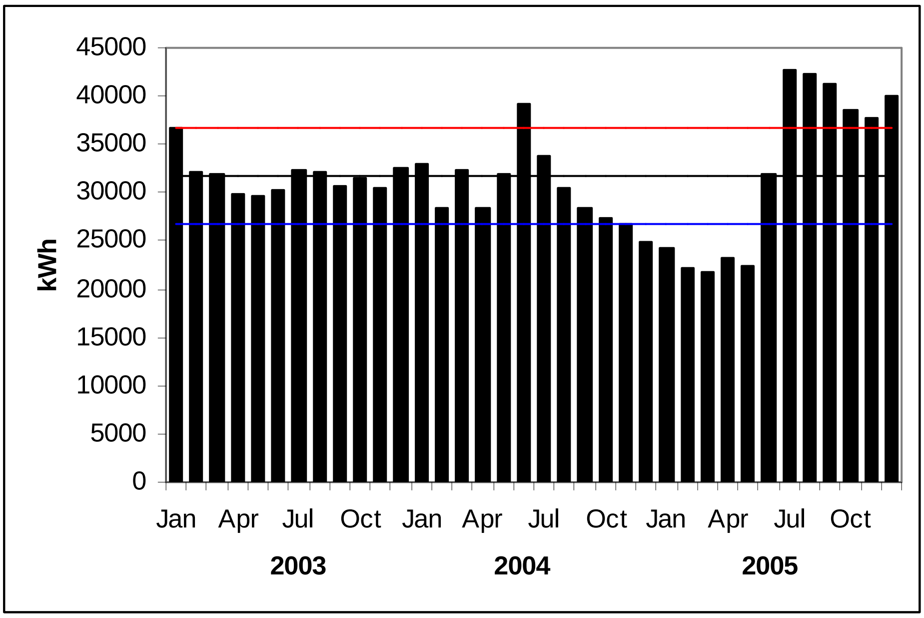


Fig. 4. A typical plot of monthly electricity consumption.

Between January 2004 and April 2004 consumption was nearly constant and within the normal bands of variation. However, there is a sudden surge in June 2004 followed by progressive monthly reductions until March 2005. This downward trend would be consistent with a phased replacement strategy – e.g. progressive installation of low energy lighting etc. In June/July 2005 there is a sharp rise in consumption by 80% above early 2005 levels and 30+% above the historic average. This high level is maintained thereafter. This sudden change is almost certainly associated with a malfunction of major equipment. This sudden change in consumption represents an increase of £10 000+ per annum in energy bills over early 2005 or around £6000 per annum over historic costs.

In a similar manner to the bands drawn for the degree day plot, upper and lower bands could be drawn for electricity data. In this example bands are drawn at +/- 4000 kWh above and below the mean initial consumption level. With such bands in place a reporting incident would have been triggered in June 2004. There after there would have been justification of a revision of the bands following the measures which took place in late 2004. A further reporting incident would then have been triggered by the major surge in June / July 2005 and would have provided early notification of a potential problem.

3.4 Raising Environmental Awareness among staff.

Effective Environmental Policies leading to reductions in energy and water demand require the corporation of the staff and awareness issues should be part of staff training. However, every day issues are important such as checking that unnecessary equipment is switched off. For this to be effective there needs to be Environmental Champions in each office to ensure and encourage the staff that it is to their benefit to ensure that they adopt environmentally sound working practices. Having one such Champion per 20 staff members could be effective as has been shown at the Kings Lynn Branch.

There appears to be a general policy that computers and IT equipment apart from servers are switched off at night, and this practice is to be commended. However, there is some evidence from the survey, that not all appliances were switched off and this may arise from the difficulty in crawling under tables etc to find the relevant plug. One solution is to invest in devices such as the Powergenie shown in Fig. 5.

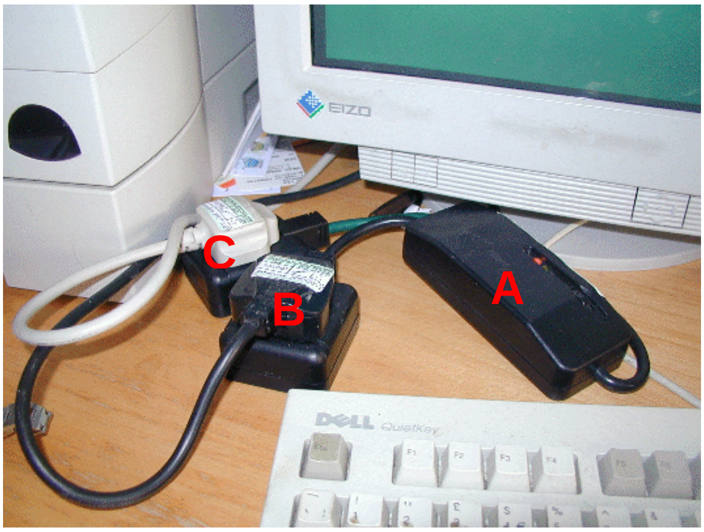


Fig. 5 the Powergenie device which can help ensure appliances are switched off.

The Powergenie works by specifying a master appliance which is relatively easy to switch off. This device is connected to the socket on the black wire (B in Fig. 5). When this appliance is switched off, sensing circuits in box A detect this and automatically switch off appliances connected to the plug with the green wire (C). This a single action on one appliance will ensure that all other related appliances are switched off.

Evidence of what can be achieved in energy saving through a concerted effort of all staff is demonstrated in Fig. 6. This represents the Registry building at the University of East Anglia. Daily monitoring was undertaken for each day of April 2005. In the meantime, the staff were encourage to think specifically about their actions on Friday 21st April 2005. A significant reduction was achieved with no change in effective output from the staff. However, there is some evidence of a little backsliding in the following week after the action finished and this demonstrates the need for proactive and continual action by “Energy Champions” to ensure these benefits are replicated throughout the year.

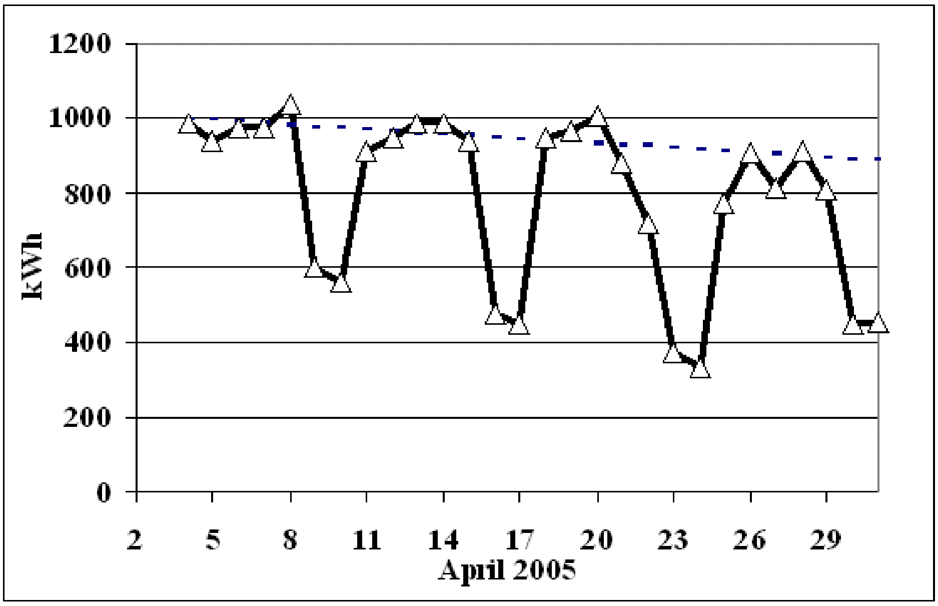


Fig. 6 Daily Electricity consumption at the Registry Building at UEA showing improvement that was achieved by concerted action on 21st April 2005

3.5 Carbon dioxide and Global Warming.

Global warming and Climate Change is one of the biggest challenges facing mankind. Temperatures on the earth have risen around 0.8°C in the last 50 years over the long term average, and are set to rise by at least another 1°C and possibly as much as 5°C by the end of the century. Such rises will bring many consequences ranging from more extreme weather events such as prolonged droughts, increased flooding, and increased incidence of Hurricanes etc. In addition sea level is set to rise. Carbon emissions arise from the use of fossil fuel energy and have caused a rise in atmospheric concentrations from around 320 parts per million about 50 years ago to 380 ppm and it is this that is the trigger for this rise in temperature. It is important to ensure that the need for reducing energy demand is brought to the forefront of the agenda of everyone not only in their homes but in their places of work. Each individual in the UK is responsible, either directly or indirectly, for the emission of 9 tonnes of carbon dioxide per annum. This equates to the volume occupied by 5 hot air balloons and over the next 40 – 50 years it is essential that this emission is reduced by 60% or to 2 hot air balloons per person. Through out this report the symbol of the hot air balloon, as shown below (Fig. 6), will be used as a summary of the situation in each of the branches.

Fig. 6. Schematic representation of the volume of carbon dioxide emitted to sustain the lifestyle of a single person in the UK (2005). By 2050 we must reduce the number of balloons from 5 to 2.

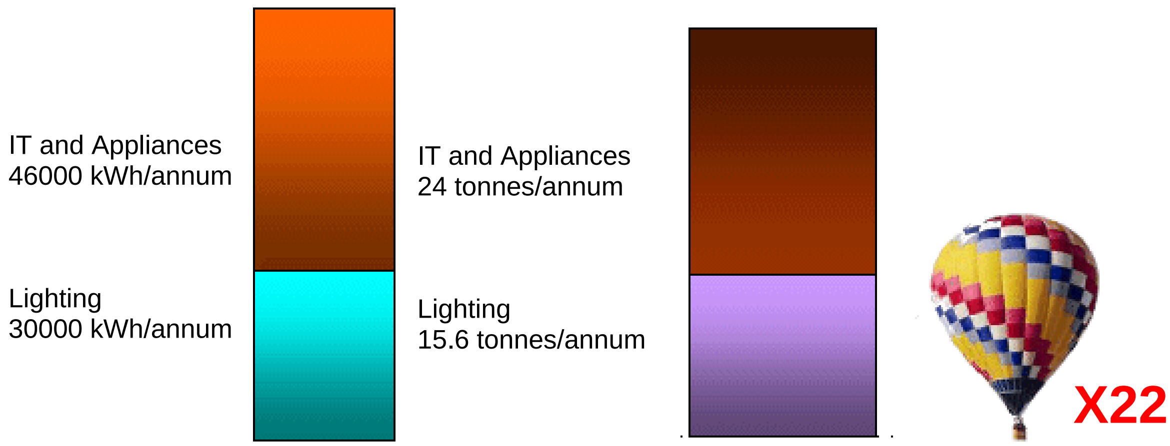
4. Site 1 Cambridge Area Office, St John's Innovation Park, CB4 0DS

Date of Visit: Tuesday 14th February 2006

Contact Person: Liz Wilson 01223 546 101

Summary of Audit at the Cambridge Office

The building occupied by HSBC for less than 6 months. It is a new building, and thermally seems to have been built to the current standards. There are no energy, or water data and no direct analysis of overall energy or carbon emissions can be made. Estimates can be made of likely use of electricity assuming a typical working pattern. This information is summarised in Fig. 7a. Fig. 7b and 7c summarise the carbon dioxide emissions and the equivalence in hot air balloons.



a) Electricity Consumption b) CO_2 Emissions c) Balloon equivalents

Fig. 7 Estimated electricity and carbon dioxide emissions for the Cambridge Branch for lighting and IT and Appliance use.. NOTE: no meter readings are available so no information on other electricity use or heating is available.

The lighting within offices appears to be on all the day. When questioned staff indicated that they preferred the lights on, although one member of staff reported a preference for more daylight. Blinds on the south side were drawn and there may be scope for a limited amount of lighting reduction near these windows. Following a survey the overall perception was that the lighting was slightly too bright. While HSBC are tenants, it might be difficult to achieve in the present office, but there might be scope elsewhere to have the units containing the three short strip lights rewired to have either one or two in each unit on separate circuits. This would allow all units in an area to have either one, or two lights on or by have both all three as at present. There is a potential saving of up to 2 tonnes of carbon dioxide by this means or about 1.1 hot air balloons.

The thermal comfort study indicated that overall the temperature was ideal. However, the measured temperatures at 23°C are warmer than most office environments and many staff had adjusted their clothing to suit (short-sleeved shirts for instance). Is this a case of staff adapting to the relatively warm environment? There may be scope to engage with the staff as to whether they would prefer wearing warmer clothing (as was seen at other offices) such as long-sleeved shirts etc. There could thus be opportunities to save a little on energy and still have the same level of thermal comfort.

There is scope for saving energy by having the coffee machines time switched to come on at the start of the day. The casing of the machine on the first floor was hot indicating it was wasting more energy than comparable machines in other branches.

There is scope in reducing electricity consumption and carbon emissions by more widespread use of flat screens, and these should be phased in as soon as practicable.

There is a need to identify a "Green Champion" at the location to ensure that good practice is maintained and that workstations are indeed switched off each night.

Cambridge Area Office Report

4.1 Pre-Audit Data Supplied

Year	Type	FTE	m^2	Waste (tonnes)	Elec (kWh)	Gas (kWh)	Water (m^3)
2003	Area Office	48	638.7298	n/a	n/a	n/a	n/a
2004				n/a	n/a	n/a	n/a
2005				n/a	n/a	n/a	n/a

4.2 Background

The building is new and is situated in a modern innovation park to the north of Cambridge which adjoins the A14 Trunk Route (Figs. 8 and 9). HSBC occupy two floors and rents the accommodation from a landlord. The ground floor is the retail area focused primarily on business customers. The first floor is an open plan office area. The eastern end of the building is a communal area containing stairs and access to the top floor where a separate tenant has offices.

Fig. 8 General View of the southern façade of the building. HSBC occupy the lower two floors. The area to the right is the communal area.

Fig. 9   The main entrance to the building

HSBC moved into the premises last September and have not yet experienced a full year of operation.   In particular there may be problems of overheating on the south side of the first floor in summer, despite the provision of blinds.

The construction of the building conforms to current Building Regulations with double-glazing throughout and very little evidence of draughts near the windows was experienced.

The area occupied by HSBC has been partitioned to satisfy HSBC needs, but in places this causes problems with control of lighting etc with light switches not always in a logical position, particularly on the first floor.

Figs, 10 and 11 show views of the ground floor public area of the bank.   This area is spacious and behind this main area are interview rooms a conference room, kitchen, and store room where the main server is housed.

Fig. 10. The western end of the ground floor showing the cash points

Fig. 11 The eastern end of the HSBC section of the ground floor

On the ground floor there are also offices, a conference room, a kitchen and a store room housing the server.

The first floor is largely an open plan office stretching the full width of the building (from south to north) as shown in Figs. 12, 13 and 14.

Fig. 12. The south side of the first floor. The blinds are drawn to prevent glare but all lights are on the south side. Several staff were wearing short-sleeved shirts.

Fig. 13. The north side of same office. Once again short-sleeved shirts are in evidence.

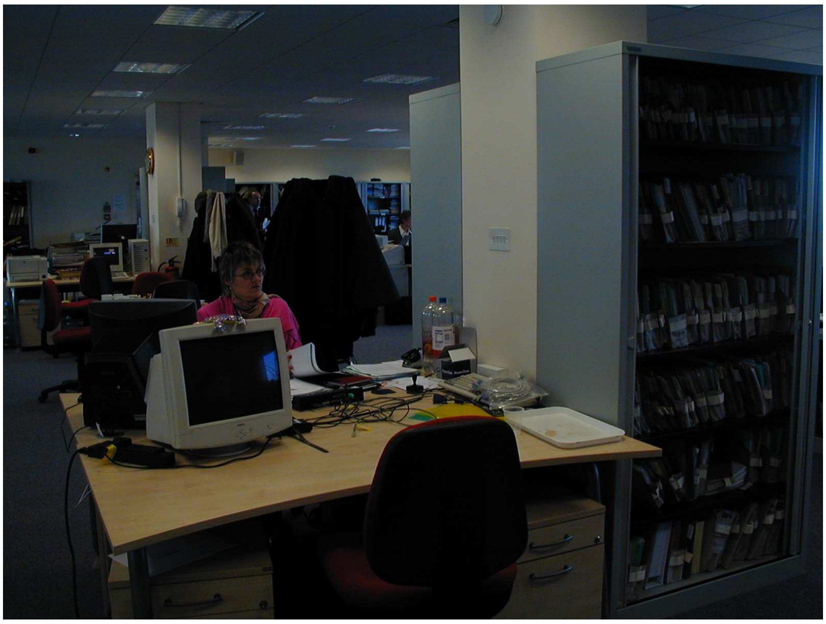


Fig. 14 View of the central area of the first floor office

In addition to the kitchen on the ground floor there is also a coffee machine in the first floor office (Fig. 15).   The casing of this appeared to be quite hot indicating a high heat loss (unlike the coffee machines in Norwich which were quite cool to touch).

Fig. 15. The first floor coffee machine. The outer surfaces of this machine were quite hot on the day of the visit.

The landlord is responsible for the heating, however it is uncertain what the heating mode is, but presumed to be gas.

4.3 Maintenance and Cleaning

Situation

Maintenance and cleaning are organised by the landlord there seem to be few opportunities for change here.

4.4 Heating

Situation

The heating on both floors is controlled by a single thermostat and this may potentially cause problems on the first floor particularly in the summer. Despite little evidence of draughts, one or two staff working near north windows did indicate they felt cold at times, and this is reflected by the generally thicker clothing that they were wearing. Though the survey was done in winter, many of the staff were wearing short-sleeved shirts (Figs. 5 and 6).

Temperatures measured in the first floor office at approximately 15:00 were as follows.

Location	Dry Bulb	Wet Bulb	Mean Radiant Temperature
South Side	23.0	15.5	22.0
Middle	23.0	16.0	22.0
North Side	22.0	15.0	22.0

There is little difference in temperature across the room and the predicted mean votes with the activity level of 60 kcal/m^2/hr and a clothing level of 0.8 clo varies from 0.04 on the north side to 0.20 in the centre and 0.18 on the south side. With the vote just above zero this indicates that the temperatures are near optimum for the activity and clothing. The Mean Radiant Temperature is close to the air-temperature which is as expected in a building with a relatively high level of insulation in the walls and windows.

However, individuals tend to adjust their clothing to the perceived level of thermal comfort and the figures computed probably reflect some adaptation. A trial questionnaire is being used to ascertain the level of actual thermal comfort and when data is available from this there may be a better indication on whether there is scope for a downward change in temperature. There is evidence that staff are wearing relatively thinner clothing than they would normally do (short-sleeved shirts even in winter). A one degree reduction would lead to an 8% saving in energy and carbon emission and this saving might be possible if the norm for clothing was the equivalent of a business suit rather than the present short-sleeved shirt environment. A temperature of 23^{o}C is warmer than expected in most offices.

The building has been in operation for only 6 months and has yet to experience potential problems of overheating in the summer. This may be an issue on the south side.

Opportunities

There is very limited control over the thermal environment in this building as heating is provided by the landlord. However, there is evidence judging by the thin clothing that many staff are wearing that there is scope for a small reduction in temperature (~ 0.5^{o}C) leading to a saving of approximate 5% in energy and CO_2 emissions. This needs to be monitored carefully and needs the cooperation of the staff and confirmed by exploratory questionnaires such as the one shown in Appendix 1.

4.5. Lighting

Situation

Ground Floor

The ground floor lighting system is automatically controlled on a timer basis which is typically on from 07:30 – 18:00 each weekday. Therefore lights are on in the conference room and 5 interview rooms even when unoccupied and also in the store room housing the computer server. In addition there are spot lights in the conference room illuminating display boards which appear to be on even when people are not present.

Most of the lighting is provided by banks of 3 x 2 ft fluorescent tubes which have reflectors (Fig. 9). All lamps were working. The total number of light fittings of this type on the floor is approximately 60 representing a total wattage of approximately 3.3 kW, and a daily consumption of 35 kWh. In addition there are smaller numbers of Compact Fluorescent Lamp (CFL) units, seven 50W spot lights over the Cash Points and 6 larger spots (see Fig. 3). Finally there are two 50 W display spots in the conference room. These additional lights increase the daily total electricity consumption on this floor to about 48 kWh per day

Fig. 16. Typical lighting fitting on both ground and first floors

Most of the lighting is provided by units containing three x 2 ft long T8 fluorescent tubes rated at 18W all of which have reflectors (Fig. 16). All lamps were working. The total number of light fittings of this type on the floor is approximately 65 representing a total wattage of approximately 3.5 kW, and a daily consumption of 38.6 kWh (assuming that the information concerning the automatic times the lights come on and go off – i.e. 07:00 – 18:00 is correct). In addition there are smaller numbers of CFL units, seven 50W spot lights over the Cash Points and 6 larger spots (see Fig. 10). Finally there are two 50 W display spots in the conference room.   These additional lights increase the daily total electricity consumption on this floor to around 50 kWh per day.   Lights were on in all offices and interview rooms regardless of whether they were in use, and this is considered to be the norm in this branch.

First Floor

Once again, the lighting on the first floor is largely controlled automatically. On this floor all lights including 88 in the main office are units containing three 2ft-long T8 tubes representing a total energy consumption of 52 kWh per day.

Overall the total weekday lighting consumption for both floors and the stairwell is estimated at around 105 kWh. Assuming five and a half days per week and closure over statutory holidays the estimated annual consumption for lighting is about 30 000 kWh representing the emission of about 15.6 tonnes of carbon dioxide.

4.6 IT & Appliances

Situation

Ground Floor

The ground floor is largely open plan with four computers: one at the reception desk and three at each of the sales desks. Each has flat screens and is linked to a printer. The back office is used primarily for file storage and houses the server, and there are also interview rooms equipped with a computer. In the staff area there is a dishwasher (reportedly used once a day ~1kWh per day)); and two fridges one of which is C-rated (at 225 kWh per annum) and has an annual consumption twice that of the other; and a microwave oven (900W). It is difficult to obtain a precise figure for consumption of IT and appliances on this floor as the power consumption of cash machines is unknown and the exact use of appliances in the kitchen is also unknown. However, based on observations of the interior of a cash machine at Norwich, a reasonable estimate is 250W per machine (100 W for the CRT, 60 W for the PC, 90W for the other peripherals). Overall a reasonable estimate for consumption in the appliances on this floor is around 15500 kWh per year or about 8 tonnes of emission of CO_2.

First Floor

The first floor has 41 workstations including 38 CRT screens (200W); 3 flat screens (39W); In addition there are 4 laptops; 8-networked printers and 2 photocopiers. Assuming base units are rated at 60 W (a figure derived from similar units at UEA), and the intermittent use of Lap Tops and the IT peripherals inflates the consumption by 20%, then the mean electricity consumed will be approximately 12 kW during the working day.

It is the policy to turn all computers off at night (which is commendable). However, it was not clear exactly who was responsible for this or whether there were occasions when individual work stations were left on. However, assuming an average working day of 9 hours (08:00 – 17:00) there the energy consumed by the workstations on the first floor would be about or about 110 kWh per working day, representing the emission of 63.5 kg of carbon dioxide a day. The other IT equipment (printers, phones etc) would probably inflate this total by around 25% giving an estimated total consumption of 115 kWh per day of this floor.

Data is unavailable for the coffee machine, but based on measurements made in Norwich this equates to around 500 kWh per year (a figure 20% higher than the Norwich figures has been assumed as this machine appears less efficient in retaining heat than the one at Norwich). The annual electricity consumption on this floor will be around 30 500 kWh and will be associated with the emission of about 15.8 tonnes of carbon dioxide.

The total electricity use on both floors for IT and is thus estimated as 46 000 kWh per year representing the emission of approximately 24 tonnes of carbon dioxide.

4.7 Overall Electricity Consumption

There are no data on electricity consumption in this office. However, the above analysis suggests that the total direct consumption within the HSBC area is likely to be around 75 000 kWh and this will be associated with about 39 tonnes of carbon dioxide. In addition there will be a contribution from HSBC use of the communal area staircase and toilets, however, the extent of this is not known.

4.8 Overall Energy Consumption

Like the electricity data there are no reported values for gas consumption at the present time. It is difficult to provide a reliable figure of total energy use or carbon emissions.

4.9 Thermal Comfort Analysis and perception of Lighting

At the Cambridge branch a trial Thermal Comfort Questionnaire was distributed to staff for completion in the week March 6^{th} – 10^{th}. Approximately 25% of the staff in the first floor office were sampled. They were all asked to note their clothing level and their perception of thermal comfort at approximately two hourly intervals. They were also questioned on their perception of illumination in the office. The questionnaire and associated reference tables are shown in Appendix 1. The information regarding this survey only became available late on 15th March shortly before the deadline for submission of the this report. The following is thus an initial analysis of the data.

A total of 144 responses were received from the 10 people questioned over the 5 day period. The mean clothing level was 0.82 clo very close to the assumed value of 0.8 assumed during the visit (see section 3.4). In that section it predicted that the mean vote would average around 0.12 between the north and south sides of the office. This figure is the predicted vote from 100+ different individuals. Nevertheless from the sample of 10, the mean vote was -0.04 indicating that the thermal environment was as close to optimum as it could be. Indeed two respondents specifically noted that the thermal environment was very comfortable.

Though the mean clothing level was 0.82, 27% of respondents were wearing clothes with a clo value of 0.55 corresponding to the short sleeves noted at the time of the visit, and a further 44% were wearing clothing with a clo value of 0.65. The mean value is affected by one person wearing clothing to a level of 1.6. Interestingly, this person still indicated that he/she was slightly cool voting -1 on all occasions. The data relating to the clo value is shown in Fig. 17.

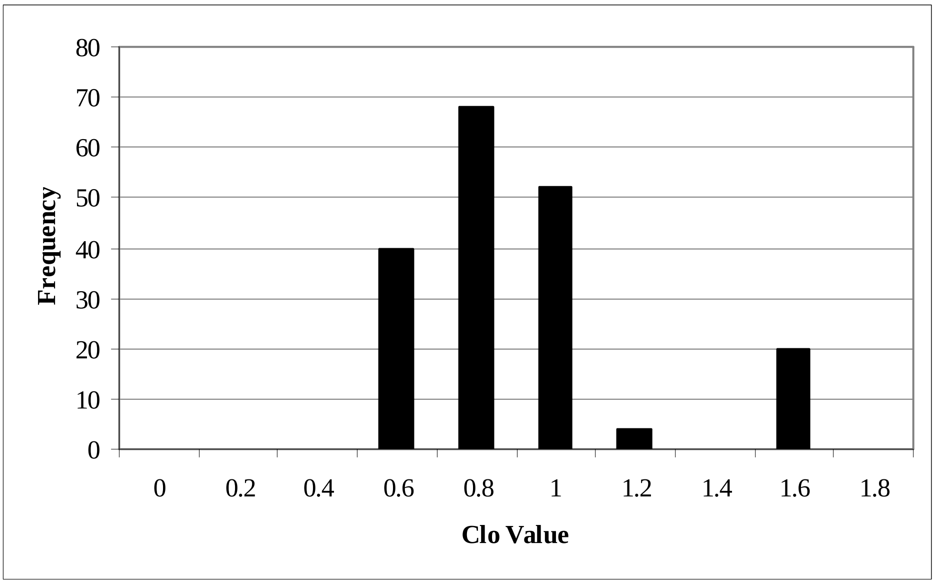


Fig. 17. Clothing levels of staff in Cambridge Office.

One member of staff was clearly wearing different clothing levels on different days, but this did not affect the perception of thermal comfort. A second member of staff appeared to adjust the level of clothing through the day and this appeared to be related to when that person started feeling warm.

It is interesting to note the relatively low clothing level for a significant number of staff. It could be argued that they have responded to past thermal environments and have adjusted their clothing levels to suit accordingly. Whether there is scope for a small reduction in temperature, which could be achieved by the staff wearing slightly warmer clothing is another matter and needs to be considered carefully with periodic thermal comfort surveys of the type indicated in this study.

In addition to the thermal comfort study a lighting survey was done (see Appendix 1). The mean response indicated a lighting perception value at 0.45, suggesting there is some scope for slightly reducing lighting level. One member of staff commented on the fact that blinds were drawn and yet he/she would prefer a little more natural daylight.

4.10 Waste

Situation

Waste is separated at source into confidential and ordinary categories using a twin bin system. Cardboard is separated and stored in open areas. The waste contractor, Donarbon, provides a standard paladin and a locked recycling bin for cardboard (Fig. 18). The locking system decreases the chance of contamination and also prevents others from using this recycling opportunity without permission. It was impossible to tell how much waste is generated although each of the 10 groups of stations on the first floor had one 10-litre bin for ordinary waste and one 25-litre bin for confidential waste. A brief inspection indicated that waste composition in the ordinary bins ranged from waxed paper coffee cups from the coffee machines to food packaging, plastic drinks bottles and cans and packaging from stationery, typically plastic wrapping.

Fig. 18 The waste bin which is locked preventing cross contamination of waste

4.11 Water

Situation

The kitchen area had one dishwasher and sink. There was some evidence of use. The landlord manages the toilets. Taps are not fitted with low flow spray devices. Toilet cisterns are standard size. There was no low flush option visible.

4.12 Travel

Situation

Because of the location, all staff drive to work. The car park was full and overflowing. There was no visible public transport to the Innovation Park, but public transport is available from the City Centre to the nearby Park and Ride scheme at Cowley Road. Buses from villages to the north of Cambridge stop in Milton Road about 5 minutes walk away from the Innovation Centre. Some staff cycle in the summer. There may be some opportunities for car sharing perhaps with other businesses on the Innovation Park.

4.13 Level of Control

The level of control over heating and lighting systems was assessed to be low as accommodation is shared between tenants. Heating and lighting are controlled by the building maintenance team contracted by the landlord Atisreal. Where control does exist, the opportunities are limited because of confusing and in some cases inappropriately located switches for lighting etc. There seems to be little opportunity for control of heating apart from general temperature settings.

Lighting appears to be automatically switched on at the beginning of the day, 07:30 and off at about 18:00. One set of lights in the darkest part of the main office (i.e. the centre) was switched off during the visit. This did reduce light levels and the lighting was needed. However, the blinds on the south side were largely drawn to prevent glare (Fig. 5), and there is possibly some scope for having some of the lights on the south side switched off during the middle of the day particularly in summer. The HSBC contact person asked staff in the first floor office about switching of lights following a brief test during the site visit. Most responded that they preferred the lights on. However, it is not clear whether this also applies to those on the south side adjacent to the windows, where illumination could be controlled by use of the blinds. The survey suggests the lights are slightly on the bright side.

One suggestion made during the survey was that the overall level of lighting might be unnecessarily high, but that no lighting was not an option, nor were zones which were switched off. However, the option of having two out of the three lights in each unit was suggested as a sensible way forward. If this were possible in a refurbished office (i.e. having optional control via wiring circuits installed at time of refurbishment) to have each unit wired with either two or one unit on, then some savings would be possible. Assuming two lights were on instead of three, a saving of 5000 kWh could be achieved in the first floor office representing 2.5 tonnes of CO_2, and a monetary saving of £280 per year.

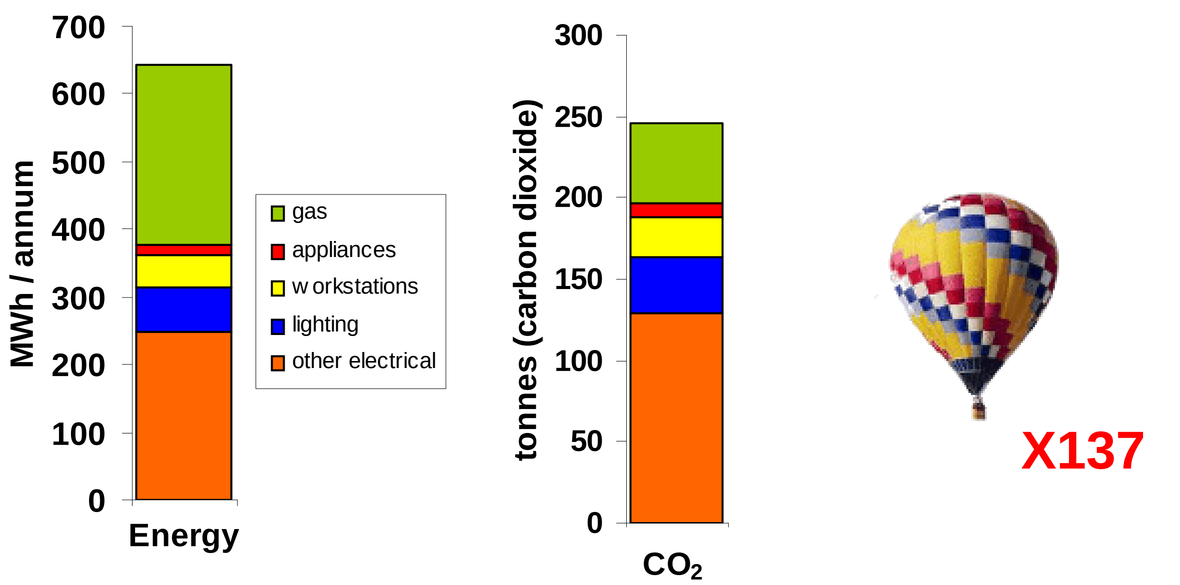
5. Site 2 Norwich, 18 London Street, Norwich. NR2 1LG

Dates of Visit: Thursday 16th February 2006 and Friday 10th March 2006

Contact Person: Aidan Marshall 01603 243 226
Mark Briggs for technical matters

Summary of Audit at the Norwich Branch

The building is around 40+ years old. Data for both electricity and gas consumption were available and these were averaged over a three year period. Estimates were made of the likely electricity consumption from lighting, computer use and appliances, and these were deducted from the total electricity use to estimate other uses – e.g. supplementary heating and air-conditioning. This energy information is summarised in Fig. 19a while Fig. 19b and 19c summarise the carbon dioxide emissions and the equivalence in hot air balloons.



a) Electricity Consumption b) CO_2 Emissions c) Balloon equivalents

Fig. 19 Estimated electricity and carbon dioxide emissions for the Norwich Branch.

What is particularly surprising from Fig. 19 is the fact that total gas consumption is only two thirds of the consumption of electricity, and that the total estimates of identifiable electrical appliances only account for approximately one third of total electricity consumption. Normally this figure is much higher and almost double that figure in the other branches for which there are data. The other uses of electricity are particularly high and are almost certainly associated with supplementary heating and air-conditioning. Space heating provided by electricity is not only more costly than heating by gas, but also the carbon emissions are significantly higher with electricity.

The gas consumption associated with heating appears to correlate reasonably with temperature suggesting that controls, in general are functioning. However, unlike other branches, the electricity data are read remotely and are thus likely to be reliable estimates. Nevertheless there are some data points on the consumption versus Degree Day plot which suggest excess consumption or particularly low consumption for approximately one or two months each year. It is important to ascertain the causes for these deviations so that lessons can be learnt for the future.

The electricity consumption data was reasonably static for 15 months at around 30 000 kWh per month. However, there was a significant and welcome decrease over six months to just over 20000 kWh per month. This trend is indicative of significant and continual improvements to energy efficiency, possibly due to installation of low energy lighting or flat screen workstations of the period. Despite this improvement there is a very worrying sudden increase to over 40000 kWh per month in summer 2005 and the consumption has remained at that level since. If this trend continues it would represents an excess project consumption of around 200 000 kWh a year representing a cost of around £10000 to £12000 per annum at present electricity costs. It also represents an increase in carbon dioxide of around 100 tonnes. It is understood that the air conditioning unit controls have malfunctioned and that this unit is running even in winter which presumably means that additional supplementary heating is also required. It is important that urgent consideration be given to repairing any defective controls.

There are clearly areas of the building which are in infrequent use where lighting and air-conditioning is left on unnecessarily. Such rooms include the conference rooms and awareness levels should be raised to encourage good practice of switching off unnecessary lights etc when vacating such rooms.

In the third and fourth floor offices there is generally good day lighting provision and there is scope to ensure that lights are not used unnecessarily in these areas through awareness raising.

Electricity consumption at the Norwich branch (at and average of 289 kWh/annum) is more than double the consumption rate in terms of floor area of other branches in this study and this is almost certainly as a result of issues associated with air-conditioning and heating mentioned above. In terms of consumption per employee, the consumption rate is within the range of other branches studied.

Water consumption at the Norwich branch is nearly four times the consumption rate per employee at other branches. The causes of this excess consumption rate need to be identified.

As with other branches, there is need for key personnel to promote environmental issues through the staff as a whole. The Norwich branch is a large site with many rooms and with nearly one hundred staff. One member of staff (Mark Briggs) appears to have a knowledge of much of the energy system, but it is unreasonable to expect him alone to be a sole “Green Champion” for the whole branch. Instead there needs to be a team of about four or 5 people each responsible for a designated area who would also work in co-ordination with Mark Briggs. They would ensure, for instance that workstations and lights in their area are indeed switched off at the end of each working day.

While it is recognised that a move to new offices may take place within the next 6 – 12 months, it is important that the above issues are addressed at an early stage, including the issue of the controls on the air-conditioning units. Even if the premises are vacated and sold, there will almost certainly be a requirement to ensure that such infrastructure is of good standard before a sale proceeds.

Norwich Branch Report

5.1 Pre-Audit Data Supplied

Year	Type	FTE	m^2	Waste (tonnes)	Elec (KWh)	Gas (KWh)	Water (m^3)
2003	Bank	99	1306.171	15.6	380,788	269,738	1,665
2004				15.6	364,671	295,692	1,327
2005				15.6	388,219	230,428	1,394

5.2 Background:

Fig. 20. The exterior of the Norwich Branch in London Street. The top floor is set back from the parapet and not visible in this photograph.

This is a large city centre branch occupying 6 floors dating from the 1960s. It is situated in a pedestrian precinct with no nearby parking. HSBC own the freehold. The five public floors include:

Ground Floor: General Banking
First Floor: Counter Service
Second Floor: Business Banking
Third Floor: Conference Facilities
Fourth Floor: Private Banking

In addition there is a basement which also houses the air-conditioning unit. On the third floor there is a separate kitchen and a large rest area with attached kitchenette. There is a further kitchen on the top floor.

Planning permission has been received for a new building to house many of the public services. This is in response to the shift in the centre of gravity of the retail activity in the city of Norwich following the opening of the Chapelfields shopping Mall. The target date for the move is sometime in the next 12 months. Some of the offices will be retained for the immediate future. Unlike the present building, HSBC will not hold the freehold of the new building. London Street is a freehold building but will soon be relocated closer to the centre of gravity for retail outlets in Norwich.

Though temperature measurements were taken throughout the building, it was not possible to undertake a thermal comfort survey using a questionnaire at the branch. However, this would be important to do when possible using the questionnaire illustrated in Appendix 1 and tested successfully at the Cambridge Office..

Fig. 21 The Ground Floor Lobby area looking into the inner Lobby.

The northern end of the building has a staircase for public access to all floors, apart from the basement. There is also a lift to all floors. At the southern end there is a stair case used solely by staff. This latter staircase is illuminated with circular fluorescent bulbs, one per floor which give a low but adequate level of illumination. The public staircase is well lit particularly between the ground and first floor where the normal counter services are located. On the first, second, and fourth floors there are public area and interview rooms. These are located towards the northern end of the building adjacent to the public staircase. On the third floor are conference and training facilities.

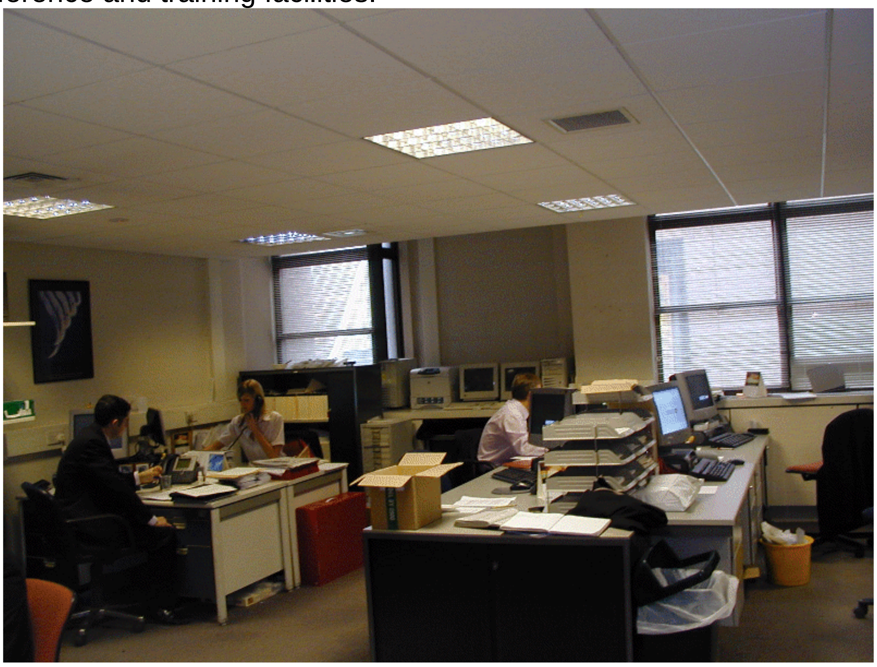


Fig. 22. First Floor Office. There is limited natural daylight in this office. This office is reputed to be the hottest of all – one member of staff has short sleeve top suggesting this is indeed the case.

To the south side of the building on all floors apart from the basement and ground floor are open plan offices (Figs, 22, 23, and 24), the largest of which is on the second floor. A small area at the southern end of the ground floor provides facilities for servicing the cash point machines located in the outer foyer.

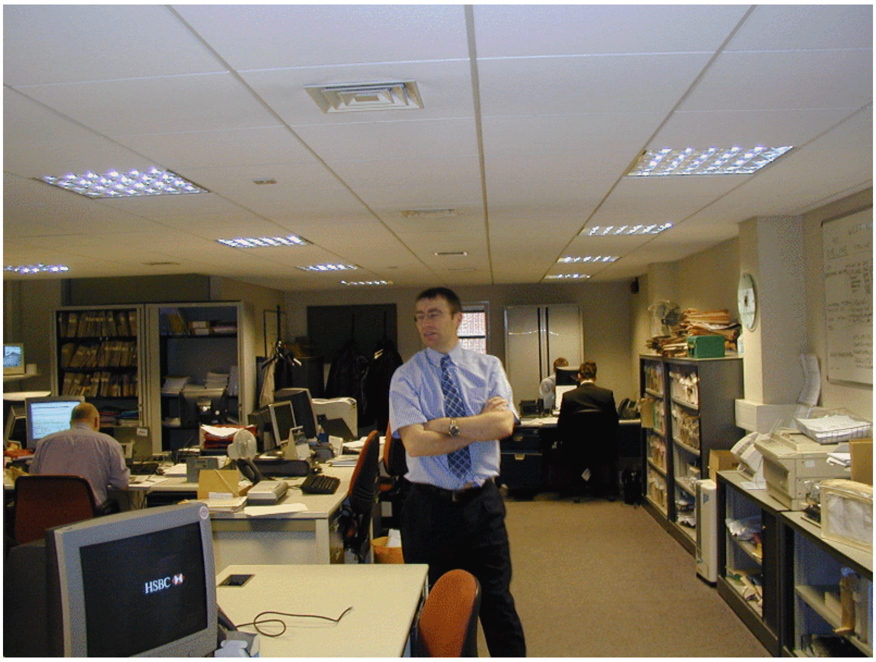


Fig. 23. Second Floor Office. This is the largest of all and once again there is limited natural daylight. Short-sleeved shirts are again in evidence.

Fig. 24. The third floor office. This is smaller than the second floor and there is much more natural daylight. However, lights near the window were on during visit. A particular problem arises in this office from the glare from the roof of the building opposite seen through the window. When this photograph was taken the sun was not shining directly onto the roof.

At the time of the first visit the sun was reflected directly causing significant discomfort to those at the workstations in this picture.

All windows in the building are single glazed and there is some evidence of draughts close to the window. This might explain why some staff are feeling cold even though the temperatures as measured in the rooms indicates that the temperature is adequate and possibly slightly on the high side.

5.3 Maintenance and Cleaning

Maintenance and cleaning are contracted to HSBC's national contractors.

5.4 Heating

Situation

Heating is provided by three ROCA NG100 gas boilers on the top floor. These have provision for automatic control, but this control is poor and manual override control is used and could be potentially wasteful. No one on site has information on consumption nor are bills available. There is a staff member (Mark Briggs) who deals with day to day matters regarding heating and air-conditioning. The air-conditioning plant is housed in the basement.

Heating is provided by perimeter units beneath the windows, but these are generally inadequate and supplemented by a number of electric fan heaters in many of the offices suggesting inadequate heating from the centralised plant. In some rooms there are stand-alone 2kW convector heaters, and there was an additional heater in the general store area of electrical equipment on the ground floor. None were switched on at the time of the second visit. The presence of these suggests that there is a problem with the main heating. Controls for the perimeter heaters are largely inaccessible.

Problems have been reported with the air-conditioning plant and indeed it has now been running continuously 24 hours a day since summer 2005. However, in view of the impending move, repairs have not been done to the main air-conditioning unit. There are individual controls on fan assisted hot water radiators, but controls are not easy to get to. Several rooms have dehumidifiers.

Anecdotal evidence suggests that the first floor office is always hot. On the second floor, two staff complained of always feeling cold, despite the measured temperatures. The fourth floor is always very cold on Monday. This office has sloping walls and probably has limited insulation in view of the time of construction of the building. The temperature measurements were all taken on a Thursday, which suggests more than adequate levels of heating. However, they may be atypical of the key times on a Monday. Free standing 2 kW convector heaters were observed, but none were in use at the time of either visit.

The conference room on the third floor can be divided into two separate sections. The southern section is the larger of the two. Both parts of the conference room have separate control of air-conditioning/heating. At the time of the first visit, the partition was closed. Neither room was in use. The larger room was noticeably cooler than anywhere else in the building (see table below) and the temperature control was set at 18^{o}C. The smaller room was also unoccupied, but in this section the control was set for heating and warm air was being blown from the unit,

Room Temperatures

The following measurements were made during the mid-morning of Thursday 16th February 2006.

Location	Dry Bulb	Wet Bulb	Mean Radiant Temperature
First Floor Office	23	16.5	20.5
Second Floor Office	22.8	14.5	20.8
Third Floor Office	22.5	14.5	22.0
Conference Room 1	19.5	13.5	21.0
Conference Room 2	23	15.5	21.0
Fourth Floor Office	23	15.2	21.2

With the exception of Conference Room 1 (which had the air-conditioner working in the cooling mode), the dry bulb temperatures were comparable to those in Cambridge. The mean radiant temperatures were 1 – 2^{o}C cooler as is to be expected in an older building with relatively inferior insulation in the walls and windows. Consequently, staff at the Norwich Office are likely to feel marginally cooler than at Cambridge.

Opportunities

It is understood that the heating is currently controlled manually. This probably explains why staff report feeling cold on a Monday. The heating is off for much of the latter part of weekend. Some advance pre-heating would help here. Even though the gas consumption would rise slightly, it would be possible to reduce (and possibly eliminate) the use of the free-standing units. Since electricity has a much higher carbon emission factor, and also is more costly than gas, such a change in strategy would save carbon dioxide and also save money. However, as the current heating season is near the end, and the majority of staff will be moving to a new location within 12 months, it is questionable whether such a strategy is relevant. However, following the move, some staff will remain, and the situation should be reviewed at that time.

5.5 Lighting

Situation

Basement

All lights in this area are 75W fluorescent tubes. All lights apart from those in the cleaners room and meter room were on. The total daily consumption is estimated at 12 kWh.

Ground Floor lighting:

Main Foyer: This area is illuminated with units each of which has two CFLs each rated at 18W. A few of the units are slightly smaller with 13W lamps. However two bulbs were missing and three units were not working. In addition there are two 50 W spotlights which were not in use. Despite the missing lamps the area was brightly lit. At the time of the visit there were restrictions on the use of this lobby area by the general public during out of hours. However, it is assumed that in normal operation, this foyer would be illuminated during out of hours

Outside: There are 14 lights which were not on and are presumably light sensitive. It is difficult to ascertain what type these are.
Inner Foyer: This area has 32 units each with two 18W CFL.
Offices: There are 10 such offices each with 4 twin CFL units and a further 24 such units in offices.
Public Stairs to First Floor: This area is illuminated with three large floods directed at the ceiling and five twin CFL units with lamps rated at 18W
Counting Area: The corridor area has 4 units each with four 2ft long T8 tubes each rated at 18 W. The counting area itself has 2 units each with four 4ft long T8 tubes each rated at 36 W.

The total wattage on the ground floor including the outside is estimated at about 4.5 kW with a total daily consumption of around 56 kWh. Allowance has been made for illumination out of hours in the main foyer.

First Floor lighting:

Customer Area: This area is illuminated by unit each with two 18W CFL. There are in addition nine 50 W spotlights used for display purposes.
Counter Area: This includes both the main counter area and that within the Thomas Cook Area. There are ten twin CFL units here.
Main Office: This area has 17 units each with four 2ft long T8 lamps. These are similar to those at Cambridge and shown in Fig. 9 except each unit has four bulbs instead of three.
Service Areas: The small staff corridor, store room and Ladies Toilet has a variety of lamps including 5ft and 6ft T8 fluorescent tubes and one circular fluorescent in the toilet.
Customer Stairs to Second Floor: There are five units each with two 18W CFL and also two circular fluorescent tubes.

The total wattage on this floor is 3830W and an estimated daily consumption during working hours of 38 kWh.

Second Floor

Business Lobby and Interview Rooms: The whole area is illuminated by twin 18W CFL units.
Main Office: This has 24 units each with four 2ft T8 fluorescent tubes.
Service Area: This includes the store room, staff corridor and Men's Toilet and is the same as the floor below.
Customer Stairs to Third Floor: There are five units each with two 18W CFL and also two circular fluorescent tubes.

The total wattage on this floor is 3100W and an estimated daily consumption during working hours of 31 kWh.

Third Floor

Office: There are 14 units each with four 2ft T8 fluorescent tubes
Corridors: There is a mixture of 6ft long T8 fluorescent tubes and CFL units each twin 18W bulbs.
Conference Rooms: These are serviced by 27 CFL units each with twin 18W bulbs
Rest Room, Kitchen: There are both 5ft and 6ft T* units in these areas.
Store and Kitchen: The store room has three 6ft long T8 units while the toilet has two circular fluorescent tubes.

Customer Stairs to Fourth Floor: This area is illuminated by five CFL twin 18W units and two circular fluorescent tubes.

The total wattage on this floor is about 3400W and an estimated daily consumption during working hours of 34 kWh.

Fourth Floor

Main Office: This has windows on two sides and has the most natural daylight of any area. There are 13 units each with four 2ft T8 fluorescent tubes.
Private Banking and Offices: These are all illuminated with CFL twin 18W units.
Kitchen and Corridor: These have 6ft and 5ft T8 fluorescent tubes.
Toilet: This has two circular fluorescent tubes.

The total wattage on this floor is about 3100W and an estimated daily consumption during working hours of 31 kWh.

Staff Stairs:

There is one circular fluorescent tube per floor.

The total daily consumption for the whole building during working hours is estimated at 204 kWh. If lights are on for an additional two hours for cleaning etc, this increases to 240 kWh. The annual consumption for lighting is estimated at 66000kWh representing the emission of 34.4 tonnes of carbon dioxide.

Opportunities

All areas have low energy CFL or efficient fluorescent tube units, and there is no scope for energy reductions here.

There is limited natural lighting and consequently artificial lighting is needed in most areas. Possible areas where savings could be made are:

- Lights nearest windows on floor 3 and floor 4 offices might be unnecessary in daylight hours, however, the saving here is likely to be small
- The conference room lights are not needed when these rooms are not in use. On the first visit the smaller room had lights off, but the larger room had lights on. On the second visit the partition was folded back to form one large room. On this occasion all lights were on.
- The restroom is used intermittently and potential saving could arise here from use of PIR sensors.
- There are a few meeting rooms on the upper floors which do not need lighting all the time.

The maximum saving from all these measures is estimated at 20 – 25 kWh per day or 10%. However, in reality it is likely to be somewhat less as it relies on a proactive awareness campaign. The experience of the Kings Lynn Branch suggests that this could be achieved.

Several of the lights in the main foyer were either missing on not functioning. Despite this the light levels were more than adequate. There is possible scope to remove a few additional bulbs without affecting the general impact of the foyer area, although some experimentation would be needed. This issue is perhaps something which should be considered when the move is made to the new building.

5.6 IT & Appliances

Situation

IT equipment

Flat Screen workstations are used throughout the front offices, interview rooms etc, but the staff offices have mostly CRTs and a few flat screen workstations. A few lap tops are in use in some of the offices. All workstations in interview rooms have a printer, and there are typically three printers per office on all floors. All offices have a photocopier. In total there are about 65 workstations with around 40% having flat screens.

The estimated total daily energy consumption with an allowance for additional peripherals – e.g. servers, network units, telephones etc is 175 kWh per day giving an annual total of 48000 kWh corresponding with a carbon dioxide emission of 25 tonnes.

To ascertain the actual consumption of workstations a cost plug (Fig. 25) was installed on one unit (Fig. 26).

Fig. 25 A cost plug to measure electricity consumption

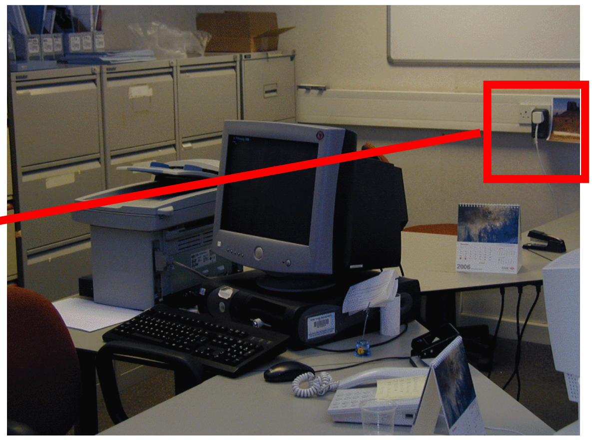


Fig. 26. Work station in First Floor Office under test for electricity consumption

The results from occasional readings over a week indicate that the work station was not always switched off at night (Fig. 27).

Appliances

The following appliances of note were recorded: three coffee machines, cash machines in the main lobby, fans in several offices, portable heaters, dehumidifiers, wall mounted fan heaters, and several TV monitors. In the kitchen areas there are three fridges, one fridge freezer, kettles and one cooker which tends not to be used at the present time as it is causing damage to adjoining worktop units.

The cash machines contain several component parts. The CRTs are rated at 80 -100 W, and there is a computer base unit and several peripherals – e.g. printer for receipts, counting facility etc. A total consumption of 250 W is estimated.

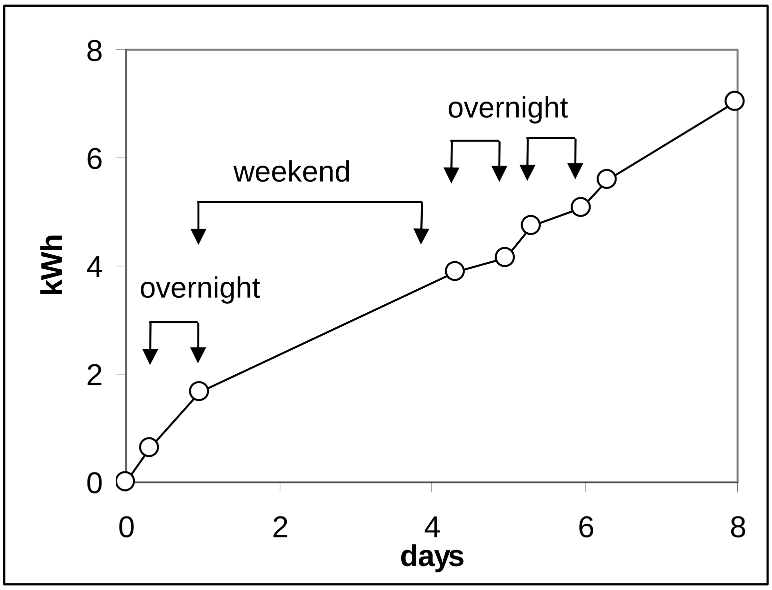


Fig. 27. Energy consumption of a work station over a period of 8 days. On the nights of day 0 – day 1 it is clear that the work station was not switched off. There is also significant use over the weekend. For days 5 and 6 when readings were taken both in the morning and evening, the results show that the computer has been consuming some power over night even when apparently off.

As with the workstation above, the coffee machine on the first floor was monitored over a period of 14 days. These machines are left on 24 hours a day. The trend is linear (Fig. 28) with a high coefficient of correlation (0.9988).

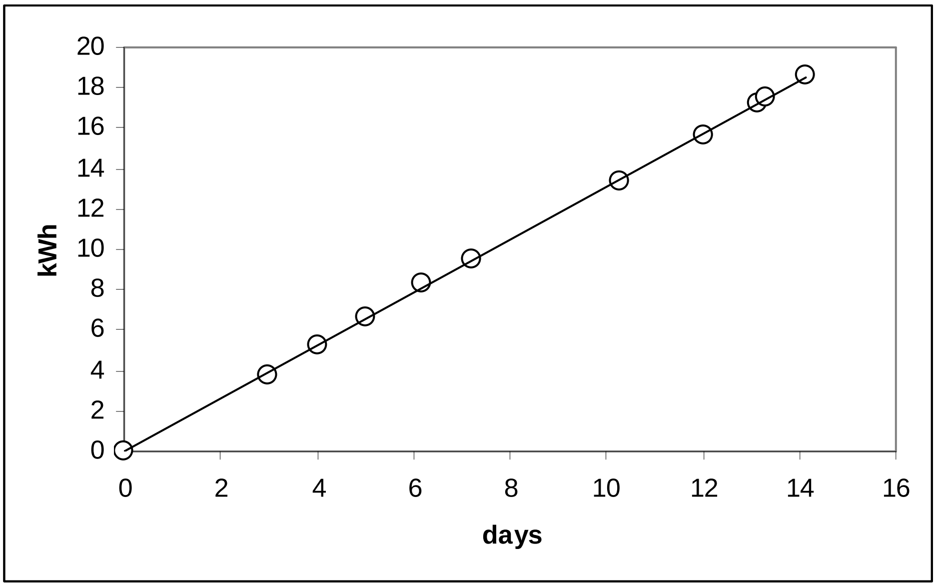


Fig. 28. Energy consumption from coffee machine.

The daily consumption is 1.31 kWh per day, and this includes the heat loss from the machine and the actual energy to heat the water. Each coffee cup from the machine holds 200 ml, and it is possible to estimate the energy requirement per cup as 20 Wh. Thus if there were no losses, the energy consumption is equivalent to around 65 cups per machine per day. A more likely figure is around 20 representing a daily total of 0.4 kWh. This implies a loss of 0.9 kWh from the casing per day or around 0.5 kWh overnight. Though this is a wastage the 3 coffee machines waste less than 0.3% of the total energy consumption from lighting and IT appliances use. It should be noted that unlike the coffee machine in the Cambridge Office the insulation level appeared particularly good. The total consumption of electricity in appliances (other than fan heaters, convector heaters, fans, dehumidifiers etc) is about 15000 kWh per year.

Opportunities

The main area of energy reduction in the IT and appliance area would arise from replacing the CRT screens on the majority of the workstations in the staff offices etc with flat screens. The total potential saving in electricity by converting all such screens could be up to 15000 kWh representing the emission of 7.5 tonnes of carbon dioxide, and a potential monetary saving of around £1000 per annum. There is a policy to switch off all computers apart from the servers each evening, but there is evidence to indicate this is not always the case, and the estimates of energy consumption from IT given above may be underestimates. To be effective there must be an energy champion to ensure that such equipment is switched off when not being used.. There is limited scope from switching coffee machines off at night, although this would results in a small saving.

5.7 Overall Electricity Use.

The total monthly electricity consumption is shown in Fig. 29 for the three years 2003 – 2005. These data were provided by HSBC with a note indicating that some readings are estimates. However, there is no indication which readings are indeed estimates. However, in the case of Norwich, the meter is read remotely and thus there should be confidence that all readings are indeed actual rather than estimated readings. It is not clear whether these readings relate to exactly the same day of the month. Assuming that the readings are exactly monthly there are some interesting trends.

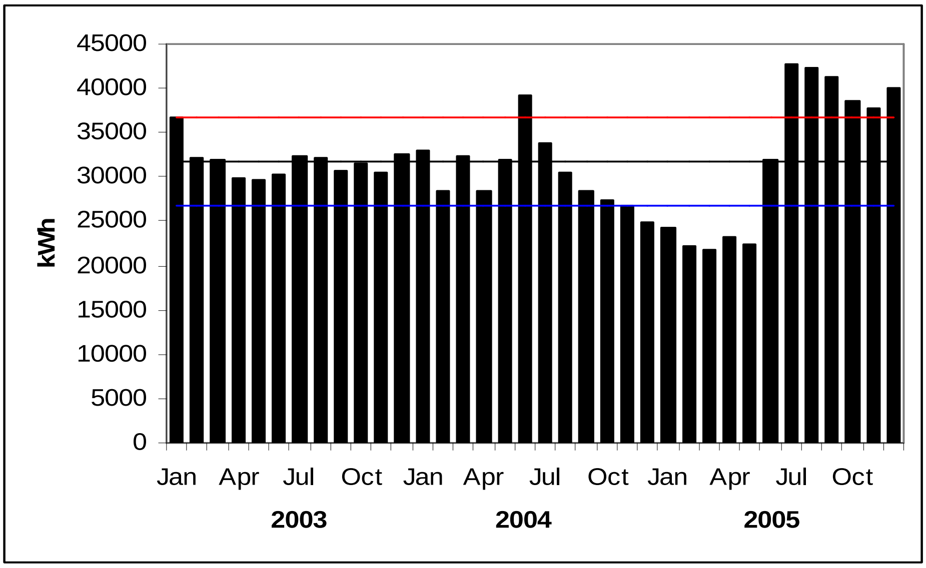


Fig. 29 Electricity consumption at Norwich. Since the readings are read remotely it is assumed that these represent actual consumption rather than estimations. See section 3.3 for a discussion of the significance of the upper and lower band.

The total electricity estimated for lighting, IT and appliance use is around 130 000 kWh per year or about 35% of the total electricity consumption at 380 000 kWh. The remaining 65% will be associated with air-conditioning and supplementary heating, dehumidification and the use of fans.

Throughout 2003 there was almost constant use of electricity indicating that any heating in winter was balanced by air-conditioning in summer. In the middle of 2004, there is a sudden increase in energy use followed by a progressive reduction in energy. This trend would be consistent with the phased introduction of conservation measures – e.g. low energy lighting. A reduction of nearly 30% in electricity consumption was achieved by May 2005 compared to the baseline values of 2003. However, in the middle of 2005 there was a sudden jump in demand and this has remained at a high level since corresponding to an increase of 25-30% over 2003 levels and an 80% increase over the levels in April/May 2005. This is an extremely worrying trend. However, it is reported that the air-conditioning controls failed in the summer of 2005 and is now running continuously despite the fact it is winter. The observed trend is consistent with this fault. Had a banding system been in place as discussed in section 3.3, then such issues would have been identified at an early stage.

In 2003 the emission of carbon dioxide associated with the electricity use was 198 tonnes. Had the improvements achieved by mid 2005 been maintained, then this would have fallen to around 143 tonnes, a saving of 55 tonnes. However, because of the problems with the air-conditioning it is projected, on the current consumption that the emissions will increase to 249 tonnes, a wastage of over 100 tonnes of that which is potentially achievable. Furthermore the cost for this increase will be around £10 000 to £12 000 per annum at current electricity prices.

5.8 Overall Energy Use

The gas consumption at the Norwich Branch is shown in Fig. 30. Unlike that at Kings Lynn this shows a trend following an expected seasonal pattern and within the normally expected range of values attributable to climate variations between the years. It suggests that these data are in the most part genuine and not estimated readings No data were recorded for the period July to September 2005, but consumption over this period is likely to be small anyway.

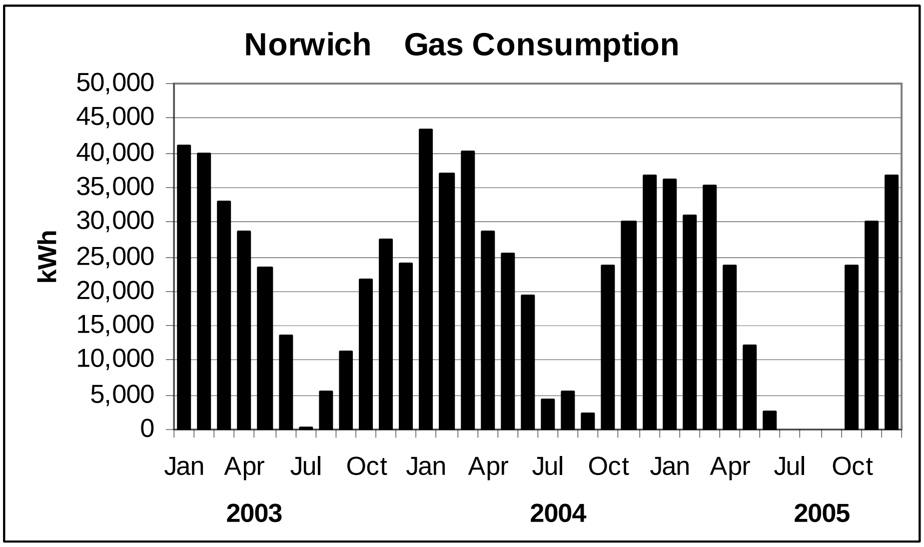


Fig. 30 Gas consumption at the Norwich Branch.

Fig. 31 shows the monthly gas consumption data plotted against degree days. There is a linear relationship with a moderately high coefficient of correlation (0.8077) which implies that the automatic control of the heating system is responding in a reasonable fashion, and furthermore that the data for this branch are likely to be reasonably reliable. Typically of coefficient of correlation of between 0.8 and 0.9 is expected where there is system with responsive control. The relationship indicates that the heat loss rate for the building is 4.4 kW $^oC^{-1}$. The upper and lower bands shown in red and blue respectively are drawn with a band width of +/- 8000 kWh. The significance of these bands is discussed in section 3.2. Such a band width would have triggered a reporting incident on four occasions during the three year period or just over once a year. The purpose of such reporting is to identify the causes of particularly high or particularly low consumption figures so that lessons can be learnt in the future. The report level of about once a year is considered to be a reasonable initial level for such a report mechanism.

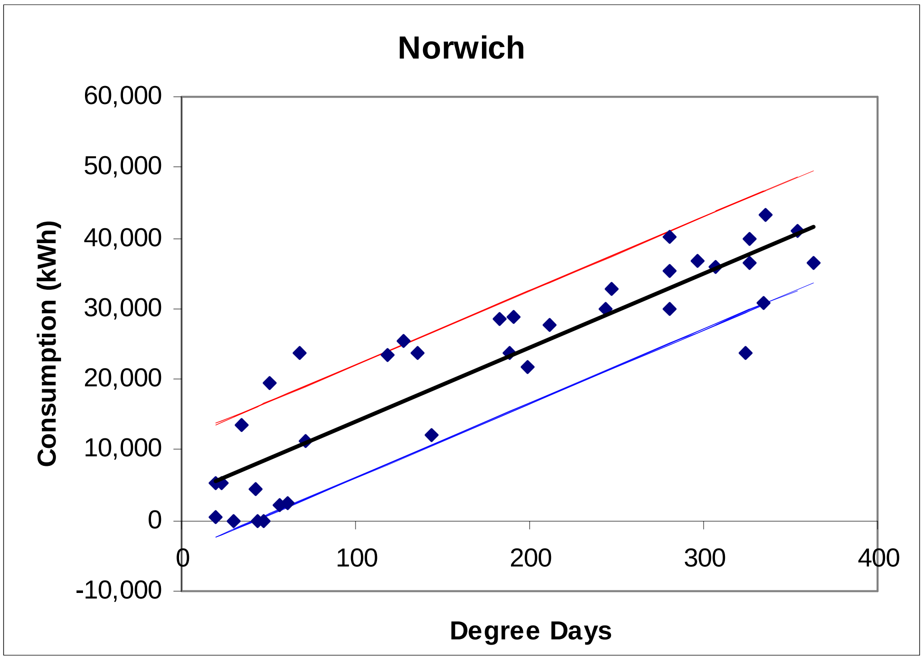


Fig. 31. Relationship between consumption and Degree Days for Norwich Branch.

However, somewhat surprisingly the annual consumption of gas is only about 70% of the consumption of electricity as shown in Table 5.1.

Table 5.1 Summary Energy and carbon dioxide emissions for the Norwich Branch

	Electricity	Gas	Total CO_2	Electricity		Carbon Dioxide	
	kWh	kWh	tonnes	kWh/sqm	kWh/employee	kg/sqm	tonnes / employee
2003	380,788	269,738	248.2	291.6	3846.3	190.0	2.51
2004	364,671	295,692	244.6	279.2	3683.5	187.3	2.47
2005	388,219	230,428	244.7	297.3	3921.4	187.4	2.47
Average	377,892	265,286	245.8	289.4	3817.1	188.2	2.48

The data in terms of electricity consumption per square metre may be compared with similar requirements in local authority civic offices (Table 5.2). The value for Norwich is 60% above the average consumption level for an air-conditioned office. Once again, the performance is almost certainly affected by the malfunction of the air-conditioning unit and the significant use of supplementary electric heating.

Table 5.2. HSBC Norwich Branch compared to Local Authority Offices (kWh/m^2/annum).

<table>
<tr><th rowspan="2"></th><th colspan="2">Local Authority Offices</th><th rowspan="2">Norwich</th></tr>
<tr><th>Naturally ventilated</th><th>Air-conditioned</th></tr>
<tr><td>Good Practice</td><td>54</td><td>97</td><td rowspan="2">289</td></tr>
<tr><td>Typical</td><td>85</td><td>178</td></tr>
</table>

It is noted in section 5.4 that supplementary electric fan heaters are in use and also free standing convector heaters. Furthermore, the air-conditioner has been in operation 24 hours a day since the summer of 2005 further increasing the electrical load. What is particularly noticeable is that the electricity consumption per unit floor area is more than 2.5 times that in the other branches, and coupled with the relatively low gas use (compared with electricity), does tend to confirm that significant space heating is provided by supplementary electrical means rather than by the installed gas boilers. From a carbon dioxide point of view this is particularly inefficient as even noting that the boilers are non-condensing, 1 unit of useful heat provided by the gas boilers will emit the equivalent of 0.26 kg of carbon dioxide as opposed to 0.52 kg if provided by electricity. Thus the extensive use of supplementary electrical heating is not consistent with a low carbon strategy. The per capita energy consumption is intermediate between that of Kings Lynn and Great Yarmouth but arises primarily from the significantly smaller floor space per employee in this branch. The floor space per employee at approximately 13 sqm per employee is comparable with that at Cambridge (however, no energy data is yet available from Cambridge).

5.9 Waste

Situation

Trade waste is kept in the basement and collected by Norwich City Council's trade waste contractor. It is estimated that this represents 5 bags a day. The confidential waste is collected by Hayes and amounts to approximately 90 bags a month. This is similar to other branches audited. It is unclear how data from the waste contractor is collected as the collection vehicle mixes HSBC trade waste with trade waste from other commercial premises. The vehicle is weighed on the weighbridge at the landfill site. It is possible that the waste data provided is simply an average of the waste collected by the vehicle divided by the number of commercial premises on the collection round.

5.10 Water

Situation

The toilets have individual hot water heaters. However, no low spray taps are fitted. The cisterns do not have a low flush option.

The water use is shown in Fig. 32.

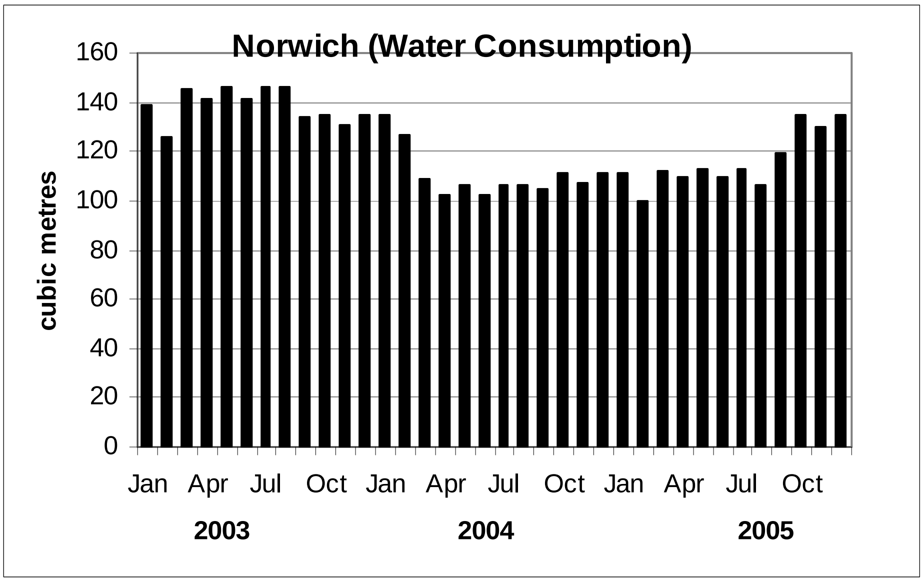


Fig. 32. Water Consumption at Norwich

The data are variable but less so than in the other branches. There is a significant drop in early 2004 and a gradual rise in late 2005. The reason for the reduction is unclear but appears to be at almost exactly the same time as reduction were noted in the other branches. The current use of water is 14000 litres of water per employee per year or about 56 litres per person per day which is relatively high and more than four times the average of other branches visited.

Opportunities

With the impending move within the next 12 months, there is little justification for improvements here. However, discussions should be encouraged with any potential landlord of the new premises to see that such low water consumption units are in place when the transfer of staff takes place.

5.11 Travel

Situation

The majority of the staff based at the branch use park and ride schemes. There is a small staff car park for those that travel around. There is limited scope for improvement here given the high participation in Park and Ride. However, the situation should be monitored following the move to the new premises. It is important to encourage that staff to continue with this practice and not find the convenience of a nearby car park a compelling reason to drive into the centre of Norwich.

5.12 Level of Control

The level of control of heating is poor. It is difficult to adjust the perimeter heating, and the operation of the central boilers seems inadequate that stand alone convector heater are in evidence. While these are potentially very controllable, electric heating is an inefficient way of controlling the thermal environment not only in overall energy terms, but also in terms of carbon emissions and potential monetary savings. The impending move from these premises makes it questionable whether much should be spent in the way of improvements at the present time, but the sudden jump in electricity consumption in the summer of 2005 to 30%+ more than that in 2003 is worrying and probably relates to the poor control now offered by both the central heating plant and the air-conditioning facility.

5.13 Suggested Bands for Degree Day Plot for the Norwich Branch

The following data in Table 5.3 are the suggested baseline data values for gas consumption references against Degree Days for the Norwich Branch. When consumption exceeds either the upper or lower limit, a reporting system should be triggered. The significance of these bands is discussed in section 3.2. If consumption data in any month lies outside the range defined by the upper and lower bands then action should be triggered. The bandwidth is set at 8000 kWh for Norwich and would trigger action once or twice a year. A plot showing these bands with actual data is shown in Fig. 31.

The band width should be reviewed at regular intervals, and with time it would be expected that the width will become narrower. Whenever there are conservation improvements, there may also need to be a revision as discussed in section 3.2.

Table 5.3 Suggested initial Bands for the Norwich Branch for the Degree Day Plot.

Norwich (kWh)							
Degree Days		Bands		Degree Days		Bands	
	Mean	Upper	Lower		Mean	Upper	Lower
0	3586	11586	0	200	24524	32524	16524
10	4633	12633	0	210	25571	33571	17571
20	5680	13680	0	220	26618	34618	18618
30	6727	14727	0	230	27665	35665	19665
40	7774	15774	0	240	28712	36712	20712
50	8821	16821	821	250	29759	37759	21759
60	9868	17868	1868	260	30806	38806	22806
70	10915	18915	2915	270	31853	39853	23853
80	11962	19962	3962	280	32900	40900	24900
90	13008	21008	5008	290	33946	41946	25946
100	14055	22055	6055	300	34993	42993	26993
110	15102	23102	7102	310	36040	44040	28040
120	16149	24149	8149	320	37087	45087	29087
130	17196	25196	9196	330	38134	46134	30134
140	18243	26243	10243	340	39181	47181	31181
150	19290	27290	11290	350	40228	48228	32228
160	20337	28337	12337	360	41275	49275	33275
170	21384	29384	13384	370	42322	50322	34322
180	22431	30431	14431	380	43369	51369	35369
190	23477	31477	15477	390	44415	52415	36415

Degree Day information may be found on the Carbon Trust Web Site.
www.thecarbontrust.co.uk/energy/pages/page_318.asp

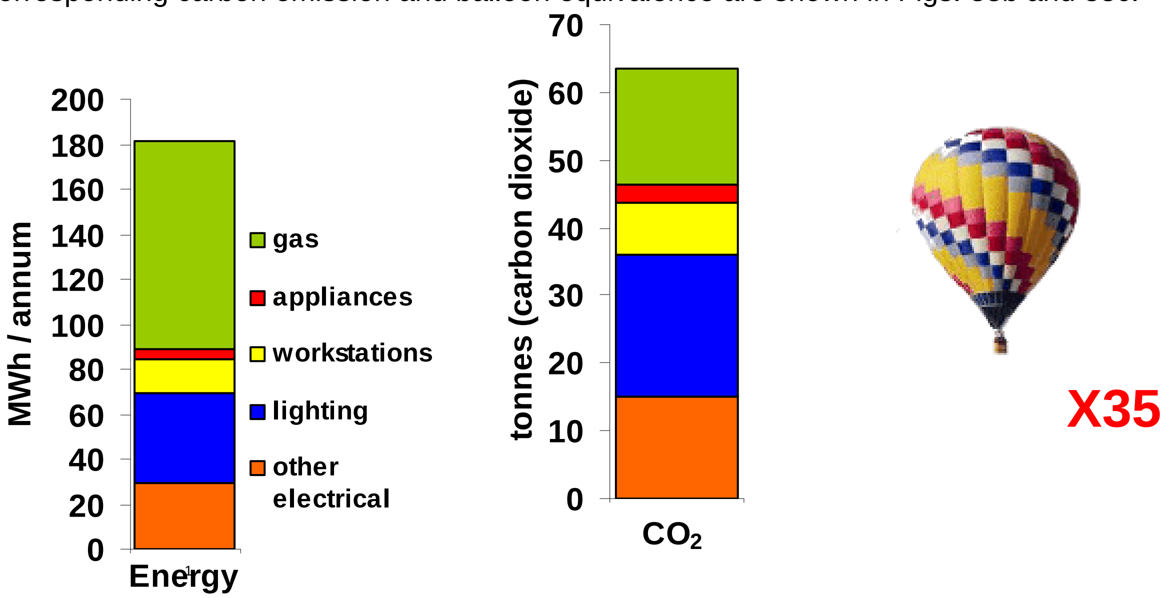
6. Site 3 Great Yarmouth

Date of Visit: Wednesday 1st March

Contact Person: Mandy Watts – 08455 833394

Summary of Audit at the Great Yarmouth Branch

The building is now over 80 years old and there are issue regarding the maintenance of the fabric. Data for both electricity and gas consumption were available and these were averaged over a three year period. However, several of the data are clearly estimates and it is not clear exactly which were real data and which were estimated values. However, assuming that the average over a three year period is reasonable the following summary illustrations of overall energy use can be constructed. As with the other branches the estimates of workstation and lighting use were done by direct observation and assumption regarding the daily use of such equipment. The information about direct appliance use is a very rough estimate. Other electrical use includes any supplementary heating and air-conditioning. The summary energy information is displayed in Fig. 33a while the corresponding carbon emission and balloon equivalence are shown in Figs. 33b and 33c.



a) Electricity Consumption b) CO_2 Emissions c) Balloon equivalents

Fig. 33 Estimated electricity and carbon dioxide emissions for the Norwich Branch.

The gas and electricity consumption figures for Great Yarmouth are almost the same. In the case of electricity consumption approximately 67% can be attributed to lighting, workstation and appliance use suggesting that just one third of electricity is used in air-conditioning and supplementary space heating.

The gas consumption associated with heating appears to correlate reasonably with temperature suggesting that controls, in general are functioning. However, there are clearly erroneous data values and it is important that when readings are estimates these can be clearly identified.

There are serious issues on general maintenance at the branch ranging from tiles becoming loose on the outside to significant damp problems in some of the rooms rendering some unusable. The training room too has such an issue with dampness that no electrical sockets can be used in the room and trailing leads have to be used from the adjoining corridor. This is a serious health and safety issue which should be addressed as a matter of urgency. The building itself is listed and there are important additional issues to address in any external maintenance work that is undertaken.

There are issues of overheating in the office and this is not helped by the dark blue blinds which were installed to match the furniture but which act as strong absorbers of solar heat which is re-radiated into the room.

The electricity consumption has been somewhat erratic over the three period. However, some of this is almost certainly to arise from the erratic estimated readings, but this cannot account for all the variation. Some investigation into this erratic consumption behaviour would be helpful, but it is probably too late now to identify key issues. Instead future data should be monitored carefully and analysed in a manner suggested in section 3.3.

The average electricity consumption per square metre is towards the lower end of the premises visited, but the consumption per employee was significantly above average. This is due the fact that this is a large building with significant areas used as store rooms etc. It is not clear what policy there is at this branch regarding lighting in the store rooms, and this might be an area of possible saving for the future. Other branches have a proactive policy in place which ensures lighting is not on in such rooms except when actually needed.

Water consumption showed a substantial reduction in February 2004 by as much as 50%. This revised level has been maintained. It is difficult to ascertain the reason for this reduction. Overall the water consumption at Great Yarmouth was by far the lowest of any branch visited both in terms of consumption per square metre and per employee.

There is clearly and issue of staff morale regarding the condition of the building and the control of the thermal environment. As with other branches, there is need for key personnel to promote environmental issues through the staff as a whole. If this results in rational improvement to the conditions with the building this would be particular beneficial to the general morale of the staff.

Great Yarmouth Branch Report

6.1 Pre-Audit Data Supplied

Year	Type	FTE	m^2	Waste (tonnes)	Elec (KWh)	Gas (KWh)	Water (m^3)
2003	Bank	19	712.0105	4.37	76,006	87,515	201
2004				4.37	99,996	82,352	117
2005				4.37	91,622	105,379	61

6.2 Background

Fig 34. The front of the Great Yarmouth branch.

Originally a 1920s hotel, the building is freehold but now listed due to the art deco tiles. Unfortunately these are now leaking creating damp rooms inside. On-site discussions indicated that extensive investigations have taken place to determine the source of the leaks. It remains unclear to staff on site if the problem is with the tiles themselves or the grouting in between. The building has single glazed windows with aluminium frames. These are draughty. The building consists of four floors including the basement.

There are 25 people now on site, though some travel so not all are on site at any one time. The building has been occupied by HSBC for 20 years or so but activities are now scaling down. Some of the additional space is used for storage from other branches. The basement, reportedly haunted, is used primarily for storage and plant room. The ground floor is the main retail area. Commercial banking is on floor one. The second floor training suite and more storage (in old bedrooms). Generally the building is in poor condition. Insulation levels are low because of age and the single-glazed aluminium framed windows. However, due to listing, it appears that there is relatively little that could be done to the fabric of the building.

Though temperature measurements were taken throughout the building, it was not possible to undertake a thermal comfort survey using a questionnaire at the branch. However, this would be important to do when possible using the questionnaire illustrated in Appendix 1 and tested successfully at the Cambridge Office.

6.3 Maintenance and Cleaning

Fig. 35. View of the side of the building showing the problems with the tiles. It was reported that some had fallen off and been cemented back on.

HSBC appointed maintenance and cleaning contractors (Mowlem and OCS) provide these services. Mowlem operate on a three-level staged call-out system, which was reported to work effectively. However, the major problem with the ingress of water through the tiles is proving difficult to fix.

Fig. 36. Dampness on inside of building

Fig. 37 Room now unusable

Inside the building this is causing damp walls (Fig. 36). Some attempts to mitigate this have been made by installing false walling over the damp areas. One room has become uninhabitable (Fig. 37). The training room (Fig. 38) on the second floor has outside walls so damp that electrical equipment is plugged into an adjacent corridor and leads trailed into the room for fear of electrical short circuit in the training room itself.

Fig. 38. The training room

6.4 Heating

Situation

There is a gas fired wet central heating system, possibly installed as part of a previous refurbishment. It seems that this is ineffective in providing even warmth throughout the building as a more modern electric climate control (Mitsubishi) system has also been installed. Some of the controls appear to be handled by Group HQ through a modem connection, whilst others are operated locally. Evidence from the commercial office on Floor 1 indicates that these systems are in conflict; a situation made worse by intense solar gain through large west facing windows covered by dark coloured (and therefore heat absorbing) blinds. Clearly this is having a detrimental effect on staff morale.

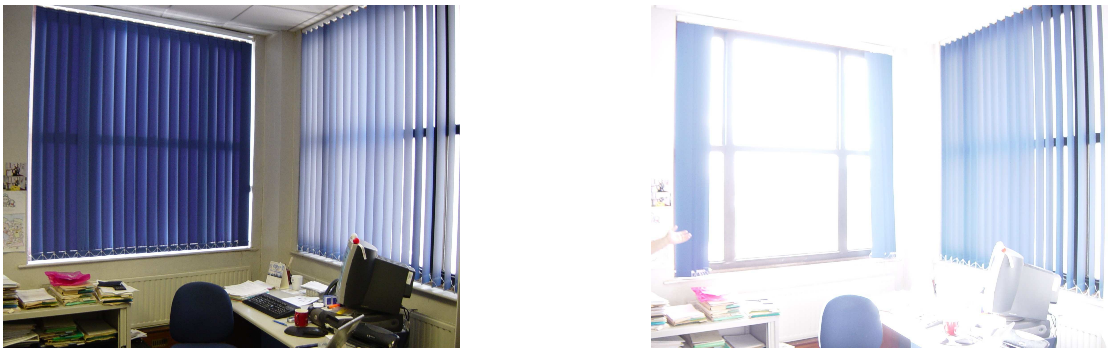


Fig. 39 Coloured blinds drawn and open

Fig. 39 shows the difference in glare when the blinds are closed and open. The colour of the blinds was chosen to match the furniture. Had they been a lighter colour more of the heat would have been reflected.

Though three of the four radiators around the room were off (operated by Thermostatic Radiator Valves TRVs) the associated pipe work was still heating the room.

6.5 Lighting

Situation

The lighting fitments were in similar arrangements to most of the other branches. The provision is as follows:

Basement: 14 x 58W T8 fluorescent tubes

The total wattage on this floor is 812 representing 8.12 kWh in a 10 hour day

Ground floor: 23 units each with 4 x 2ft T8 fluorescent tubes
4 units each with 2 x 2ft T8 fluorescent tubes
9 spotlights behind counter (wattage unknown possibly 50W)
2 x 6ft T8 fluorescent tubes (70W)
4 x 58W 5ft T8 fluorescent tubes
81 units each comprising 2 CFL 18W bulbs
2 x 140W (arranged in 4 rows of 35W strip lights)

The total wattage on this floor is 5818W representing 58.18 kWh in a 10 hour day

1st floor: 2 units each with 4 x 2ft T8 fluorescent tubes
20 x 18W CFL
14 x 105W (arranged in 3 rows of 35w strip lights)
9 x 58W T8 fluorescent tubes
3 CFL 18W bulbs

The total wattage on this floor is 2559W representing 25.59 kWh in a 10 hour day

2nd floor: 1 x 18W CFL
2 X 58W T8 fluorescent tubes
3 x 174W (arranged in 3 rows of 58W 5ft T8 strip lights)
15 x 152W (arranged in 4 rows of 36W 4ft T8 strip lights)

The total wattage on this floor is 2936W representing 29.36 kWh in a 10 hour day.

The total daily electricity requirement for lighting is estimated at 121 kWh which increases to 145 kWh per day if a 2 hour cleaning allowance is made. Overall the annual consumption for lighting is estimated at 40000 kWh corresponding with a carbon emission of 20.8 tonnes of carbon dioxide.

6.6 IT & Appliances

Situation

A total of 22 workstations are in use and a further 7 laptops. Of the workstations, 8 flat had flat screens. The total daily electricity use is estimated at 55 kWh per day. The annual consumption is estimated at 15000 kWh corresponding to the emission of 7.9 tonnes of carbon dioxide. The was little information available regarding other appliances, but this is probably less than 5000 kWh per annum.

6.7 Overall Electricity use

The total annual electricity use from lighting IT and appliances is estimated at 55 000 kWh per annum and is associated with the emission of 28.7 tonnes of carbon dioxide. The average total electricity consumption over the period 2003 – 2005 is 89200 kWH implying that appliance, IT and lighting accounts for around 60% of total electricity demand with the remainder coming from ventilation fans etc. This total of electricity corresponds to an emission of about 46.5 tonnes of carbon dioxide. The profile of electricity use is shown in Fig. 40. This plot is somewhat erratic but probably reflects estimated readings or readings taken on different days of the month. There is no obvious trend is visible from summer to winter suggesting that the lights are on continuously each working day irrespective of daylight.

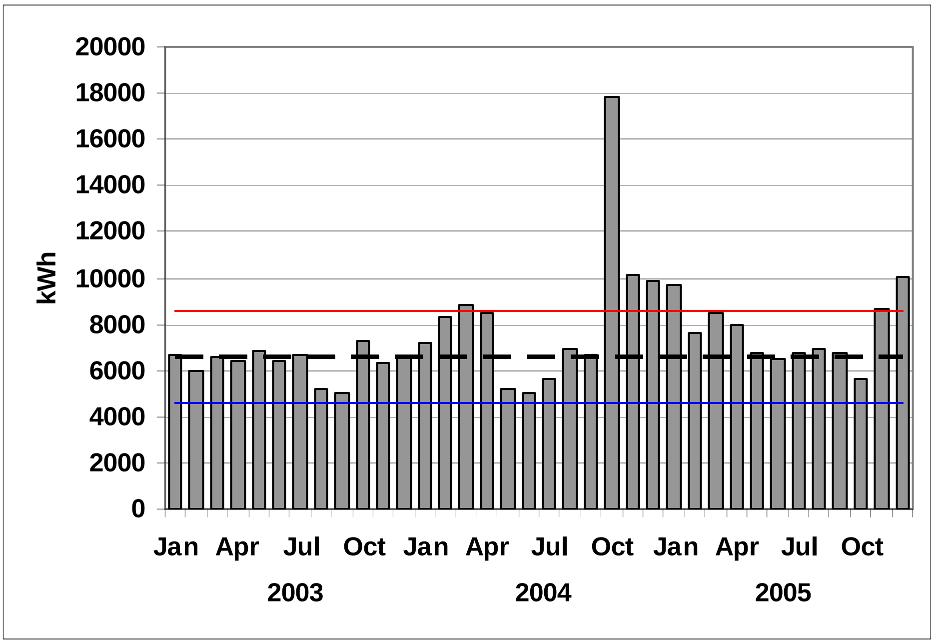


Fig. 40. Variation in Electricity consumption at Great Yarmouth over period 2003 – 2005.

The mean monthly consumption level during the first 20 months of the data period was 6580 kWh per month and is indicated by the dashed line. The upper and lower band line are drawn at 2000 kWh above and below this level and which would trigger a reporting incident about twice a year (see section 3.3).

6.8 Overall Energy use

The gas consumption data are also clearly affected by estimated readings and probably variations in the date in each month on which readings were taken. The information is displayed in Fig. 41. There are clearly issues with the data in August 2003 and February 2004. Nevertheless the trend follows a generally expected seasonal pattern.

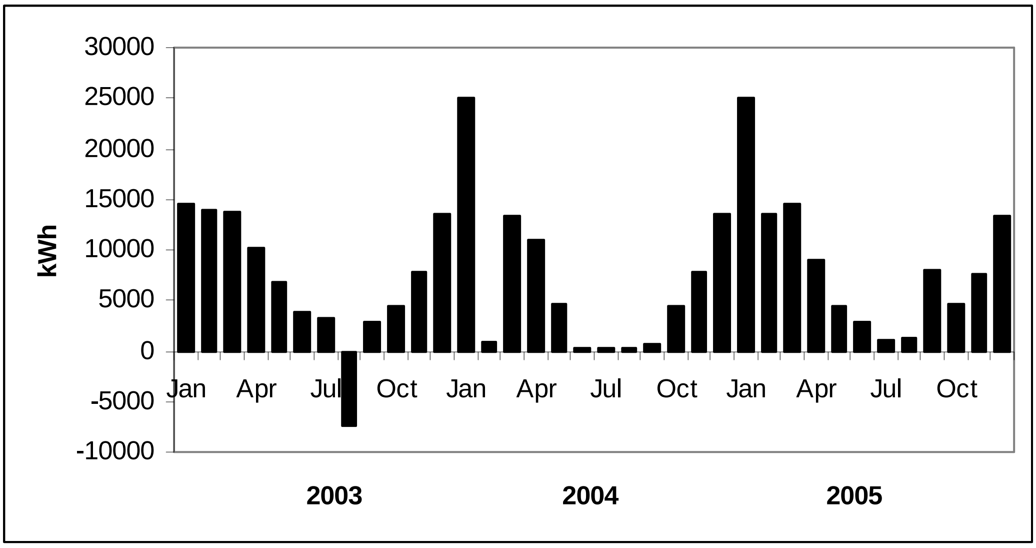


Fig. 41. Gas consumption at Great Yarmouth.

A plot of gas consumption against Degree Day is shown in Fig. 42.

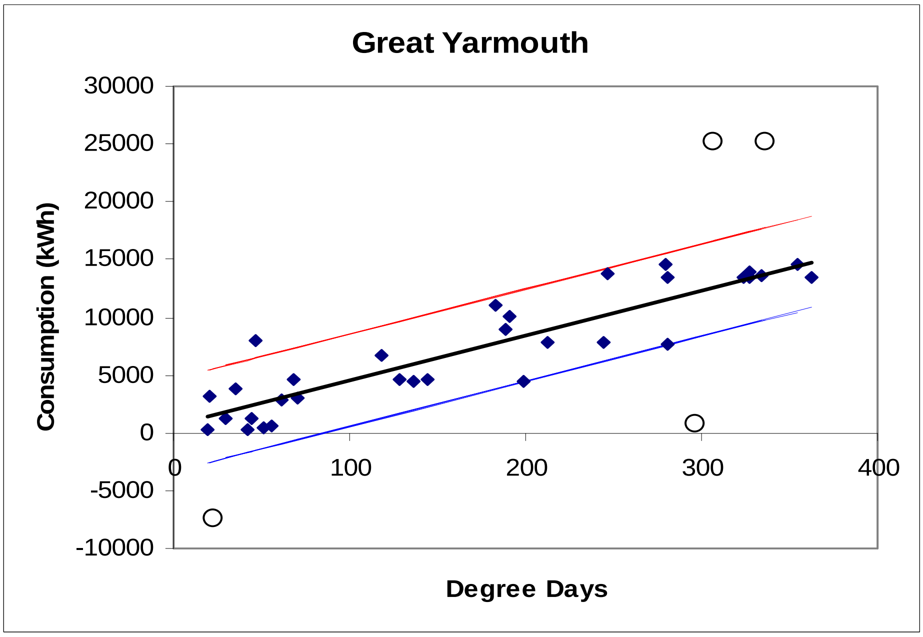


Fig. 42. Relationship between Gas Consumption and Degree Days for Great Yarmouth Branch. Four of the data points, shown as open circles, are clearly somewhat in error.

Though there is a trend line, the coefficient of correlation is relatively low at 0.6307 and is influenced by four data points which are clearly outliers as indicated by the four open circles. Interestingly there are in exactly the same months as the questionable data for Kings Lynn suggesting a systematic problem with data collection for those months. If these outliers are excluded from the regression analysis, the coefficient of correlation now becomes 0.8151 which is more realistic. From the edited data set, the heat loss rate for the building is estimated at 1.63 kW^oC^{-1}.

Following the analysis suggested in section 3.2, upper and lower bands have been drawn which are +/- 4000 kWh per month above and below the mean trend line. If a reporting system were initiated whenever points plotted outside this band it is likely to trigger action about once every 15 months. Once the problem of identifying estimated data has been resolved it should be possible to reduce the width of this band.

The electricity and gas consumption, on average, are approximately the same (Table 6.1). There is a variation of +/-10% in the annual consumption for both energy sources. Part of this reason is likely to arise from estimated readings followed by actual readings, but also from different dates on which readings are taken. What is of concern is the 20+% increase in gas use in 2005, but this might be associated with the deterioration in the overall condition of the building.

The consumption of electricity per employee is noticeably higher than the Kings Lynn branch despite a similar number of employees in both branches. This probably arises from the use of the Mitsubishi air handling units for heating to supplement the normal gas central heating. Using electricity for heating will inevitably increase the carbon emissions, as even allowing for the efficiency of the boiler present, the emissions of carbon dioxide will be around 0.26 kg/kWh compared to double that figure for electricity.

Table 6.1 Summary Energy and carbon dioxide emissions for the Great Yarmouth Branch

	Electricity	Gas	Total CO_2	Electricity		Carbon Dioxide	
	kWh	kWh	tonnes	kWh/sqm	kWh/employee	kg/sqm	tonnes / employee
2003	76006	87,515	55.8	106.8	4000.3	78.4	2.94
2004	99,996	82,352	67.3	140.4	5262.9	94.5	3.54
2005	91,622	105,739	67.3	128.7	4822.2	94.5	3.54
Average	89208	91,869	63.5	125.3	4695.2	89.2	3.34

The data in terms of electricity consumption per square metre may be compared with similar requirements in local authority civic offices (Table 6.2). The Great Yarmouth Branch data falls within the range for air-conditioned offices.

Table 6.2. HSBC Great Yarmouth Branch compared to Local Authority Offices ($kWh/m^2/annum$).

	Local Authority Offices		Great Yarmouth
	Naturally ventilated	Air-conditioned	
Good Practice	54	97	125
Typical	85	178	

6.9 Waste

Situation

There is a close similarity to the Cambridge office. Staff estimated that 50 bags of confidential waste were collected every two months (roughly 12 bags per person per year). The number of bags varies depending on activities, such as stock clear outs. It was reported that the relatively new publicity material ordering system was helping to reduce the amount of confidential waste disposed. There was some discrepancy between staff who put all of this material into the confidential waste and those who tore up the brochures and put them in the trade waste.

Of the bags on site during the audit it was estimated that the average bag weight was somewhere between 8-12 kg. This would equate to around 96-144kg per person per year.

There was no cardboard collection at this site although we later learned that Hays offer to take cardboard at other sites. We were able to inform the manager about a potential cardboard recycling scheme for commercial premises operating in Great Yarmouth. The manager is investigating this.

The trade waste was similar in composition to other branches consisting largely of food packaging, plastic bottles, waxed paper coffee cups from the coffee machines and mixed stationery wrappings (plastic film). There was evidence by one coffee machine that staff use their own mugs rather than the waxed paper cups. This will help to reduce trade waste generation. Trade waste is collected by the Great Yarmouth Borough Council contractors.

One other waste stream more noticeable at this site than others was the damaged furniture. It was unclear of this was being stored here from other sites or had been damaged through damp at this site. Refurbishment of branches will generate wastes, much of which will be handled by the refurbishment contractors. Great Yarmouth (and other areas with a similar social setting) operates furniture recovery schemes, which may be an outlet for unwanted but operational furniture.

6.10 Water

Situation

The pre-audit data indicates that water use has reduced considerably since 2003 (Fig. 43). It is unclear why this might be. Assuming that this data is accurate, it seems likely to be related to the decreasing number of staff on site. The introduction of drinking water stations rather than drinking tap water might also be a causal factor. It was unclear what amounts of water were used by OCS in their cleaning routines, although it would be surprising if these had changed much in the past couple of years. The taps in the toilets and kitchens were not fitted with waster reducing devices such as spray nozzles.

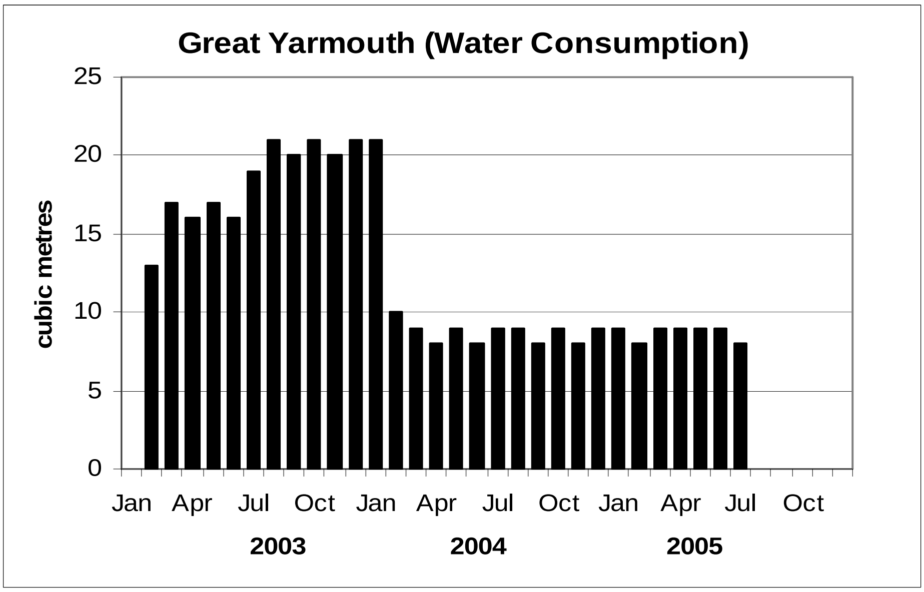


Fig. 43. Water consumption at Great Yarmouth

Cisterns in the toilets were not fitted with water saving devices. The introduction of coffee machines, which appear to be plumbed into the mains will not have had a material effect, unless the coffee is so bad that staff have reduced their consumption markedly. This seems unlikely as the proportion of coffee cups in the trade waste bins was quite high. There were no records of leaks being fixed during this period, though this could be one source of reduction.

The mean consumption of water per employee is 3200 litres per annum which is equivalent to 13 litres per day per employee which is just over half the level at King's Lynn and less than a quarter of the use in the Norwich Branch.

6.11 Travel

Situation

A list was provided illustrating the modes of travel from home to the site. Of the 26 staff on the list 2.5 use the bus or moped. The remainder travel by car. Interestingly nine staff live within three miles, the length of journey one might consider cycling. The branch car park is used by locals on market day, which is one example of informal community support. Although some staff travel during the working day there could be opportunities to encourage a car share or cycle to work scheme here.

6.12 Suggested Bands for Degree Day Plot for the Great Yarmouth Branch

The following data in Table 6.3 are the suggested baseline data values for gas consumption references against Degree Days for the Great Yarmouth Branch. When consumption exceeds either the upper or lower limit, a reporting system should be triggered. The significance of these bands is discussed in section 3.2. If consumption data in any month lies outside the range defined by the upper and lower bands then action should be triggered. The bandwidth is set at 4000 kWh for Great Yarmouth and would trigger action once or twice a year. A plot showing these bands with actual data is shown in Fig. 43.

The band width should be reviewed at regular intervals, and with time it would be expected that the width will become narrower. Whenever there are conservation improvements, there may also need to be a revision as discussed in section 3.2.

Table 6.3 Suggested initial Bands for the Great Yarmouth Branch for the Degree Day Plot.

Great Yarmouth (kWh)							
Degree Days		Bands		Degree Days		Bands	
	Mean	Upper	Lower		Mean	Upper	Lower
0	660	4660	0	200	8460	12460	4460
10	1050	5050	0	210	8850	12850	4850
20	1440	5440	0	220	9240	13240	5240
30	1830	5830	0	230	9630	13630	5630
40	2220	6220	0	240	10020	14020	6020
50	2610	6610	0	250	10410	14410	6410
60	3000	7000	0	260	10800	14800	6800
70	3390	7390	0	270	11190	15190	7190
80	3780	7780	0	280	11580	15580	7580
90	4170	8170	170	290	11970	15970	7970
100	4560	8560	560	300	12360	16360	8360
110	4950	8950	950	310	12750	16750	8750
120	5340	9340	1340	320	13140	17140	9140
130	5730	9730	1730	330	13530	17530	9530
140	6120	10120	2120	340	13920	17920	9920
150	6510	10510	2510	350	14310	18310	10310
160	6900	10900	2900	360	14700	18700	10700
170	7290	11290	3290	370	15090	19090	11090
180	7680	11680	3680	380	15480	19480	11480
190	8070	12070	4070	390	15870	19870	11870

Degree Day information may be found on the Carbon Trust Web Site.
www.thecarbontrust.co.uk/energy/pages/page_318.asp

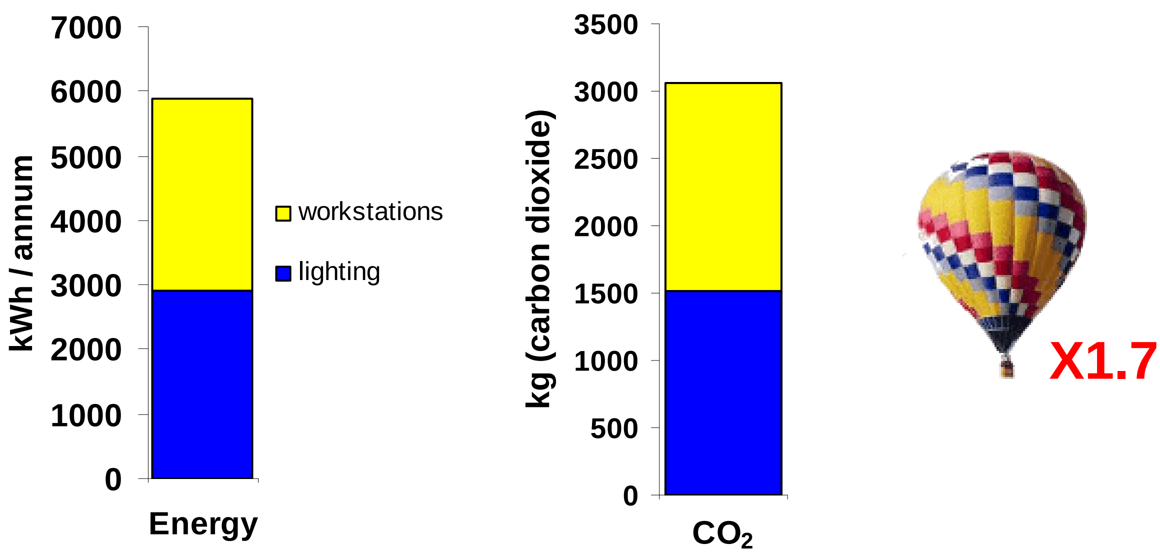
7. Site 4 UEA

Date of Visit: Wednesday 8th March

Contact Person: Maggie Spanswick

Summary of Audit at the University of East Anglia (UEA) sub branch

The premises are rented from the University of East Anglia and the branch is believed to be serviced by staff from the main Norwich Branch. There are no energy, or water data and no direct analysis of overall energy or carbon emissions can be made. Estimates can be made of likely use of electricity assuming a typical working pattern. This information is summarised in Fig. 44a. Fig. 44b and 44c summarise the carbon dioxide emissions and the equivalence in hot air balloons.



a) Electricity Consumption b) CO_2 Emissions c) Balloon equivalents

Fig. 44 Estimated electricity and carbon dioxide emissions for the UEA Sub Branch for lighting and IT and Appliance use.. NOTE: no meter readings are available so no information on other electricity use or heating is available.

This sub-branch is only manned for restricted times. It would be appropriate in this case for a “Green Champion” to be associated with the parent Norwich Branch.

Several of the similar retail / commercial outlets in the University have direct and remotely read meters for electricity. It would be important to explore the possibility for this as otherwise charges might be nominal with little regard to actual consumption.

The basic information regarding the floor area of the sub-branch is clearly significantly in error and this information should be corrected as soon as possible.

University of East Anglia Sub - branch Report

7.1 Pre-Audit Data Supplied

Year	Type	FTE	m^2	Waste (tonnes)	Elec (KWh)	Gas (KWh)	Water (m^3)
2003	Bank	n/a	994.9988[1]	Not serviced	0	0	0
2004				Not serviced	5,417[2]	0	0
2005				Not serviced	10,920	0	0

[2] These are incomplete data sets

7.2 Background

The HSBC branch at the University of East Anglia is rented although there is some uncertainty about rental charges and what they cover. Electricity is metered separately and paid separately. Heating and water are likely to be part of rental charge as the building is part of the University's district heating scheme.

The branch is much smaller than the other sites visited comprising a retail floor with small back office and a basement with kitchen, toilets and storage area. Only three staff were present at the site during the audit. There is little additional room for any more staff.

Though temperature measurements were taken throughout the building, it was not possible to undertake a thermal comfort survey using a questionnaire at the branch. However, this would be important to do when possible using the questionnaire illustrated in Appendix 1 and tested successfully at the Cambridge Office.

7.3 Maintenance and Cleaning

Maintenance and cleaning are provided by HSBC's national contractors. The branch was in reasonably good condition. The area declared for this sub-branch is clearly in error (perhaps by a factor of 10??)

7.4 Heating

Situation

Of the 8 radiators located throughout (5 in basement) only 3 were on as the building is always warm (thought to be largely due to network of heating and hot water pipes throughout basement that are exposed and warm). The rental charge is likely to cover costs for heating, though passive heating from solar gain along with the heating from pipes traversing the building mean that the radiators are seldom in use. There were no reports of cold starts on Mondays that doesn't calculate actually use.

Three small air coolers portable air coolers (1x90W and 2x70W) had recently been installed. This was, in part, due to the inability to open windows through noise and dust from adjacent building works.

[1] This figure seems erroneous. The branch is very much smaller than this.
[2] Meter readings for five months only in 2004.

Two electric hand dryers in the basement toilets will contribute to the overall heating, though this is likely to be minimal. Hot water for hand washing is provided by electric hot water heaters.

7.5 Lighting

Situation

Basement: 8 x 18W CFL (5 in toilets, 3 on stairs and hall)
1 x 6ft T8 (70W) fluorescent lights in kitchen
3 x 40W fluorescent lights in store room

Ground floor: 20 units each with twin 18W CFL tubes, 15 in customer area, 3 in back office and 2 behind cashier's desk)
5 x spot lights (estimated 50w each), 3 in customer area, 1 in back office and 2 behind cashier's desk)
4 units each with 4 x 2ft T8 fluorescent tubes (72W per unit) - all behind cashiers desk
2 x 18W fluorescent tubes in customer area above cashier's desk

The total wattage is 1700. However, in this sub branch the opening hours are less. In addition there are periods when the branch is not open e.g. or Saturdays, and when the University is closed.

The estimated annual consumption for lighting allowing for cleaning periods is around 2900 kWh corresponding with the emission of 1.5 tonnes of carbon dioxide.

7.6 IT & Appliances

Situation

IT equipment consisted of 3 CRTs and 3 flat screen computers; 4 small printers/photocopiers/faxes; 1 video monitor; 2 CCTV screens.

The kitchen contains a kettle and microwave oven (650W). Neither of these appliances is used extensively. The estimated annual consumption for appliances is 3000 kWh per annum corresponding with an emission of 1.5 tonnes of carbon dioxide.

7.7 Overall Electricity consumption

The total electricity consumption from lighting, IT and appliances is estimated at 3000 kWh per annum slightly less than the annual consumption of a house in the Norwich area. If we assume, from other branches, that the electricity consumption from such sources is inflated by use associated with heating etc by a factor of 2 then the annual consumption will be around 6000 kWh. Unlike some of the neighbouring shops at UEA which are remotely metered on a daily basis, the HSBC bank on campus does not appear to have such facilities.

7.8 Overall Energy consumption

No information is available for gas consumption. Furthermore the information relating to the area of the site is clearly erroneous so no meaningful analysis can be made for this site.

7.9 Waste

Situation

Confidential waste collected when required, usually twice annually and around 25 bags per collection. That equates to about 17 bags per year, slightly above the figures from the other branches. Non-confidential trade waste was minimal. It is collected and disposed of by cleaner (OCS) and probably disposed of through the University's palladin bins nearby. Cardboard is taken to recycling bins on campus by HSBC staff.

7.10 Water

Situation

Water use is minimal. The main water use is in the toilets and kitchen where there are 3 washbasins and 2 WC's. The kitchen washbasin had an electric heated water source. Separate water metering may reduce charges if calculated annually as part of rental.

A water cooler provides chilled water. The kitchen kettle is used for hot drinks. In both cases staff used their own mugs and glasses.

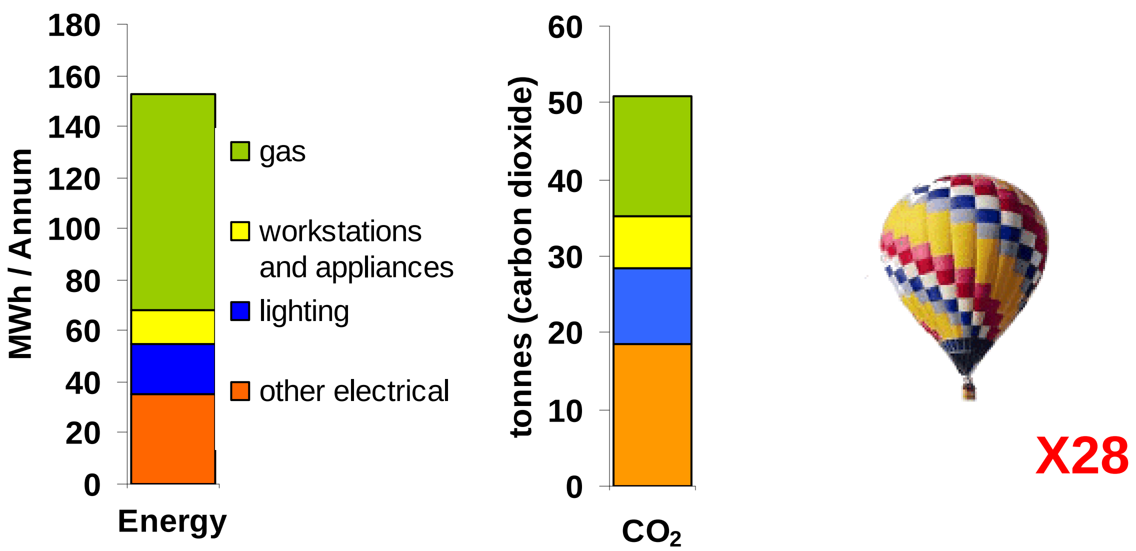
8. Site 5 Kings Lynn

Date of Visit: Tuesday 7th March

Contact Person: Debbie Condron – 08455 834130

Summary of Audit at the Kings Lynn Branch

The building is now over 80 years old and there are issue regarding the maintenance of the fabric. Data for both electricity and gas consumption were available and these were averaged over a three year period. However, several of the data are clearly estimates and it is not clear exactly which were real data and which were estimated values. However, assuming that the average over a three year period is reasonable the following summary illustrations of overall energy use can be constructed. As with the other branches the estimates of workstation and lighting use were done by direct observation and assumption regarding the daily use of such equipment. In this branch the electricity associated with direct appliance use was amalgamated with the IT and workstation data. Other electrical use includes any supplementary heating and air-conditioning. The summary energy information is displayed in Fig. 45a while the corresponding carbon emission and balloon equivalence are shown in Figs. 45b and 45c.



a) Electricity Consumption b) CO_2 Emissions c) Balloon equivalents

Fig. 45 Estimated electricity and carbon dioxide emissions for the Norwich Branch.

The annual gas consumption in the Kings Lynn Branch is 25% higher than the average electricity consumption and this is as expected. In the case of electricity consumption approximately 48% can be attributed to lighting, workstation and appliance use suggesting that around 50% of electricity is used in air-conditioning and supplementary space heating. However, the estimates of lighting and IT workstation use were based on observations of exactly which appliances were in use at the time of the visit. It was noticed that in none of the unoccupied rooms was lighting on (unlike all other branches). If an estimate had been made of electricity use by lighting assuming all were actually on then this would have reduced the proportion likely to be used for supplementary heating and air-conditioning to around 45%.

The gas consumption associated with heating appears to correlate reasonably with temperature suggesting that controls, in general are functioning. However, there are clearly erroneous data values arising from estimated readings, but otherwise almost all data values lie within a suggested band width analysis (see section 3.2).

There was noticeable evidence that there was some proactive encouragement to ensure that unnecessary lights were switched off, and the same is true about the heating where many thermostatic radiator values were turned to low settings and in the conference room the room temperature was 19.5^{o}C, the coolest measured in any of the sites. The clearly visible large thermometer in this conference room was undoubtedly a reminder to staff to ensure energy was not wasted unnecessarily.

Good practice in terms of energy awareness was evident, and much of this is down to the manager who personally checks whenever possible that all lights etc are off. She is clearly acting in a de facto role of “Green Champion”, and this role is to be encouraged further as an exemplar for other branches.

This proactive attitude toward energy consumption is saving up to 3500 kWh a year at a cost of £200 - £250 and a saving of 1.9 tonnes of carbon dioxide (just over 1 hot air balloon equivalent).

The average electricity consumption per employee is noticeably lower than average and this reflects the proactive policy mentioned above.

The heating / air-conditioning control in the main downstairs office is confusing and few if any staff are aware of how it functions. There is a need for staff training here and / or replacement of the control with a more simple variety such as the one in the upstairs office.

Water consumption showed a substantial reduction in February 2004 by as much as 50% at exactly the same time as was noted in the Great Yarmouth Branch. This is odd that two different branches should show such a substantial reduction at precisely the same time when there is no obvious reason (e.g. low spray taps etc). Unlike the Great Yarmouth Branch however, there has been a subsequent increase in consumption, but still well below the initial consumption levels in 2003.

8.1 Pre-Audit Data Supplied

Year	Type	FTE	m^2	Waste (tonnes)	Elec (KWh)	Gas (KWh)	Water (m^3)
2003	Bank	21	484.0114	2.91	67,999	84,051	162
2004				2.91	66,507	80,032	96
2005				2.91	68,745	89,874	122

8.2 Background

This branch is located on a corner in the High Street in a building owned by HSBC (Fig. 52).

Fig. 46. The Kings Lynn Branch in the High Street which is a pedestrian precinct.

The branch has three floors including a basement where the central heating boiler is housed.

On the ground floor is the main area for customer services (Fig. 47). The counter area (Fig. 48) leads off the main office area (Figs 49 – 51). On the first floor are the toilets, a store room, kitchen, small office (Fig. 52) in a corner room over the main entrance and a conference / training area room (Fig. 53).

Though temperature measurements were taken throughout the building, it was not possible to undertake a thermal comfort survey using a questionnaire at the branch. However, this would be important to do when possible using the questionnaire illustrated in Appendix 1 and tested successfully at the Cambridge Office.

Fig. 47. The main customer area. Notice the spot lights which are unnecessary

Fig. 48 The counter area.

Fig. 49. The main downstairs office

Fig. 50. The corner of the downstairs office. All heating is provided by panel radiators as shown with some having fins. All radiators are equipped with thermostatic valves although some need a little attention. The control for the air-conditioning is shown highlighted by the red circle. This is a confusing unit and few, if any, staff appear aware how to control it.

Fig. 51. The ground floor office. Natural daylight is limited in this office and there is little scope for reduced lighting.

Fig. 52. The upstairs corner office.

Fig. 53. The conference / training room. This room like most of the other rooms not in use at Kings Lynn had the lights off. The temperature of this room was lower than others as indicated by the wall thermometer (Fig. 54).

8.3 Maintenance

No information is available at present from this branch but is assumed to be as other branches.

8.4 Heating

Situation

Heating is provided primarily by an Ideal Concord CX gas central heating boiler housed in the basement. Hot water is circulated through radiators, all of which are equipped with thermostatic valves. Almost all thermostatic valves were readily accessible. All windows are single glazed.

The control of radiators and the measured temperatures are summarised below.

Main Office and Counter Area

Radiators

Location	Radiator Type	size	Thermostat setting	Comments
under window	twin no fins	3 ft x 2ft	5	hot
under window	twin no fins	3 ft x 2ft	3.5	warm
by coffee machine	twin no fins	3 ft x 2ft	3	very very slightly warm
by coffee machine	twin no fins	3 ft x 2ft	3	very very slightly warm
Far wall	twin with fins	5 ft x 2ft	2	cold
Small Office	Single no fin	2 ft x 2 ft	4	warm
Behind counter	singe	5 ft x 2ft	5+	very hot

There is additional control of air-conditioning/ heating in the small counter area. This temperature is readily adjusted by staff to suit their own needs.

Temperatures

Location	Temperatures (^oC)		
	dry bulb	wet bulb	mean radiant
Near coffee machine	22.2	13.5	22.2
Centre of room	22.2	13.5	22.3
Near window	21.8	14.0	22.0
Entrance to counter area	21	14.0	21.5
Customer Area in Banking Hall	23	14.5	22..5

First Floor

Radiators

Location	Radiator Type	size	Thermostat setting	Comments
Corridor outside gents toilet	single fin	5 ft x 2ft	5	hot
corridor	single fin	4 ft x 2ft	5	hot
Gents toilet	single fin	4 ft x 2ft	5	hot
Ladies toilet				Not seen – presumed to be as in gents
Store room				Not recorded
Kitchen	Double with 1 fin	3ft 6”” x 2ft	3	Cool but faulty thermostat – rotates and difficult to adjust correctly
Conference	single fin	4 ft x 2ft	2.5	cold
	single fin	4 ft x 2ft	5	hot
	single fin	4 ft x 2ft	3	slightly warm
Office	single fin	4 ft x 2ft	3	cold
Office	single fin	4 ft x 2ft	3	cold
Office	single fin	4 ft x 2ft	5	hot
Office	single fin	4 ft x 2ft	4	warm

Temperatures

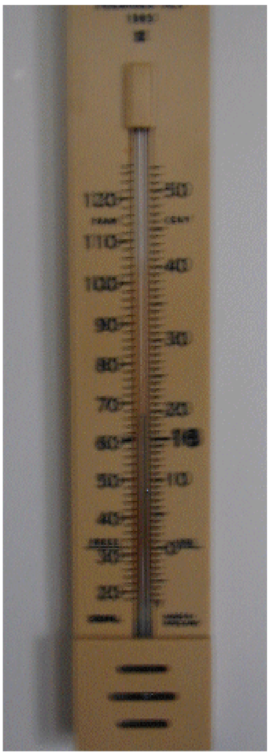


Fig. 54. The thermometer clearly visible on the wall in the conference room – registering 19.5^oC. This room was not in use and heating was at a low level.

Location	Temperatures (^oC)		
	dry bulb	wet bulb	mean radiant
Corridor outside kitchen	21.5	14.0	21
Corner Office	21.4	14.2	21
Kitchen	22.0		
Store Room	19.0		
Conference Room	19.5		

The temperature in the conference room was clearly visible on a wall mounted thermometer near the door (Fig. 54).

There is little variation in temperature across the ground floor office, although as expected the mean radiant temperature is slightly lower near the windows. On average the air temperature is nearly 1 degree lower than either Cambridge or Norwich. Apart from in the small counter area which has individual control of temperature, no staff were wearing short sleeved shirts, and some had additional clothing layers. This does support the premise that if temperatures are kept high, staff will tend to wear thinner clothing than normal. The first floor office had the lowest temperatures of any measured at the three locations. Generally staff were wearing thicker clothing than at either Cambridge or Norwich(see Fig. 58).

Part of the reason for the relatively lower temperature in this room might be the fact that there is only a limited partition between this and the conference room next door which was heated to a lower level. There is evidence that fans have been used in this room in summer. However, air-conditioning was fitted in this room in the summer of 2005 and these fans are probably not needed in future. The control of this air-conditioning is easy to understand.

It was not possible to enter the interview rooms on the ground floor, but it was noted that one room had an electric oil filled radiator.

Opportunities

There already appears to be good control of the radiators and most seem to be functioning correctly as there was a range in temperatures of the radiators related directly to the thermostat setting. On one radiator the valve head was loose, making it difficult to judge exactly what the setting was. This should be remedied. The control of the air-conditioning temperature in the downstairs office is confusing and replacement by a more simple control such as that newly fitted in the first floor office should be considered.

8.5 Lighting

Situation

The following summarise the light fitments in the building:

Ground Floor

Main Office and Annexe Office is lit with 26 units each with four 2ft long T8 tubes. There are circular fluorescent tubes on the staircase and 5ft long fluorescent tubes in the small annexe at the bottom. In the banking hall, illumination is provided by a large number of twin CFL units and a few ceiling mounted spotlights which appear to have no effect on overall illumination. The interview offices also have twin CFL units and two spotlights used to illuminate display boards. In total the total daily consumption is estimated at 46 kWh/day during the working day.

First Floor

The first floor office and conference room both have 11 units each with four 2 ft long T8 tubes. Elsewhere, in the store room, corridor toilets etc, illumination if provided by 5 ft long T8 tubes. The total daily consumption during working hours on this floor would be 34.8 kWh/day. However, lights were off in those rooms not in use, i.e. store room, conference room, and kitchen. If it is assumed that these rooms are used only 25% or the time, then the daily consumption would average 24.1 kWh/day.

Overall, on both floors, the annual consumption, allowing for lights being off in these areas is around 19300 kWh per annum. If an additional 20% (2 hours) is added to allow for cleaning etc, then the total rises to 23100 kWh corresponding with an emission of 12.0 tonnes of carbon dioxide. If the lights were left on continuously then the total would be over 26000 kWh. The strategy of turning off unnecessary lights results in an estimated saving of 3500 kWh per annum, corresponding to 1.9 tonnes of carbon dioxide and a monetary saving of £200 - £250.

Opportunities

Unlike the Cambridge and Norwich branches, there appears to be good control of lighting through awareness, as only those areas requiring lighting were lit. There is limited natural daylight, and the scope of further reduction is limited. However, there are at least two spot lights in the ceiling of the main banking hall which are superfluous although these would make limited overall saving. All the lamps in the banking hall appeared lit, whereas in Norwich a number were missing or not functioning. Whether there is scope for removing one of the two bulbs, in say a quarter of the twin CFL units needs experimentation, but this is a possible further saving.

8.6 IT & Appliances

Situation

As with other branches, all counter and interview rooms had base units with flat screens, whereas there were few flat screens in the staff offices. Making allowance for other appliances, such as the coffee machine, the total annual consumption for IT is estimated at 13000 kWh corresponding to an emission of just under 7 tonnes of carbon dioxide per annum.

Opportunities

As with other branches the workstations should be switched off overnight. At Kings Lynn this would be consistent with the current awareness. Indeed some computers in the office were off during the site visit. The main area of potential saving would be converting the CRTs to flat screen, however, in this branch the number is relatively small.

8.7 Overall Electricity Use

Of all three sites for which information on electricity consumption is complete – i.e. Norwich, Great Yarmouth, Kings Lynn, the annual consumption at Kings Lynn is remarkably constant averaging 67750 kWh per year and varying by less than 2% from year to year. The total estimated consumption from lighting and appliances (assuming the good housekeeping policy is replicated throughout the year) is about 36000 kWh representing 53% of the total electricity use. The difference will come from fans in the air-handling units and air-conditioning. In total the electricity use of 67750 kWh correspond with the emission of 35 tonnes of carbon dioxide at an approximate cost of £3800.

The monthly electricity data are shown in Fig. 55.

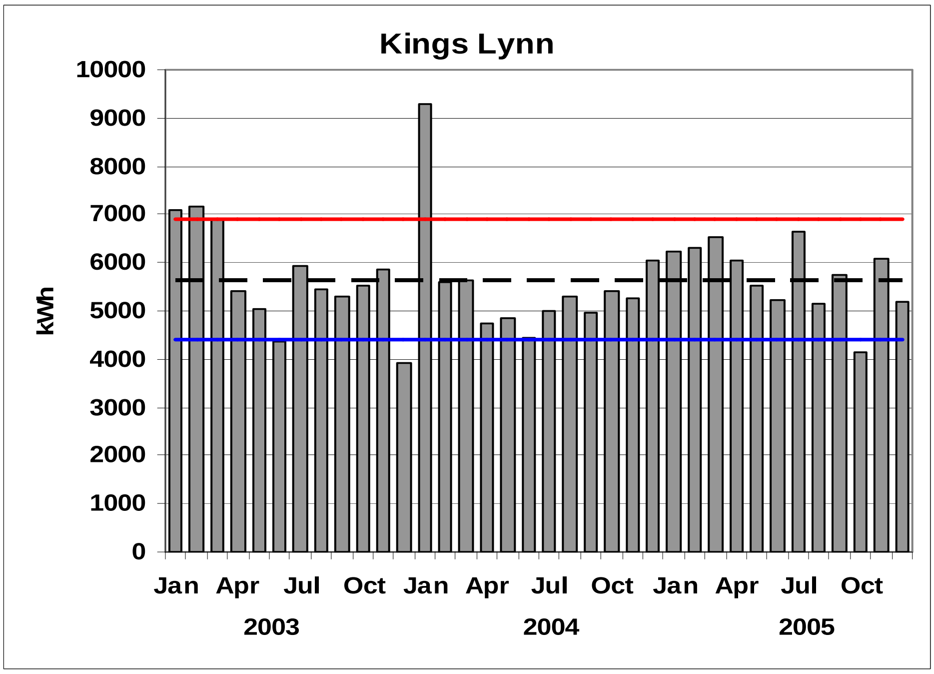


Fig. 55. Unlike Norwich, it is believed that the meter is manually read and thus some readings are likely to be estimates. This would account for the significantly different reading in January 2004.

Despite the variations in the monthly data shown in Fig. 55, the annual consumption figures are remarkably consistent as shown in Fig. 56.

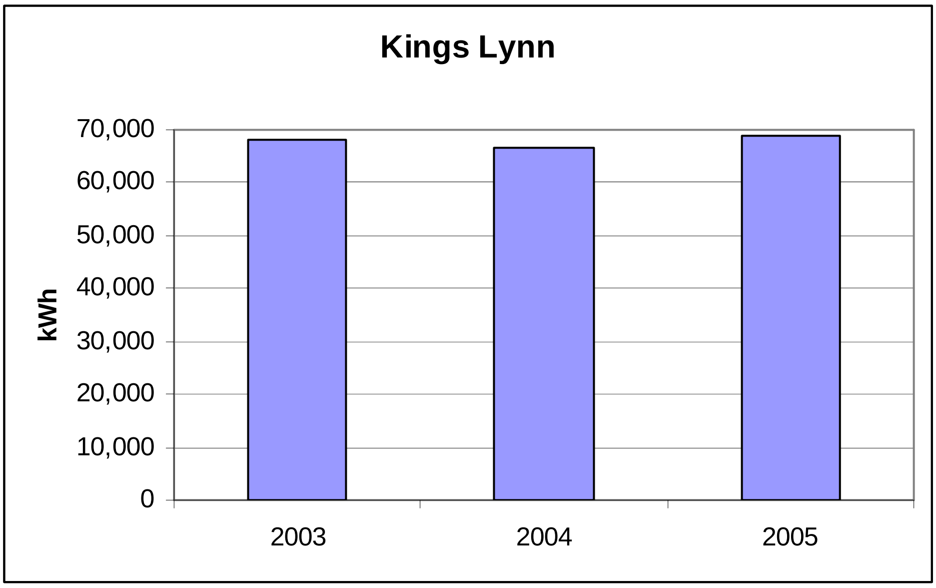


Fig. 56. Annual electricity consumption data at Kings Lynn. The consumption is remarkably constant over the three years.

The scatter of monthly data electricity consumption values appears greater than in other branches, but this is due in the most part to the lower overall consumption and the larger plotting scale. Apart from a single surge in demand in just one month there is no obvious change in pattern. Nevertheless the bandwidth (see section 3.3) in Fig. 61 has been drawn at +/- 1250 kWh per month only 62% of the level at Great Yarmouth where there is a comparable consumption level. This reduced bandwidth is consistent with a proactive attitude to energy conservation as was witnessed at the time of the visit. Despite the much narrower bandwidth reporting incidents would occur less than twice a year on average.

8.8 Overall Energy Use

The gas consumption at Kings Lynn is relatively constant varying from 80 000 to 90 000 kWh per annum. A range of up to +/- 10% from one year to the next is to be expected from climatic variations and these figures are within these values. The data available for gas consumption clearly included erroneous or estimated readings (Fig. 57).

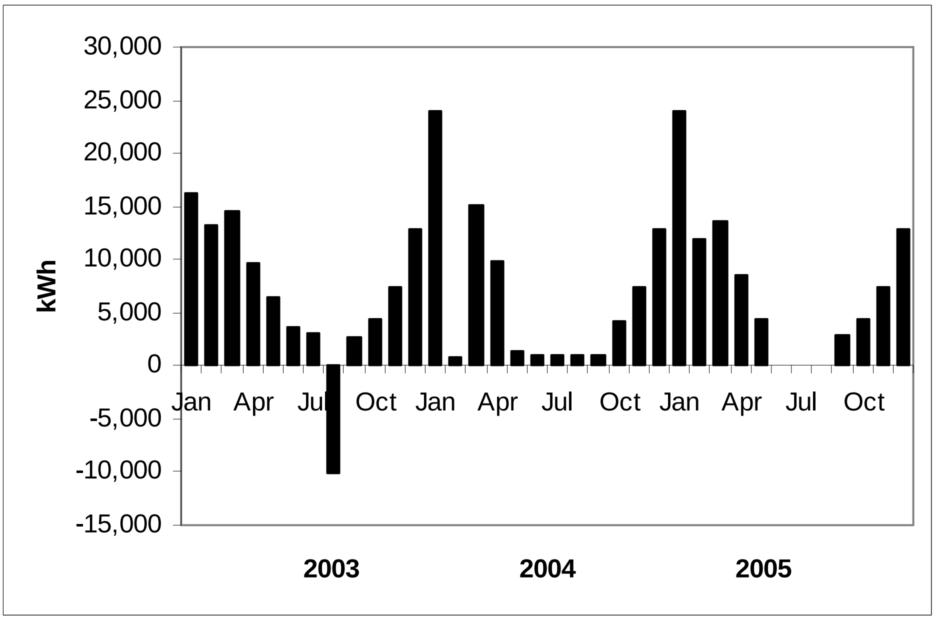


Fig. 57 Gas consumption at Kings Lynn.

Fig. 58 shows the relationship between gas consumption and Degree Days. The coefficient of correlation at 0.65 is not high. As with Great Yarmouth there are four outlier data points (shown as open squares). Interestingly these are exactly the same month as suspicious data were report for Great Yarmouth suggesting a systematic reporting problem of the data for those months.

If the outlier points are excluded from the trend line analysis, the coefficient of correlation becomes 0.8278, slightly low, but possible. From this the heat loss rate from the building is estimated at $1.70 kW^{o}C^{-1}$. The bandwidth is drawn at +/- 4000 kWh per month and this would appear to generate a reporting incident (see section 3.2) less than once a year. There is scope for reducing the bandwidth to perhaps 3000 kWh per month at this branch.

The overall annual consumption and carbon emissions at the Kings Lynn branch may be estimated as shown in Table 8.1:

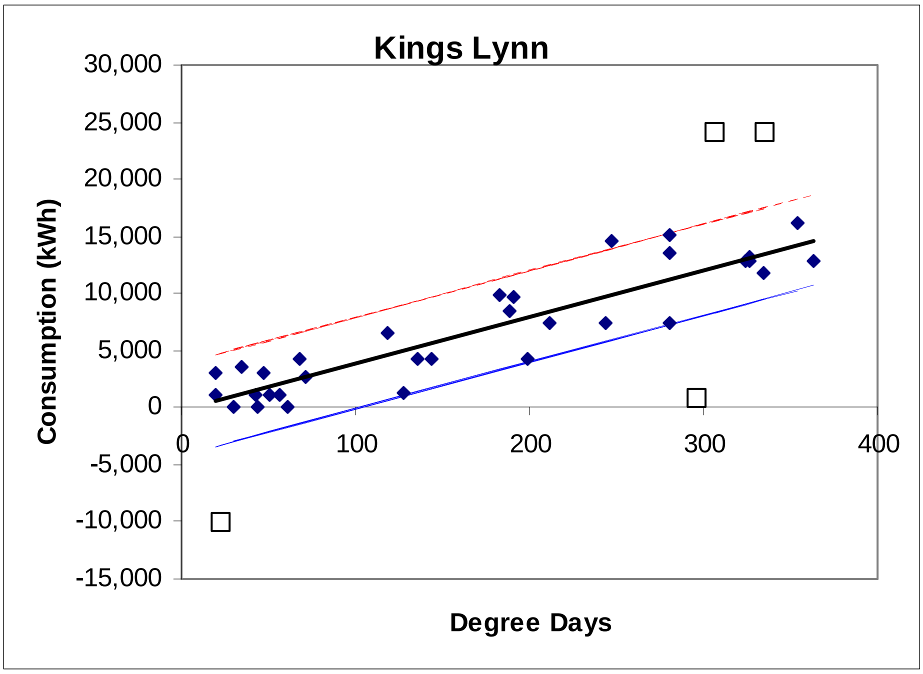


Fig. 58. Relationship between gas consumption and Degree days of Kings Lynn

Table 8.1 Summary Energy and carbon dioxide emissions for the Kings Lynn Branch

	Electricity	Gas	Total CO_2	Electricity		Carbon Dioxide	
	kWh	kWh	tonnes	kWh/sqm	kWh/employee	kg/sqm	tonnes / employee
2003	67,999	84,051	51.0	140.5	3238.0	105	2.43
2004	66,507	80,032	49.5	137.4	3167.0	102	2.36
2005	68,745	89,874	52.5	142.0	3273.6	108	2.50
Average	67,750	84,652	51.0	140.0	3,226.0	105	2.43

The data in terms of electricity consumption per square metre may be compared with similar requirements in local authority civic offices (Table 8.2). The Kings Lynn Branch data falls within the range for air-conditioned offices.

Table 8.2. HSBC Kings Lynn Branch compared to Local Authority Offices (kWh/m^2/annum).

	Local Authority Offices		Kings Lynn
	Naturally ventilated	Air-conditioned	
Good Practice	54	97	140
Typical	85	178	

The average annual household consumption of electricity in Norwich is 3700 kWh/annum and in most of rural Norfolk is around 5000 kWh/annum. The consumption per employee is thus over 60% of the total consumption of electricity by each employee in their respective homes.

8.9 Waste

Situation

General waste is collected by the Local Authority once a week. Cardboard is recycled and collected at the same time as confidential waste.

8.10 Water

Situation

None of the taps in the gents toilet were fitted with low spray taps, and there was no low flush option on the toilets. The variation in water consumption over the three year period is shown in Fig. 59.

The reported water use is erratic and there are two sustained periods where the consumption was static suggesting that these were estimated readings. The current water use is 5800 litres per person per annum or about 23 litres per person per day.

Opportunities

There is scope in any refurbishment to replace all taps with low spray devices and also to fit cisterns to toilets which have low flush options.

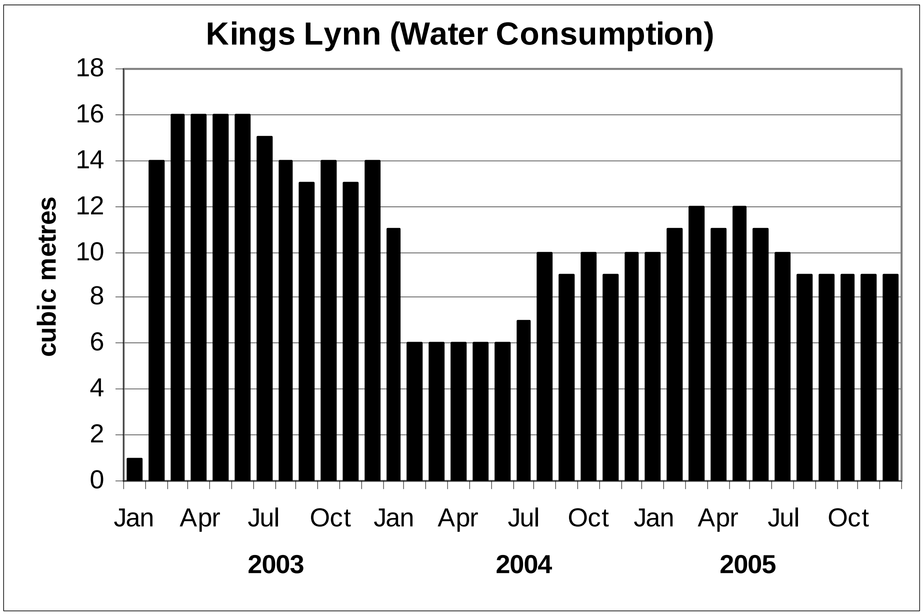


Fig. 59 Water consumption at the King's Lynn branch.

8.11 Travel

Situation

Apart from one person, all members of staff are believed to drive into Kings Lynn and park in one of the car parks within 5 minutes walking distance of the Bank.

Opportunities

The Bank has a sub branches at Hardwick and attached branches at Downham Market and Swaffham and clearly there is a requirement for personal transport to service these two branches. However, there may be some scope to promote a car sharing scheme.

8.12 Level of Control

Kings Lynn has little information on their exact energy usage etc, however, of all the branches, this appears to be the most proactive in terms of energy conservation. This was demonstrated by the lights being off in all rooms which were not in use. It might be argued that these were turned off just prior to the site visit. However, in both the store room and conference room, the temperature was lower than in the remainder of the building and this effect requires several hours to be manifest and the awareness appears to be genuine. Indeed the contact person indicated that she personally ensures that all unnecessary lighting etc is off when leaving each day.

The opportunity for control of heating is good as there are individually controlled thermostatic radiator valves which are clearly working. These controls are (with few exceptions) readily accessible and the variation in settings indicates that they are being used sensibly.

8.13 Suggested Bands for Degree Day Plot for the Kings Lynn Branch

The following data in Table 8.3 are the suggested baseline data values for gas consumption references against Degree Days for the Kings Lynn Branch. When consumption exceeds either the upper or lower limit, a reporting system should be triggered. The significance of these bands is discussed in section 3.2. If consumption data in any month lies outside the range defined by the upper and lower bands then action should be triggered. The bandwidth is set at 4000 kWh for Kings Lynn and would trigger action once or twice a year. A plot showing these bands with actual data is shown in Fig. 58.

The band width should be reviewed at regular intervals, and with time it would be expected that the width will become narrower. Whenever there are conservation improvements, there may also need to be a revision as discussed in section 3.2.

Table 8.3 Suggested initial Bands for the Great Yarmouth Branch for the Degree Day Plot.

Kings Lynn (kWh)							
Degree Days		Bands		Degree Days		Bands	
	Mean	Upper	Lower		Mean	Upper	Lower
0	0	3827	0	200	7996	11996	3996
10	235	4235	0	210	8404	12404	4404
20	644	4644	0	220	8813	12813	4813
30	1052	5052	0	230	9221	13221	5221
40	1461	5461	0	240	9629	13629	5629
50	1869	5869	0	250	10038	14038	6038
60	2278	6278	0	260	10446	14446	6446
70	2686	6686	0	270	10855	14855	6855
80	3094	7094	0	280	11263	15263	7263
90	3503	7503	0	290	11672	15672	7672
100	3911	7911	0	300	12080	16080	8080
110	4320	8320	320	310	12489	16489	8489
120	4728	8728	728	320	12897	16897	8897
130	5137	9137	1137	330	13305	17305	9305
140	5545	9545	1545	340	13714	17714	9714
150	5954	9954	1954	350	14122	18122	10122
160	6362	10362	2362	360	14531	18531	10531
170	6770	10770	2770	370	14939	18939	10939
180	7179	11179	3179	380	15348	19348	11348
190	7587	11587	3587	390	15756	19756	11756

Degree Day information may be found on the Carbon Trust Web Site.
www.thecarbontrust.co.uk/energy/pages/page_318.asp

9. Comparison of the Sites

9.1 Overall Summary Data

It is not possible to compare information from the Cambridge Site as no data are yet available. Furthermore the data from the UEA site is limited. This section thus concentrates on a comparison of the other three sites.

The three tables presented in each of the respective sections are reproduced again for easy direct comparison

Table 9.1. Summary energy data for the Norwich Branch

	Electricity	Gas	Total CO_2	Electricity		Carbon Dioxide	
	kWh	kWh	tonnes	kWh/sqm	kWh/employee	kg/sqm	tonnes / employee
2003	380,788	269,738	248.2	291.6	3846.3	190.0	2.51
2004	364,671	295,692	244.6	279.2	3683.5	187.3	2.47
2005	388,219	230,428	244.7	297.3	3921.4	187.4	2.47
Average	377,892	265,286	245.8	289.4	3817.1	188.2	2.48

Table 9.2. Summary energy data for the Great Yarmouth Branch

	Electricity	Gas	Total CO_2	Electricity		Carbon Dioxide	
	kWh	kWh	tonnes	kWh/sqm	kWh/employee	kg/sqm	tonnes / employee
2003	76006	87,515	55.8	106.8	4000.3	78.4	2.94
2004	99,996	82,352	67.3	140.4	5262.9	94.5	3.54
2005	91,622	105,739	67.3	128.7	4822.2	94.5	3.54
Average	89208	91,869	63.5	125.3	4695.2	89.2	3.34

Table 9.3. Summary energy data for the Kings Lynn Branch

	Electricity	Gas	Total CO_2	Electricity		Carbon Dioxide	
	kWh	kWh	tonnes	kWh/sqm	kWh/employee	kg/sqm	tonnes / employee
2003	67,999	84,051	51.0	140.5	3238.0	105	2.43
2004	66,507	80,032	49.5	137.4	3167.0	102	2.36
2005	68,745	89,874	52.5	142.0	3273.6	108	2.50
Average	67,750	84,652	51.0	140.0	3,226.0	105	2.43

The highest emission of carbon dioxide per unit floor area occurs in the Norwich Branch, and this is also associated with a much higher electricity consumption per unit floor area. It is noted that, somewhat surprisingly, the gas (heating) consumption is significantly lower than the electricity consumption and this is associated with fairly extensive use of supplementary electric heating in this branch. Space heating provided by electricity causes twice the emission of carbon dioxide as heating with gas, and this, at least in part is a reason for the particularly high carbon emission figure.

On the other hand the carbon dioxide emission per employee at Norwich is very comparable with that at Kings Lynn. The area allocations per employee at Kings Lynn and Great Yarmouth are 23 and 37 sqm per employee respectively whereas it is just 13 sqm per employee at Norwich (and a similar figure at Cambridge).

The data in terms of electricity consumption per square metre may be compared with similar requirements in local authority civic offices (Table 9.4). The Kings Lynn and Great Yarmouth Branch data falls within the range for air-conditioned offices, but the value for Norwich is 60% above the average consumption level. Once again, the performance of this latter office is almost certainly affected by the malfunction of the air-conditioning unit and the significant use of supplementary electric heating.

Table 9.4. HSBC Branches compared to Local Authority Offices (kWh/m^2/annum).

	Local Authority Offices		Norwich	Great Yarmouth	Kings Lynn
	Naturally ventilated	Air-conditioned			
Good Practice	54	97	289	125	140
Typical	85	178			

9.2 Awareness by Staff

It was particularly noticeable that no unoccupied room had lights on in the Kings Lynn Branch and this seems to arise from the conscientious approach by the manager who apparently does a quick check every evening. This, at least in part, explains the generally better performance of the Kings Lynn branch in terms of carbon emissions per employee at this branch. While there are a large number of rooms in the Norwich Branch, and most were in use, there were some rooms such as the conference rooms which had lights on unnecessarily at the time of both visits (on one visit, one room had them off). The question of having Energy Champions in different areas of the bank was raised during the site visit. Their responsibility would be to try to ensure that all unnecessary lights were off. However, this was seen as an additional burden on the staff. Indeed at the time of the first visit, the staff at Norwich did appear to be particularly stretched. However, the situation at Kings Lynn does demonstrate what could be done.

9.3 Energy Data for Heating

Plotting the gas consumption data against Degree Day information allow data which is suspect to be identified. Such data may arise from either estimated readings, or readings taken on noticeably different days of a month. The heating requirement for any one month may vary by up to +/-10% (and sometimes more) compared to the equivalent month in a different year. It is important that procedures are in place to allow for such variations and yet still identify potential problems and faults with the control of heating systems. The plot of consumption against published Degree Data information is one method by which this could be done. Data on the Degree Day information for the most recent month is available from the Carbon Trust website (Carbon Trust 2006a), while historic Degree Day data since January 2003 is available from Carbon Trust (2006b).

There will inevitably be scatter in heating demand, but it is important to identify issues which suddenly cause increases in demand at an early stage. Equally if demand reduces then it is important also to identify the causes as if this were the result of any action (e.g. technical or management) then these strategies could be replicated in future months and lead to reduced energy consumption, a saving in financial terms and also environmental terms.

Fig. 60 replicates Fig. 31 for the Norwich Branch. The upper (red) and lower (blue) lines are drawn at a monthly consumption 8000 kWh above and 8000 kWh below the defined trend line. The band width was chosen arbitrarily to include most of the data points. Following the procedures outlined in section 3.2, it is noted that four points lie at or outside the main central band and these could initiate reporting incidents to provide early warning to faults or of particularly effective control. An effective policy for the future would be the identification of the causes of these deviations. The aim of the suggested band width was to ensure that most months did not trigger action (typically one or two a year). Once such a policy were established this should provide environmental benefits and the band width could be progressively reduced to half the value indicated above.

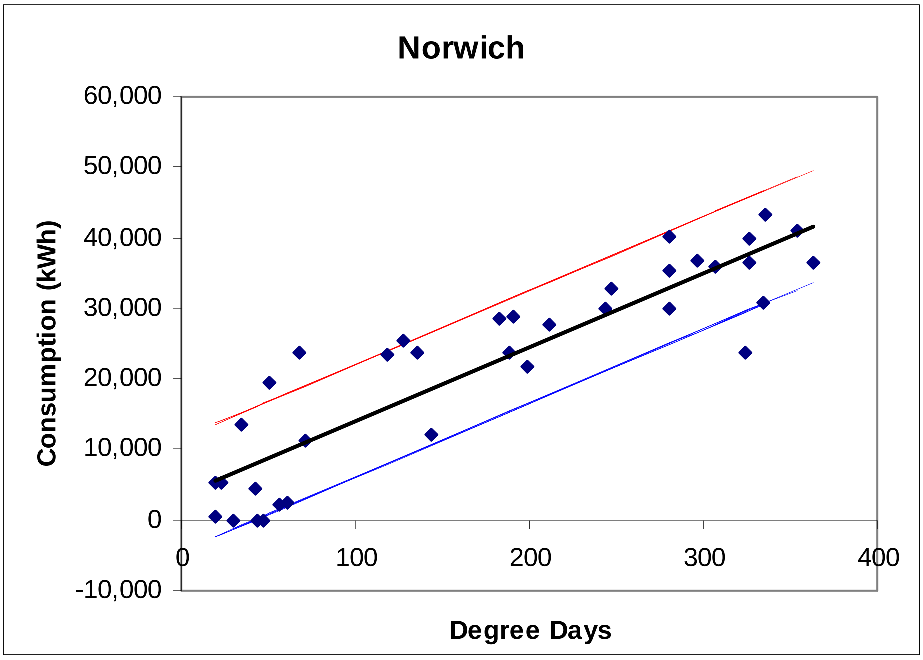


Fig. 60 The plot of gas consumption against Degree Days for Norwich together with a suggested upper and lower limits (+/- 8000 kWh/month) at which reporting might be required.

Fig. 61 shows the equivalent figure for Great Yarmouth (the original figure is Fig. 42). As this is a smaller premises, the band width here has been drawn at +/- 4000 kWh per month above and below the trend line. Such a band would immediately identify the outliers discussed in section 5.8 and one or two other points. The frequency of points falling outside the band width would typically be two per year.

Fig. 62 shows the corresponding plot for Kings Lynn (original is displayed as Fig. 58). As with Great Yarmouth a bandwidth of +/- 4000 kWh per month has been used. Once again the reporting frequency is likely to be about two occurrences per annum, but most of these are associated with estimated data as indicated by the highlighted points. There is scope to consider a narrower bandwidth at this branch.

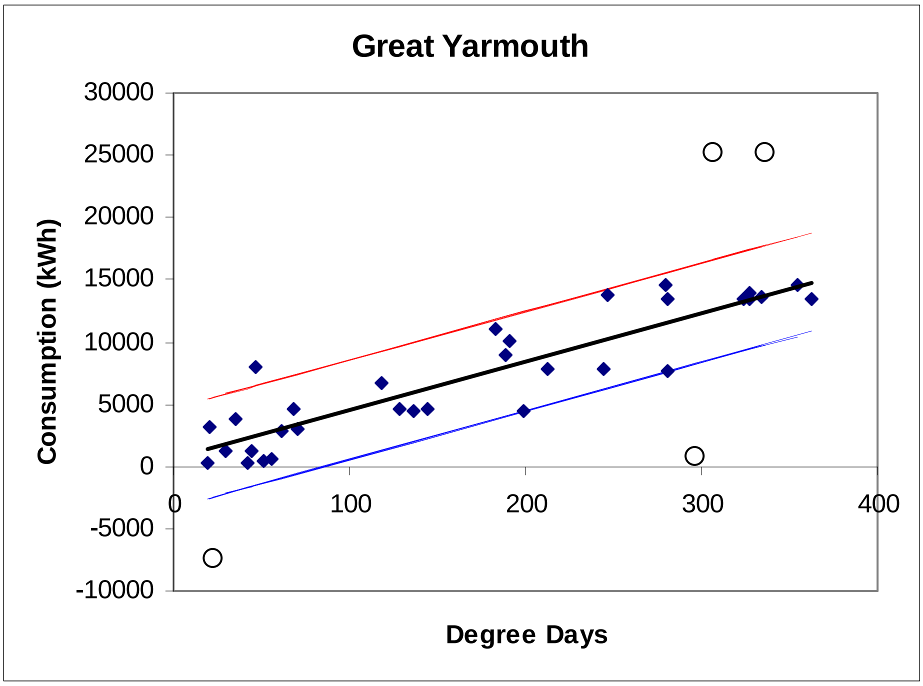


Fig. 61. The plot of gas consumption against Degree Days for Great Yarmouth together with a suggested upper and lower limit (+/- 4000 kWh/month) at which reporting might be required.

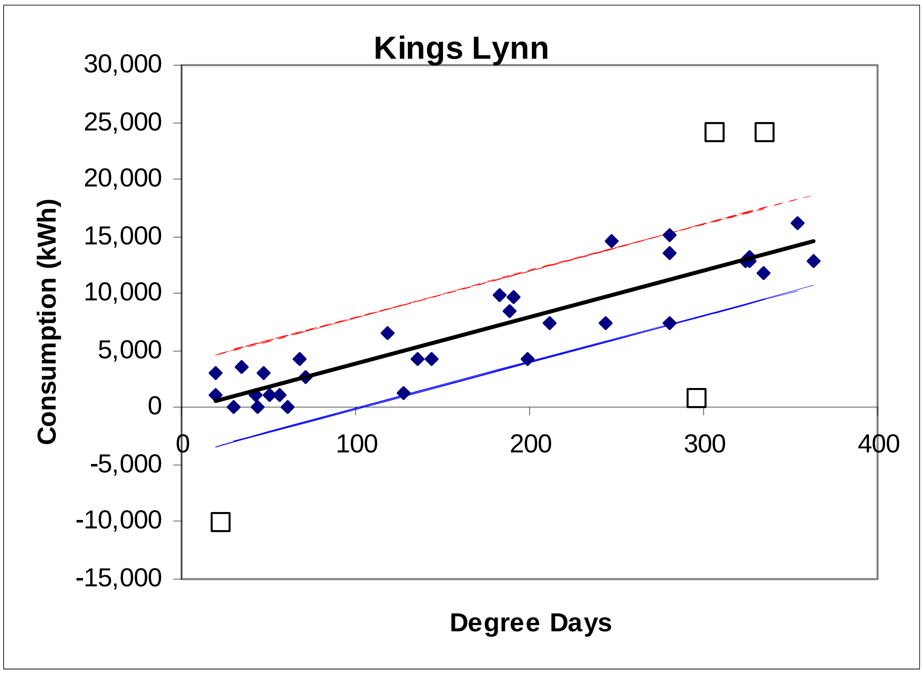


Fig. 62. The plot of gas consumption against Degree Days for Kings Lynn together with a suggested upper and lower limit (+/- 4000 kWh/month) at which reporting might be required.

9.4 Electricity Data

Section 3.3 suggested methods whereby a similar type of banding system could be used to track electricity data. There are several component parts to electricity consumption as outlined in section 3.3. These are i) lighting use, ii) IT and workstation use, iii) appliance use (e.g. coffee machines kettles etc)(, and iv) supplementary heating and air-conditioning. In none of the branches was there significant use of natural daylight. Consequently all plots are expected to be similar to Fig. 3.

Fig 63 replicates Fig. 29 for the Norwich Branch. These data are considered to be robust as the meter for the branch is remotely and automatically read. The horizontal black line represents the mean monthly consumption level in 2003. The red line represents a consumption level 5000 kWh per month higher than the mean and the blue line 5000 kWh per month lower than the mean. As discussed in section 5.7 had a banding system been in operation then in June 2004, the sudden increase in consumption would have been identified for possible investigation. The subsequent progressive decreases in annual might be due to possible energy conservation strategies but the cause is unknown. By December 2004, the consumption level had fallen below the lower band and this too would have identified an issue for identification. Why did it happen? should be a question asked, and furthermore, because it represents a saving what could be learnt for the future. The consumption remained nearly constant and this lower level would warrant a redefinition of the bands. In July 2005 the consumption increased significantly and has remained at this much higher level than any previous readings ever since. Once again this should trigger questions as to why this has happened. As indicated in this situation, the problem has probably arisen from the fault in the air-conditioning unit. The substantial increase in energy consumption not only increase carbon emissions significantly, but also has a not insignificant cost which would be worth investigating. However, since many activities in this branch may be moving within the next 12 months to a new location, there are questions about whether it is worth doing so in this particular case. However, in a more normal situation the suggested method of banding results would give an early warning for potential remedial action. Indeed even in the Norwich Branch and assuming the move does take place as planned and the premises are sold, there is likely to be a need to rectify any faulty heating / cooling equipment before sale under the new legislation where energy performance will become a requirement of a seller to provide information which must be passed to any prospective purchaser.

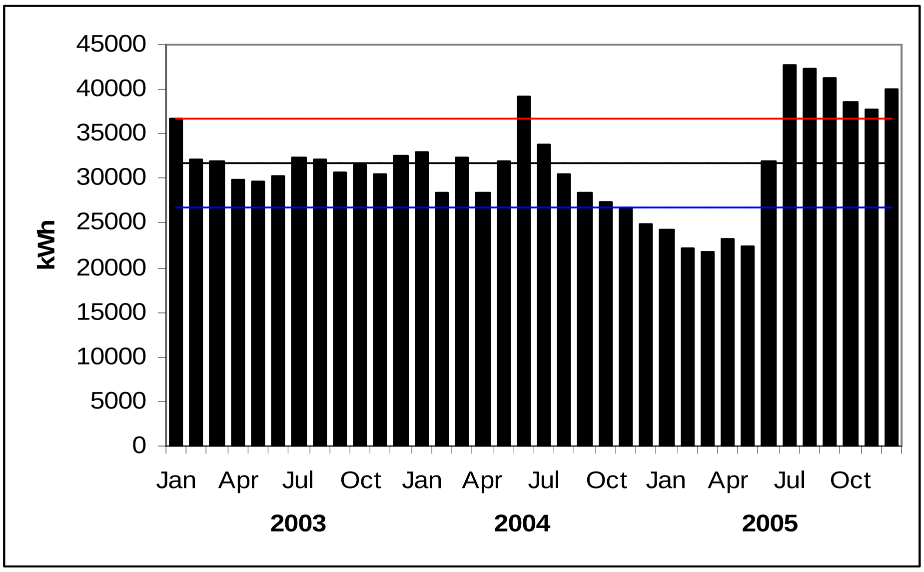


Fig. 63 Electricity data for the Norwich Branch with upper and lower bands at +/- 4000 kWh

Figs. 64 and 65 replicate the similar data for Great Yarmouth and Kings Lynn from Figs. 40 and 55 respectively. The plot for Kings Lynn has been reproduced on the same scale as that for Great Yarmouth for easy comparison.

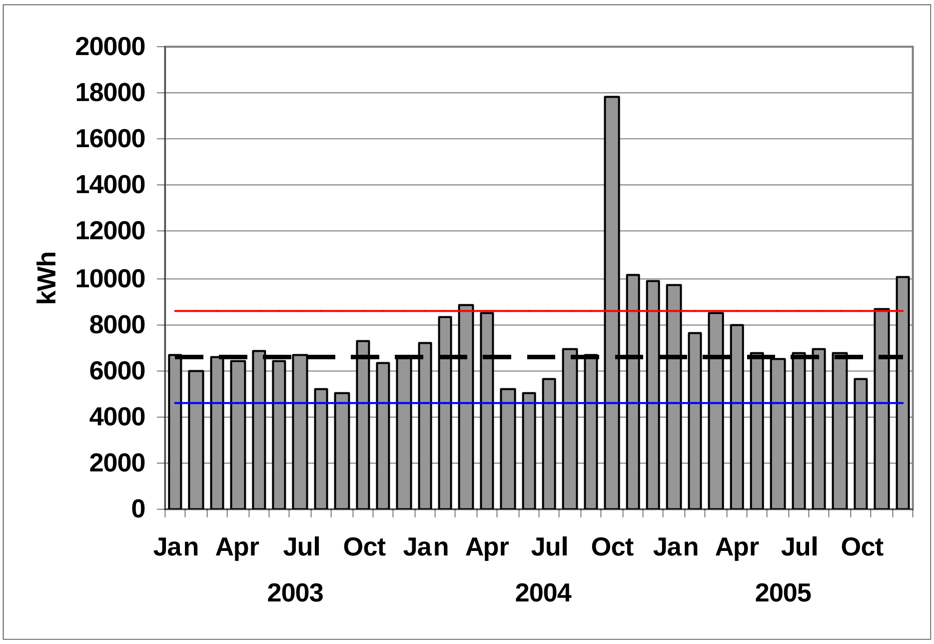


Fig. 64. Electricity data for the Great Yarmouth Branch with upper and lower bands at +/- 2000 kWh

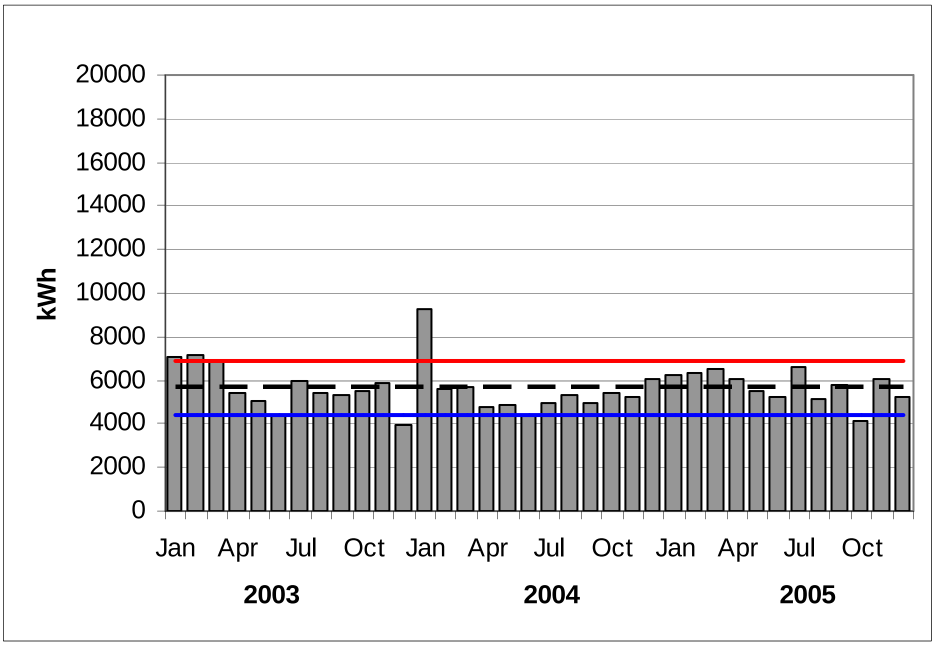


Fig. 65. Electricity data for the Kings Lynn Branch with upper and lower bands at +/- 1250 kWh

The much reduced scatter compared to the Great Yarmouth Branch is evident in Fig. 71 and confirms the proactive attitude towards energy conservation in the Kings Lynn. Furthermore the upper and lower bands have been drawn at 62% of the width of Great Yarmouth, and yet should produce no additional reporting incidents in any year

9.5 Water Data

Data for the most recent year from the three sites from which water data is available is summarised in Table 9.5

Table 9.5 Summary Water Data

	Annual Consumption (m^3)	Daily Consumption per employee (litres)
Norwich	1394	56
Yarmouth	61	13
King's Lynn	122	23

As indicated in the various sections there is some question over even the long term data set for water consumption as in all three branches there was a sudden reduction in water consumption in the middle of 2004 even though there is little evidence of the use of low spray taps etc. Nevertheless the above table does give a summary. It seems very surprising that the per capita consumption of water should be 4.5 times higher in Norwich than in Yarmouth even allowing for possible discrepancies in the data. It would be important to try to understand the reasons behind the form of the data and in particular the sudden changes in monthly consumption.

10. The Toolkit

The remit of this work was to conduct site audits at five HSBC branches and develop a prototype sustainability toolkit. Of course sustainability is a broad and inclusive concept encompassing many diverse economic, environmental, social, cultural and ethical dimensions. This audit has focused on specific aspects of environmental sustainability, namely energy, waste and water. Therefore, the toolkit described here is only a component of what could become a much wider sustainability toolkit.

Given the complexity of its dimensions, whether or not something has become sustainable is often difficult to define precisely. It is easier to measure whether the indicators of sustainability are moving in the right direction. Sustainability is less of an endpoint and more of a transition. The indicators we have adopted reflect this.

Toolkits for measuring the transition to a more sustainable state are becoming more common, particularly for assessing the impacts of policy decisions (SustainIT 2006). Industry focused toolkits tend to concentrate on savings in cost and/or time with an increasing interest in the reputational advantages of being more sustainable (ARIES 2004). In a business setting sustainable toolkits are intended primarily to help prioritise (and justify) action and to report progress. These types of toolkits can be qualitative or quantitative.

We have assumed that the purposes of this toolkit are:

1. To help HSBC categorise relatively easily the environmental performance of its offices and branches;

2. To determine at which offices or branches action is necessary; and

3. To enable HSBC to report on environmental improvements to its properties portfolio to stakeholders.

Our starting point was the pre-audit data, which was generally patchy and confusing. Assuming this to be indicative of the quality of data for all sites (a big assumption) it seems clear that the next steps should not be overly complex, but seek to improve data quality to the extent that a better understanding of the general position at different sites can be established. Two particular aspects of the pre-audit data that need addressing are i) to identify clearly which of the data are estimates and which are not; ii) on which day of the each month were the relevant energy and water readings taken. The proposed toolkit is based almost exclusively on the site audits conducted. Even within the five sites studied, representing 0.05% of the whole portfolio, there were very significant differences in context and performance.

There are two separate Action Lists which will need to be administered centrally and a separate checklist which could be done in individual branches by relevant staff. The first Action List relates to general and generic issues as to how the environmental performance may be improved. This Action List is discussed in section 10.1. The second Action List is a more technical one which together with the general Action List can be used to identify specific issues which could improve environmental performance. This List is discussed in Section 10.2. A specific Checklist if discussed in section 10.3 and this is for use partly as a corporate strategy and partly for use in individual branches.

10.1 Proposed Elements of the General Action list

This proposed Action List is built around three key categories of indicators: building fabric; central purchasing; and local engagement and displayed in Table 10.1. These categories reflect the different levels of control identified during the site audits. Control over building fabric is limited largely to ownership, though in the case of Great Yarmouth the planning system was also influential. Central purchasing decisions, including influence and control of contractors' performance, will also drive forward better environmental performance and so should be reflected in the toolkit. This category will tend to promote sites that have been recently refurbished with lower energy technologies. To counterbalance this central influence we have included a third category, local engagement, which is intended to reflect staff commitment on site. Staff engagement will be vital in improving environmental performance at some stage, whether that be in switch off activities or recycling office waste. Including this as a category for performance measure should enable an old site with little refurbishment to move someway up the overall site listing.

Within each category a number of indicators are proposed. Alternative scoring and weighting systems can be applied to this depending on the degree of complexity required. Decisions about the type of scoring system used should be driven by the degree of classification required across the estate. For example in the most simple form, if each of the 12 indicators were scored in a binary fashion, 1 for yes and 0 for no, then the maximum score would equal the total number of indicators, in this case 12. Assuming that HSBC sites were to be distributed evenly across this scale - an unlikely outcome - that would produce about 890 sites in each category. The question is, is that a useful outcome?

If not, then an alternative, more detailed scoring system should be used to help differentiate further. For instance instead of a simple binary scheme a scoring scheme of say 0 – 5 indicating how well a particular issue is being addressed, either corporately or at the branch level (in this case 0 would represent no progress whereas 5 would indicate complete progress towards an ultimate and agreed objective).

In our experience organisations with multiple sites around the world usually stick to something quite simple. A twelve-point rated scale would be at the higher end of the complexity we have seen. Adding more indicators increases the complexity of reporting at site level and will likely reduce the quality of data received.

A weighting system whereby some categories are weighted more heavily could be incorporated into the toolkit to enable HSBC group to emphasise the impact of these categories or indicators. This is one way of increasing the sensitivity of the tool to encourage performance in specific areas.

Site level data generated by the toolkit could be coupled with meter reading information to compare resource use and waste generation per person or per m^2. We are unsure of the quality of this data at this point so it is difficult to know whether or not this is a feasible option. If data quality from meters or contractors is of a lower quality than required to make a sensible judgement on performance then meter reading and waste collection information could be part of the role for any green team established at a branch.

10.2 Proposed Elements of the Technical Action List

This Action List is intended to identify specific issues on a month to month basis to ensure that optimum performance is being achieved. The General Action List can highlight the corporate aims and objectives of a sustainable approach to the future. The Technical Action

List will provide a pathway to allow these aims to be achieved. There will need to be a small investment in time to ensure that these technical issues can be address effectively. For example adaptation of spreadsheets which currently record utility data in include Degree Day information and band widths such as those explained in section 3.2.

This Technical Action List not only identifies the action needed, but also the person or persons responsible, a relative time scale and relative cost. In this section a short time scale implies a period of up to 6 months whereas medium signifies a period from 6 months to several years. With respect to costs, a low costs implies that the cost is small and might be achieved by a reallocation of individual responsibilities. A Medium cost generally signifies that one or more staff may need to be employed to ensure the activity is carried out effectively. Alternatively some actions might be undertaken by independent consultants.

10.3 Proposed Elements of the CheckList.

This checklist has two parts: the first is for use for corporate policy and the second for use in individual branches and is included as Tables 10.3 and 10.4. Many of the items for corporate policy use are to effect action according to points raise in the technical Action List.

Table 10.1 The Proposed General Checklist

	Category	Indicator	Measurement	Comment
Item	**Building fabric**			
1		Ownership	Freehold or Leasehold	Freehold offers more control in most situations.
2		Size	Area (m^2)	Larger sites will have more opportunities for change.
3		Age	Old/New or on an age scale	Newer sites should be better insulated and designed.
4		FTE	Large/small	Larger sites may have more opportunities for change.
	Central Purchasing			
5		Switch to (really) renewable electricity	By type of renewable energy	Three types of energy tariffs are available Wholly renewable; supporting the development of renewables; or fossil based.
6		Low energy lighting (LED)	Type of lighting	As new lower energy lighting becomes available (e.g. LED) so refurbishment offers the opportunities for installation.
7		Low energy IT equipment	Energy rating of IT equipment	As new lower energy IT equipment becomes available so refurbishment offers the opportunities for installation.
8		Water saving devices	Installed or not	Indicative of lower water usage per person.
9		Recycling	Occurring or not	Might be arranged through national contractors or organised by local staff using local schemes available.
	Local engagement			
10		Existence of Green Team	Does a green team exists (evidence could be meeting minutes)	A site-specific green team will provide an excellent counterbalance for activity at central purchasing level. There will be some opportunities that can only be delivered by site specific actions. Some training of these teams will probably be needed to ensure they act in the most effective way.
11		Travel to work	Existence of travel plan	May need evidence of operation. Points could be scored for proportions using public transport, cycling or car sharing.
12		Switch off campaigns	In place or not	If not organised centrally (perhaps as a competition) this could be encouraged locally. Savings to be reinvested in the branch as an incentive?

Table 10.2 The Proposed Technical Action List

Item	Category	Affecting	Action needed	By whom	Timescale	Costs	Comments
1	Procurement	Electricity	Replace workstation CRT monitors with flat screens	Central Purchasing	Phased over say 2 years	medium	Flat screen monitors consume significantly less electricity than CRT monitors. Each monitor replace would save up to 100 kg CO_2 a year and reduce demand for air-conditioning.
2	Data Reporting	Gas, Electricity, Water, Waste	Identify estimated readings, indicate date of readings	Mowlem	Immediate	Negligible to Low	With data supplied currently it is not possible to identify these two issues with any certainty making any analysis difficult.
3	Data Acquisition	Gas, Electricity, Water	Move towards remotely read automatic metering in all main branches.	Mowlem	Phased over 5 years – main branches first	Medium	Will avoid issues of estimated data and differences in reporting date. It is now possible to combine all meter readings via a single modem unit, and costs for such metering and servicing are around £700 over a period of 10 years, and provide reliable information which provide opportunities to more than recoup these costs.
4	Data Reporting	Gas, Electricity, Water, Waste	Report consumption data to branches for action	Mowlem and individual branches	Short term	Low	With item 10 in the General Action list, this will provide incentives to encourage the Green Team with the possibility of improved awareness and engagement in the future.
5	Preliminary Analysis	Gas (or oil), Electricity, Water, Waste	Analyse consumption data on a per employee and per unit area basis.	Mowlem, independent Consultants or specialist in house staff	Short term	Low	Will provide a rational basis to compare performance of branches. However, in case of heating and electricity consumption, significant differences are likely to exist depending on fabric and age of building requiring more specific analyses outlined below..
6	Specific Consumption Analysis	Gas (or oil) and electricity in branches where only electricity provides heating.	Analyse gas (heating) consumption data in terms of Degree Days	Mowlem, independent Consultants or specialist in house staff	Short to medium term	Low to moderate depending on extent of analysis	Some simple extension to basic spreadsheet software would need to be developed (sections 3.2 and 3.3). A banding system with upper and lower limits should be developed so that deviations in normal consumption can be identified. Consumption data exceeding limits should trigger action. Initially bands should be wide to avoid undue reporting, but narrowed as experience is gained. Where significant energy conservation measures are implemented, a recalculation of the base line relationship and band widths would be needed.

Table 10.2 The Proposed Technical Action List continued

Item	Category	Affecting	Action needed	By whom	Timescale	Costs	Comments
7	Specific Consumption Analysis	Electricity	Analyse electricity consumption data	Mowlem, independent Consultants or specialist in house staff	Short to medium term	Low to moderate depending on extent of analysis	Specific relationships need to be ascertained – but initially a standard constant monthly consumption level should be set together with upper and lower bands. As with gas, if these limits are exceeded, action should be instigated to identify cause. As conservation measures are implemented, the mean consumption and bands widths may need to change.
8	Overall Emission Analysis	Gas (or oil), Electricity	Routinely determine overall carbon dioxide emissions at the branch level	As above	Short to medium term	Low	Can be determined from robust data obtained in (1) and preferable (2) above, coupled with analyses in (5) and (6). Will require some adaptation of spreadsheets.
9	Staff Awareness	All Environmental Issues	Establish a "Green Champion" in all branches and in larger branches a "Green Team"	HSBC Corporate Policy	Short	Low	Effective environmental action will only occur if there are personnel at all levels who are committed to the environmental cause. It is necessary to have representatives in all branches. See also item 10 of General Action List.
10	Staff Awareness	All Environmental Issues	Training of "Green Champions" and "Green Teams"	In house or external consultants	Short Term and ongoing	Low but regular commitment	Persons in these responsibilities need to know exactly what their responsibilities are. Regular updating of training reviewing new ideas will be needed. Will be a regular commitment to training if the best aspects are to be achieved. Relevant also to item 10 of General Action List.
11	Staff Awareness	All Environmental Issues	"Green Teams" disseminate and train other staff	"Green Teams"	Medium Term	Low – part of normal training	Environmental Policies require action by all staff and these need to be fully briefed on action expected. . Relevant also to item 10 of General Action List.
12	Overall Environ-mental Performance	All Environmental Issues	Appoint central "Green" Coordinating staff to monitor progress actions	HSBC Corporate Policy	Medium Term	Medium as salaries	Required to provide a focus for all activities and to disseminate good practice throughout the group

Table 10.2 The Proposed Technical Action List continued

Item	Category	Affecting	Action needed	By whom	Timescale	Costs	Comments
13	Reporting anomalous trends	Initially Energy but later water	Acting on feed back of energy data at regular intervals	Green Teams to explain anomalous trends to central Coordinator	Medium Term when items 5 and 6 are in place	Generally low	The rational behind this is explained in sections 3.2 and 3.3 to identify at an early stage unusually high or low consumption. Reporting incidents are likely to be of the order of 1 – 2 per branch per year in the early stages.
14	Maintenance	Initially Energy but later water	Action to rectify technical faults identified under 11 at an early stage	Green Teams or central coordinator to Mowlems	Medium	Neutral as maintenance costs are likely to be needed anyway	Early action on faults can be implemented before there is a deterioration of environmental performance
15	Incentives	All employees	Establish a reward scheme to recognise good practice either as an individual but also as a branch	HSBC Corporate Policy	Short to medium	Generally low	Providing incentives can significantly improve employees actions towards improving environmental performance. Incentives could be any range of measures from public recognition in house newsletters or the HSBC radio network, through special functions for all staff in a branch to individual awards. This is closely related to item 12 of the General Action List.

Table 10.3 General Policy Checklist

This checklist should be consulted in conjunction with the relevant item(s) in the Technical Action List in table 10.2 above.

☐	Implement building energy monitoring, targeting and reporting throughout HSBC sites following the Action List items 2 - 8 and 12 – 14.
☐	Appoint Green Champions (and where necessary Green teams) to oversee the activities in individual branches Action List items 9 – 11 and 15.
☐	Provide training for Green Champions and Green Teams. Action List item 9
☐	Implement a purchasing policy to ensure all office equipment is energy efficient and where relevant has inbuilt energy management systems.
☐	Implement a sustainable transport policy to encourage car sharing, the use of public transport and where possible the use of audio or video conferencing where personnel from different sites are involved

Table 10.4 Checklist for use in Individual Branches

Note this checklist should be consulted in conjunction with the relevant item(s) in the Technical Action List in table 10.2 above. Some items are contingent on action outlined in the General Policy Checklist in 10.3 above. These actions should be implemented by the Green Champion and / or Green Team.

☐	Ensure desks are positioned so that heat is distributed efficiently from radiators and thermostatic radiator valves are set to a sufficient setting. Where possible allow individuals to be able to adjust their heating but training on correct use of thermostatic radiator valves is necessary.
☐	Provide all staff with training on environmental issues and use this as a forum to implement improvements where possible.
☐	Ensure security or cleaning staff are made responsible for switching lights off and reporting any equipment left on.
☐	Encourage all staff to switch off lighting and appliances and air-conditioning in rooms when not in use. [There may need to be a person from the Green Team in each area of a branch to ensure and monitor that this is happening]

Table 10.4 Checklist for use in Individual Branches continued

Note this checklist should be consulted in conjunction with the relevant item(s) in the Technical Action List in table 10.2 above. Some items are contingent on action outlined in the General Policy Checklist in 10.3 above. These actions should be implemented by the Green Champion and / or Green Team.

☐	Ensure all staff are conversant with heating and air-conditioning controls and how to operate them correctly
☐	Review lighting circuits to implement separate switches for areas of the office that are lit by a master switch but rarely used. Where units include more than one bulb consider wiring to allow control of one, two or three bulbs in a unit where relevant
☐	Maximise daylight use by opening blinds and turning off lights. This will need to be done in conjunction with the review noted above.
☐	Encourage printing double-sided and/or two sides per page where applicable.
☐	Check that the mean temperature is adequate. By law thermostats should not be set above 19^{o}C. Evidence suggests staff are adjusting to over warm environments by wearing very thin clothing. Initiate a dialogue with staff on this matter perhaps using a questionnaire as shown in the Appendix to obtain ration data.
☐	Staff who are sedentary will tend to feel colder than those who are more active. Consider changing layout of office so that sedentary staff are in the warmest locations.
☐	Ensure windows are not left open in winter.
☐	Encourage staff to boil only the minimum amount of water when using a kettle
☐	Ensure that staff always switch off their workstations at night, and also the monitors during the day if they are away from their desks for prolonged periods – e.g. over lunch.

11. Conclusions and Recommendations

11.1 General Conclusions and Recommendations

The UK retail banking sector is changing with less reliance on visiting branches and more focus on on-line and telephone support. Commercial and private banking relies less on a single site. Ultimately this may have the biggest impact on reducing the environmental impact of branches, as transactions become more automated. Nevertheless, the HSBC estate still consists of over 10,000 buildings worldwide in over 170 countries. Improving the environmental performance at these locations is a significant challenge. Measuring the improvements perhaps even more so. Some of this challenge can be met through central control with greater influence on contractors, particularly during refurbishment and ongoing maintenance. However, we believe that a proportion - likely an increasing proportion as time goes by - will need to be met through increased staff engagement at a local level.

The CRed audit team visited only five sites. Yet it was surprising that each site proved to be quite different, particularly in terms of the building fabric, its history and context. Central purchasing and the appointment of national subcontractors for maintenance and cleaning mean that many of the fittings and fixtures are similar. Staff openness and willingness to participate in the audits was particularly encouraging, and fully supports our view that local engagement on environmental issues is feasible, even where major changes are occurring. Of particular note was the contact person at the King's Lynn Branch. It would appear that unofficially she has instilled an awareness in terms of energy use in the building.

Our proposed checklist focuses on three main elements: building fabric; central purchasing control; and local staff engagement. The toolkit proposed can be implemented at a variety of different levels of complexity depending on the scoring and/or weighting system used.

Any toolkit will require pilot testing at a variety of sites throughout the UK and beyond. It goes without saying that the outputs of any toolkit approach have to be useful, although the precise nature of how usefulness will be measured by the HSBC Group is not yet clear to us.

The pre-audit data provided to the CRed team proved to be patchy and of questionable accuracy. With this in mind we recommend that a review of data acquisition be conducted to establish if processes could be improved to enhance data quality, possibly through reviewing procedures with subcontractors. The implementation of any toolkit approach should consider the collection of more accurate site data by staff on-site.

Sustainability is a broad concept encompassing more than energy, waste and water. As such this toolkit should be seen as a component of a wider mechanism, as yet undeveloped. As developments occur it is quite likely that contradictions will be encountered and difficult balances will have to be struck. To illustrate this, in one case, Great Yarmouth, there seems to be a broad possible set of approaches ranging from one extreme, vacating the building to the other, a fully committed restoration of an important landmark. Moving to new premises would almost certainly reduce the branch's environmental impact. However, fully restoring the premises would add an important dimension to the local social and cultural heritage of a deprived area, and would potentially gain HSBC some important reputational advantage. Which is more sustainable? Neither option is obviously right or wrong. Both would have a positive impact on staff morale.

11.2 Specific Recommendations.

Several issues listed as part of the Technical Checklist in section 9.2 are specific recommendations which should be considered for implementation at an early stage. Some of these recommendations are necessary pre-requisites for the General Checklist described in section 9.1. The following are these specific recommendations:

i) Meter reading data should be identified where the readings are estimated and in addition the date of reading of the data should be clearly identified. This will allow checks on the robustness of data to be made.

ii) The basic data, normalised to a full month, should be passed to each branch so that "Green Teams" as recommended in item 10 of the General Checklist can act accordingly to identify possible faults or reinforce savings made through good management.

iii) Consideration should be made to the more widespread use of remotely read meters. The relative costs have come down, and the opportunities to analyse the robust data provided and thereby identify faults at an early stage will usually make such action very cost effective.

iv) Steps should be taken to provide a running reference data set for consumption of key utilities in all main branches and subsequently in all branches. These reference sets will include information based on historic trends, but modified, where relevant, according to controlling parameters. For instance in the case of heating, the data should be related to the relevant Degree Day parameter for the reporting month. Example reference sets for three of the branches visited are included in Appendix 2.

v) Upper and lower bands should be identified for each utility to define a normal band of operation within which all consumption data should lie. Examples of such bands are shown in Appendix 2. Initially the bands should be sufficiently broad so as to include the majority of the consumption data points. However, as staff and systems become more responsive to environmental concerns, the width of these bands should be reduced progressively.

vi) The deviation of the upper and lower bands from the mean consumption level should be reviewed regularly and at least on an annual basis. Where significant changes in consumption take place as a result of conservation measures or the change in activity level, then these bands should be redefined.

vii) A reporting system should be established to ensure that when consumption falls outside either the upper or lower band is notified to the relevant people. When consumption increases for no apparent reason, this is likely to arise from a technical fault from equipment. Where consumption falls below the lower limit, this will often occur as a result of improved energy conservation from either technical measures or awareness through good management. It is important to ensure such benefits are noted and promoted in future.

viii) A schedule to train staff members of the "Green Teams" should be implemented at an early date.

11.3 Concluding Remark.

It is probably worth making a comment on the rate of use of energy in the branches, and electricity in particular, compared to other activities. The electricity consumption per employee varies from 3200 kWh per annum per employee at the King's Lynn branch, where there appears to be a proactive attitude to switching off unnecessary lights etc. to 4700 kWh per annum per employee at the Great Yarmouth branch. It is noteworthy that this range is very comparable to the average electricity consumption in a household at 3727 kWh per annum in Norwich. Thus employees are consuming as much electricity during their working hours as the whole of their house does during the year.

12. References

Australian Research Institute in Education for Sustainability (ARIES) (2004) Industry Sustainability Toolkit Project. National Environmental Education Council Industry Working Group.

Carbon Trust (2006a) What are Degree Days?.
www.thecarbontrust.co.uk/energy/pages/page_318.asp
website viewed on March 16th 2006

Carbon Trust (2006b) Historical Degree Day Data
www.thecarbontrust.co.uk/energyCMS/CarbonTrust/items/Documents/Resources/February06_Degree_Days___202.pdf

Fanger P.O. (1970) Thermal Comfort, Danish Technical Press, Copenhagen

SustainIT (2006) http://www.sustainit.org/about-us.php Website viewed on March 13th 2006.

13. Appendix 1: HSBC Thermal Comfort Survey

HSBC is committed to reducing the carbon footprint of its world wide operations, and a pilot study is being undertaken to see how this might be achieved. There are many aspects to this study, but one particular aspect is the temperature experienced in the work place. This has import aspects as if the temperature is too cold then staff will feel uncomfortable and not perform to their best. Equally if they are too hot the same will apply. If buildings are overheated in the UK, the each $1^{o}C$ of overheat corresponds to an unnecessary waste of 8% in terms of energy and consequential carbon emission.

The purpose of this survey is to ascertain whether there are cold or hot spots in the building to provide background where the overall thermal environment can be improved. Please fill in the following table using the scales shown over leaf. You do not have to fill the forms in at precisely the noted time - these are for guidance only.

HSBC Branch ……………………….. Week of ……………………………………………….

	Time			Clothing Level (see chart over)					Comments
	Approx:	Actual	Activity seated or standing	Above Waist	Below Waist	Add cols (5) and (6)	VOTE (see chart overleaf)	Lighting Vote	
Mon	09:00								
	11:00								
	13:00								
	15:00								
	Other								
Tues	09:00								
	11:00								
	13:00								
	15:00								
	Other								
Wed	09:00								
	11:00								
	13:00								
	15:00								
	Other								
Thurs	09:00								
	11:00								
	13:00								
	15:00								
	Other								
Fri	09:00								
	11:00								
	13:00								
	15:00								
	Other								

THERMAL COMFORT Voting Scale

ASHRAE SCALE for comfort

3	very hot
2.5	
2	hot
1.5	
1	slightly warm
0.5	
0	neutral
-0.5	
-1	slightly cool
-1.5	
-2	cold
-2.5	
-3	very cold

Lighting

3	very bright
2.5	
2	bright
1.5	
1	slightly bright
0.5	
0	Just right
-0.5	
-1	slightly dull
-1.5	
-2	dark
-2.5	
-3	very dark

THERMAL COMFORT CLOTHING CHART

	Above waist
1.6	Shirt + sweater + jacket + coat
1.4	shirt + thick sweater + medium weight coat) or (jacket +light cagoulec)
1.25	shirt + thick sweater+medium/tick jacket
1.10	shirt + thin sweater + medium jacket
0.95	shirt + thick sweater
0.80	shirt + medium open jacket or medium sweater
0.65	shirt + light open jacket or light sweater
0.50	shirt + open light cardigan
0.40	vest + shirt
0.30	long-sleeved shirt
0.20	open-necked /short-sleeved shirt
0	nude

	Below waist
0.65	heavy-weight trousers
0.50	medium-weight trousers
0.35	light-weight trousers (skirt + tights)
0.20	shorts (or skirt) + long socks
0.10	shorts
0.00	nude

i) For values above 1.0 (in (a) above) subtract 0.1-0.2 if jacket is open, subtract a further 0.1-0.2 if coat is open.
ii) For V-necked sweaters subtract 0.05, for polo-necked sweaters add 0.05.
iii) For a scarf add 0.2.
iv) For a hat add 0.1, for a hood add 0.3.

14 Appendix 2: Suggested Reference Data for Gas Consumption in selected Branches

The following are the suggested baseline data values for gas consumption references against Degree Days. When consumption exceeds either the upper or lower limit, a reporting system should be triggers. The significance of these bands is discussed in section 8.3. If consumption data in any month lies outside the range defined by the upper and lower bands then action should be triggered. The bandwidth is set at 8000 kWh for Norwich and 4000 kWh for the other two branches. Such banding would trigger action once or twice a year.

Degree Days	Norwich (kWh)			Great Yarmouth (kWh)			King's Lynn (kWH)		
		Bands			Bands			Bands	
	Mean	Upper	Lower	Mean	Upper	Lower	Mean	Upper	Lower
0	3586	11586	0	660	4660	0	0	3827	0
10	4633	12633	0	1050	5050	0	235	4235	0
20	5680	13680	0	1440	5440	0	644	4644	0
30	6727	14727	0	1830	5830	0	1052	5052	0
40	7774	15774	0	2220	6220	0	1461	5461	0
50	8821	16821	821	2610	6610	0	1869	5869	0
60	9868	17868	1868	3000	7000	0	2278	6278	0
70	10915	18915	2915	3390	7390	0	2686	6686	0
80	11962	19962	3962	3780	7780	0	3094	7094	0
90	13008	21008	5008	4170	8170	170	3503	7503	0
100	14055	22055	6055	4560	8560	560	3911	7911	0
110	15102	23102	7102	4950	8950	950	4320	8320	320
120	16149	24149	8149	5340	9340	1340	4728	8728	728
130	17196	25196	9196	5730	9730	1730	5137	9137	1137
140	18243	26243	10243	6120	10120	2120	5545	9545	1545
150	19290	27290	11290	6510	10510	2510	5954	9954	1954
160	20337	28337	12337	6900	10900	2900	6362	10362	2362
170	21384	29384	13384	7290	11290	3290	6770	10770	2770
180	22431	30431	14431	7680	11680	3680	7179	11179	3179
190	23477	31477	15477	8070	12070	4070	7587	11587	3587
200	24524	32524	16524	8460	12460	4460	7996	11996	3996
210	25571	33571	17571	8850	12850	4850	8404	12404	4404
220	26618	34618	18618	9240	13240	5240	8813	12813	4813
230	27665	35665	19665	9630	13630	5630	9221	13221	5221
240	28712	36712	20712	10020	14020	6020	9629	13629	5629
250	29759	37759	21759	10410	14410	6410	10038	14038	6038
260	30806	38806	22806	10800	14800	6800	10446	14446	6446
270	31853	39853	23853	11190	15190	7190	10855	14855	6855
280	32900	40900	24900	11580	15580	7580	11263	15263	7263
290	33946	41946	25946	11970	15970	7970	11672	15672	7672
300	34993	42993	26993	12360	16360	8360	12080	16080	8080
310	36040	44040	28040	12750	16750	8750	12489	16489	8489
320	37087	45087	29087	13140	17140	9140	12897	16897	8897
330	38134	46134	30134	13530	17530	9530	13305	17305	9305
340	39181	47181	31181	13920	17920	9920	13714	17714	9714
350	40228	48228	32228	14310	18310	10310	14122	18122	10122
360	41275	49275	33275	14700	18700	10700	14531	18531	10531
370	42322	50322	34322	15090	19090	11090	14939	18939	10939
380	43369	51369	35369	15480	19480	11480	15348	19348	11348
390	44415	52415	36415	15870	19870	11870	15756	19756	11756

Degree Day information may be found on the Carbon Trust Web Site.

www.thecarbontrust.co.uk/energy/pages/page_318.asp