South Place Hotel

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Innovate UK project number	450112
Project lead and author	Hoare Lea and Partners Ltd.
Report date	2015
InnovateUK Evaluator	Robert Cohen (Contact via www.bpe-specialists.org.uk)

Building sector	**Location**	**Form of contract**	**Opened**
Hotels	London	Design and build	2012
Floor area (NIA)	**Storeys**	**EPC / DEC**	**BREEAM rating**
6000 m^2	8	B (34) / N/A	Excellent

Purpose of evaluation

The study started at the same time as hotel opening, and included a period of enhanced handover for the first few months of systems settling-in and fine-tuning. This was followed by energy and water consumption analysis and user feedback analysis for permanent (staff) and transient (guest) users. The hotel was built using sustainable construction techniques and included combined heat and power (CHP) for the hotel to generate electrical power and heat which is used for water heating. Energy analysis compared metered data with CIBSE *Guide F* and CIBSE *TM46* benchmarks. The report also covers the hotel's water consumption.

Design energy assessment	**In-use energy assessment**	**Electrical sub-meter breakdown**
No	Yes	Partial

Thermal (gas) consumption was reported to be 316 kWh/m² per annum, with electricity at 247 kWh/m² per annum. Electricity consumption was significantly (~ 80%) higher than benchmark. The high energy consumption was attributed to high occupancy rates (the hotel's occupancy rates were 85% on average, with regular 100% occupancy during the week, which the hotel operator stated was higher than average in the industry). The hotel's high-end specification meant the building is heavily serviced with audio-visual systems in each bedroom. Other factors such as plant inefficiencies and controls may have raised energy consumption, but these were not specifically identified in the study.

Occupant survey	**Survey sample**	**Response rate**
BUS, paper-based	22 of 50	44%

A BUS occupant satisfaction survey was distributed to all staff members via the hotel's management team. The BUS results showed high overall satisfaction. Staff felt they would benefit from more storage space for office material, goods and furniture (which is changed regularly). While the outside doors are generally opened for guests by a member of staff, the inside doors, due to their weight, are not automated and are usually left open for the ease of guests. This created discomfort for the receptionists and guests sitting in the lobby area. An overdoor heater was retrofitted by the operator.

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About this document:

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This report template has been used by BPE teams to draw together the findings of the entire BPE process and to record findings and conclusions, as specified in the Building Performance Evaluation - Guidance for Project Execution (for domestic buildings) and the Building Performance Evaluation - Technical Guidance (for non-domestic buildings). It was designed to assist in prompting the project team to cover certain minimum specific aspects of the reporting process. Where further details were recorded in other reports it was expected these would be referred to in this document and included as appendices.

The reader should note that to in order to avoid issues relating to privacy and commercial sensitivity, some appendix documents are excluded from this public report.

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Contents

1.0 Executive Summary

This report covers the two-year Building Performance Evaluation (BPE) project of South Place hotel.

1.1 The Building

The building is a boutique hotel located in inner London. It includes 80 bedrooms, 2 restaurants, and associated uses including small spa and conference facilities.

The hotel was built by a private developer. The hotel operator has significant restaurant experience and it was their first hotel. Procurement was through a Design and Build contract based on RIBA Stage E, with the external architects and interior designers novated to the contractor and the mechanical, electrical and public health (MEPH) engineers retained in a client monitoring role.

The hotel opened in September 2012 with partial completion (PC), reaching full PC a few weeks later. At the time of this report i.e. over two years after opening, there remains a small number of defects which the contractor is involved with, but the hotel is fully operating. It has since its opening experienced high occupancy rates and high levels of guest satisfaction.

The design intent was for a best practice hotel and the building achieved BREEAM ‘Excellent’ and a B-rating Energy Performance Certificate (EPC), at design and as-built stages. The design approach included a highly-efficient envelope, mechanical ventilation, and cooling provided in most areas. All bedrooms are provided with fan coil units for heating and cooling. In addition, bedrooms on the two top floors are provided with openable windows, which if open de-activate the fan coil units. The building is served from a basement plant room including boiler and Combined Heat and Power (CHP) plant, as well as roof plant including Air Handling Units. Controls are linked to the Building Management System (BMS), and to a separate room control system for bedrooms.

1.2 Methodology

The BPE was led by the sustainability consultants, independent but part of the organisation who provided MEPH services at design stage. The sustainability consultants were involved from early design stages, including setting up the energy strategy in the support of the planning application.
The study started at the same time as hotel opening, and has therefore included a period of ‘enhanced handover’ for the first few months of systems settling-in and fine-tuning. This was followed by energy and water consumption analysis and user feedback analysis for permanent (staff) and transient (guest) users. The methodology and analysis tools included:

- Regular engagement with the hotel operator and project team: site visits, review of contractor proposals, and meetings as part of the handover and defect period. One- and two-year meetings were held with the client and design team to summarise intermediate conclusions.
- Analysis of energy consumption:
    - High-level analysis by comparison of metered data with CIBSE Guide F and CIBSE TM46 benchmarks
    - CIBSE TM22, using data from sub-meters over a year (where available)
- Analysis of water consumption using meter readings provided by the contractor or hotel operator’s facilities management (FM) team
- Permanent user (i.e. staff) satisfaction surveys using the Building Use Surveys distributed to all staff members; interviews with heads of department
- Transient users (i.e. hotel guests and restaurant customers) feedback: analysis of customer review websites.

1.3 User Feedback – Permanent Users

An occupant satisfaction survey, using the Building Use Studies (BUS) format, was distributed to all staff members via the hotel’s management team. Responses were gathered from 22 members of staff, out of about 50 distributed. It was made clear to the staff that these surveys aimed to capture design and performance lessons on the building itself, and not to capture Human Resource (HR) issues. ‘Satisfaction’ is therefore with the building and its ability to meet the needs of its users. The full BUS report is available in Appendix A.

More detailed feedback was also gathered by interviewing 8 key members of staff, including the facilities manager, head of human resources, concierge, ground floor restaurant manager, and head of housekeeping.

Feedback from staff was generally highly positive, including:

- High overall satisfaction – see Figure 1.1, where the building is in the top 10% performers amongst BUS results
- Highly-rated overall design – see Figure 1.2
- Very good response to request from changes, with the highest score in the database – see Figure 1.3. This is to the credit of the FM team, and commonly found in Post Occupancy Evaluation studies [1, 2] as highly influential in overall user satisfaction i.e. users tend to be more tolerant when they have some control on their environment or, in buildings with lower levels of individual control, when they know their complaints are being heard and acted upon.

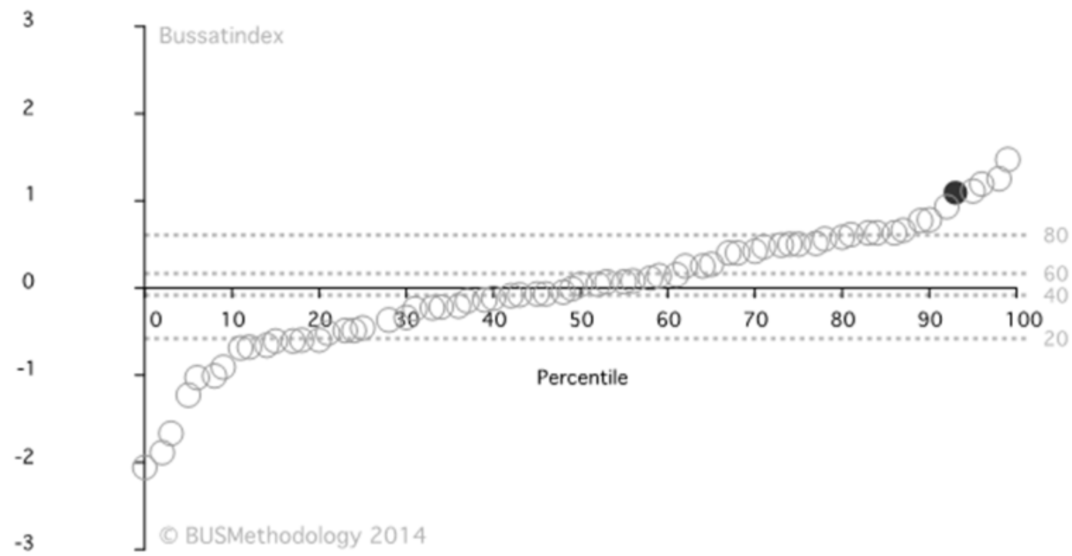


Figure 1.1 – Staff satisfaction survey: overall satisfaction (BUS surveys): the analysis shows that the hotel is rated among the top 10% ‘overall satisfaction’ performers, when compared to the BUS database of similar buildings.

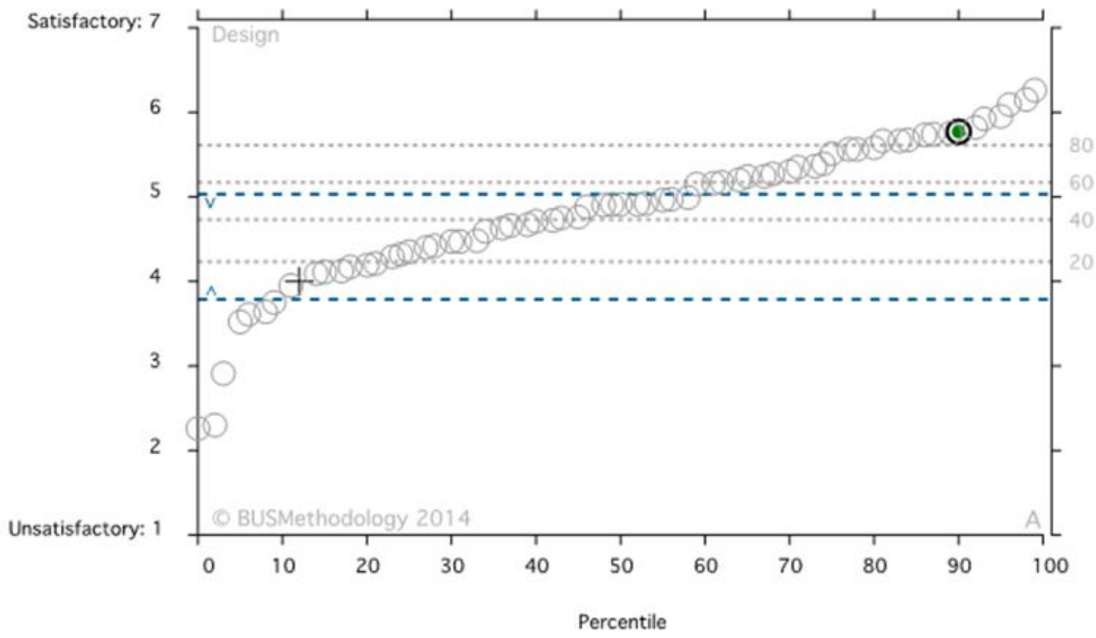


Figure 1.2 – Staff satisfaction survey: overall design (BUS surveys): the analysis shows that the hotel is rated among the top 10% 'overall design' performers, when compared to the BUS database of similar buildings.

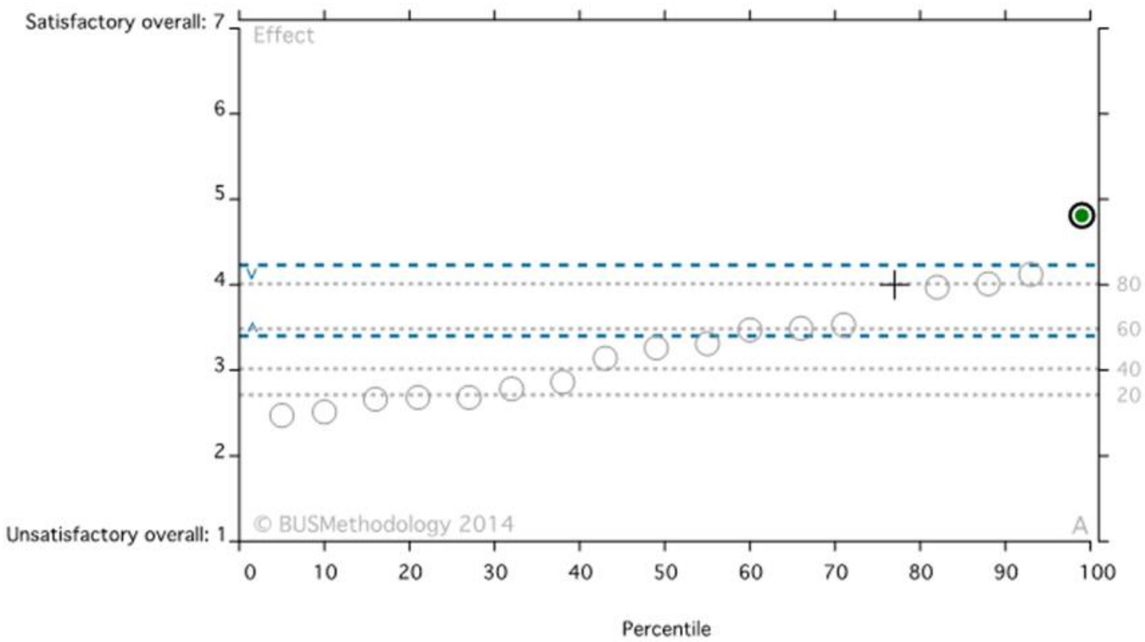


Figure 1.3 – Staff satisfaction survey: Effectiveness of response to request for changes (BUS surveys): the analysis shows that the hotel is rated 'best in class' for effectiveness of response to request for changes, when compared to the BUS database of similar buildings.

The following points were also noted from staff surveys and interviews:

- Staff feel they would benefit from more **storage space** for office material, goods and furniture (which is changed regularly) , although there is a recognition by the hotel's management team that 'the more storage you get, the more you need'. This has in part led to the use of the original cycle store for bin storage, despite a number of staff keen to commute by cycle. Cycles are available nearby from the Mayor of London's bike hire scheme but cannot be relied upon to be available at all times, and nearby external cycle storage areas have not proved secure enough.

- Hotel staff typically work long shifts (more so than those in the ground and top floor restaurants) and back-of-house areas are therefore more prominent in their feedback e.g. storage areas for cycles and personal belongings, break-out areas. **Back-of-house areas are seen by the HR team as crucial in staff retention**, particularly in such a successful establishment where this could help differentiate the hotel from other employers. This is a challenge to design teams and hotel operators given the high pressure on space in such an inner London location.

- **Hotel reception's draught lobby**: while the outside doors are generally opened for guests by a member of staff, the inside doors, due to their weight, are not automated and are usually left open for the ease of guests. This created discomfort for the receptionists and guests sitting in the lobby area, an issue commonly arising from POE studies. An overdoor heater was retrofitted by the operator.

Most of these issues were expected by the project team at early design stages, but compromises had to be made to reconcile conflicting requirements such as external appearance, back-of-house support functions, and revenue-generating front-of-house areas.

1.4 User Feedback – Transient Users

In contrast to buildings with permanent users, such as offices, where the BUS surveys are well-established and have been used in hundreds of buildings, there is no well-established user satisfaction survey methodology for 'transient' users, such as guests in hotels and restaurants, customers in shopping centres etc. A draft version similar to the permanent users BUS was made available for this study (see Appendix B) but was considered by the hotel's management team as too difficult to integrate within the hotel's brand, due to its fixed length and questions. Feedback from hotel and restaurant guests was therefore gathered through a variety of more informal sources, including:

- Customer feedback received by hotel staff, made available via staff interviews
- Reception logs, where every comment by guest deemed worthy of action is recorded (approx. 25-30 incidents per month)
- Customer feedback left on travel review websites, including overall rankings and more detailed review of the reviews on one website (Trip Advisor). It should be noted that this website (and others) is used by the hotel management team themselves to gather feedback and respond to individual comments from guests.

There are currently almost 1,000 customer reviews on two popular travel review websites, both showing **high rankings for the hotel: within the 'top 20 London hotels' on one, and overall 9.3 out of 10 mark on the other**. **Occupancy levels are high** (85% on average, with routinely 100% occupancy on weekdays) and, while always high weekdays for business travellers, are growing for weekend leisure trips. There is a high proportion of repeat visits.

A number of reviews on Trip Advisor were examined in more detail in the first year of occupation (total of 88: the first 48 in the first 6 months of operation, from September 2012 to March 2013, and a further 40 from mid-September 2013 to December 2013). These were systematically analysed to identify and count the issues mentioned by guests, and whether these were positive or negative, as illustrated in Figure 1.4. While it is recognised that this method is not a formal way to gather and analyse user feedback, **trends were broadly in line with the facilities manager's feedback and the reception logs**. This is therefore viewed by the team as an acceptable and useful compromise between formal methods and the hotel's business operatives. The issues most commented on by guests were:

- general quality, design and atmosphere of the bedrooms
- quality of service.

These are followed by the location of the hotel, overall design and atmosphere, and facilities such as the bar, restaurant etc.

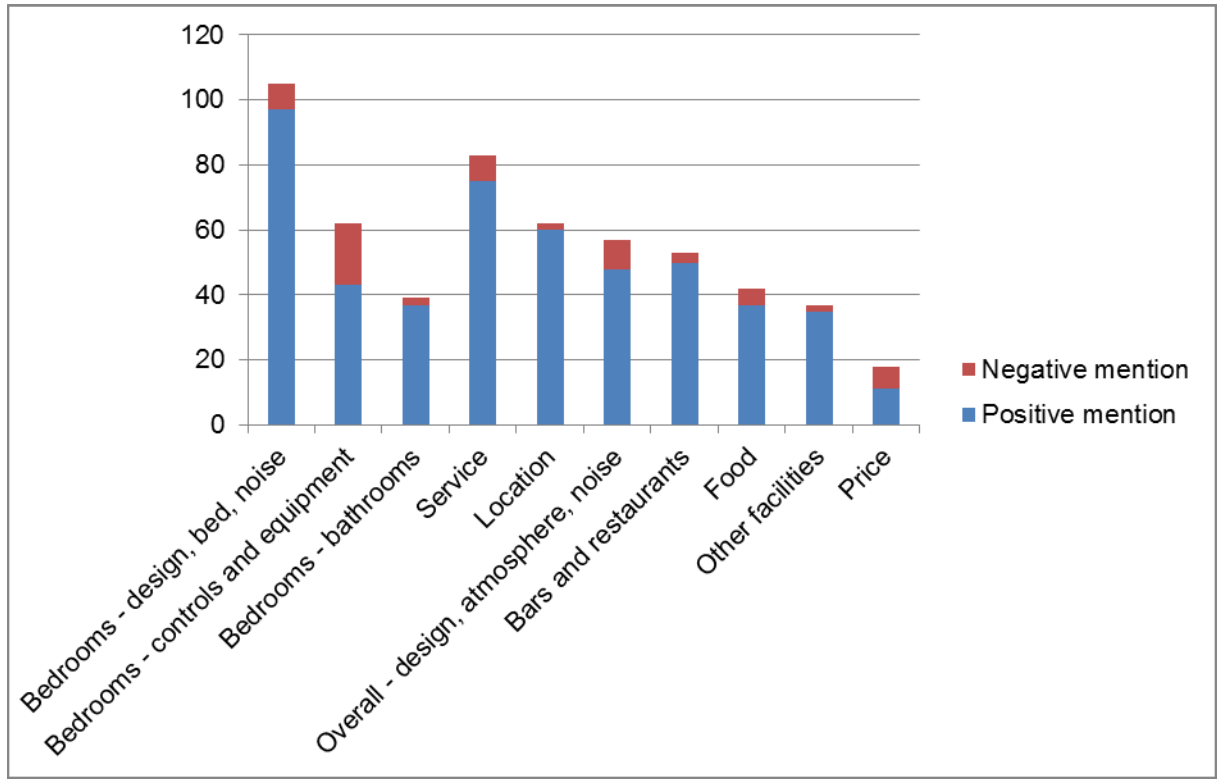


Figure 1.4 - Number of mentions in guest reviews, out of 88 reviews [sample Trip Advisor reviews, from September 2012 to September 2013]

More specifically in the bedrooms, the bed and bathrooms were singled out by guests as particularly positive features – with 'huge beds', **'rain showers' and 'huge bath'** (mentioned in 20 out of 88 reviews) particularly appreciated. This feedback needs to be accounted for by design teams as a clear challenge to sustainability and water consumption objectives.

The next dominant items of feedback are the **quality of service and attention to detail**, almost solely driven by the hotel operator, as are the hotel location and provision of bar / restaurant facilities.

The interior design was also regularly noted ('stylish', and 'modern' in particular). With the exception of lighting, which was commented on positively as part of the overall design quality and atmosphere, building services were rarely if at all mentioned. It is probably the case that, had their performance been unsatisfactory, for example with insufficient, excessive, or noisy HVAC, this would have been identified in guest feedback.

Bedrooms on the top two floors of the hotel are provided with **openable windows**, which when open de-activate the fan coil units. This feature seems to be appreciated by some guests, even in a hotel in an urban location on a busy road, and the hotel management team see this as a strength in their flexibility and offering as staff have reported that a small proportion of guests do request openable windows. There is incidental evidence from the rooms monitoring and control system that windows are used, which then de-activates or delays the operation of the fan coil units. This cannot be directly correlated to energy consumption as the room control system is separate from the main BMS, but is an item that could be further analysed by the FM team in the future in order to identify whether the feature offers worthwhile energy cost savings (in addition to customer satisfaction) in their future hotels.[1]

More moderate feedback was received on the following issues, with relative consistency between travel review websites, staff feedback, and the reception logs:

- Noise from the ground floor and first floor terrace bars and the street (especially during construction works outside). This was partially addressed through measures such as re-sealing of some façade elements by the contractor, and the addition of a roof onto the terrace bar to reduce noise travel upwards into the bedrooms. It should also be noted that the hotel hosts a large number of evening events, which had not been part of the initial brief and design intent.
- Complexity of bedroom equipment, specifically the TV remote and media hub, and complexity and reaction time of controls over lighting and blinds.

Negative mentions only represented approximately 10% of the total number of comments over the 88 guest reviews analysed, and such occurrences significantly reduced from the 1st period analysed (i.e. the first 6 months of occupation) to the 2nd one (first three months of the 2nd year). These improvements match information provided by the hotel operator on measures taken, including façade remediation works and fine-tuning of bedroom controls, and highlight the importance of seasonal monitoring and tuning, especially in the first year. They can also probably be attributed to the quality of staff service, with staff becoming more familiar with the rooms and their features, and improving their introduction to guests ('room-in service').

[1] Notes for further areas of research / analysis: In addition to energy consumption, the impact on room temperature should be reviewed i.e. whether opening the windows has the desired effect. It is also not know whether guests appreciate the de-activation of fan coil units as an 'intelligent control' feature, or whether they would expect both openable windows and mechanical systems to be available to them.

1.5 Key Conclusions and Lessons Learnt – Energy Consumption

Overview

Overall energy consumption was established from the mains gas meter (half-hourly) and mains electricity meter (half-hourly), and verified against the facilities management's team manual readings, taken daily from the opening of the hotel.

Monthly consumption over 2 years (March 2013 – February 2015) is shown below, from manual readings taken by the FM team. This excludes the first six months of operation of the hotel (September 2012 – February 2013). Consumption is similar in the 1st and 2nd years, and with marked seasonal variations, with gas consumption peaking in winter and electricity peaking in summer.

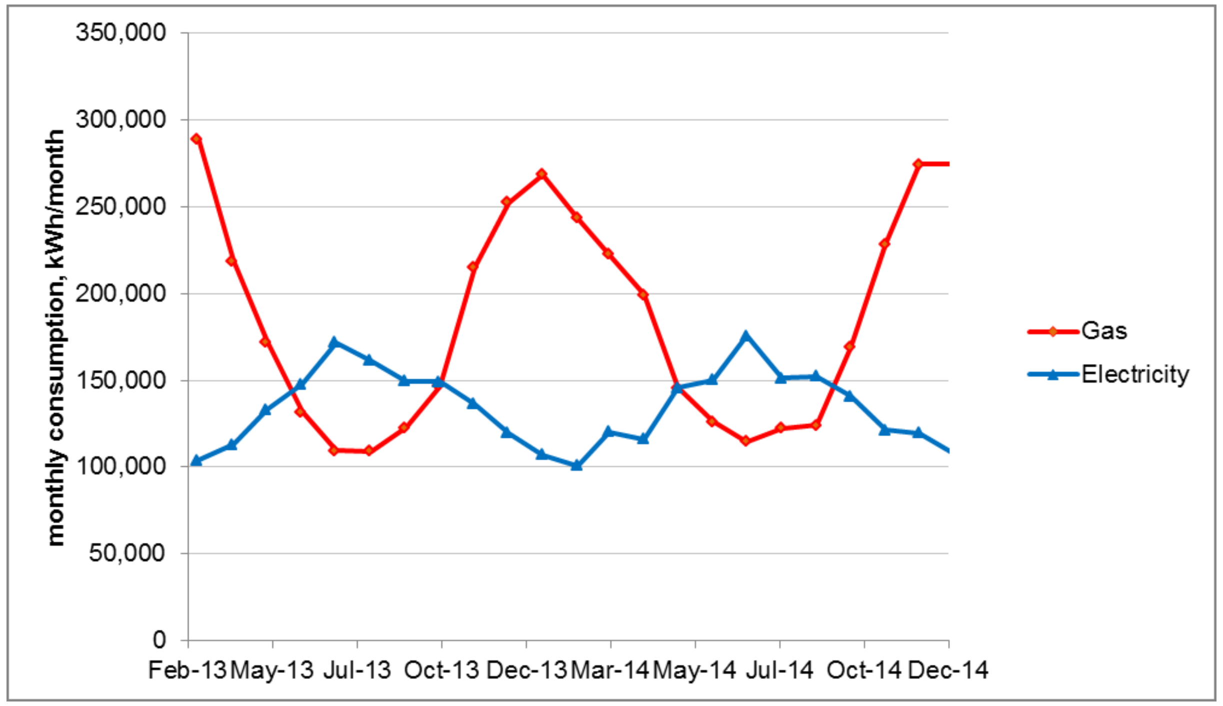


Figure 1.5 – Monthly gas and electricity consumption, Mar 2013 – Feb 2015

A CIBSE TM22 analysis was carried out covering approximately the second year of operation (mid-July 2013 to mid-July 2014). Annual energy supplies against the following benchmarks are shown in Figure 1.6 and Table 1.1:

- CIBSE TM46 'Good Practice' benchmark for Business / Holiday hotels
- 'User specified', i.e. area-weighted CIBSE Guide F good practice benchmark for hotels + CIBSE Guide F good practice benchmark for restaurants, applied to the top floor restaurant, to represent the high level of restaurant / catering provision in this hotel.

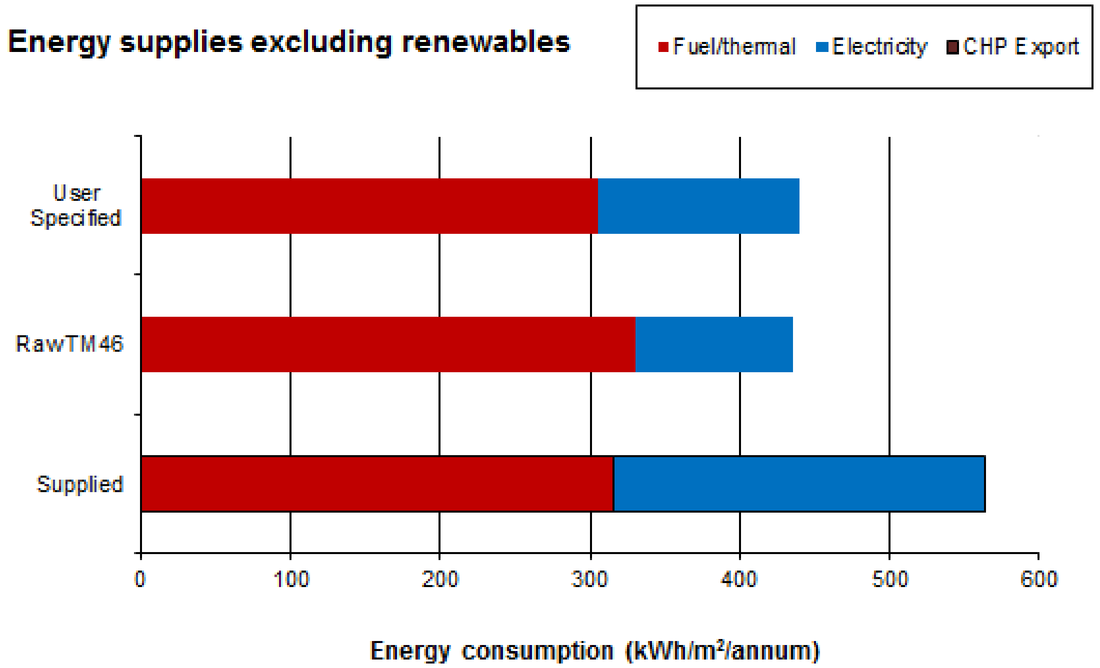


Figure 1.6 – Overall annual gas and electricity supplies against CIBSE benchmarks, July 2013 – July 2014

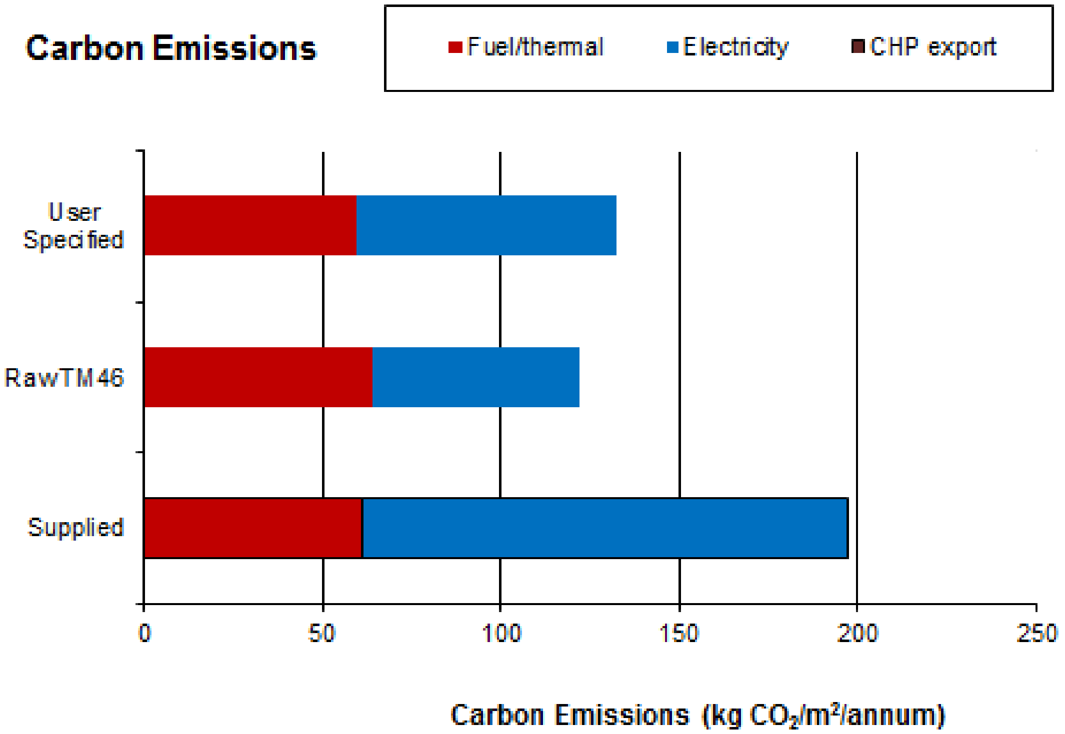


Figure 1.7 – Overall annual CO_2 emissions against CIBSE benchmarks, July 2013 – July 2014.

An estimate was made of what the gas and electricity supplies to the hotel would have been without CHP, i.e. assuming the same thermal output produced by boilers instead, and an additional import of electricity. This is summarised below. Note an assumption had to be made about the boiler plant efficiency (85%), as no reliable data on its output is available for that period.

Table 1.1 – Summary comparison of energy supplies with CIBSE benchmarks

Reference	Gas	Electricity	Carbon
South Place hotel 13 July 2013 – 13 July14	2,162 MWh/yr	1,695 MWh/yr	1,352 $tonCO_2/yr$
	316 $kWh/m^2/yr$	247 kWh/ m^2/yr	197 $kgCO_2/m^2/yr$
South Place hotel 13 July 2013 – 13 July 14 *without CHP - theoretical*	1,839 MWh/yr	1,935 MWh/yr	1,421 $tonCO_2/yr$
	268 kWh/ m^2/yr	282 kWh/ m^2/yr	207 $kgCO_2/m^2/yr$
CIBSE TM46 hotel	300 kWh/ m^2/yr	105 kWh/ m^2/yr	122 $kgCO_2/yr$
Adjusted CIBSE Guide F Good Practice benchmark: hotel + additional top floor 'restaurant with bar'	306 kWh/ m^2/yr	133kWh/ m^2/yr	132.5 $kgCO_2/m^2/yr$

Using carbon emissions factors from TM22, it is therefore estimated that the CHP led during that 1-year period to carbon emissions savings of approximately 5%, with electricity supplied from the grid reducing by ~14% and gas consumption increasing by ~ 15%. The impact of CHP on carbon emissions in that year is therefore beneficial but not substantial due to remaining issues which much reduced its operation.

Gas

Gas consumption is similar to the CIBSE Guide F 'Good Practice' benchmark, for a hotel with additional restaurant. As noted above, without CHP gas consumption would be lower, approximately 10% better than benchmarks (~10% lower).

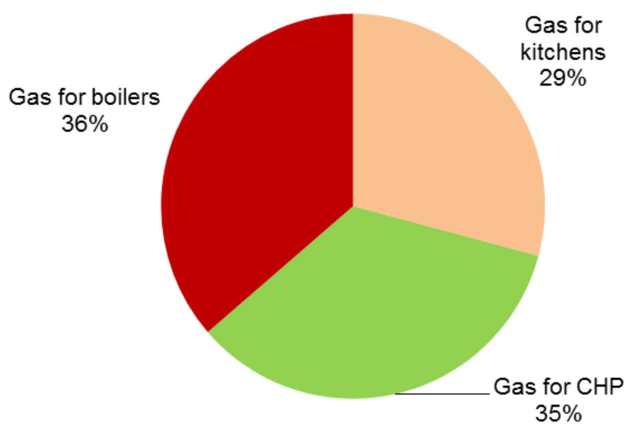


Figure 1.8 – Annual split of gas consumption (June 2013-June 2014)

Gas consumption is split into about 2/3rd for space heating and domestic hot water (i.e. regulated), and 1/3rd for catering gas. Over 50% of the regulated gas is used by the CHP, and this would be expected to grow if remaining issues with the operation of the CHP, particularly in the summer, allowed increased running hours.

The thermal load (i.e. non-catering) is split evenly between hot water and space heating, as highlighted below. The profile of monthly thermal loads over the year can provide an estimate of the base thermal load, at about 46,000kWh/month. This is could in theory support, if thermal storage had been provided as intended at the design stage and even in the summer, approximately 13 running hours (full load equivalent) of CHP operation.

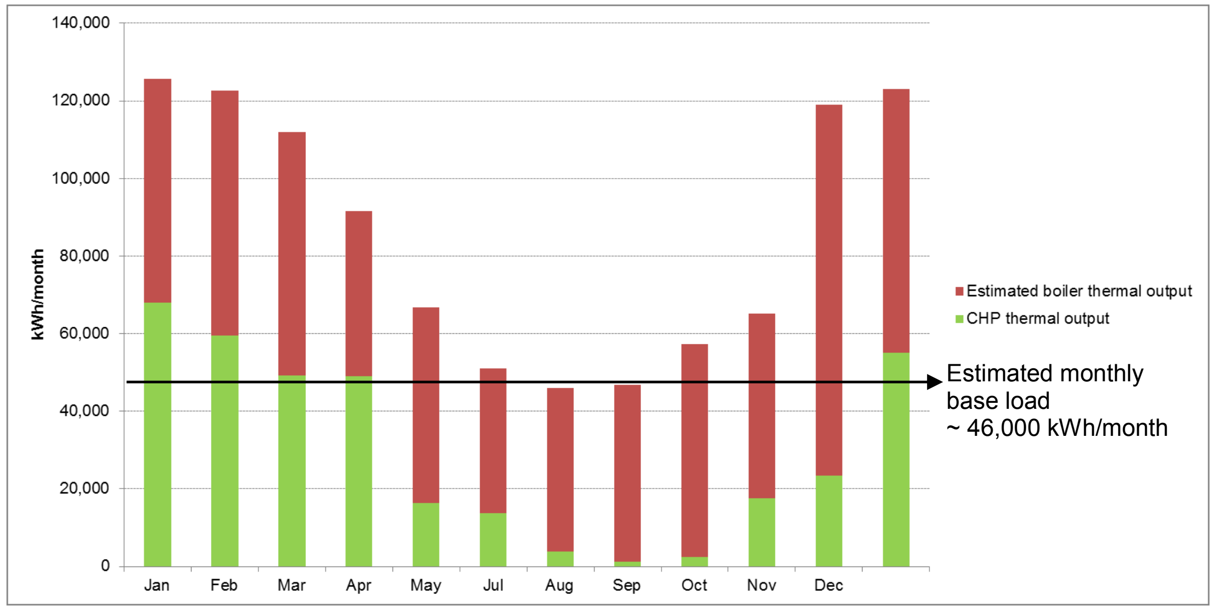


Figure 1.9 – Annual profile of monthly estimated thermal loads met by CHP and gas boiler (June 2013-June 2014, shown against Jan-Dec year)

Space heating gas consumption is approximately half that of a 'good practice' benchmark, as could be expected in a new building with higher fabric and heating plant efficiencies compared to the benchmark database (from 1999). The overall high gas consumption is due to catering consumption, which is high compared to benchmarks (see further information below and in section 10.6), and to the luxury nature of the hotel, with high water usage for showers and baths, and associated high gas use.

Table 1.2 – Summary comparison of gas consumption with good practice benchmarks

Reference		Total gas	Space heating gas	Hot water gas	Catering gas
South Place Hotel (13 July 2013 – 13 July14)	kWh/ m^2/yr	316	88	135	92
Adjusted CIBSE Guide F Good Practice benchmark: hotel + additional top floor 'restaurant with bar'	kWh/ m^2/yr	306	171	77	58

Electricity

Electricity consumption is significantly (~ 80%) higher than benchmark. Supported by feedback from the hotel management team, this may be attributed to a number of factors including:

- Age of the benchmark: data refers back to 1999. This can affect the benchmark in two opposing ways: more efficient uses such as lighting, but typically more small power uses from IT and consumer appliances.
- High occupancy rates: the hotel's success results in occupancy rates at 85% on average, with regular 100% occupancy during the week, which the hotel operator have stated are higher than average in the industry
- High-end specifications, meaning that the building is heavily serviced and includes a number of appliances and high-end equipment, including AV, in each bedroom.
- Other factors such as plant inefficiencies, controls etc will also impact on energy consumption, but have not been specifically identified in this study. The facilities management team are very pro-active in energy management and this is expected to some extent to limit inefficiencies.

The contribution of each of the above is difficult to quantify due to the relatively limited availability of detailed benchmarks, and there is a need for more benchmark data, including more recent case studies and wider samples.

The following estimated breakdown was created using CIBSE TM22, highlighting the main uses as fans and pumps, small power, and catering. Estimated efficiencies are included in this report.

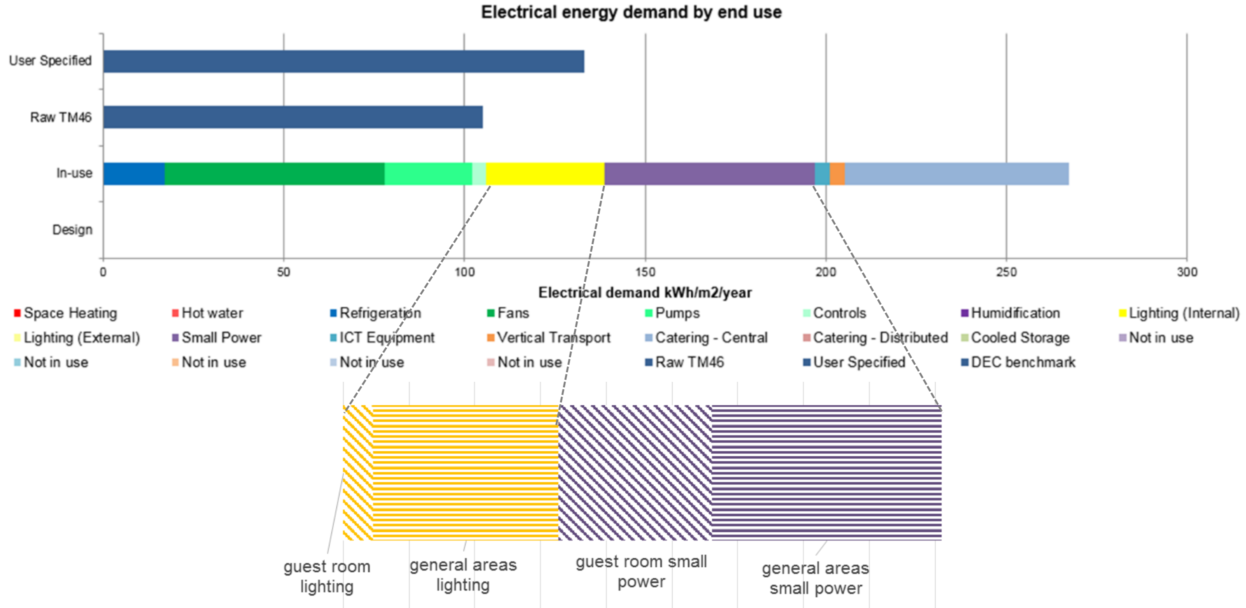


Figure 1.10 – CIBSE TM22 breakdown of electricity uses, including breakdown of lighting and small power into guest rooms and communal areas (June 2013-June 2014, shown against Jan-Dec year)

The building's base load was estimated at ~150kWe (~22W/m^2) occurring between 2 and 4am, and similar on weekdays and weekends, resulting in approximately 75% of the annual electricity consumption. This is higher than the design stage estimate and, while it may be partly explained by the 24/7, air conditioned nature of the hotel, may also indicate an area of potential energy savings. The main components of this base load are MCC power, general lighting and small power, kitchen equipment, fans, and guest room lighting & small power (20kW, i.e. 250-300W per bedroom). The large contribution of MCC to overall consumption is also reflected in the overall 'fans and pumps' allocation. In relation to fans consumption, it should be noted that modifications to the initial design were implemented by the contractor which may impact energy consumption, including serving the two restaurants from the same air handling unit.

Unregulated loads are a significant contributor to the hotel's energy consumption, with catering gas ~ 30% of the total gas consumption and unregulated electricity ~ 50% of the total electricity consumption, split equally between small power / appliances and catering electricity[2]. Beyond equipment selection and controls, this relates to the hotel and restaurant management team and is largely out of the control of the design team.

Catering gas and electricity were benchmarked using average meal data provided by the hotel:
- Gas: 9.5-11.4 kWh/meal, depending on the kitchen
- Electricity: average 4 kWh/meal (no individual sub-metered data available on the energy management software and therefore to the BPE, although meters are installed).

A simple comparison with benchmarks [CIBSE TM50, ref. 7] indicates that this catering consumption is high, particularly for gas.

Domestic Hot Water (DHW) generation and CHP Operation

The CHP unit size (70kWe) was as per specified, but the unit was installed as per final design by the contractor, with the omission of thermal stores compared to the design stage where large stores were proposed. The installation also included modifications to the DHW generation design.

The CHP operation and analysis represented a significant part of the time spent by the BPE team (other than time spent gathering metered energy data and using it in the CIBSE TM22 tool). This was related to three main issues:

- DHW generation, including drops in temperature. Modifications to the controls strategy were implemented in the 2nd year of operation but, at the time of this report, the FM manager still reports recurring issues with the hot water temperature (on occasions below 55^{o}C at the calorifier outlet). This remains an important outstanding defect.
- The omission of thermal stores
- Electrical modulation on the CHP unit was installed but thermal modulation was not (despite being specified). This was identified by the contractor approximately two years after hotel opening, towards the end of the BPE project. Thermal modulation was retrofitted and this, along with modifications to the controls strategy, led to increased running hours during a short period at the end of the summer, reviewed by the BPE team; the installation was therefore approved on the proviso of further monitoring (by the FM team) to be carried out the following summer, 2016. Further issues however occurred shortly afterwards which the contractor attributed to the modulation kit being wrongly connected to the BMS and interfered with it, and the kit was therefore disconnected. At the time of this report, a correct connection still needs to be installed and this remains an important outstanding defect.

Overall, the CHP unit has contributed to approximately 35% of the thermal load (July 13 – July 14), producing approximately 10% of the building's electricity consumption and reducing carbon emissions by approximately 5%. It has operated long hours in winter (18-19 hours per day on average) but at much reduced hours in the summer when hot water demand was highly intermittent. In the summer, the above modifications seemed to have allowed running hours to reach 8-9 full load equivalent hours per day on average, compared to the estimated available 13 daily hours of full load operation – this should be confirmed over a longer summer period, once the modulation kit is re-installed.

[2] Small power also includes, for part of the period analysed under CIBSE TM22, the outdoor heater retrofitted by the hotel operator. This was not individually itemised in the TM22 spreadsheet but would strictly speaking fall under 'space heating' uses.

1.6 Key Conclusions and Lessons Learnt – Water Consumption

There remains defects relating to the water metering strategy, key of which

- Mains water meter: one of the meters can be read manually, and readings are taken daily by the FM team, however the data available on the BMS is widely inaccurate.
- Cold water sub-metering: while total cold water consumption is available, the breakdown into sub-meters available on the BMS does not add up and this is a significant constraint in identifying restaurant vs hotel bedroom use. This is discussed in more detail in the water consumption analysis section 11.

The following figure shows monthly water consumption over 2 years, from March 2013 to February 2015, which excludes the 1st six months of operation. The hotel's management team implemented efficiency measures at the start of the 2nd year but there is an upwards trend in water consumption, which without more accurate data on bedroom and restaurant uses cannot be explained by the BPE team at this stage.

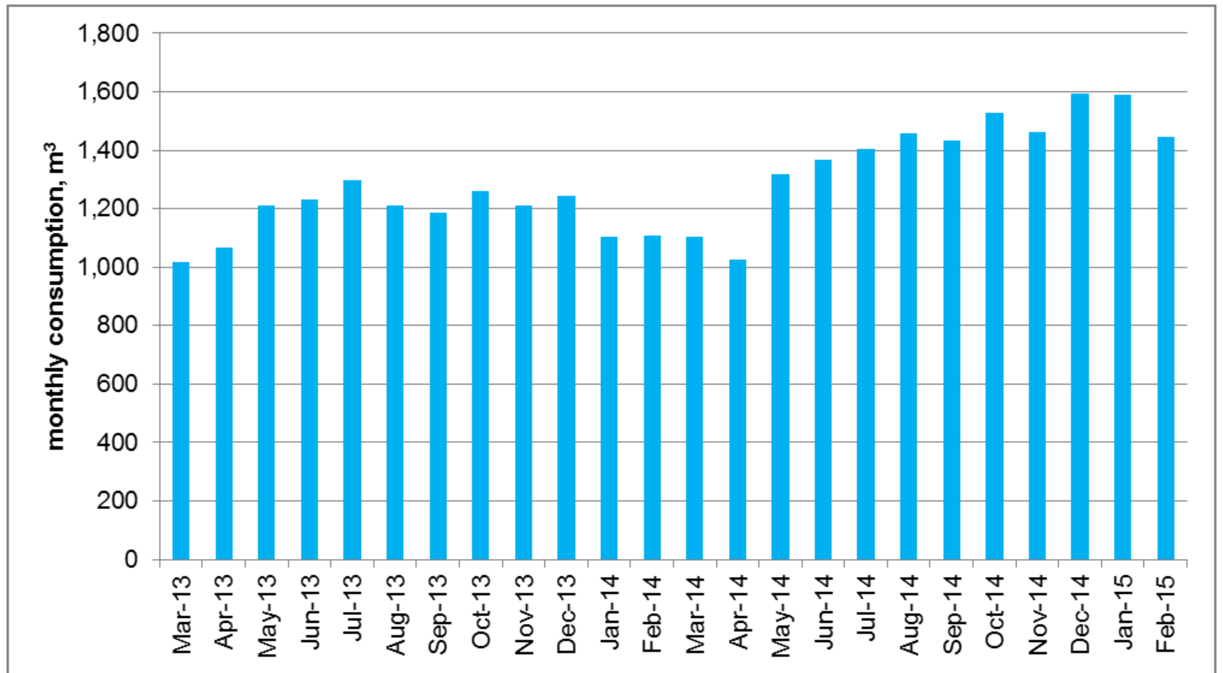


Figure 1.11– Monthly water consumption, Mar 13 – Feb 15

Benchmarking is not straightforward due to the relative lack of benchmarks: luxury hotels are known to have high water consumption: they have been shown to use 300-450 litres per bedroom [4], and this figure is consistent with the hotel operator's own benchmark from previous operations. Benchmarks from CIRIA [5] are however much lower – see table below. Consumption is presented here in relation to the number of bedrooms sold (as per data available from the hotel) rather than guests (used in benchmarks); most bedrooms are expected to be used by single occupants, as weekday business guests form a large part of the rooms sold. More accurate data on guest numbers is however not available to the BPE team.

Table 1.3 - Comparison of South Place water consumption with benchmarks

South Place Hotel, February 2013- February 2014		590 l / bedroom	14, 152 m³ / yr
South Place Hotel, February 2014-February 2015		697 l / bedroom	16,727 m³ / yr
Green Hotelier (from EMH) – also used by South Place FM team from previous operations	Excellent	300 l / guest	
	Good	450 l / guest	
	High	700 l / guest	
CIRIA	Best practice		2,400 m³ / yr
	Good practice		4,800 m³ / yr
	Above average		12,000 m³/ yr

Overall water consumption data from this hotel is well above CIRIA benchmarks, and above 'good', approaching 'high' benchmarks from the hotel operator. This is attributed to two key factors:

- The data relates to the building's total water consumption, including both restaurants. Given the significant contribution of the ground and top floor restaurants to overall gas and electricity consumption, it is expected that they will also contribute significantly to the building's water consumption.
- As a luxury hotel, bathrooms are seen as a significant part of the offer to guests, and the quality of the water appliances is regularly commented on extremely positively in customer reviews (see section 8.2 for detail).

Due to remaining defects in the water metering, an accurate analysis of water consumption into individual uses cannot be made, however the following was estimated (see section 11 for details).

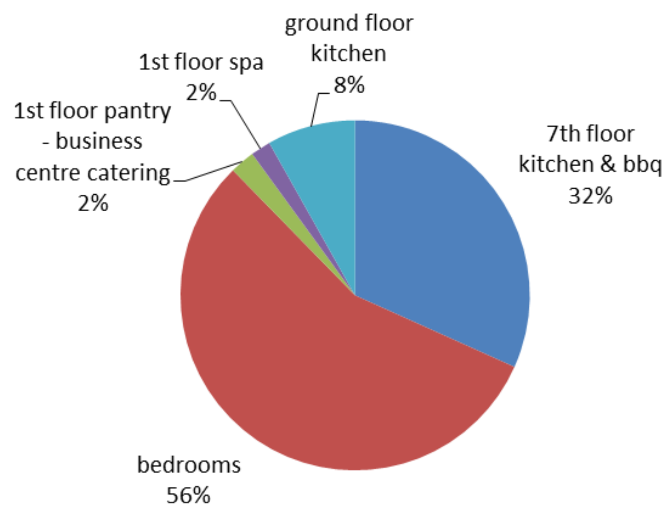


*Figure 1.12– **Estimated** Water consumption breakdown into uses [total from opening i.e. Sept 12 – Mar 15]*

On this basis, the water consumption from bedrooms would then be just over half of the total, with the resulting benchmarks:

- Bedrooms: 390 litres / bedroom sold
- Restaurants: Ground floor ~ 17 litres / meal; 7th floor restaurant ~ 150 litres / meal.

The wide difference in the estimated water consumption per meal between both restaurants is not explained and should be treated with caution due to the lack of reliable data and reliance on assumptions – see section 11 for details.

Water saving measures were implemented by the FM team over the course of a few weeks in the hotel's second year of operation, with the introduction of flow restrictors on showers and wash hand basin taps. This was carried out with incremental changes to the flow rates and starting on a small number of bedrooms only, while monitoring the feedback of guests (helped in this by the large proportion of repeat guests). While not directly quantifiable as historic water consumption in guest rooms is not available, this is expected to have led to significant savings, allowing the shower flow rates to be reduced by approximately 15% (from approximately 20l/min to ~15-17l/min).

1.7 Key Conclusions and Lessons Learnt – Technical Issues

Building services

- **There are over 80 meters in the building, most of them now connected to the BMS and/or energy monitoring software.** While **this large amount of meters** (i.e. the resulting data) may be useful in the long-term as energy and water management moves from overall analysis to focusing on specific items, it **has in itself proved a challenge for the BPE study** (and the FM team), due to the time and work involved from the contractor in ensuring meters were all fully operational, connected and providing reliable data to the BMS and energy monitoring software. At the time of this report there remain defects with the metering strategy, including the BMS connection of one of the mains water meters which means that the FM team still relies on manual readings for monitoring of overall water consumption (while data on the majority of the sub-meters is now available on the BMS). In addition, while a number of small energy uses are sub-metered (e.g. individual meters on each lift), large uses are omitted or expected to be analysed by 'virtual metering' (i.e. by summing or subtracting totals from other meters) – this does not help the data reconciliation exercise and analysis.
- **Complex services, controls and sub-metering require a robust handover and commissioning** period. High-tech controls and gadgets are also appreciated provided they work well, and a period of fine-tuning is therefore very beneficial in ensuring guest satisfaction. Support from the facilities manager was crucial in facilitating the study and optimising performance.
- In hotels, room control systems (AC, lighting etc) are often procured separately from the BMS. Linking room controls to the main BMS rather than to a dedicated system would facilitate energy monitoring and management.
- In the absence of thermal stores, CHP electrical and thermal modulation functions are critical in order to maximise running hours and allow efficient operation. CHP can then make a significant contribution to the annual thermal load – in this hotel this is estimated at approximately 60% of the annual load.

Architecture and interior design

Feedback from both transient and permanent users is very positive on the overall architecture and interior design. This is detailed in the user feedback sections 8.1 and 8.2. Key lessons identified are:

- **Interior design and luxury amenities (e.g. water appliances)** were key parameters in guest satisfaction. This represents a clear challenge to cost- and water-savings.
- There will be **challenges in combining front-of-house, back-of-house, and staff needs,** particularly in dense urban locations. The inclusion of end users in the design process is useful, for example for crucial areas such as reception and entrances which are heavily used and are the establishment's 'public front', and to inform storage space requirements. While specialist end-users can inform individual items, involving an experienced hotel manager should also be considered to provide an overarching view and help prioritise the various needs and constraints.
- Early design briefs cannot necessarily accommodate future changes in operation. For example, the success of the ground and first floor bars has meant a higher numbers of events than initially expected, and the need for regular management by the hotel to avoid disturbance to other hotel or restaurant guests. The hotel has implemented a mitigation measure in installing a light canopy roof on the outside first floor bar to avoid noise disturbance to the surrounding bedrooms.

BREEAM

The building achieved BREEAM Excellent at design stage (carried out by the sustainability consultant) and post-construction (carried out by the contractor's assessor). While a high BREEAM rating is no guarantee of a truly 'sustainable' building, it is a sign of the client's aspirations and of the team's capacity to deliver against these aspirations from briefing through to design stage and post-construction review, which can be used as independent quality check on specific items.

A review by the BPE team of post-construction evidence highlighted that some credits were attributed which did not necessarily reflect the as-built installation. In addition, key credits such as those requiring seasonal commissioning for the first year of operation can be and were attributed on the basis of contractual arrangements or commitments, rather than verified implementation. **Opportunities for BREEAM to help deliver better performance in practice are therefore not taken full advantage of**. This is considered representative of industry practices.

As anecdotal evidence, the number of **cycle storage** spaces required for BREEAM is well below that which the staff would require. This aligns with feedback gathered incidentally by the BPE organisation on a number of other projects in London, where cycle take-up is often higher than designed for.

1.8 Key Conclusions and Lessons Learnt – Process and Procurement

End-user involvement in the design - While specialist hotel consultants were involved in the design process, and commercial imperatives and space constraints would always be difficult to balance, the hotel manager and facilities manager were only involved 6 months before completion, well into the construction stage. The project would likely have benefited from earlier input from an individual experienced in hotel management to balance the various demands and take an overarching decision role. This was compounded by the fact that it was the first hotel for the hotel operator, in contrast with the restaurants, in which they are very experienced.

Robust handover - The study highlighted the need for a robust handover period, including significant attention to commissioning and meter reconciliation. The BPE project started at PC of the hotel and the scope was therefore always structured to include a period of 'enhanced handover' rather than only building performance evaluation. This proved useful in providing a certain level of continuity through staff changes in the project team, and in ensuring a focus on performance and efficient operation rather than solely defects solving. To some extent the role of the BPE team extended to tasks which could be expected to be carried out by others as part of their normal duties (e.g. issues related to DHW production and meters commissioning). Again, this is expected to be somewhat representative of the industry, where services post-PC often focus on solving major defects rather than performance and the many elements of the BPE study are typically outside the normal scope.

This is a common lesson from post-occupancy evaluation studies but is compounded in the case of hotels or other buildings with 24-hour operation, which cannot benefit from periods where the building is empty or little used, such as evenings or weekends in offices. As a result and in retrospect, the developer has commented that it may have been beneficial to delay the hotel opening to allow more actions to be completed before PC and opening.

Management and operation: 'Gold Dust' - Support from the facilities manager is crucial in facilitating the evaluation of a building and optimising its performance. The hotel's facilities team, and particularly the facilities manager, are very pro-active and have been instrumental to the BPE project by providing daily manual readings of the gas and electricity meters, as well as ensuring the focus remained on the contractor to resolve defects. There is no doubt that this is an extremely important factor in this building's performance. It should be noted that the facilities management team do not receive financial incentives for energy and water consumption savings, and any savings in the utilities budget are not transferred into a fund for capital investment into further efficiency measures.

The quality of service is also a crucial factor in guest satisfaction. In this hotel, this helps ensure that high-tech appliances and controls are understood by staff – this is however clearly outside the design team's control and should not be relied upon at design stage.

Impact of procurement on performance outcomes – a number technical issues, for example the installation of CHP, resulted from changes which were implemented on the original design proposals, and existing verification processes such as BREEAM were not necessarily used to the full. In addition, a number of findings on this project are recurring themes from POE studies (e.g. the importance of handover, the tendency for controls to be too complex and/or require extensive fine-tuning before full acceptance by end-users). It is expected that there would be value in a wider analysis of performance processes on performance outcomes, to ensure that 'lessons learnt' are disseminated but also facilitated by procurement processes, appointments, definitions of roles and responsibilities of key individuals etc.

Quality checks - Fabric: Airtightness and thermography surveys were carried out before completion and results seemed satisfactory, however it seems that the detailed conditions and procedures employed probably mean the results should be viewed with caution, and **opportunities for these tests to help review and improve fabric performance were not taken full advantage of**.

1.9 Challenges during the BPE project

Defects period and data availability

The BPE project experiencing delays and challenges compared to the initial monitoring plan. These were largely related to issues un-resolved on site outside of the control of the BPE team. This has proved a serious challenge in limiting the availability of reliable meter data and reducing the period available to evaluate the performance of the building overall and of key items, including the CHP. On the other hand, the BPE project probably helped ensure a retained focus on some actions and on building performance rather than defects only.

It should however be noted that long-standing defects and the lack of reliable meter data are considered representative of the industry, and can be compounded in new buildings by the presence of a large number of meters; this is therefore considered a conclusion in itself. As a result, it is recommended that energy consumption data from the first year of operation should typically only be used with caution - this study is mostly based on data from the second year.

Resources and staff continuity

Key members of the engineering design team left the team towards the start of the BPE project: the project Partner left before start of the BPE project; the lead mechanical engineer left on sabbatical in the first few months of the BPE project and then left the organisation. While other MEPH engineers were then involved, this resulted in a loss of historic knowledge and intimate involvement on the project. This did not facilitate the BPE but also to some extent highlighted its importance in providing a certain level of continuity and additional resources to the handover process.

CIBSE TM22

The TM22 tool is considered a useful tool in meter data reconciliation and benchmarking, particularly for buildings where reliable and extensive benchmark data is available, e.g. offices. In this project however, the time spent on gathering energy consumption data and using it in the CIBSE TM22 tool represented over 50% of the project's total time spent. It is unlikely that most post-occupancy evaluation projects would be able to accommodate the same amount of time, without funding such as that provided for the BPE.

Alternative methods will likely be preferable in most cases for at least the first stages of analysis, involving less sub-metered data and focusing on key items e.g. annual consumption, patterns of consumption during times of low and high occupancy (e.g. to identify needless energy use at periods of low operation), and main plant items and building uses such as, in the case of a hotel, catering and hot water. It is also expected that the equivalent amount of time spent on site visits and working closing with the building management teams would be more likely to identify opportunities for energy savings and performance optimisation.

1.10 Feedback Loop and Dissemination of Lessons Learnt

Engagement with industry and other designers

Key lessons have already been disseminated to industry via two events: the CIBSE technical symposium, April 2015 [6], and Green Sky Thinking event, April 2015, organised by Innovate UK.

The BPE organisation are working as building services engineers and sustainability consultants in the design of a new restaurant for the same operator as South Place Hotel, and designed by the same interior architect. This has already provided opportunities for direct feedback and incorporation of lessons learnt. For example, while over-door heaters had been considered at early stages and not included in South Place hotel, their retrofitting in the 2nd year of operation means that the design team for the new restaurant reviewed their possible installation, planning for it earlier on and allowing its connection to the central hot water services.

Engagement with academia

- Masters student from UCL in summer 2013, to build dynamic model (TAS) for energy consumption modelling – see Appendix C
- Presentation to KLC School of Design master students as part of 'Hotel of the Future' project – see presentation Appendix D

Opportunities for future dissemination

- Publication in wider press e.g. joint paper with client and architecture team
- Presentation to hotel operator and representatives from their other establishments – this could help provide data to the FM team for benchmarking energy and water use
- Dissemination within BPE organisation e.g. part of internal presentations and CPDs

2.0 Glossary

A&M	Allies and Morrison
AHU	Air Handling Unit
BMS	Building Management System
BPE	Building Performance Evaluation
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Methodology
BUS	Building Use Studies
CHP	Combined Heat and Power
CIBSE	Chartered Institution of Building Services Engineers
CIRIA	Construction Industry Research and Information Association
DHW	Domestic Hot Water
EPC	Energy Performance Certificate
ERs	Employer's Requirements
FM	Facilities Management
GIA	Gross Internal Area
IES	Integrated Environmental Solutions, proprietary name for building modelling and simulation software
LTHW	Low Temperature Hot Water
MCC	Motor Control Centre
MEPH	Mechanical Electrical and Public Health
NIA	Net Internal Area
O&M	Operation and Maintenance
PC	Practical Completion
POE	Post Occupancy Evaluation
RIBA	Royal Institute of British Architects
TAS	proprietary name for building modelling and simulation software
TSB	Technology Strategy Board, now Innovate UK
VOCs	Volatile Organic Compounds

The following definitions are used throughout the report:

- Benchmark: figure taken from industry standard source (e.g. CIBSE Guide F or Energy Consumption Guide 19) or other sources (e.g. hotel manager's experience from other hotels)
- Dynamic energy model: prediction of energy consumption using dynamic modelling software (TAS)
- Actual consumption: figures taken from the reading of the hotel's gas, electricity and water meters
- CIBSE TM22 'Design': TM22 worksheet set up using installed plant items with intended operational profiles.
- CIBSE TM22 'In Use': TM22 worksheet set up using profiles to be adjusted based on knowledge of actual operating profile.
- CIBSE TM22 'sub meter data': actual consumption as recorded by sub-meters.

3.0 Introduction

3.1 The Building

South Place Hotel is a new high-end, high-specification boutique-style hotel near Moorgate, within the London Borough of Islington. It consists of approximately 6,000m² (Net Internal Area) over eight floors (1 basement and 7 above ground), and plant at roof level. The hotel comprises of 80 bedrooms, 2 restaurants and commercial kitchens, a re-heat kitchen, a bar, a gym and small spa, meeting and conference spaces, and private dining rooms. It opened in September 2012

The hotel was jointly developed by Frogmore and D&D London and is now leased and operated by D&D London as its first London hotel. Allies and Morrison were the architects for the façade and Conran and Partners, partly owned by D&D, for the interiors. The hotel was procured as a Design and Build project, with the architects (Conran and A&M) novated to the contractor and the MEPH engineers staying client side in a monitoring role:

Developer:	Frogmore
Hotel Operator:	D&D London
Project Manager:	Gardiner & Theobald
Architects:	Allies and Morrison (façade and floor layouts)
Interior Architects:	Conran
Mechanical, Electrical, Public Health:	Hoare Lea to contract, then NG Bailey
BREEAM:	Hoare Lea Sustainability to contract, then Capital Symonds for McLaren
Contractor:	McLaren
M&E Contractor	NG Bailey

It is a luxury boutique hotel and sustainability is not a key element of its marketing, although the hotel's website includes a sustainability credentials page ('Green Creds' section):

'' South Place Hotel has been built using a number of sustainable construction techniques and includes CHP (Combined Heating Power) to generate its own power which is used to heat the water. CO2 emissions are 40 per cent lower than required by current legislation, and sensors are in place to detect whether or not a room is occupied and to adjust energy settings accordingly. The restaurants and bars at South Place Hotel are members of the Sustainable Restaurant Association, and all members of staff receive training about waste management and sustainability ''.

Figure 3.1: South Place Hotel – Front elevation (south-west)

3.2 Hotel Data In Support of Analysis

The hotel management team provided the following estimated average monthly data:

Meals served

- Basement kitchen: food preparation serving all other kitchens
- Ground floor kitchen: 5,000 (full seated breakfast, lunch, dinner) + 500 room service meals
- First floor kitchen: 1,000-1,500 for events
- 7th floor: 2,500 per month (lunch and dinner).

Hotel occupancy rates

The hotel experiences high occupancy rates, with an average of 85%, and routinely 100% on weekdays. This translates into an average of 2,000 bedrooms sold per month. Room sold data was obtained for the first few months of operation, as shown below. This justifies excluding the first few months of energy and water data from the analysis, as the building was in its 'settling in' period and the hotel not yet fully established on the market.

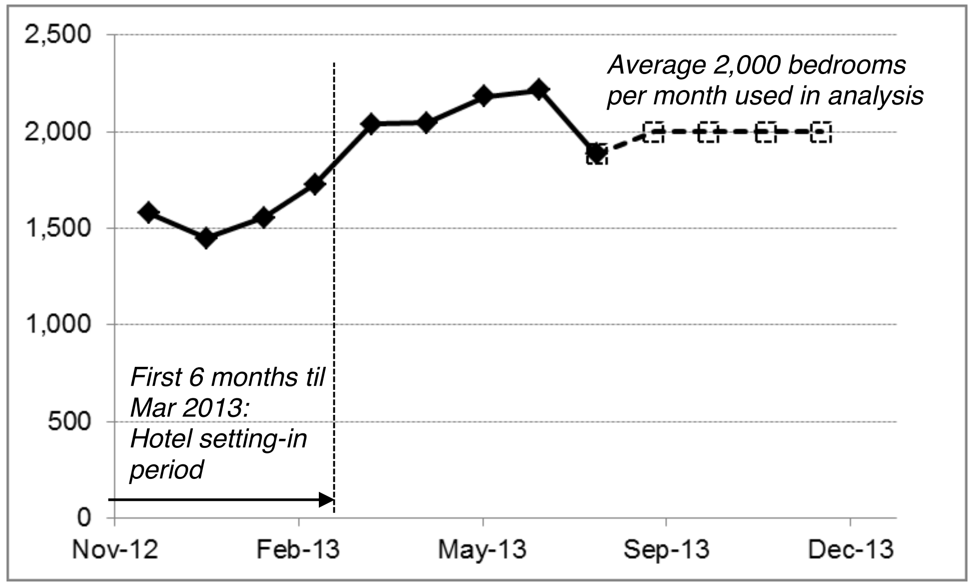


Figure 3.2: Bedroom sold data – initial figures, and average used in BPE analysis

3.3 BPE Scope and Methodology

The BPE was led by the sustainability consultants, who were involved from early design stages to develop the energy strategy in the support of the planning application and design stage BREEAM assessment. They are independent but part of the MEPH organisation.

The BPE study started on 1st September 2012, on the same week as the hotel opened with partial Practical Completion (PC). Remaining areas of the hotel were gradually completed and full PC was granted late October 2012. The contractor has remained and is still involved in resolving defects for at the time of this report.

The BPE project scope was defined as a 'hybrid' between the scope for buildings in use and that for buildings under construction, in order to bring the best benefits to the hotel from the study:

- First stage: 'enhanced handover', without actual monitoring – this was intended to cover the first two quarters but expanded as defects were not fully resolved in that period
- Second stage: initial data analysis and performance monitoring: this was intended to start after the first 6 months of occupation, and data was indeed available for analysis at that time, although less than initially planned
- Third stage: refinement in performance analysis, and production of a long-term management and monitoring plan for the hotel operator.

Regular engagement was made by the BPE team with the hotel operator and project team to understand the hotel's operation and to review key defects items and the building's performance more generally. The methodology and analysis tools included:

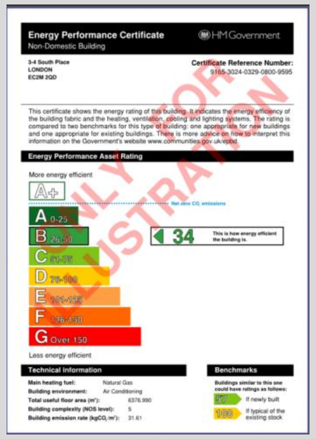
- Liaison with the hotel operator and project team: site visits, review of contractor proposals, and meetings as part of the handover and defects period attended by the project team including contract administrator, main contractor, MEPH contractor, building manager, and other team members as required such as controls sub-contractor and CHP manufacturer.
- Analysis of energy consumption:
    - High-level analysis by comparison of metered data (provided by the contractor, hotel operator and CHP manufacturer) with CIBSE Guide F and CIBSE TM46 benchmarks
    - CIBSE TM22, using data from sub-meters over a year (where available)
- Analysis of water consumption using meter readings provided by the contractor and hotel operator
- Permanent user (i.e. staff) satisfaction surveys using the Building Use Surveys (BUS)
- Interviews with the hotel manager and heads of department
- Transient users (i.e. hotel guests and restaurant customers) feedback: analysis of customer review websites and reception logs.

4.0 Review of Design Data and Metering Strategy

4.1 Design vs As-Built Data

The project was subject to high sustainability standards, largely driven by planning, with a target of BREEAM Excellent which itself includes the requirement for an Energy Performance Certificate (EPC) rating of no worse than B (40). These targets were achieved at design and as-built stages, with details as follows. [3]

Table 4.1 – Comparison of design and as-built EPC and Part L results

Design Stage (2nd December 2010)	As Built (2nd August 2012)
EPC	
For BREEAM purposes **EPC B(39)** 2006 EPC Methodology: SBEM 3.5.a.0 Sofware: TAS Virtual Environment v6.1.1	**For BREEAM purposes** **EPC B(34)** 2006 EPC methodology: Software: IES v.6.1.1.2 
Building Regulations Part L 2006	
Target Emissions Rating (TER) = 59.7kgCO_2/m²/yr Building Emissions Rating (BER) without CHP = 50.7kgCO_2/m²/yr i.e. ~ 15% improvement BER with CHP = ~ 40kgCO_2/m²/yr, estimated from an expectation at design stage that CHP would provide a 30% saving on regulated CO_2 emissions	TER = 53.3 kgCO_2/m²/yr BER with CHP = 31.6 kgCO_2/m²/yr

[3] By comparison, actual energy use (see section 10.0) is estimated to represent ~200kgCO_2/m² (i.e. over 6 times the as-built BER), over 1/3rd of which is un-regulated. This highlights both that Part L is not a prediction tool (even of only regulated uses), and that it would in any case exclude a large part of overall energy uses and associated carbon emissions.

4.2 Metering Strategy

The hotel included a large amount of meters, in order to meet Building Regulations and BREEAM requirements. In particular, the following was expected as part of the design to meet associated BREEAM credits:

- Energy sub-metering of the main energy uses and plant items
- Energy and water sub-metering of key areas, including kitchens, restaurants, spa, and bedroom floors.

A certain level of sub-metering also went beyond these requirements, for example as driven by the configuration of the hotel itself .e.g. number of risers.

The design stage metering strategy (as submitted for the BPE bid) is included in Appendix E.

Lesson Learnt - The amount of meters and resulting data may be useful in the long-term as energy management moves from overall analysis to focusing on specific items, but it has in itself proved a challenge for the BPE study, due to the time and work involved from the contractor in ensuring meters were all fully operational, connected and providing reliable data to the BMS.

Over 80 meters are now installed and linked to the BMS and energy monitoring software, broadly in line with the design stage strategy apart from:
- Omission of LTHW and chilled water sub-meters
- Omission of DHW sub-meters floor by floor, which were initially expected to allow separate monitoring or bedroom floors with and without a bath.

Please refer to Appendices E and F respectively for details of the metering strategy at design and PC stages, and to sections 5.2 and 5.3 for a more detailed commentary on the status of metering and data availability.

4.3 BREEAM

While a high BREEAM rating is no guarantee of a truly 'sustainable' building, it is seen as a sign of the client's aspirations and team's capacity to deliver against these aspiration from briefing through to design stage and post-construction review.

The hotel achieved BREEAM 2008 Excellent at the design stage (carried out by the BPE lead Hoare Lea in their role as sustainability consultant and BREEAM assessor) and at the Post-Construction Review stage (carried out by another consultant appointed directly by the contractor).The following is a high-level review of differences. The following table summarises the main differences between the design stage and post-construction assessments.

Table 4.2 – Comparison of design and post-construction BREEAM scores

	Design Stage	Post-Construction Review
Overall	**BREEAM Excellent total score 71.95%**  breeam The Code for Sustainable Buildings This is to certify that South Place Hotel, 3-4 South Place, Islington, London EC2 has achieved an interim score of 71.95%, and a BREEAM rating of EXCELLENT Pass Excellent Outstanding This Design stage assessment was carried out under the 2008 version of BREEAM Bespoke Signed on behalf of BRE Global Ltd — 27th January 2011 Date Julie Godefroy Licensed Assessor — Hoare Lea On behalf of Frogmore Developer / Client — Allies & Morrison Architect H Smith Demolition Contractor Certificate Reference: HL-BES-JGD01-4 breglobal www.breeam.org	**BREEAM Excellent total score 72.25%**  breeam The Code for Sustainable Buildings This is to certify that South Place Hotel, 3-4 South Place, Islington, London, EC2 has achieved a score of 72.25%, and a BREEAM rating of EXCELLENT Pass Excellent Outstanding This Post Construction Review was carried out under the 2008 version of BREEAM Bespoke Signed on behalf of BRE Global Ltd — 19th December 2012 Date Jacqueline Roberts Licensed Assessor — Capita Symonds On behalf of Frogmore Client / Developer — Allies & Morrison Architect H Smith Demolition Contractor Certificate Reference: BREEAM-0035-1392 breglobal www.breeam.org
Health and well-being		- 1 credit related to the Volatile Organic Compounds (VOCs) levels of internal finishes and fittings. The credit was withheld due to lack of information from suppliers. This is relatively common issue as design teams often only realise the full extent of the credit requirements, their restriction on the supply chain, and the full selection of fittings and finishes, some time during the construction process. In addition, the amount of information required at post-construction is time-consuming to gather and can be difficult to obtain from the supply chai
Energy		• + 1 credit: related to EPC rating (see above section 4.1). • Credit for floor-by-floor sub-metering of LTHW and chilled water awarded despite no such metering in place.
Water		• increase in 1 credit, not related to an increase in specifications but a different interpretation for the credit requirements (i.e. whether the requirement for solenoid valves in toilet facilities also applied to bathrooms , or only to toilet facilities)
Materials		• + 2 credits due to increased responsible sourcing levels, particularly for concrete and plasterboard
Waste		• + 1 credit for reduction of construction waste (3.64 tons per 100m^2 GIA, against the max 6.5ton originally targeted) • - 1 credit for segregation from landfill (only ~60% of construction waste was diverted, rather than the minimum 75% of construction waste and 90% of demolition waste originally targeted)
Pollution		• -1 credit for refrigeration leak detection, although it is unclear why this was not awarded since the installation seems to have been as per design

A review by the BPE team of post-construction evidence highlighted that some credits were attributed which did not necessarily reflect the as-built installation. This occurred for example when credits were attributed on the basis of contractor's statements rather than independent verified implementation or using 'for construction' rather than 'as built' information. In particular:

- Sub-metering of LTHW and water consumption, which was awarded on the basis of contractor's statement, but not installed to the level specified
- Commissioning: this was awarded on the basis of commissioning completion reports provided by the M&E contractor, but without evidence on independent commissioning monitoring. The O&M manuals (not referred to by the BREEAM report) state that an independent witnessing agent employed by the main contractor witnessed and signed off the systems, however it is unknown whether their detailed scope would have met the BREEAM requirements.
- Seasonal commissioning: awarded on the basis of a programme for seasonal commissioning submitted by the contractor, without evidence of on-going roles and responsibilities by the rest of the team, including the independent monitor.

This is in some cases attributed to the assessor's approach, and in others allowed by the BREEAM credits, which typically are awarded at post-construction without a requirement for involvement or verification in the first 12 months.

Lesson Learnt - **Opportunities for BREEAM to help deliver better performance in practice were not taken full advantage of**. This is considered representative of industry practices.

5.0 Inspection of Build Quality

5.1 Defects

Practical Completion (PC) was granted in stages from 1st September 2012, with full PC on 29th October 2012. PC was granted with a number of defects.

The resolution of the following defects was of particular importance to the BPE study:

- Availability of a number of meters on the BMS, and their reconciliation. This took a significant time of the BPE team and is not fully resolved yet.
- Energy monitoring software (SIPe): now operational, with training sessions provided to hotel staff, one of which attended by the BPE team. The BPE team was involved throughout to comment on the availability of meter data and user interface, up to the last quarter of the BPE study.
- Floor-by-floor heat sub-meters on LTHW and chilled water – see section 5.3: this was not installed and not identified on the defects list. It was agreed with the project team that, due to the disruption which would be caused to the hotel's operation by retrofitting them, the meters would not be installed.
- DHW generation and CHP operation. The design proposals were modified by the contractor, with the omission of thermal stores and the incorporation of the CHP on the DHW rather than LTHW side. This, alongside modifications to the DHW and controls strategy, contributed to limited running hours and inefficient operation (multiple on/off) from the CHP in the summer, and the BPE team spent a large amount of time on this item, working with the client-side MEPH monitor, the facilities manager, contractor, MEPH contractor, and CHP manufacturer reviewing contractor's proposals to seek a solution for optimising CHP operation. This is not fully resolved at the time of this report, almost 2.5 years after opening – see details in section 7.3.

  Other – health and safety: During their stay at the hotel, a member of the BPE team noticed that the full height windows in the courtyard bedrooms, openable for cleaning purposes but not meant for ventilation, were openable to a certain angle, albeit with a security restrictor. This was raised with the hotel operator and façade architect. Keys are meant to be provided to cleaning staff alone, and windows should generally be locked. It appears that some of the windows had not been left locked on completion by the contractor.

Lessons Learnt

- The above actions would to a large extent be expected as part of the project team's main scope, and the BPE team worked alongside them rather than leading on resolving defects, but it provided a further focus on performance, regardless of whether the hotel was 'operational'.
- While it is common for buildings to be handed over with similar defects, particularly around availability of metered data and complex systems such as CHP, resolving defects is particularly challenging in a hotel or other building with 24/7 operation, compared to buildings such as offices where works can be carried out a night-time or weekends. As a result and in retrospect, the developer has commented that it may have been beneficial to delay the hotel opening to allow more actions to be completed before PC.

5.2 Metering Strategy

As noted in the previous section 4.2, the design intent included a large amount of sub-metering. At the start of the BPE study the following diagrams were produced at to represent the as-built metering strategy as understood at the time, based on design proposals and initial information provided by the contractor (e.g. O&M manuals). These are included in Appendix F:

- LTHW / DHW System
- Catering Gas System
- CHW System
- Low voltage system overview
  - Lighting and Small Power
  - All other LV meters
  - Breakdown of Motor Control Centre Equipment through Inverter Motor Controls (produced this quarter)
- Hot and cold domestic water services.

These diagrams were reviewed during the course of the BPE project, as more information became available on actual installation. A large part of the BPE team's time , especially in the first year, was spent liaising with the contractor and energy software designer to identify actual metering provision, and ensure the production of accurate as-built metering information linked to the BMS and energy monitoring software.

As highlighted above, it became apparent during that period that the meter provision was not fully in line with the initially specifications and the level of sub-metering specified was slightly different to that previously understood (some of which affecting the level of detail available for the BPE study). It is only in the last quarter that the BPE team was provided with logged data for the past year, with gaps in places – see section 5.3 for details on gaps where assumptions had to be made for the analysis.

The final strategy is presented here, as provided by the controls contractor and reviewed with the project team and FM manager. There are over 80 meters covering electricity, gas, LTHW, and water consumption.

The meters are available on the energy monitoring software (SIPe) and the BMS. To facilitate monitoring by the FM team, some uses are grouped when displayed in the user interface software (SIPe), but raw data is also available via the BMS. Details such as the grouping of meters, naming of the groups, details to be presented on the interface etc, were agreed with the controls contractor by the FM team with input from the MEPH client-side monitor.

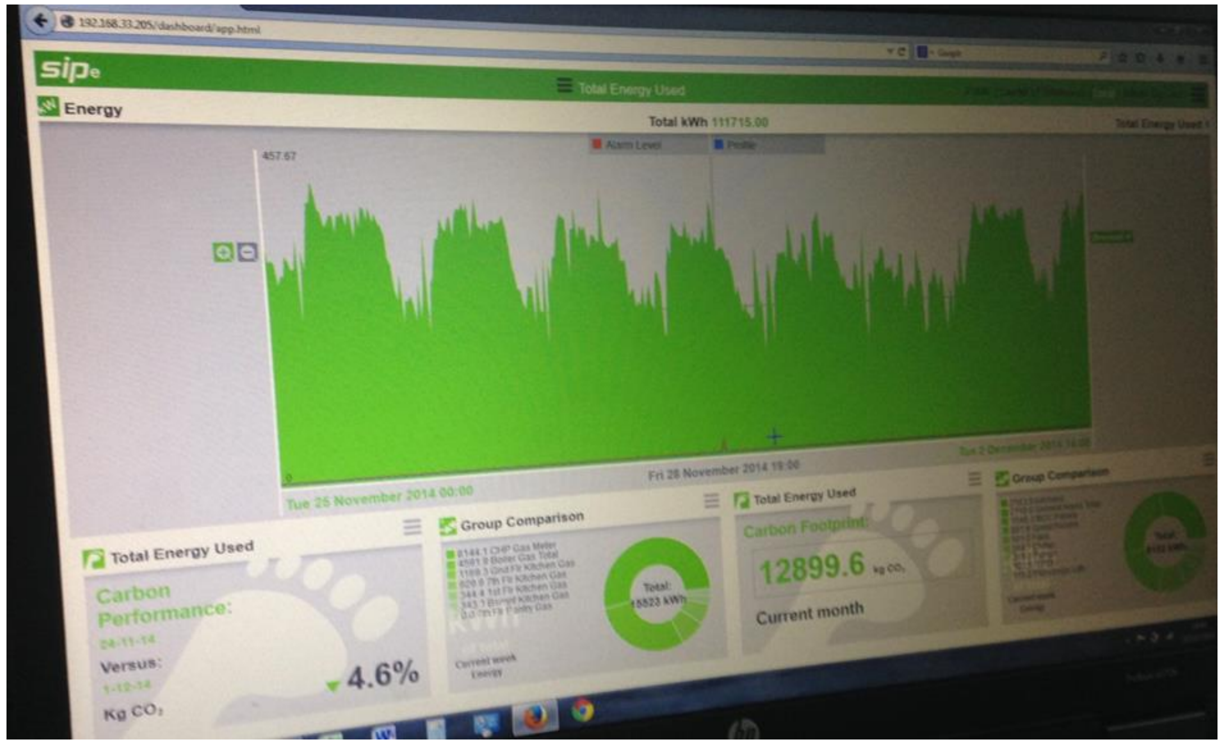


Figure 5.1: illustration of energy monitoring software interface (SIPe, December 2014)

Electricity

Electricity is substantially sub-metered, with un-regulated uses available separately apart from small power in the guest rooms, which is metered together with lighting. Un-regulated uses separately metered including the 4 lifts, small power & appliances in all other areas than the guest rooms, electricity used by the kitchens:

- Main Incomer: total electricity imported by the hotel
- CHP electricity generated by the CHP
- MCC: total kWh energy consumed by 4 MCC panel (1 in basement and 3 roof MCC panels); 5th meter also measuring the total
- Fans: grouped on the SIPe interface, displaying the electricity used by supply and extract fans and AHUs, summing up 18 meters; 19th meter also measuring the total AHU fan consumption
- Pumps: grouped to display the electricity consumed by pumps, summing up 16 meters (2 ECO, 6 chilled water pumps, 8 LTHW pumps); 17th meter also measuring the total
- Chillers: grouped to display the electricity consumed by chillers, summing up 2 meters
- General areas: displaying the lighting and small power electricity consumed in general areas, summing up 14 meters (metering lighting and power separately)
- Guest Rooms: energy consumption by lighting and small power (not separated) – total of 10 meters (i.e. one on the distribution board in each of the 10 risers)
- Kitchens: displaying the electricity consumed by kitchens, summing up 5 meters (basement, ground, 1st floor, 7th floor, 7th floor pantry)
- IT Room energy consumption
- Lifts: grouped to display the electricity consumed by lifts, summing up 4 meters (2 passenger lifts and 2 goods lifts).

Gas

Similarly to electrical uses, gas is well sub-metered, allowing the separate monitoring of un-regulated gas use in each kitchen.

- Gas main incomer
- Gas supply to boilers
- Gas supply to CHP
- Kitchen gas: individual meters on gas consumed in each kitchen, i.e. 7th floor pantry, 7th floor kitchen, 1st floor kitchen, ground floor kitchen, basement kitchen.

Low Temperature Hot Water

The following meters are available:

- Meter on CHP LTHW production
- LTHW 2ndary circuit
- LTHW to space heating (fan coil units and AHUs)
- DHW.

Apart from the CHP metered data, which is available via monthly reports from the CHP manufacturer's remote monitoring facility, data from these meters was only made available towards the end of the BPE report and does not cover an extended period (from summer 2014 at best); it was therefore not utilised in this report.

At the time of this final report, no chilled water meter data is available.

Water

The initial water meters were not pulsed meters and this was rectified during the first quarter of hotel's operation. Water is metered as an overall use from 4 meters, as well as a number of cold and hot water meters sub-meters for the following:

- Kitchens: 4 separate meters for the basement, ground, first and 7th floor kitchens
- 7th floor BBQ area
- Bedroom floors (as an aggregate)
- Spa
- Front of House areas.

This is in line with the design intent.

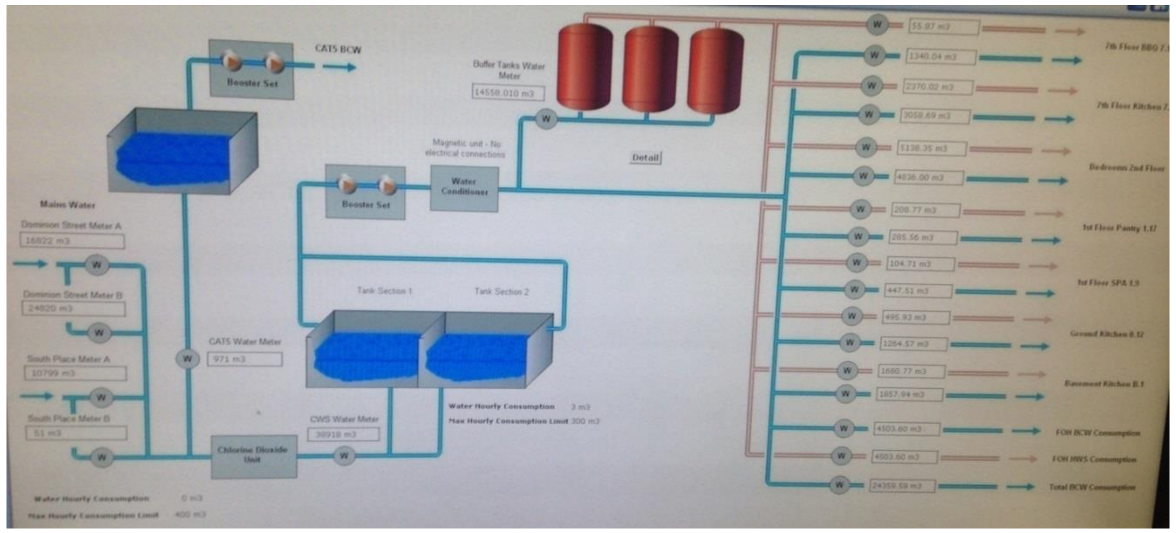


Figure 5.2: Illustration of water sub-metering strategy: BMS interface (as of early March 2015)

Key differences from initial design intent

- **Sub-meters of chilled water and LTHW** supplies on a floor-to-floor basis and within the catering areas were not installed. This was included in the specifications but not shown on the tender schematics. The omission of these meters was identified early on by the BPE team, but missed from the initial defects list, and also from the BREEAM Post-Construction Review which awarded the relevant credit on the basis of the contractor's statement that metering provision was 'as per design'. Due to the disruption to the hotel's operation and the perceived reduced benefit in retrofitting these sub-meters, they were not retrofitted.

- **Metering of DHW**. It was previously understood by the sustainability consultant and BPE lead that DHW consumption would be sub-metered by floor, which would allow a comparison of the water consumption in bedrooms with and without baths (as some floors only have one such type of bedrooms). This is, in particular, a BREEAM requirement under credit Ene3, which was targeted and awarded at the design and post-construction stages. It became apparent that this was not incorporated in the specifications and therefore not provided by the contractor.

5.3 Summary of Metering Status

The previous section summarises the meter data now available to the FM team, via the BMS and separate energy monitoring software.

The CIBSE TM22 analysis was carried out on the basis of data received towards the end of the 2nd year of the BPE project, with various levels of accuracy as illustrated in the following figures.

A substantial amount of information is now available from the large number of half-hourly meters, some of which already analysed as part of this study. Monthly reports on the CHP operation have also been available from the start from the unit manufacturer's remote monitoring system. Importantly, the facilities management team have taken daily manual readings of the mains meters for all three utilities (gas, water, electricity) from the opening of the hotel. This means that overall energy and water consumption data is available from the opening, covering over two years.

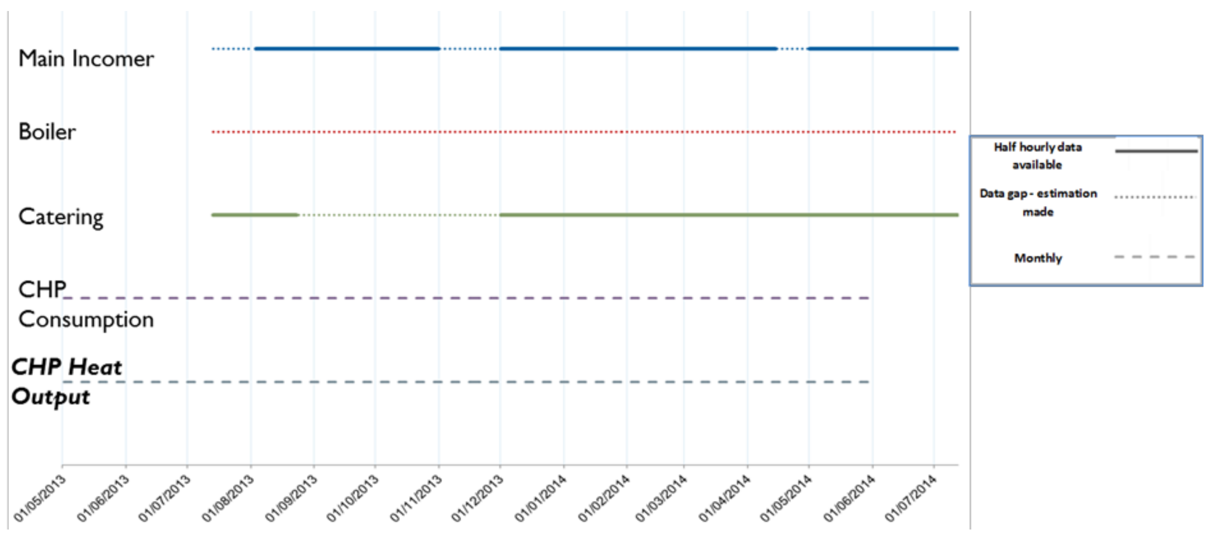


Figure 5.3: Gas – Data Availability From June 2013

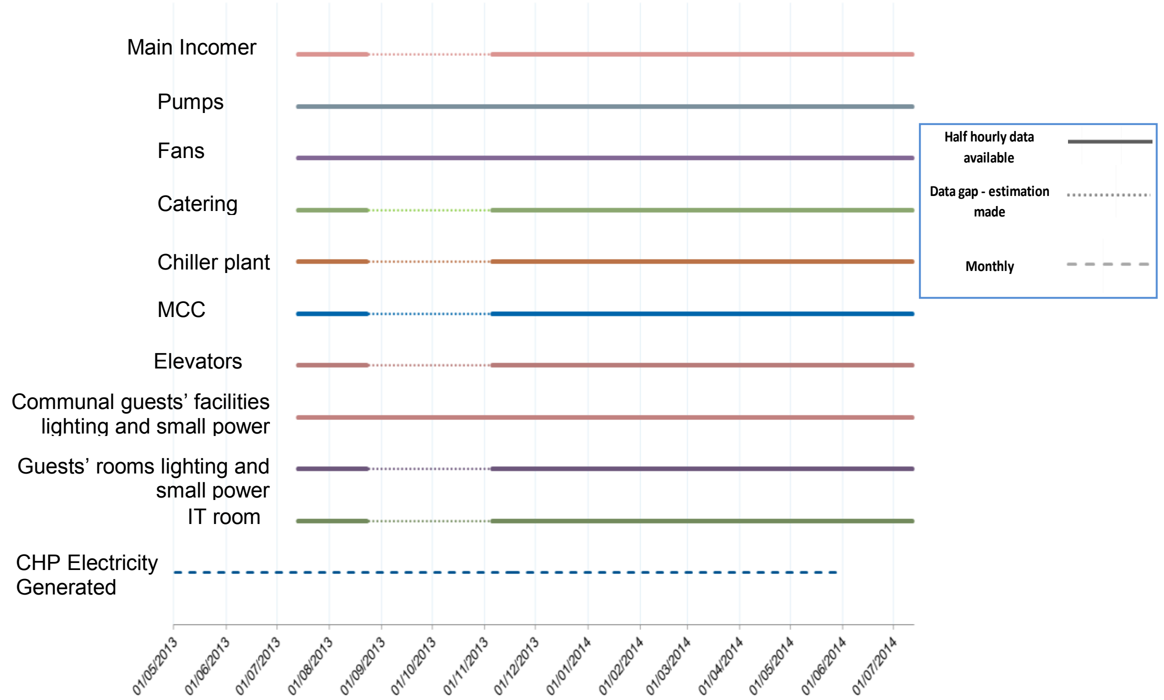


Figure 5.4: Electricity– Data Availability From June 2013

There remain defects with the status of meters and data availability on the BMS, key of which:

- Mains water meter: one of the meters can be read manually, and readings are taken daily by the FM team, however the data available on the BMS is widely inaccurate.
- Cold water sub-metering: while total cold water consumption is available, the breakdown into sub-meters available on the BMS does not add up and this is a significant constraint in identifying restaurant vs hotel bedroom use. This is discussed in more detail in the water consumption analysis section 11.2.

5.4 Review of Existing Tests

Air Pressure

The as-built Part L model states a tested air permeability of 4.5m³/(h.m²) @ 50 Pa. This is an improvement against the design target of 5 m³/(h.m²) @ 50 Pa.

Limitations of the test: The air permeability test was carried out mid-June, 2.5 months before PC. The façade architects confirmed that there were at the time numerous temporary seals on the lower floors, due to a number of façade elements not yet in place. No further tests were carried out after the completion of the building's envelope. Improvements are expected to have been achieved due to acoustic issues linked to noise penetration through the window frames – see section 8.3.

Thermography Survey

A thermography survey was carried out by the contractor before PC, as part of a BREEAM requirement. Results are summarised here, with a selection of illustrations in the following figures.

The study was undertaken between approximately 02:00 – 05:00 on the 14th June. The temperature differential was 10-13°C. The conclusion of the survey was that the hotel is generally well insulated, however a few issues with the fabric were found:

- There appears to be air leakage coming from under the cladding. However, bearing in mind the rainscreen cladding construction, this could also be from the convection of warm air within the cavity behind the panels that is leaking out.
- Thermal bridging was found around windows frames, especially in corner junctions;
- Cold spots were found around the windows caused by air leakages in the seal between the glass and frame, and also between the frame and wall. These were found to be fairly common throughout the building, and would be consistent with issues raised separately about noise penetration from outside – see section 8.3. It was noted however that despite these leaks, the building's tested air permeability was still good overall.

It is currently understood that remedial actions were not undertaken on the issues identified above as the contractor considered the construction to be within acceptable standards. The BREEAM credit Ene 6 – Building Fabric Performance and Avoidance of Air Infiltration was awarded in the post construction review, on the basis that the thermography survey does not provide any direct recommendations for remediation to be carried out.

Limitations of the survey: In the course of the BPE project, BSRIA advised the BPE team (at a workshop organised by the TSB in Autumn 2012) that the conditions during the test had not been ideal for undertaking a thermography survey, which should be undertaken during winter conditions after at least 24 hours of dry stable weather with minimal direct sunlight, reducing the chance of dissipating solar gains confusing the results. If this is not possible then it is recommended to heat and maintain a building temperature of 30°C for 24 hours before undertaking the survey at around 01:00 to 02:00 on an overcast day. It was also advised that it is almost impossible to undertake an accurate thermography survey on a rainscreen cladding system due to daytime thermal gains slowly dissipating into the cavity space. The above conclusions are therefore to be taken with caution.

Lessons learnt: While 'best practice' tests on the fabric performance were carried out and showed good results, it is likely that this was mostly done as part of a process driven by contractual requirements (including BREEAM). Specific parameters such as the particular conditions at the time of testing and the building envelope characteristics mean that results should be viewed with caution and were probably not as useful as could have been in evaluating performance and remediating defects where needed.

SOUTH PLACE HOTEL THERMAL IMAGING — SURVEY FINDINGS AND RECOMMENDATIONS

3.2 AIR LEAKAGE

Examples of air leakage were seen from outside at the bottom of the External Cladding as seen in Figure 1and Figure 2. This may be due to convection in the cavity behind the cladding, and if so, not a problem. However it may be air leakage from within the building, in which case it is a sign of heat loss.

Figure 1 Air leakage on the bottom of external cladding on the south Place Elevation

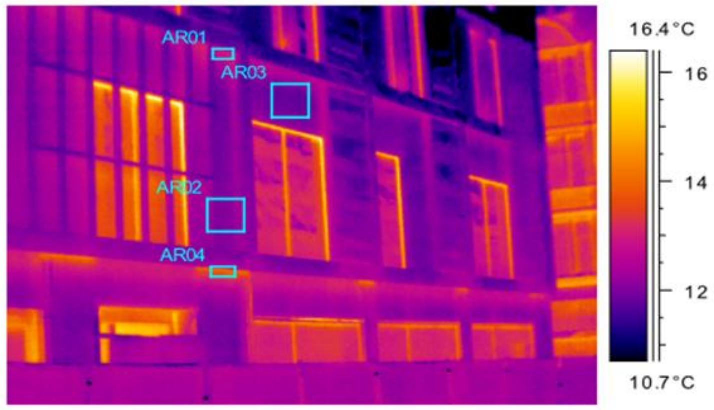


Figure 2 Air leakage on the bottom of external cladding on the south Place Elevation

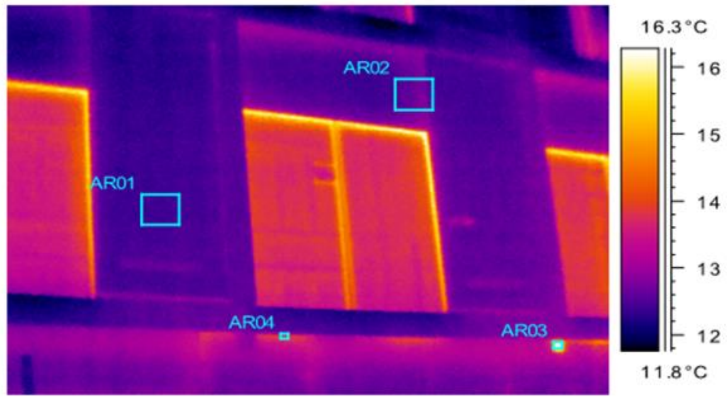


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Figure 5.5: Extract from thermography survey – air leakage (from BSRIA)

3.4 COLD SPOTS AROUND WINDOWS

Cold spots were found around many of the windows, both at the glass to frame seal and at the frame to wall edge seals as seen in Figure 3 and Figure 4

Figure 5 Example of air leakage around window seal

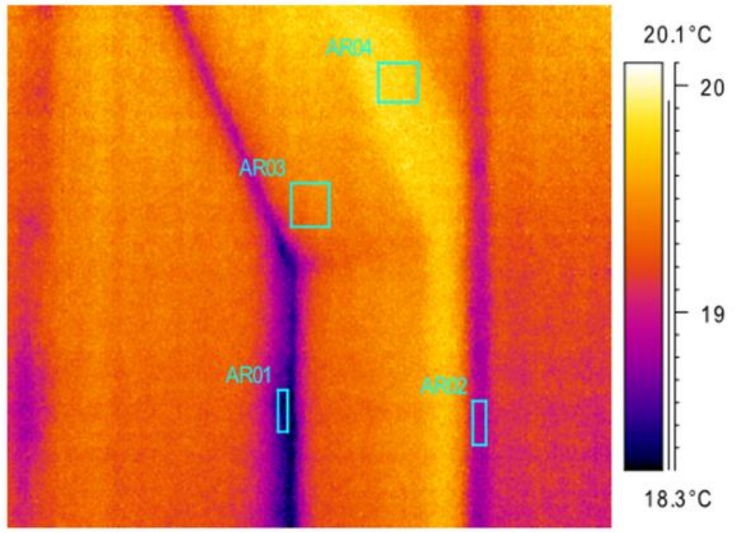
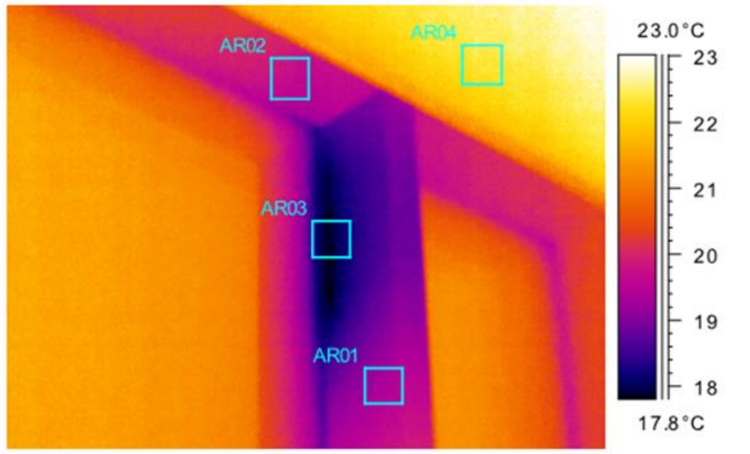


Figure 6 Example of Air Leakage around window seal (Common throughout)



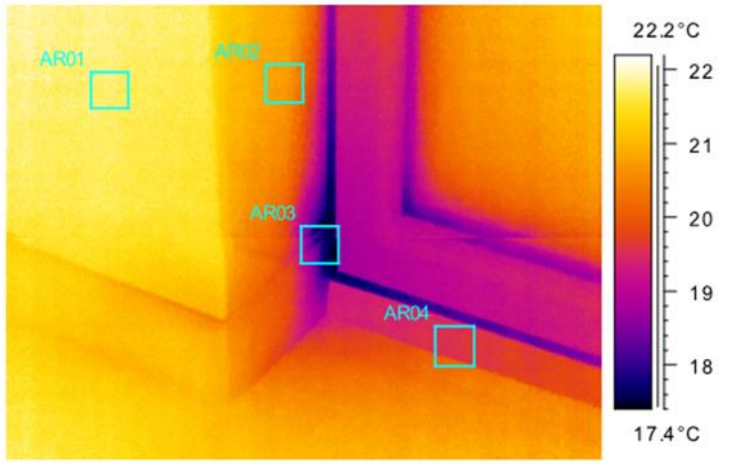
Air Leakage around Window Seals seems a common problem throughout the entire construction; However, as South Place Hotel has already passed an Airtest on a previous visit from BSRIA, and achieved an acceptable airtightness result of . 4.5 m³/hr/m² @50 Pa,

Figure 5.6: Extract from thermography survey – cold spots around windows (from BSRIA)

3.3 THERMAL BRIDGING AT WINDOW FRAMES

Examples of thermal bridging at window frames were seen from inside and from the outside as seen in Figure 1 and Figure 4. More detail of these can be seen on the relevant pages of Appendix A.

Figure 3 Thermal bridging at window frame from inside



The thermal bridging is also visible on the outside view of the window frame as warm, light coloured areas in the image.

Figure 4 Thermal bridging at window frame from outside

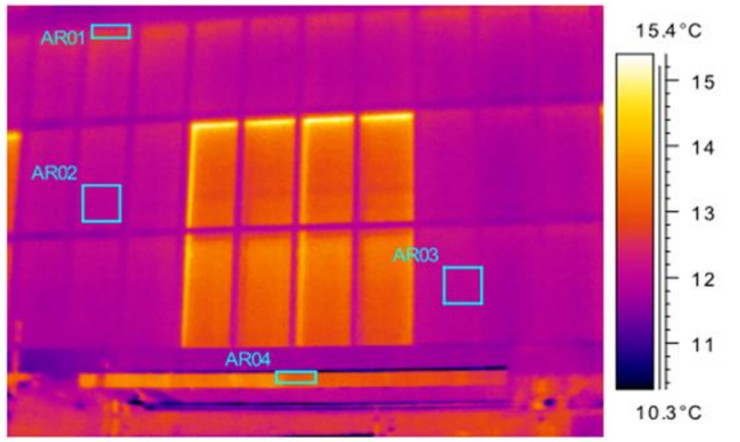


Figure 5.7: Extract from thermography survey – thermal bridging at windows frames (from BSRIA)

Acoustic Surveys

The hotel was subject to acoustic standards for noise levels inside the rooms and airborne insulation between rooms, including standards associated with BREEAM credits:

- ‘Adequate’ indoor ambient noise levels, in line with good practice levels of BS8233:1999, Tables 5 & 6
- ‘Appropriate’ airborne sound insulation levels between adjacent acoustically sensitive rooms and occupied spaces, sufficient to ensure adequate privacy
- Areas used for speech: reverberation times compliant with table 8 of BS8233 1999

The BREEAM credits were awarded in the post-construction review on the basis that acoustic testing of internal noise levels, carried out on behalf of the contractor, confirmed the relevant standards were met. There were however a large number of guest complaints in the first few months of operation, which highlight two issues:

- Installation defects in the quality of the sealing around the window frames were identified and subsequently remediated, although at the time of this final BPE report it is still debated whether the achieved performance complies with the Employer’s Requirements (ERs): the required standard is met on average, but still with slight departures from the ERs at some frequencies, particularly on the first two floors.
- The above standards apply to ambient noise levels and are not meant to address specific occurrences such as, in the case of this hotel, evening events in the courtyard bar or temporary construction works – see section 8.3 for more details.

6.0 Handover Processes

6.1 Managing and Delivering the Design Intent

The project followed a design and build procurement route based on RIBA Stage E and detailed design. The contractor has been responsible for final selection, installation, setting to work and handover. Part of the design team was novated but the MEPH designer and the sustainability consultant, also the BPE lead, were retained on the client side in a monitoring role.

The end-user was involved in the design process, with specialist consultants involved from early design stages and key members of the hotel's management team, including the hotel manager and facilities manager, coming on board approximately 6 months before completion.

From the architectural and hotel operation side, close cooperation was ensured due to the close relationship between the interior designer hotel operator organisations.

6.2 Sign-off and Commissioning Plans and Procedures

Initial feedback from the project team and subsequent information gathered as part of the BPE project indicates that the contractor implemented a number of relatively significant changes in the MEPH design proposals and specifications of individual items; the ones most apparent and influential on the BPE study and the building's monitoring and performance are the metering strategy and CHP installation. The lack of continuity in key individuals from the original MEPH design team has made it difficult to understand why or whether some of these changes were approved.

Commissioning completion reports were provided by the M&E contractor. The O&M manuals (not referred to by the BREEAM report) state that an independent witnessing agent employed by the main contractor witnessed and signed off the systems, however their detailed scope is unknown. The MEPH designer also had as part of their client monitor role a scope for monitoring commissioning.

The contractor was also required by specifications (including BREEAM credits) to carry out seasonal commissioning in the first 12 months of occupation.
It should be noted that the contractor's team remained involved in resolving defects for over 2 years.

6.3 Handover

The contractor provided information including O&M manuals. A first draft was produced by the contractor at project start (August 2011) and a revised version at handover (June 2012, before opening in September 2012). From a building performance point of view, key comments were made by the MEPH client monitor on the 1st revision of the building log book including lack of documents in appendix (e.g. commissioning completion reports), erroneous description of the chiller (described as water- rather than air-cooled), and review of metering schedule. It is understood that this was subsequently rectified.

In addition, a number of training sessions were organised by the contractor on key items, including the energy monitoring software, with the FM team providing input on final installation and fine-tuning.

The hotel was subject to a 'soft opening' with friends and family of the project team staying for a night and providing feedback before formal opening.

A simplified user guide was also produced, as per BREEAM requirements, of which selected sections are shown here which cover the guest rooms (full version in Appendix G).

SOUTH PLACE HOTEL

GUEST ROOM USER GUIDE

Media Hub

The media hub provided with in the desk allows you to use Bluetooth enabled smart phones, laptops, or MP3 players to wirelessly stream audio through the TV and bathroom speakers. It also provides you with power outlets and a convenient Internet access point.

You can play your own music through the TV sound system using a standard audio jack to connect their devices to the panel, or via built-in Bluetooth feature.

You can connect game consoles to the TV through composite audio/video or HDMI connectors.

The Media hub senses the last device plugged in and switches to the correct input. You can toggle between devices with a push of the LED button above each port. Indicator lights show you which input is active.

USB 5V power socket provides a convenient way for you to charge your portable devices.

6

SOUTH PLACE HOTEL

GUEST ROOM USER GUIDE

Room Services

The above is the master control plate for your room and is located inside the entrance door. This plate allows you to select the options indicated above.

2

Figure 6.1: User guide for guest gooms produced by contractor – selected sections

Note this version was provided to the hotel operator, but a separate version was produced by the hotel which is provided in each guest room as part of the welcome pack, and covers design items such as light and blinds controls and 'eco' settings, alongside more general items such as hotel amenities and local facilities – see following figure:

Figure 6.2: User guide for guest rooms produced by hotel operator

7.0 Review of Technical Performance

The hotel has been operating at high occupancy and feedback is generally positive. A more detailed review of technical performance is provided as part of the energy analysis (Section 10), water consumption analysis (section 11), and occupancy satisfaction (Section 8).
The main technical issues identified during the BPE project were:

- Metering: reliability and data availability on BMS or energy monitoring software – see sections 5.2 and 5.3 for details
- Unreliable DHW temperatures, some of them below 55°C, were on several occasions noted by the hotel operator
- The CHP unit operated with very reduced hours in the summer of 2013, often no more than 2-3 hours per day and with multiple starts and stops which would be expected to affect the unit's efficient operation and lifetime.

Issues related to the production of Domestic Hot water and the operation of the CHP unit represented a significant part of the work of the BPE team, with a number of meetings held with the contractor, project team, and hotel operator's FM team.

Actions agreed with the contractor included:

- Review the controls strategy of the CHP unit, boilers, and hot water vessel, in consultation with the CHP manufacturer and with the aim to maximise daytime running hours and reduce the daily number of starts. the impact of these measures on running hours would be predicted using actual load data from the previous year
- Review the feasibility of incorporating thermal storage to further increase the unit's running hours and reduce its number of starts & stops.

Progress was generally slower than agreed, partially due to the difficulty of implementing changes in a fully operational 24/7 hotel, but some actions were eventually implemented.

7.1 Meters and BMS

See sections 5.2 and 5.3 on current status and remaining defects – this is an important area of outstanding defects.

7.2 Hot Water Production

The main actions taken by the contractor were twofold:

- An installation error was noted by the contractor, and remedial actions proposed early January 2014 to align the installation of the calorifier vessels and plate heat exchanger (with CHP) with the manufacturer's recommendations, i.e. feeding the plate heat exchanger directly from a cold feed rather than, as initially installed, from the calorifier vessel. The proposals therefore aimed to allow a much greater load available to the heat exchanger (potentially meeting a temperature uplift from 10 to 60°C rather than from 50 to 60°C). See Figure 7.1 for extracts from the schematics of the installation before and after the proposed works.
- Temperature sensor: the Contractor admitted that the controls strategy relied on temperature sensors at the top of the hot water vessels, which due to stratification were not representative of the load actually available. This was rectified.

This was implemented first with 24hr tests of the proposals, followed by a longer test (2 weeks) before changes were made permanent.

At the time of this report, the FM manager has reported recurring issues with the hot water temperature (on occasions below 55°C at the calorifier outlet) and this therefore remains an important defect.

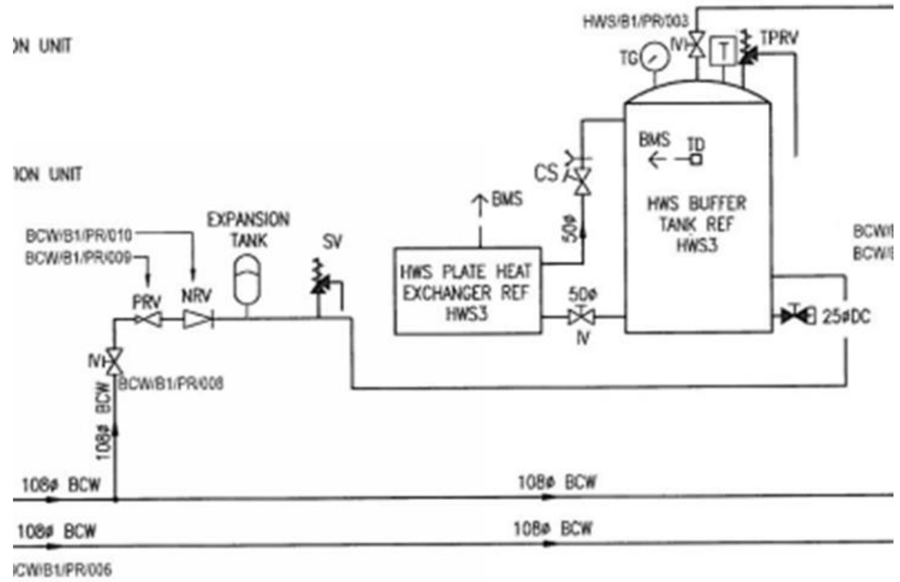


Figure 7.1: Calorifier vessel and plate heat exchanger installation, before proposed remedial works

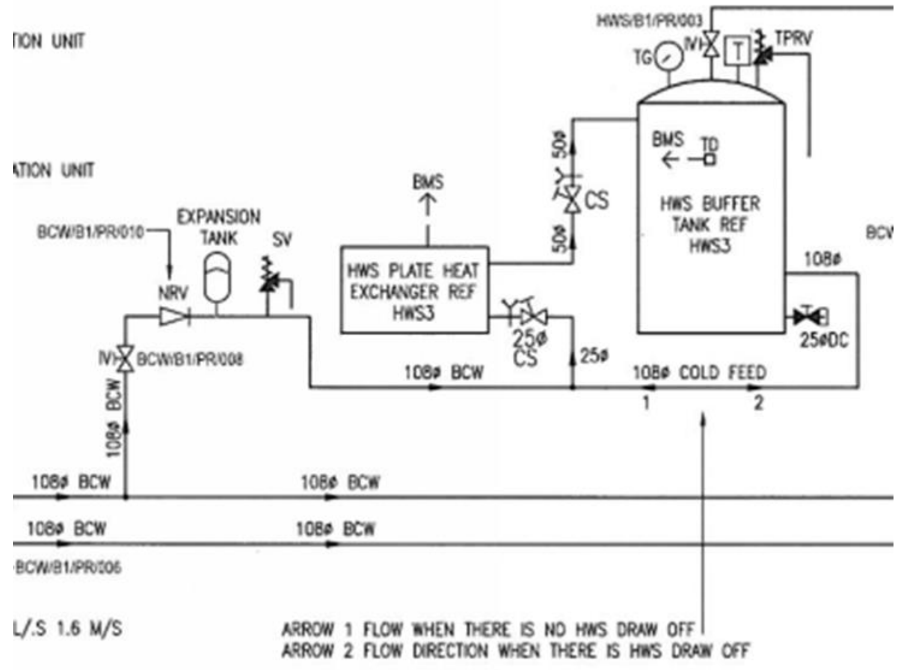


Figure 7.2: Calorifier vessel and plate heat exchanger installation, after proposed remedial works (provided by contractor, 15th January 2014)

7.3 CHP Operation

The CHP installation was modified by the contractor compared to the initial design proposals, with the omission of thermal storage: the CHP operates alongside calorifiers, which have to be kept within a narrower temperature band and therefore limits the operation of the CHP.

The modifications described above on DHW production were expected to improve the operation of CHP by expanding the temperature range available to it via the plate heat exchanger.

In addition, and crucially, it became apparent to the contractor that the CHP unit had been fitted with electric modulation kit (to reduce its output and limit export at times of low electricity demand) but not with **thermal modulation capability** (despite the specifications). This was clearly an important function to allow efficient operation at times of low demand in the summer, and was retrofitted by the contractor in September 2014, i.e. 2 years after opening and towards the end of the BPE project.

The resulting operation was analysed by the BPE team over a period of 10 days, in a period of relatively hot weather. In that period the impact of installing the modulation kit did seem very beneficial, as the hours increased to ~12.3hrs/day on average (5.8 to 20.9 hrs), or ~8.7hrs/day full load equivalent, compared to 2.3 hrs/day on average in the preceding weeks. It was estimated by the BPE team that the CHP would on average have been running at ~60-70% capacity, i.e. within the recommended loads. The installation was therefore approved on the proviso of further monitoring (by the FM team) to be carried out the following summer, 2016. Further issues however occurred shortly afterwards, including connection to the BMS, which the contractor thought may be attributed to the modulation kit, and the kit was therefore removed. At the time of this report, it is believed that the kit had been fitted incorrectly and this has not yet been remediated. This remains an important outstanding defect.

The omission of thermal storage was also thought to significantly affect the operation of CHP. The contractor was requested to review the viability of retrofitting thermal storage within the existing plant rooms, including an appraisal of technical feasibility (taking account of plant space), costs, and impact on CHP running hours using historic load data available from the previous year. A visit by the team to the plant room did identify possible areas, such as those that had at the design stage been identified specifically for that purpose. Those areas appear under-utilised, or serving for general storage – see pictures in Figure 7.3.

Figure 7.3: Visit to plant room, March 2014: areas intended at the design stage for thermal stores

Retrofitting thermal storage to operate alongside CHP was ultimately not taken forward by the team, due to the disruption it would cause to the hotel and since the above measures (especially thermal modulation) seemed to improve the CHP operation in the summer, albeit in a short period only.

7.4 Air Handling Units

The number of AHUs is understood to have been reduced by the contractor compared to the initial design proposals, with the same AHU serving both ground floor and 7th floor bar / restaurant areas, instead of separate ones as per initial design intent. This is understood to have been implemented due to space constraints and possibly cost savings. This created difficulties in ensuring comfortable conditions in all spaces, which operate independently and with highly variable occupancy levels; the FM team dealt with it by regular manual adjustments to the air supply temperature, informed by following occupant feedback.

It is expected that this will result in some inefficiencies in ventilation, since the energy consumption will be driven by the highest requirements among the various spaces served by the AHU.

8.0 Review of Occupant Satisfaction

8.1 Permanent Users

The hotel employs approximately 120 people, as well as agency staff. Staff is split into the following teams:

- Food and beverage (F&B) – managed by F&B director:
  i. Ground floor restaurant ('3 South Place')
  ii. Top floor restaurant ('The Angler')
  iii. First floor events
  iv. Bars – managed by bar manager(ground, first, and top floor)
- Front of House, including reception staff
- Administration and office, including finances, sales etc
- Operations
  v. Housekeeping
  vi. Maintenance
  vii. Cleaning
  viii. Kitchen staff.

The feedback from permanent users, i.e. staff, was gathered in a number of ways:

- Regular meetings with the FM team, in particular the facilities manager
- Interview with key members of staff, including hotel manager, facilities manager, head of HR, receptionist, and other heads of department
- Building Use Studies (BUS) surveys distributed to all staff members.

BUS

Formal surveys were distributed to all staff members via the hotel's management team, using the BUS surveys and after approval by the hotel manager. It was made clear to the staff that these surveys aimed to capture design and performance lessons on the building itself, and not to capture Human Resource issues. 'Satisfaction' is therefore with the building and its ability to meet the needs of its users.

Responses were gathered from 22 members of staff, out of about 50 distributed. The full BUS report is included in Appendix A and selected results are presented in this section, plotted against the performance of similar buildings in the BUS database. This benchmarking is very useful in understanding the performance of a building, and one of the main benefits of using standard surveys such as BUS.

Staff Interviews

The interviews were carried out with 8 members of staff including hotel manager, facilities manager, head of human resources, concierge, ground floor restaurant manager, and head of housekeeping. Individuals had been selected among the heads of department by the head of HR as those with prior experience in the hotel and restaurant sector in order to provide the most valuable feedback, by allowing comparison with other establishments.

The interviews were carried out as informal discussions following questions approved by the TSB and by the hotel management team, as below. The questions aimed to capture what would not already be covered in the BUS surveys. For example, the questions did not specifically cover issues such as storage space, indoor comfort, or ease of controls, as these are already extensively covered in the BUS surveys. A longer interview had first been carried out with the facilities manager to test the questions, and responses to that interview are included in Appendix H.

1. *What are your general responsibilities?*
2. *Where are you usually based in the hotel?*
3. *When did you start working here?*
4. *Do you have previous experience of working in a hotel?*
   i. *If yes, did this include experience in a newly opened hotel? Do you have points of comparison to offer on the status of the building at handover?*
5. *Did you have any input in the design and construction process prior to completion?*
   i. *If yes, what, and how did it contribute to the hotel's design and construction?*
6. *Have you been in contact with the design and construction team since completion, for example to request actions or information from them?*
   i. *If so, what is your feedback?*
7. *Do you have comments on the procurement process and how this may have influenced the outcome?*
8. *What do you feel works well in the design of this hotel? This includes the architecture, interior design, and services (heating, cooling, lighting, controls). Feedback could include comparison with other hotels or restaurants.*
9. *Do you have recommendations for things that could be improved to the design of the hotel -*
   i. *.. which could be retrofitted in the current hotel?*
   ii. *.. which could not be retrofitted easily, but ideally should be taken account of in future hotel projects?*
10. *Do you think there are incentives in place to encourage energy and water management in the hotel – among staff? Among customers? What could be put in place? Is it related to the design or the operation team?*

Permanent Users Feedback – Key Points

Staff are generally happy with the design of the hotel and, particularly among experienced members, understand that areas of less satisfaction are common in similar establishments e.g. limited storage areas, space constraints between front and back of house.

Feedback from staff was generally positive, including:

- High overall satisfaction – see Figure 8.1 where the building is in the top 10% performers
- Highly-rated overall design – see Figure 8.2
- Very good response to request from changes, with the highest score in the database – see Figure 8.3. This is to the credit of the FM team, and commonly found in Post Occupancy Evaluation studies [1, 2] as highly influential in overall user satisfaction i.e. users tend to be more tolerant when they have some control on their environment or, in buildings with lower levels of individual control, when they know their complaints are being heard and acted upon.

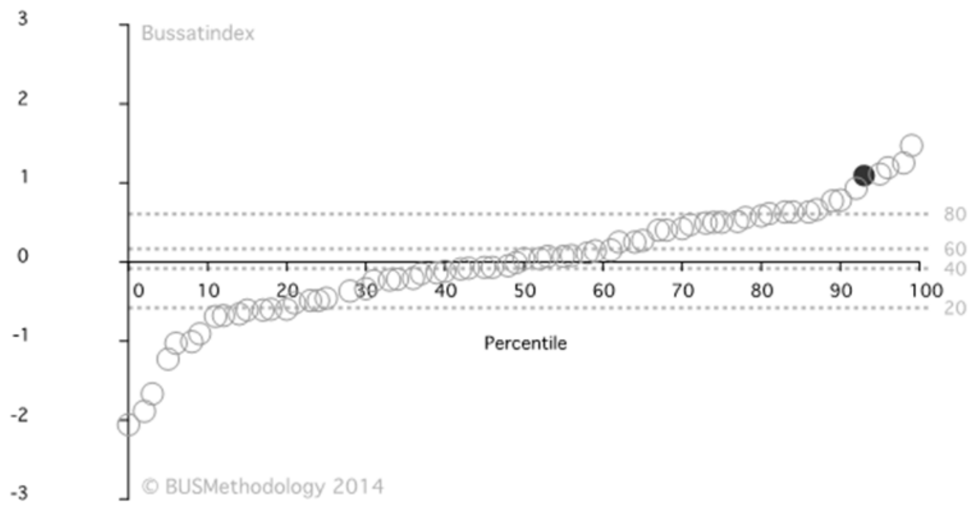


Figure 8.1 – Staff satisfaction survey: overall satisfaction (BUS surveys)

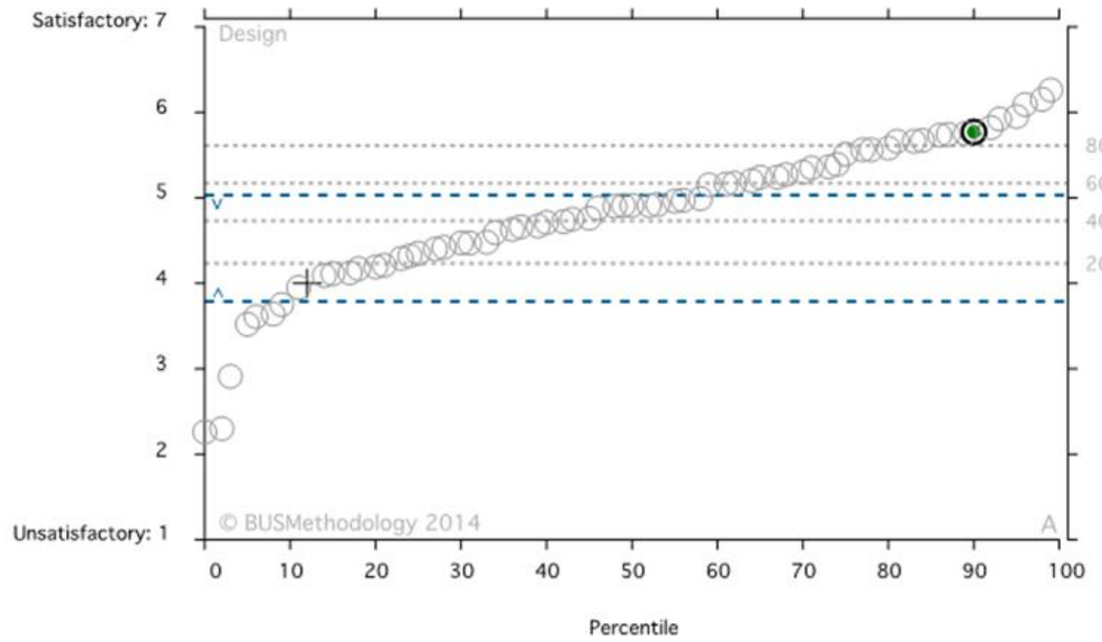


Figure 8.2 – Staff satisfaction survey: overall design (BUS surveys)

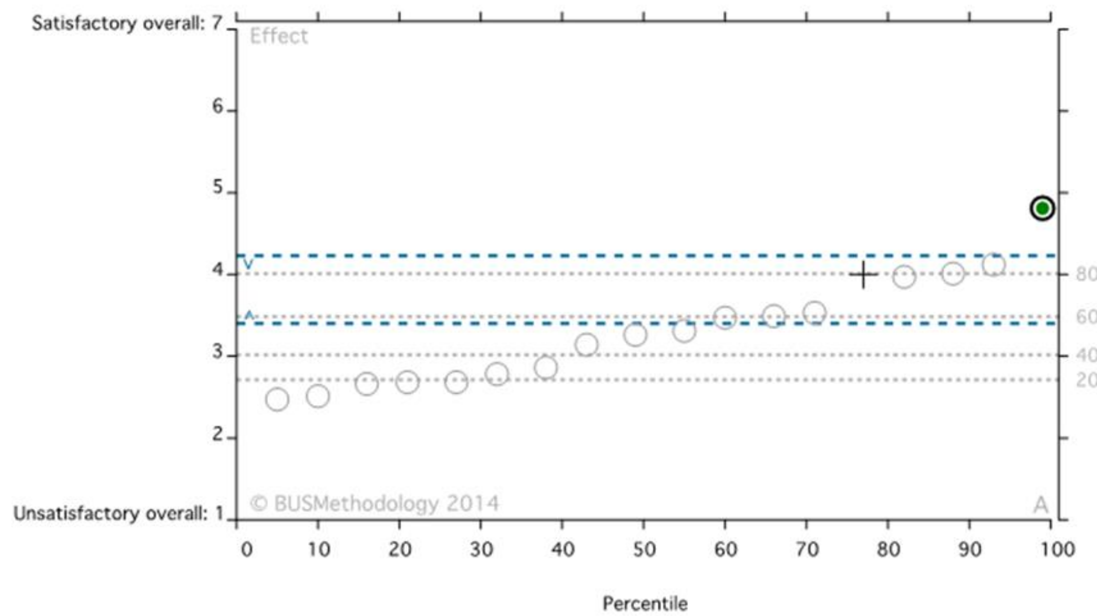


Figure 8.3 – Staff satisfaction survey: Effectiveness of response to request for changes (BUS surveys)

The following points were also noted from staff surveys and interviews. Most of these issues were expected by the project team at early design stages, but compromises had to be made to reconcile conflicting requirements such as external appearance, back-of-house support functions, and revenue-generating front-of-house areas.

- Staff feel they would benefit from more storage for goods, furniture (which is changed regularly) etc, although there is a recognition by the hotel's management team that 'the more storage you get, the more you need'. This has in part led to the use of the original cycle store for bin storage, despite a number of staff keen to commute by cycle. Cycles are available nearby from the Mayor of London's bike hire scheme but cannot be relied upon to be available at all times, and nearby external cycle storage areas have not proved secure enough.

'Sometimes bins and cycles don't mix'

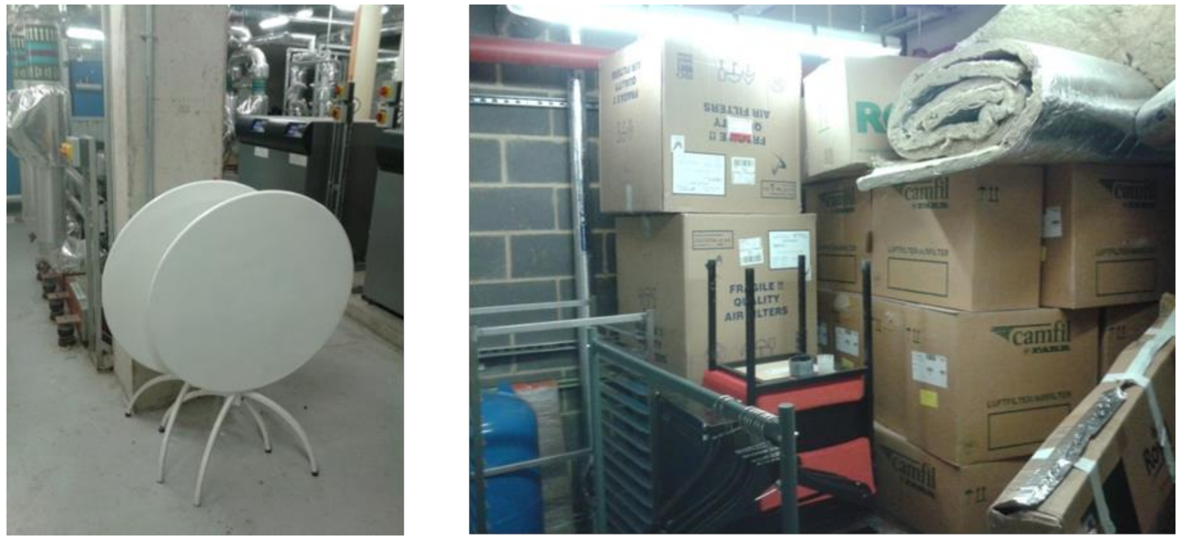


Figure 8.4 Plant room areas used for general storage

- Hotel staff typically works long shifts (more so than those in the ground and top floor restaurants) and back-of-house areas are therefore more prominent in their feedback e.g. storage areas for cycles and personal belongings, break-out areas, changing areas (particularly male areas, as the same amount was provided for male and female but kitchen staff is predominantly male). Back-of-house areas are seen by the HR team as crucial in staff retention, particularly in such a successful establishment where this could help differentiate the hotel from other employers. This is a challenge to design teams and hotel operators given the high pressure on space in such an inner London location.
- Hotel reception's draught lobby: while the outside doors are generally opened for guests by a member of staff, the inside doors, due to their weight, are not automated and are usually left open for the ease of guests. This created discomfort for the receptionists and guests sitting in the lobby area, an issue commonly arising from POE studies. An overdoor heater was retrofitted by the operator – see figure 8.5.
- Layout of ground floor , particularly around entrances and receptions. For example, the restaurant staff have noted that the reception desk is too far away from the main entrance to allow them to greet guests, which increases staffing requirement (= one near the entrance and one at the reception desk to take calls etc); a board is placed in front of the DDA door, used 'instinctively' by guests as the door straight in front of them when leaving the lifts to leave the building, while the door was meant for intermittent use and its frequent opening could lead to wear and tear, as well as discomfort for reception staff – see image 8.6 below.

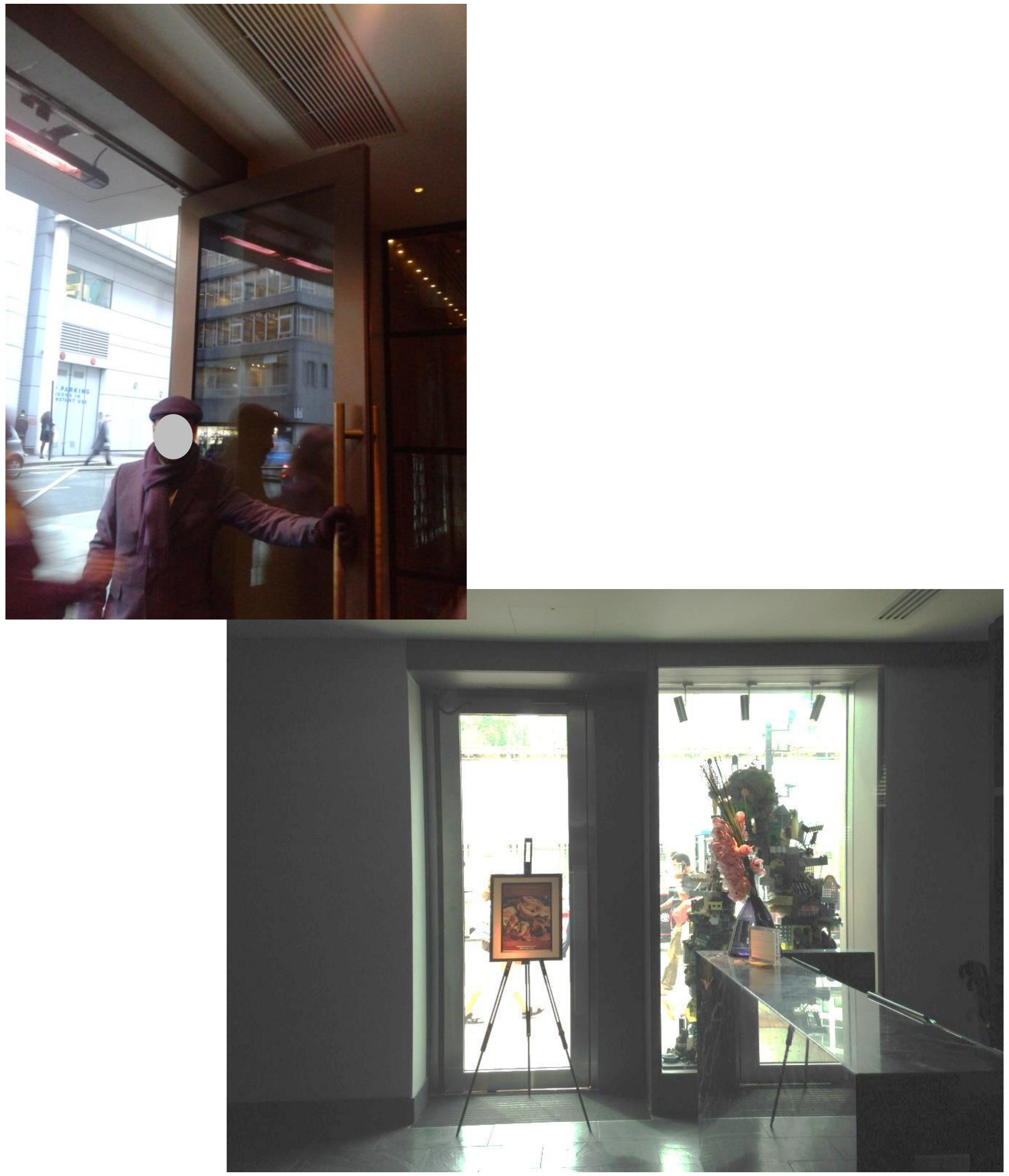


Figure 8.5: The challenges of designing entrances for ease of use, DDA, and comfort: Top: retrofitted air curtain to hotel reception; Bottom:: restaurant reception desk (right hand side of the photo), felt by staff too far away from the main entrance (revolving door on the left hand side of the photo); board located in front of the DDA door

Permanent Users Feedback – Internal Conditions

A selection of parameters from the BUS surveys is shown here, with full details in Appendix A. overall comfort is well rated but with moderate feedback on acoustics (see section 8.3 for more details) and the staff office, located in the basement, which suffers from poor daylight.

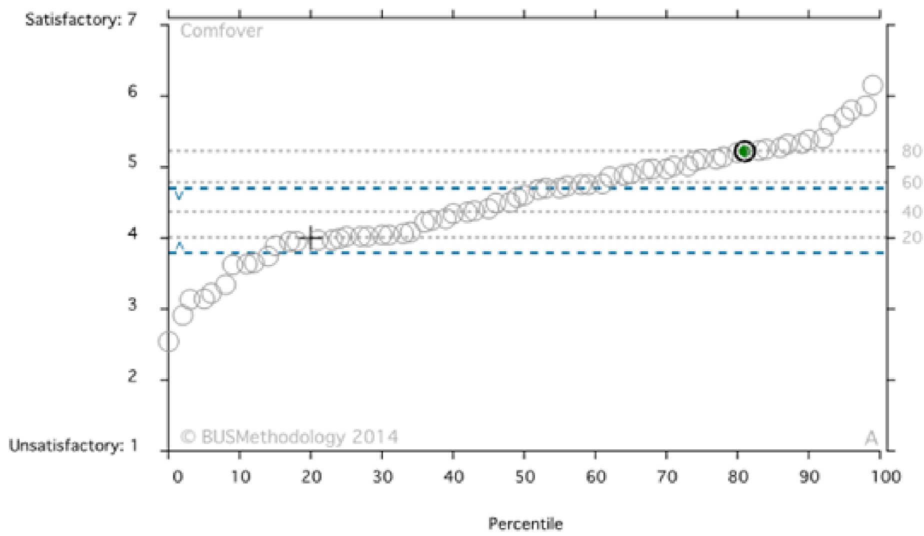


Figure 8.6: BUS survey results - Overall Comfort: high overall comfort, in the top 20% of surveyed buildings

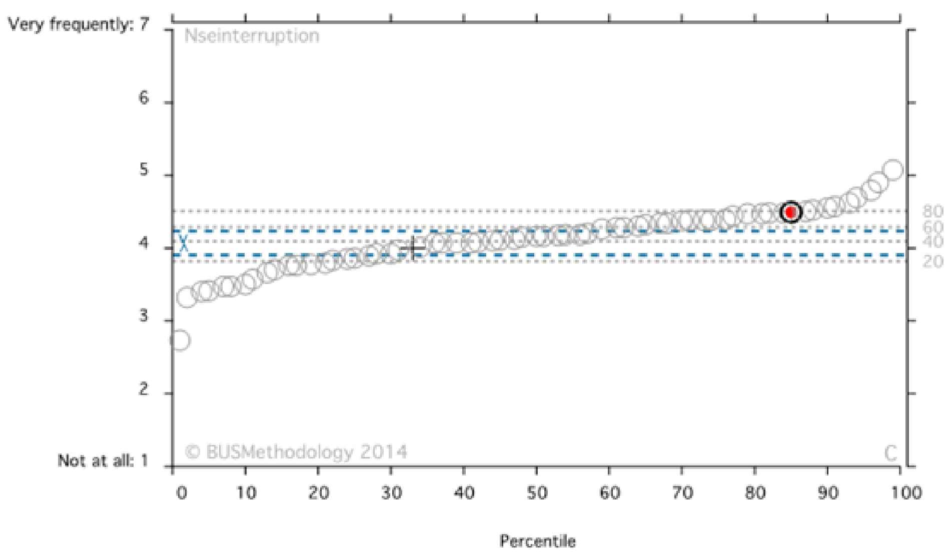


Figure 8.7: BUS survey results - Noise – Unwanted Interruption: score in the highest 20% of 'frequent' interruptions. This is related both the conditions in the back-of-house staff office, and to the interaction of hotel activities with restaurant / bar events (see section 8.3 for more details).

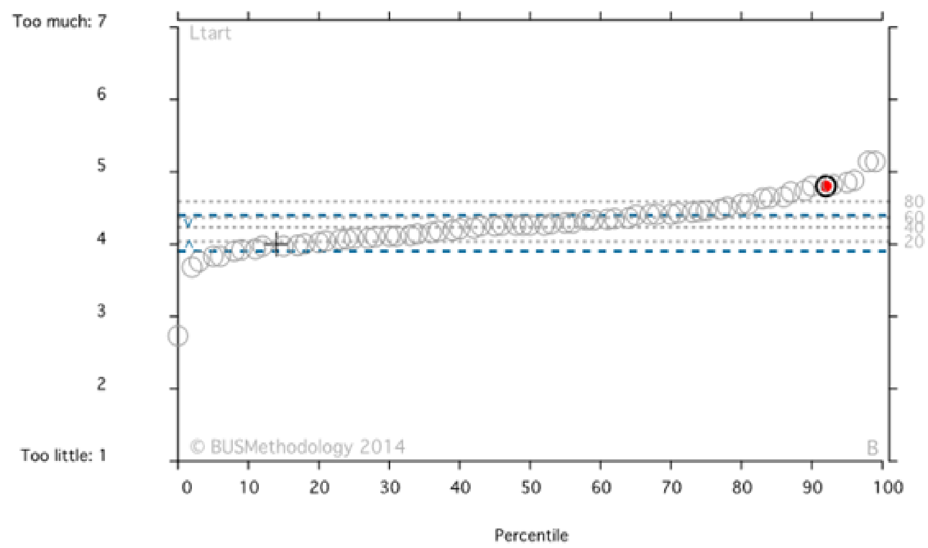


Figure 8.8: Artificial Lighting: staff noting 'too much' artificial lighting in the back-of-house office, located in the basement

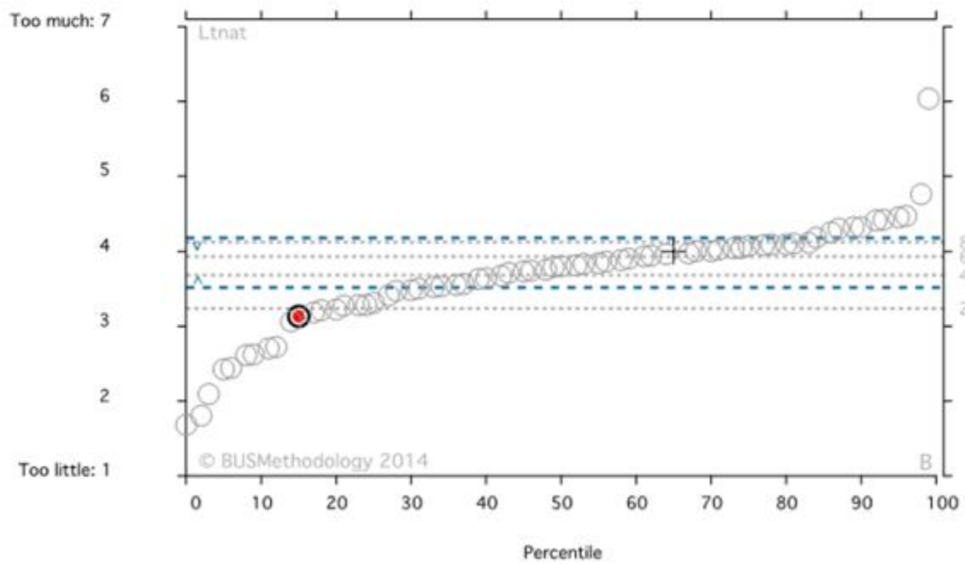


Figure 8.9: Daylighting: staff noting 'too little' daylighting in the back-of-house office, located in the basement

The low scores on daylight and artificial lighting accords with a number of comments made related to the basement offices, particularly related to headaches. This was highlighted to the hotel developer and FM team.

"Always have headaches and feel dry in the afternoon." ; "Definitely less healthy due to headaches and thirst." ; "Personally I find the office way too bright. It definitely leads to headaches. If the light above my desk could be turned off that would be great." ; ''I take more tablets''

Permanent Users Feedback – Hotel Manager

The interview with the hotel manager highlighted the following important points, mostly related to the procurement process:

- In the view of the hotel's manager, a 'fundamental flaw' in the design process was the lack of involvement of experienced hotel staff until a late stage; the example highlighted was the bedroom threshold, which means that a single leak in the bathroom can create substantial damage to the bedroom carpets. Lack of storage could be highlighted, but it was recognised that to some extent this would always be the case ('the more there is, the more people will use').
- The hotel manager recognised the potential for staff interviews and the BPE project to help identify valuable lessons learnt for the hotel operator's future projects and for the design team
- The very 'ambitious' programme and the Design and Build procurement route were seen as largely responsible for the problems identified with MEPH issues, although the manager's opinion was that careful selection of the MEPH contractor may limit exposure in this form of contacts.

8.2 Transient Users

Methodology

In contrast to permanent users where the Building User Studies (BUS) is well-established and has been used in hundreds of non-domestic buildings, there is no well-established user satisfaction survey methodology for 'transient' users, such as guests in hotels and restaurants, customers in shopping centres etc. A draft version similar to the permanent users BUS was made available for this study (see Appendix B) but was considered by the hotel's management team as too difficult to integrate within the hotel's brand, due to its fixed length and questions.

Feedback from hotel and restaurant guests was therefore gathered through a variety of more informal sources, including:

- Customer feedback received by hotel staff, made available via staff interviews
- Reception logs, where every comment by guest deemed worthy of action is recorded (approx. 25-30 incidents per month) and which was made available to the BPE team
- Customer feedback left on a popular travel reviews website (Trip Advisor). It should be noted that this website (and others) is used by the hotel management team themselves to gather feedback and respond to individual comments from guests.

At the time of this final BPE report, almost 2.5 years after opening, there are currently almost 1,000 customer reviews on two popular travel review websites, both showing high rankings (within the 'top 20 London hotels' on one, and overall 9.3 out of 10 mark on the other). Occupancy levels are high and, while always high weekdays for business travellers, is growing for weekend leisure trips. There is a high proportion of repeat visits.

An analysis of reviews was carried out after the first year of opening. A total of 193 Trip Advisor reviews (as of 5th December 2013) showed high levels of satisfaction from guests, with a large majority of 'Excellent' and 'Very Good' ratings – see Figure 8.10. This was supported by the maintenance manager, who reported generally good feedback, and by the high levels of occupancy at the hotels (some nights fully booked, and a large proportion of repeat visits).

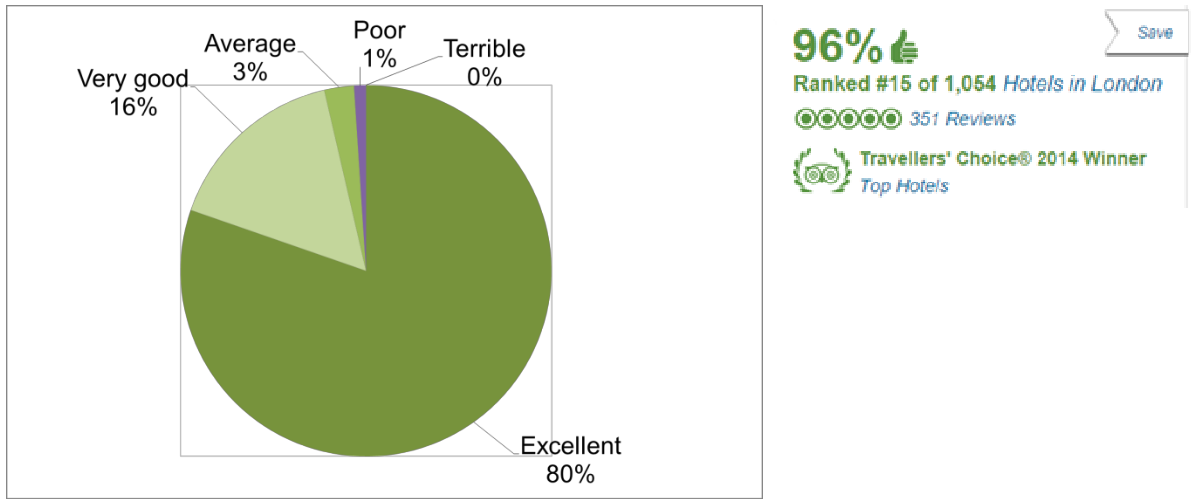


Figure 8.10: Guest reviews: Overall feedback after 1st year of opening [193 Trip Advisor reviews]

Within these 193 reviews, 88 were analysed in more detail (48 in the first 6 months of operation, from September 2012 to 11th March 2013, and 40 in the last 3 month, from 18th September 2013 to 5th December 2013). These were systematically reviewed to identify and count the issues mentioned by guests, and whether these were positive or negative. The issues most commented on by guests (by over 50%of the guests) were:

- general quality, design and atmosphere of the bedrooms
- quality of service.

These are followed by the location of the hotel, overall design and atmosphere, and facilities such as the bar, restaurant etc.

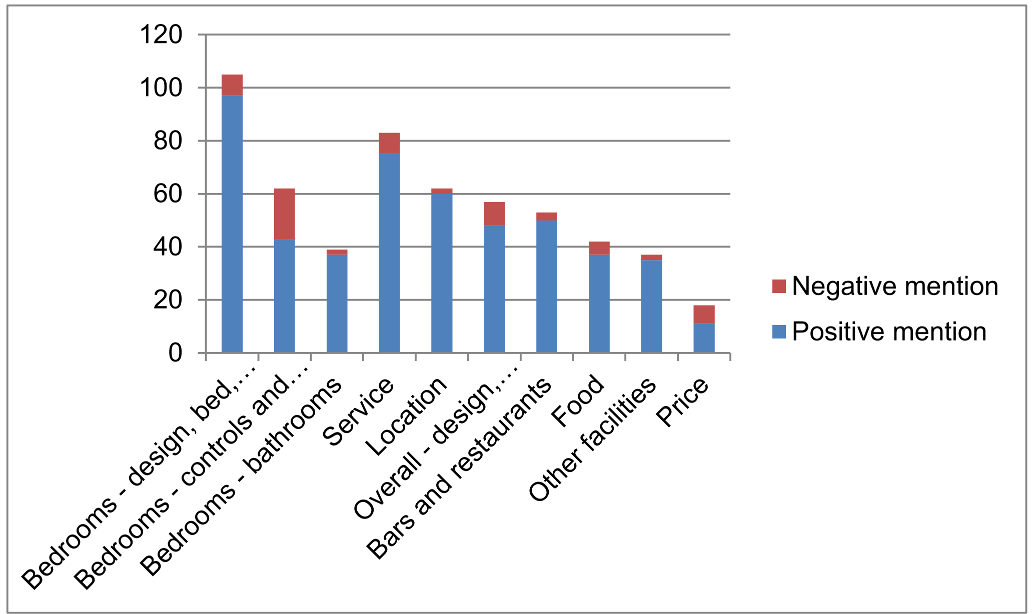


Figure 8.11 - Number of mentions in guest reviews, out of 88 reviews [sample Trip Advisor reviews, from September 2012 to September 2013)

The hotel's facilities manager noted at the BPE team 1 year review (December 2013) that this feedback was broadly in line with that recorded in the reception log book and that expressed on another travel review website (Booking.com). While it is recognised that this method is not a formal way to gather and analyse user feedback, trends were broadly in line with the facilities manager's feedback and the reception logs. This is therefore viewed by the team as an acceptable and useful compromise between formal methods and the hotel's business operatives.

More specifically in the bedrooms, the bed and bathrooms were singled out by guests as particularly positive features – with 'huge beds', 'rain showers' and 'huge bath' (mentioned in 20 out of 88 reviews) particularly appreciated.

'if you have a bath, the very size will make you feel guilty for using that much water' [the context of this remark makes it clear that this was viewed positively]

'bathroom is drop dead gorgeous'

'the largest shower area I've ever experienced in a hotel, with twin rain shower heads'

'spa-like'

'special touches that mark an exceptional hotel e.g. a mirror that doesn't steam up'

'the power points were all in the right place!'

The next dominant items of feedback are the quality of service and attention to detail, almost solely driven by the hotel operator, as are the hotel location and provision of bar / restaurant facilities.

The interior design was also regularly noted ('stylish', and 'modern' in particular). With the exception of lighting, which was commented on positively as part of the overall design quality and atmosphere, building services were rarely if at all mentioned. It is probably the case that, had their performance been unsatisfactory, for example with insufficient, excessive, or noisy HVAC, this would have been identified in guest feedback.

It should be noted that the dominant feedback ('quality of service' and 'attention to detail') is largely driven by the hotel operator (service, food, provision of bar / restaurants facilities), along with the architect and interior designer ('stylish', 'modern' being regularly used descriptions).

One engineering design issue to note is bedroom lighting, for which the Trip Advisor reviews identified very good feedback (see quotes below), but where the maintenance manager has reported anecdotal occurrences of light bulbs being taken out of pendants (above the beds) on one side of the bed only. This was attributed to one guest's desire to read and finding the LED reading light inadequate, therefore taking the bulb out on the pendant on the other side of the bed before (hopefully) switching the pendant lights on.

'Lighting was impressive'

'Lighting in the room was the best for any hotel in the city that I've experienced'

Openable Windows

Bedrooms on the top two floors of the hotel are provided with openable windows, which when open de-activate the fan coil units. A small proportion of guests do request openable windows (even in an urban location on a busy road) and the hotel see this as a strength in their flexibility and offering. There is incidental evidence from the rooms monitoring and control system that windows are used and then de-activate or delay the operation of the fan coil units. This cannot be directly correlated to energy consumption as the room control system is separate from the main BMS.

Lessons learnt

The issues most commented on *negatively* by guests (on Trip Advisor) are as follows, and show relative consistency between travel review websites, staff feedback, and the reception logs:

- Noise as an overall issue, whether in the bedrooms, the ground floor bar, or in the lobby. No single individual area was identified from these reviews as more problematic than others – see section 8.3 for more detail.
- Complexity of bedroom equipment, specifically the TV remote and media hub
- Complexity of controls, particularly the touch screen panels which control the lightings and automated blinds, viewed as too complex and slow to react.

There are just around 10% occurrences of such reviews, out of the 88 guest reviews analysed. Interestingly, this is a reduction overall compared to the first set of data analysed at the end of the first quarter of hotel operation, where in proportion these issues occurred around 25% of reviews. These improvements match information provided by the hotel operator on measures taken, including remediation measures on the façade to improve air tightness and limit noise ingress, and an iterative adjustment of bedroom controls, in collaboration with the controls manufacturer. They also highlight the importance of tuning in the first year.

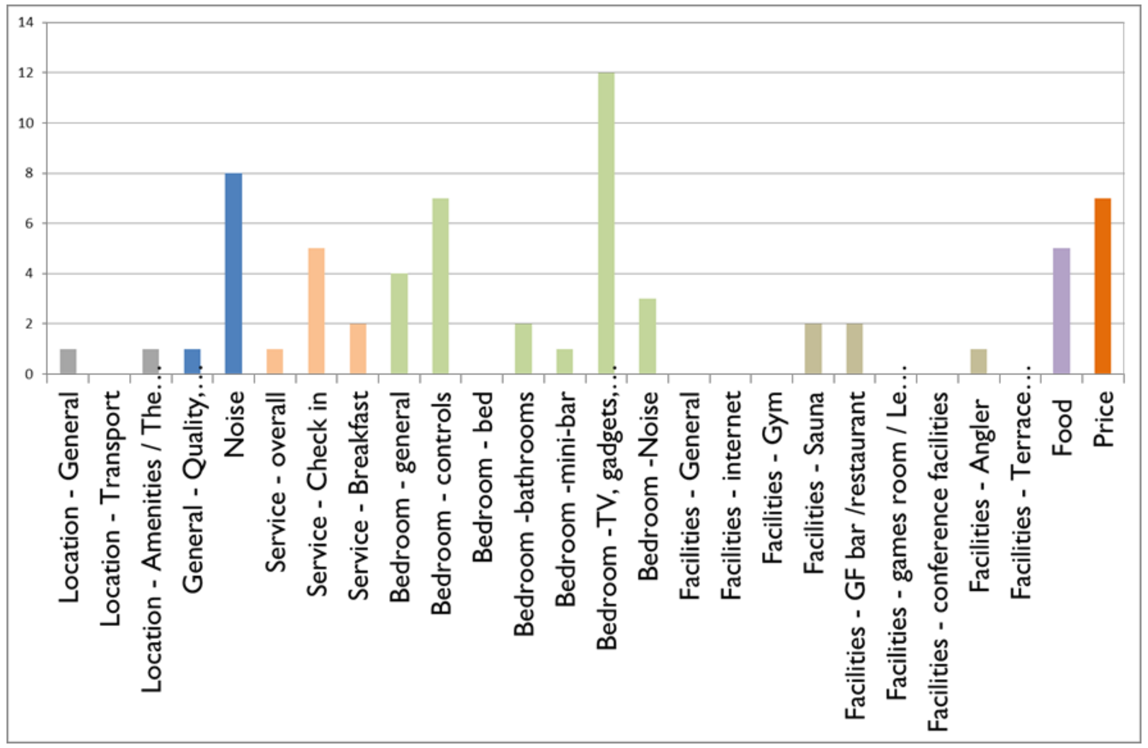


Figure 8.12: Number of negative mentions in guest reviews, out of 88 reviews

Complexity of Controls

The high-tech or complexity of bedroom equipment, specifically the TV remote and media hub, as well as the complexity and reaction time of controls over lighting and blinds were often commented on by guests with negative feedback very much tempered by a larger number of very positive reviews on the 'gadgets' and 'modern feel'.

Figure 8.13: Bedroom controls

<u>Quotes from Trip Advisor:</u>

'Modern'
'James Bond feel'
'Very cool'.
'Electric blinds clever and working (for a change...)'
'This is 'techie' heaven with remotes and buttons to press for everything, including the black-out blind on the window
'As a lover of technology this hotel was perhaps the most impressive I've ever experienced. Thankfully, it is not so technically challenging that I couldn't manage to work them all'

'Some of the technology in the room (the switches for the lights) are a little difficult to figure out'
'Touch panels weren't always responsive enough, though I like the idea very much'
'We struggled a bit with the touch-pad by the bed for the light'
'I did get rather confused with the key pass for the door. When you scan the card it unlocks the room but doesn't allow the handle to turn (you just push the door forwards) which confused me a bit. I had to ask a member of staff then felt a bit daft'

The hotel operator was aware of this from early on and investigated it in collaboration with the interior designer and controls manufacturer, with adjustment to the sensitivity of the controls. These improvements seem to have had appositive impact, as Trip Advisor reviews in the later quarter show much fewer occurrences of negative than those of the first two quarters – see following figure, which shows the breakdown of guest mentions about bedroom controls into negative and positive ones, after 6 months (March 2013, 48 reviews) and after 14 months (December 2013, 193 reviews). This highlights the importance of fine-tuning controls, as well as, probably, staff improving the 'room in' service when guests check in, with an explanation on controls.

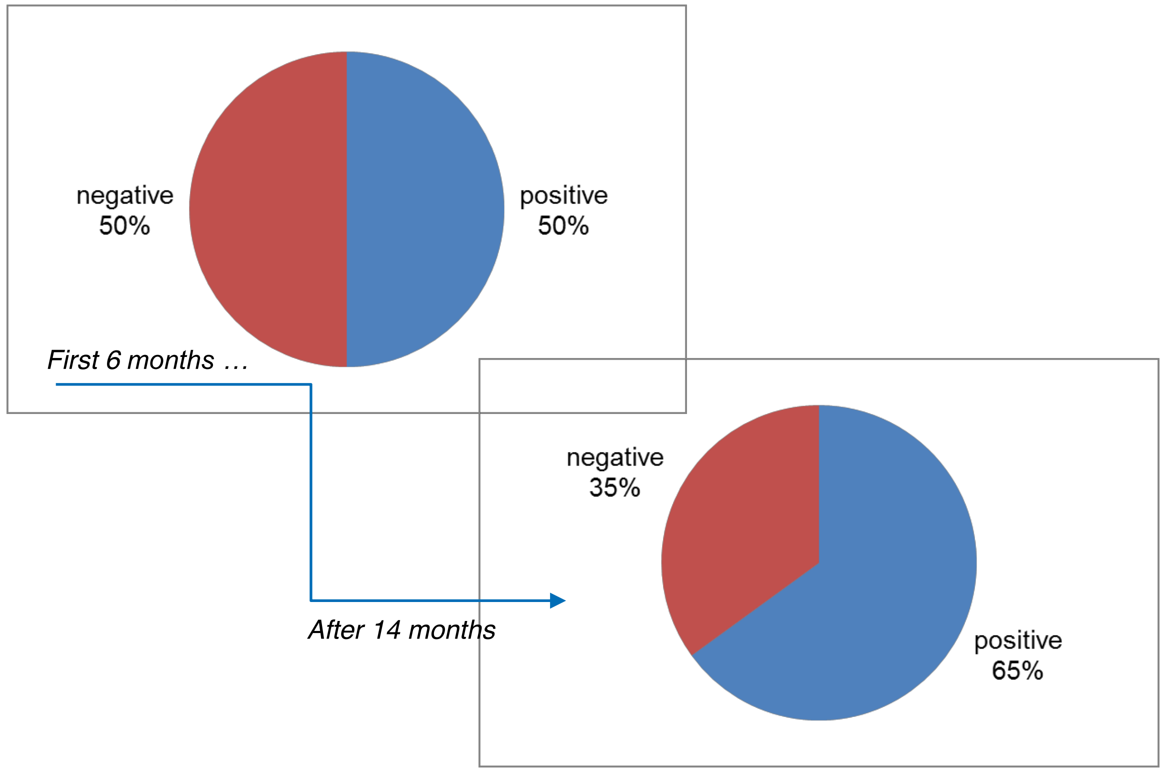


Figure 8.14: The important of fine-turning and settling in: Mentions by guests of bedroom controls: split between negative and positive, after 6 months (top) and 14 months (bottom): the majority of mentions is now positive

Overall, the maintenance manager has stated that the level of calls received by the maintenance team is lower than could be expected given the relative complexity of the controls, and this is probably helped by the simple symbols for guests to understand, and by the extremely well-rated staff and 'rooming' service where guests are explained room controls. Guests are also provided with a simple user guide – see section 6.3.

Press Reviews

The hotel has attracted a high level of media attention and the BPE team initially gathered reviews (in the first quarter) to identify any recurrent theme which may be linked to the design and management performance of the building. Reviews are presented in Appendix I. These reviews mostly relate to general quality and service issues and are not seen relevant here, however useful points identified at the time were:

- Strong design and art focus of the hotel -generally viewed positively, with one exception
- Poor acoustics in the ground floor restaurant was mentioned in one restaurant review.

Conference Facilities – Using Survey Monkey

The BPE lead organisation hosted a half-day annual group meeting at the hotel conference facilities in October 2012. This was attended by 13 people. The group spent the majority of their time in the conference room but were given a brief visit of two hotel bedrooms.

An informal survey was carried out afterwards using Survey Monkey, circulated by email. The online survey was completed the following day by members of the team. Of the thirteen attendees, seven responses were received. The survey comprised ten questions: nine evaluated on a sliding scale from 'Very poor' to 'Excellent', and the final question seeking one suggestion for an aspect to monitor over the 2-year BPE project.

Full results are included in Appendix J. While it is recognised that this is a very limited and preliminary gathering of information, and from a specialist audience (informed and interested in the built environment and sustainability), key points of the survey are as follows:

- Overall impression: very positive.
- Conference room: noise levels (from internal and external sources) and ventilation were considered to be 'Very good' and the room temperature to be 'Very good/Excellent'.
- Hotel bedrooms: the controls (lighting, 'eco' setting, blinds) provided within each bedroom were considered 'Average'. All respondents expressed a preference for a hotel room with openable windows, despite knowledge of the comfort cooling system installed.
- Overall internal lighting design: this was viewed positively, receiving 'Good/very good' responses.
- Daylight levels: the conference room yielded the most positive response, with over 70% stating that daylight in the conference room was 'Excellent', compared to the hotel bedrooms where daylight levels ranged from 'Good' and 'Excellent'.

Suggestions for topics to monitor over the 2 year BPE study were generally in line with the agreed scope of the BPE, with an emphasis on user feedback about the touch screen controls in hotel bedrooms.

8.3 Acoustics

A number of issues related to acoustics have been identified since the completion of the hotel, from Trip Advisor reviews, reception logs, and staff feedback:

- Noise breakout from the first floor courtyard bar into surrounding bedrooms
- Noise from the rain onto dormers on the front elevation
- Noise penetration from the street
- Interaction between hotel activities and restaurant / bar events on the ground and first floors.

Feedback from BUS staff surveys:

"3 South Place bar is very close to hotel reception. Whenever there's drinks reception or DJ playing it's difficult to hear your colleague, guests checking in and phones. 3SP bar and hotel lobby are merged."

"With the bar and desks not separated when it's busy, it becomes hard to hear guests / phones."

Courtyard bedrooms: The issue of acoustics in bedrooms located around the internal courtyard was identified in the first few weeks of operation and was partially related to construction defects. (During a 'test' weekend stay by a member of the BPE team, they were woken up at night by a relatively quiet conversation in the courtyard.) Following complaints by guests, investigations were carried out including site visits by the acoustician and cross-referencing with the thermography surveys (see section 5.4). Defects in the quality of the sealing around the window frames were identified and have been remediated.

In addition to this, noise issues are related to the success of the hotel and the use of the bar for a large number of events, not initially expected by the hotel and not part of the initial brief. In addition to remedial measures, a canopy was installed on the bar: this was largely driven by a desire to increase revenues, but a higher-specification canopy with acoustic attenuation was purchased in order to reduce noise impact on the surrounding bedrooms. Incidentally, a similar canopy (not necessarily acoustically-treated) is expected to be installed on the top floor terrace bar, also to increase revenues.

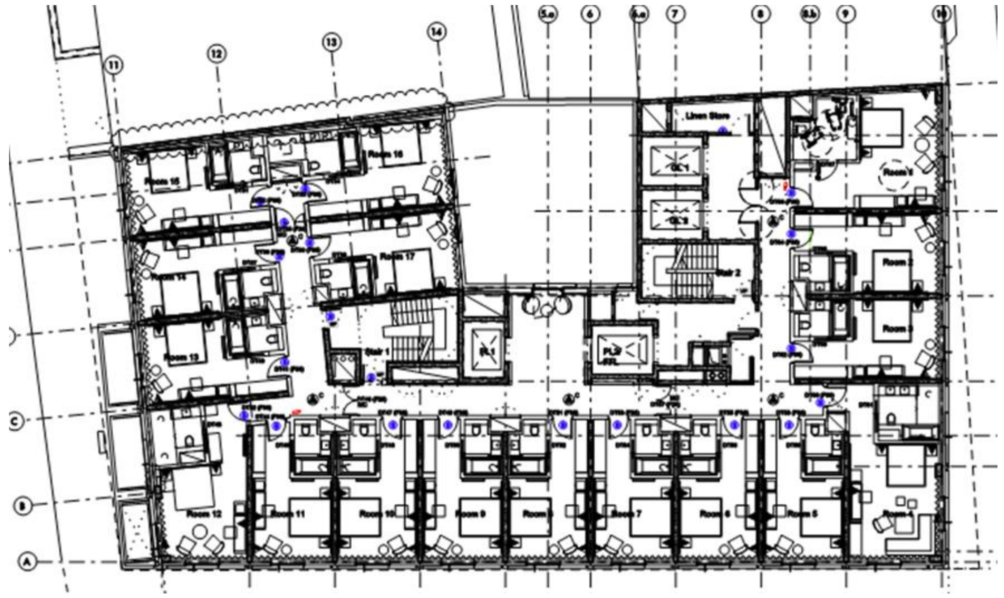


Figure 8.15: Second to Fourth floor plan, showing bedrooms located around the courtyard

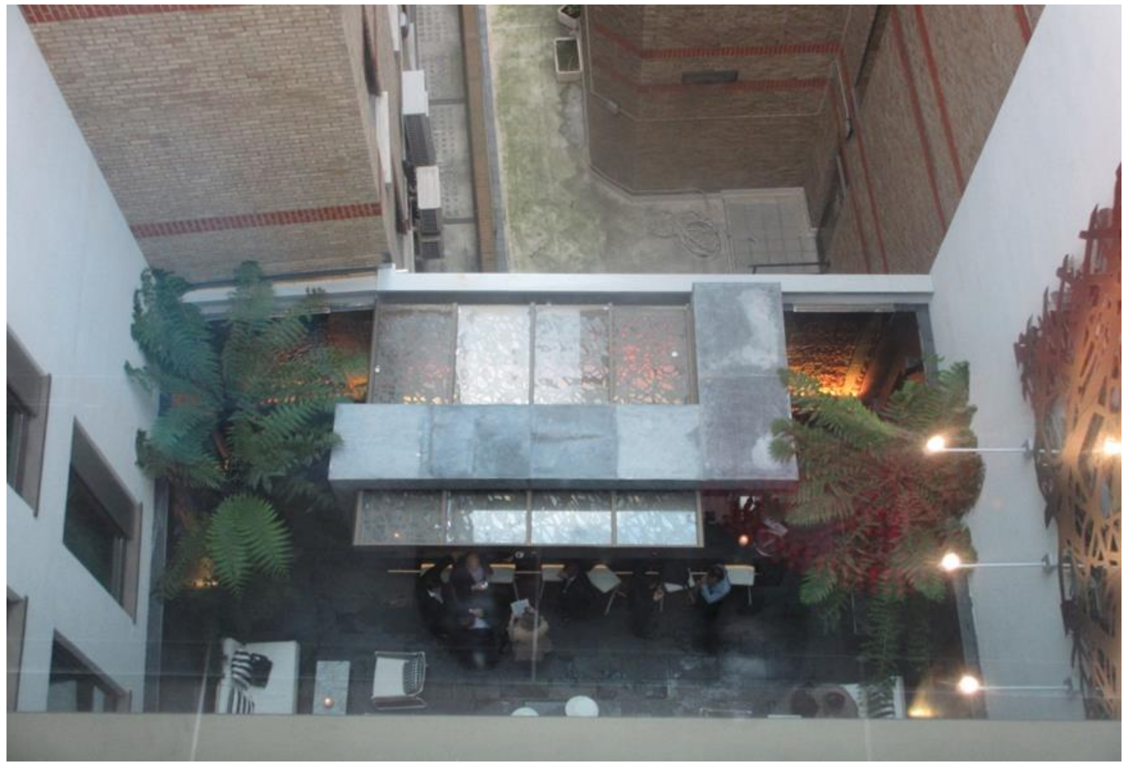


Figure 8.16:View of first floor courtyard bar, from 4th floor (before installation of canopy roof)

Street-side bedrooms: The maintenance manager's informal feedback was initially positive on how well the hotel bedrooms were shielded from external noise from the street side. There have however been occasions since of guests complaining of sleep disruption due to the noise from rain onto dormers, and a small proportion of guest reviews on Trip Advisor have mentioned traffic noise. This was heightened in the 2nd year due to construction works taking place in the vicinity. Remedial works were carried out to improve the sound reduction of the façade, addressing poor leakages due to poor seals. This led a significant improvement but at the time of this report it is still debated whether the achieved performance complies with the ERs (the required standard is met on average, but still with slight departures from the ERs at some frequencies for the first two floors).

Applicable standards: It should be noted that the hotel was subject to acoustic standards for noise levels inside the rooms and airborne insulation between rooms (in part associated with BREEAM credits), and acoustic testing of ambient internal noise levels, carried out on behalf of the contractor, confirmed these standards were met (see section 5.4 for details). These standards however apply to ambient conditions and are not meant to address specific events, such as evening events in the courtyard bar (the frequency of which had not been part of the initial brief) or construction works.

9.0 Management

The hotel is actively managed with a number of characteristics which facilitated the BPE study and must also contribute positively to the performance of the hotel, including:

- The hotel maintenance staff have been recording and monitoring energy and water consumption, taking daily manual records of the main utilities meters from the 1^{st} day of opening.
- Customer feedback is logged at reception, with logs interrogated daily by staff. This was used by the BPE team as check against customer reviews on travel websites.
- High-standard of customer service: ‘room-in’ period where staff explain the operation of the room (e.g. controls of lighting and blinds, operation of AV, ‘eco’ settings). This is expected to help good operation of the bedrooms’ features, and is also an opportunity for staff to collect informal feedback on guests’ initial reactions to ease of use (or not) of these features.
- Regular meetings between the FM manager and general staff to implement energy and water management procedures e.g. switching off lighting equipment after hours; switching off the air conditioning in empty rooms: these are programmed to revert to background setting after a certain period without occupation, but room staff were instructed to prompt that background setting earlier when they enter an unoccupied room.
- Regular meetings between the FM manager and FM managers from other restaurants of the same owner, specifically on ‘green’ issues (there are no other hotels in the same ownership).

The hotel’s facilities management team also helped ensure a continuous source of information and focus on remaining defects.

It is worth noting that the facilities management team do not receive financial incentives directly related to energy and water consumption. While the facilities manager is in charge of the budgets for both utilities and maintenance, these are separate and savings from energy and water consumption are not made available for capital investment into further efficiency measures.

Lesson learnt - The hotel’s facilities team, and particularly the facilities manager, are very pro-active and it is apparent that this is an extremely important factor in evaluating and maintaining building performance and occupant satisfaction (see Figure 8.3 from BUS in section 8.1).

Over-door heater

Partly due to their weight and despite a member of staff being located at the front entrance door to ease operation for the guests, the entrance doors tended to be left open for large periods of time, which created discomfort at reception and in the surrounding lobby – please refer to previous quarterly reports where this had been discussed. In the last quarter, the hotel retrofitted an electric over-door heater in the hotel’s draught lobby. In previous quarters there were discussions about linking the door heater to the hotel’s hot water system, however the system installed is electric. It includes a control panel at low level, allowing 3 fan speeds – see pictures in Figure 9.1.

The heater was installed without prior knowledge of the BPE team, and without individual metering.

Figure 9.1: Over-door heater retrofitted by the hotel in Quarter 6

Lesson learnt - The BPE organisation are currently involved as building services engineers and sustainability consultants in the design of a new restaurant, which will be operated by the same organisation and is designed by the same interior architects as South Place Hotel. This has already provided opportunities for direct feedback and incorporation of lessons learnt. For example, while overdoor heaters had been considered and not included in South Place hotel, their recent retrofitting means that the design team for this newer building has decided to consider the issue seriously from early stages, and to plan for an over-door heater connected to the central hot water services.

Energy and Water Efficiency Retrofitting

The hotel’s facilities management team have implemented energy and water saving measures from the end of the first year of operation.

Installation of new water flow restrictors on the showers (from 18l/in previously to 15-16l/min) and hand basins (from 6l/min to 4l/min). Shower flows were tested down to 12l/min, but these were judged of unsatisfactory quality, particularly given the very large head which made the flow look all the smaller. The restrictors were installed over January 2014, in stages to monitor impact on consumer experience. The very high consumer satisfaction levels with water appliances were noted by the BPE team in previous quarters, and are closely monitored by the hotel’s management team via the reception’s logs (where feedback tends to focus on complaints) and two travel review websites (including Trip Advisor, also used by the BPE team in previous quarters for initial analysis). As no changes in consumer feedback were recorded after the implementation of the first restrictors, they were fitted to all bathrooms on the 2^{nd}, 3^{rd}, and 4^{th} floors. They were not fitted on the 5^{th} and 6^{th} floor bathrooms as the flow rate is expected to already be around 15-16l/min due to water pressure. Interestingly, a large developer working with the BPE team on a high-end residential project recently reviewed a range of shower heads and also came to the conclusion that a very high quality ‘experience’ could be obtained with good showerheads at ~ 15l/min, with no significant benefits when increasing the flow to 18l/min.

Unfortunately due to the lack of reliable sub-metering at this stage, the impact of these measures could not be quantified as part of the study. in fact water consumption has followed an upwards trend (see section 11), which cannot be attributed without more accurate data on rooms and meals sold.

Replacement of light fittings:

- The pendants on each side of the beds, i.e. the only non-LED light fittings in bedrooms, were changed as and when they failed, from October 2013 to March 2014 (from a 42W light with 60W output to a 28W light with 30W output).
- Some light fittings in the ground and top floor restaurants were changed (from 50W to 32W). The original ones were described as ‘like a heater’, particularly in the top floor restaurant which is under a mansard roof and therefore of relatively low ceiling light in places.

These works were carried out in stages, some of it before detailed sub-meter data was available, and they were therefore not quantified in the BPE project. Note anyway that lighting in the bedroom is not sub-metered, but rather grouped with small power.

10.0 Energy Consumption Analysis

10.1 Data Input for TM22

The TM22 analysis was carried out at the end of the 2nd year of the BPE project, with meter status as follows. Importantly, the facilities management team have taken daily manual readings of the mains meters from the opening of the hotel. This means that overall energy consumption data is available from the opening, covering over two years and allowing checks against annual and monthly total for the main meters.

Table 10.1: Data availability from electrical meters (for TM22 analysis

End uses by meter	Period covered by consumption data	Data source	Energy data reading intervals: Monthly	Daily	Half hourly	Comment on data quality
Main Incomer	13/07/2013 - 13/07/2014	Half Hourly data from SIPₑ Energy Management System	✔	✔	✔	Continuous data available save for the period 24/08/2013-04/11/2013 (data logger issues eventually corrected by the contractor) Annual total verified against FM team manual readings – within 0.5%, i.e. considered reliable
Kitchen equipment – basement, ground, first and 7th floor	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	Continuous data available save for the period 24/08/2013-04/11/2013 (data logger issues eventually corrected by the contractor)
Chiller Plant	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	
MCC	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	
Elevators	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	
Guest rooms lighting and small power	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	
IT Room	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	
Pumps	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	1 year of reliable and continuous half hourly data available
Fans	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	
Communal areas (incl. kitchen and restaurant) lighting and small power	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	
CHP Electricity Generated	01/05/2013-31/05/2014	Manual meter reads (Provided by Energi and Hotel Maintenance Manager)	✔	✕	✕	Data appears to be reliable

Table 10.2: Data availability from gas meters (for TM22 analysis)

			Energy data reading intervals			
Areas covered by meter	**Period covered by consumption data**	**Data source**	**Monthly**	**Daily**	**Half hourly**	**Comment on data quality**
Main Incomer	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	Continuous data available save for the periods 13/07/2013-02/08/2013 and 1/11/2013-30/11/2013 (data logger issues eventually corrected by the contractor) Annual total verified against FM team manual readings – within 0.5%, however monthly totals from SIPe show very wide discrepancy from manual readings (10-40%), therefore the annual total entered in TM22 is from manual readings
Boiler gas consumption		Estimated to cover June 2013-May 2013 based on subtracting CHP and catering gas consumption from the main incomer on a month-by-month basis	✕	✕	✕	Lack of data due to faulty boiler gas meter that has been replaced by contractor recently
5 sub-meters covering kitchen catering consumption on various floors	13/07/2013 - 13/07/2014	Half Hourly data outputted from SIPₑ Energy Management System	✔	✔	✔	Continuous data avilable save for the periods 24/08/2013-30/11/2013 (data logger issues eventually corrected by the contractor)
CHP Gas Consumption	1/12/2012-31/01/2014	Manual meter reads (Provided by Energi and Hotel Maintenance Manager)	✔	✕	✕	Data provided by CHP installer and maintenance contractor so considered robust and reliable
CHP Heat Output	1/12/2012-31/01/2014	Assumed manual meter reads (Provided by Energi and Hotel Maintenance Manager)	✔	✕	✕	Data provided by CHP installer and maintenance contractor so considered robust and reliable

Please refer to the CIBSE TM22 spreadsheet issued as separate file alongside this report.

CIBSE Guide F Benchmarks

CIBSE Guide F is a widely used industry source for energy benchmarks. For hotels, Guide F detailed benchmarks are largely based upon Energy Consumption Guide 36 'Energy Efficiency in hotels – a guide for owners and managers' (ECG 36). ECG 36 is based upon data from over 300 hotels of various kinds and benchmarks are available for three hotel types: luxury, business/holiday hotel, and small hotel. For each type, Typical and Good practice values are given.

The most representative benchmark for South Place is considered to be 'Type 2 – good practice – business or holiday hotel' i.e. 'a three or four star purpose-built hotel catering principally for the business or holiday trade. There is a restaurant, conference rooms and leisure facilities, 100 – 500 beds hotel with generous reception and circulation spaces and large bedrooms.

The Guide F benchmarks also provide a breakdown of energy consumption for various end uses:

- Space heating
- Domestic hot water
- Space cooling
- Ventilation: fans, pumps, controls
- Lighting
- Household/office appliances
- Catering
- Air conditioning
- Other equipment.

TM 22 – User Specified benchmark

TM22 creates a "Raw TM46" benchmark with an option to define a "User Specified" energy consumption benchmark for comparison with the actual building's "In-use" data. The User Specified benchmark was used to create a more bespoke and less generic hotel benchmark that would be more representative of South Place Hotel. This benchmark includes the additional restaurant on the 7th Floor, defined as 'Restaurant (with bar)' in CIBSE Guide F. The composite South Place benchmark was created using relative floor areas.

Energy demand by building end-use

In order for TM22 to show total building energy demand use broken down into constituent end uses, sub-meter readings need to be aligned with the defined end use classes within TM22. The annual energy consumption extrapolated from the available sub-meter data was used (see previous tables with commentary on accuracy of meter readings), however, the boiler gas consumption needed to be apportioned out into heating and hot water uses, using monthly profiles and estimating domestic hot water as the 'base load' constant throughout the year (see section 10.3); similarly, as guest room and communal areas electricity meters capture both lighting and small power, this was broken down using the lighting installation and applying estimated usage profiles to them, and the remaining consuming estimated to be small power.

Alignment of "In Use" data with sub-metered data

Within TM22 sub-metered data is used to verify the assumptions that have been made on the running hours of building energy end uses that summate to define the building's "In-Use" energy consumption. The extrapolated sub-meter data was used to make adjustments to the usage factors of building end uses so that the "In-use" energy demand for these items reflect the extrapolated sub-metered data (within 5%, and total within 1.5% discrepancy).

10.2 Overview of Energy Supplies and Carbon Emissions

Overall Energy Consumption

Overall energy consumption was established from the mains gas meter (half-hourly) and mains electricity meter (half-hourly), and verified against the facilities management's team manual readings.

Monthly consumption over 2 years (March 2013 – February 2015) is shown below, from manual readings taken by the FM team. This excludes the first six months of operation of the hotel (September 2012 – February 2013). Consumption is similar in the 1st and 2nd years, and with marked seasonal variations, with gas consumption peaking in winter and electricity peaking in summer.

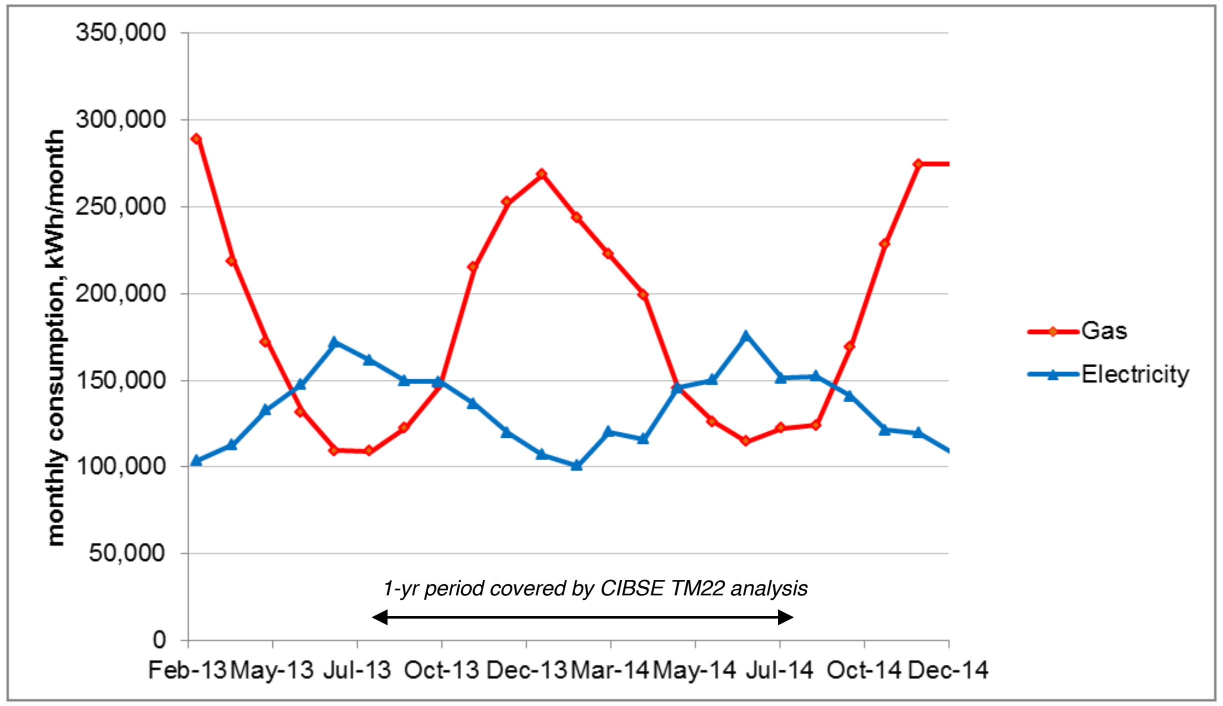


Figure 10.1 – Monthly gas and electricity consumption, Mar 2013 – Feb 2015

In addition, the CIBSE TM22 analysis was carried out covering approximately the 2nd year of the BPE project (July 2013- July 2014), and is summarised below alongside the following benchmarks':

- CIBSE TM46 benchmark s for Business/Holiday hotels, good practice.
- 'User specified', i.e. area-weighted CIBSE Guide F good practice benchmark for hotels + CIBSE Guide F good practice benchmark for restaurants, applied to the top floor restaurant, to represent the high level of restaurant / catering provision in this hotel, as described above.

Table 10.3 – Summary comparison of energy supplies with CIBSE benchmarks

Reference		Gas	Electricity
South Place hotel 13 July 2013 – 13 July14		2,162 MWh/yr	1,695 MWh/yr
		316 kWh/m²/yr	247 kWh/ m²/yr
CIBSE TM46 hotel – good practice		300 kWh/ m²/yr	105 kWh/ m²/yr
Adjusted CIBSE Guide F Good Practice benchmark: hotel + additional top floor 'restaurant with bar'		306 kWh/ m²/yr	133 kWh/ m²/yr
Alternative CIBSE Guide F benchmark: hotel per bedroom + additional top floor 'restaurant with bar'	Good Practice	256 kWh/ m²/yr	110 kWh/ m²/yr
	Typical Practice	367 kWh/ m²/yr	175 kWh/ m²/yr

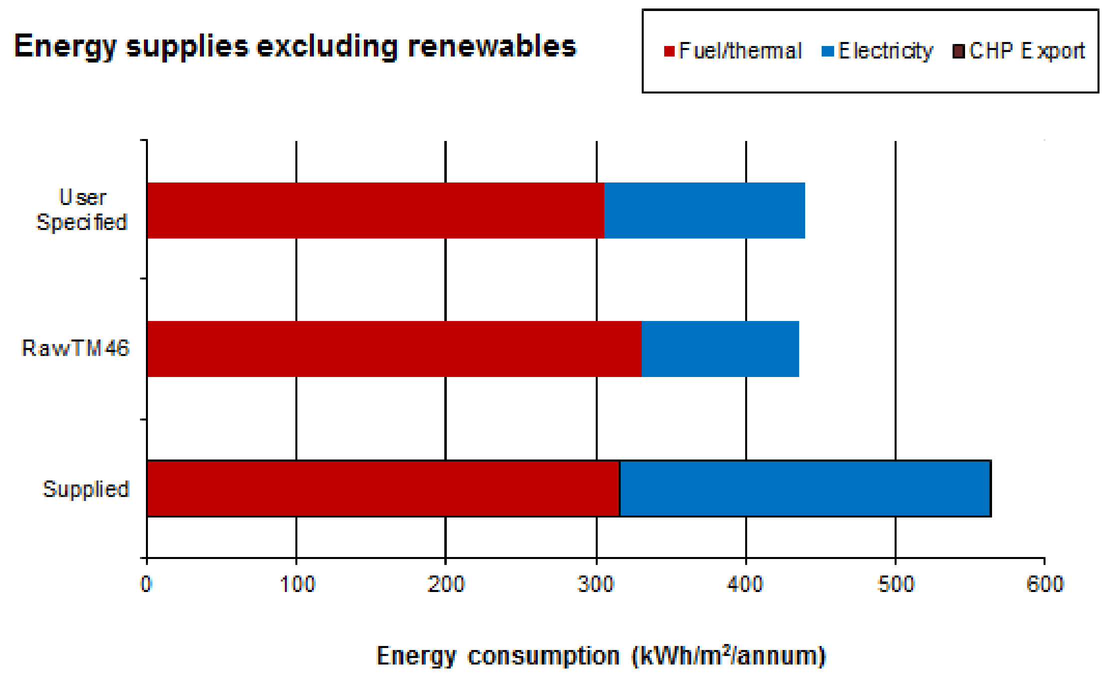


Figure 10.2– Overall annual gas and electricity supplies against CIBSE benchmarks (from TM22)

The CIBSE TM22 also calculates the resulting carbon emissions associated with the building's energy supplies, using the following carbon emissions factors (different from those used in Part L):

- Gas: 0.194 $kgCO_2/kWh$
- Electricity: 0.55 $kgCO_2/kWh$

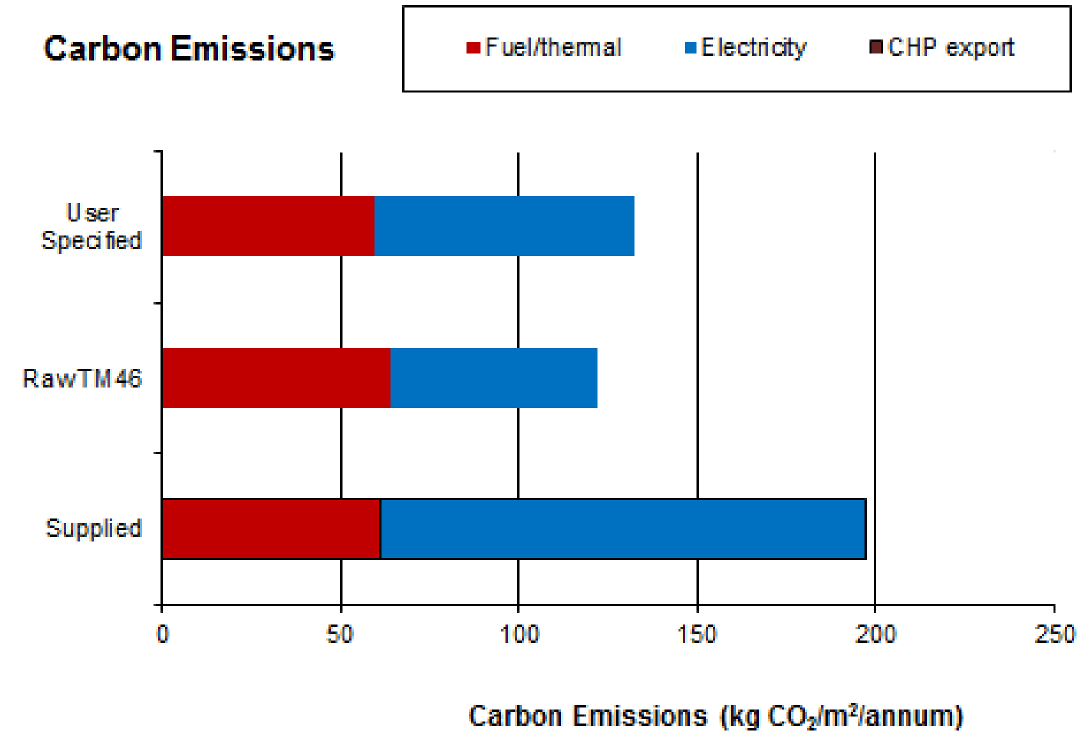


Figure 10.3 – Overall annual CO_2 emissions against CIBSE benchmarks (from TM22)

The building's overall energy consumption and carbon emissions are higher than benchmarks, particularly due to its electricity consumption which significantly higher than benchmarks. This can be found in new buildings which have more equipment and be more heavily serviced than those in the pool of buildings used to establish the benchmarks. Gas consumption is similar to good practice benchmarks (per area) and between 'good' and 'typical' practice when benchmarked per bedroom. Both gas and electricity consumption are examined in more detail in the following sections.

It should be noted that while gas consumption is higher than benchmarks (~6% higher than the adjusted CIBSE benchmark), the hotel uses CHP which means that, for a given demand, gas consumption will be higher than if only delivered by boilers. On the other hand, this is expected to result in carbon savings through the generation of electricity on site – see section 10.5 for more detail.

The team note the relative difficulty of benchmarking good practice. In the case of hotels, both CIBSE TM4 and Guide F refer to Energy Consumption Guide 36, which dates back to 1999 and is based on a relatively small sample of 50 hotels, split over 3 categories.

10.3 Gas Consumption

Gas consumption is similar to good practice benchmarks, and would be lower if heat was supplied by gas boilers rather than in part by CHP – see section 10.5 for more detail.

Gas consumption is split into about 2/3rd for space heating and domestic hot water (i.e. regulated uses), and 1/3rd for catering gas (un-regulated).

Over 50% of the regulated gas is used by the CHP, and this would increase if the CHP operation was optimised, once remaining defects are addressed – see section 10.5.

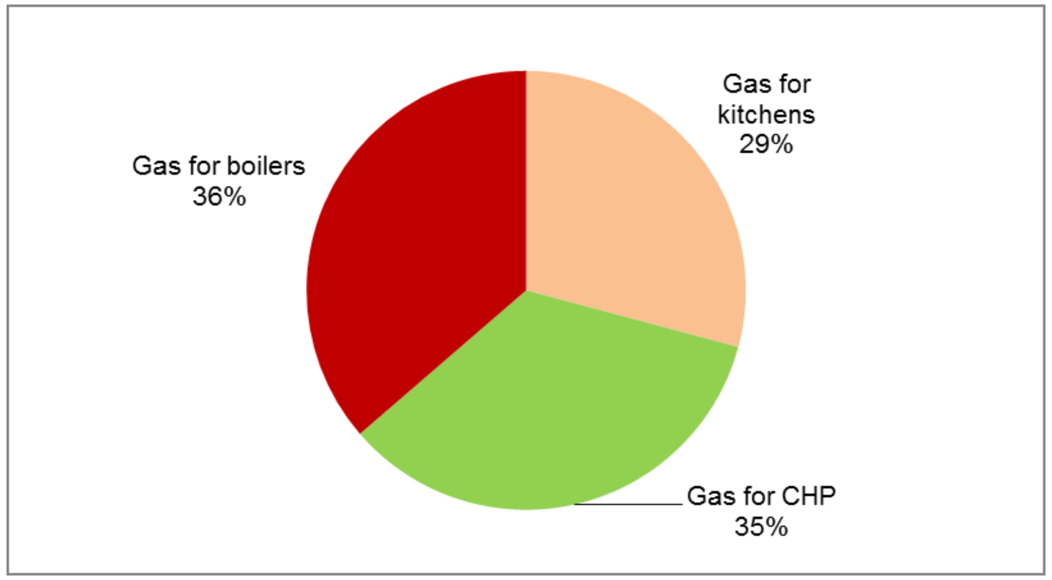


Figure 10.4: Annual split of gas consumption (July 2013-July 2014)

Monthly thermal output from the CHP is available from the remote monitoring unit, and the output from the boiler was estimated using an efficiency of 85%, in the absence of reliable metering data over the period analysed. This is plotted in the following figure against monthly heating degree days available from Bizee [3], using a 15.5ºC base and the Heathrow weather station.

This indicates that there is generally a good correlation between heating degree days and gas consumption: this is usually an indicator of relative efficiency (i.e. a building operating inefficiently may not see its heating load decrease much in periods on warmer weather).

The monthly profile can also be used to assess the domestic hot water as, approximately, the minimum monthly load, constant throughout the year. In this case the base load was estimated at 46,000kWh/month, i.e. just over 50% of the total annual thermal load.

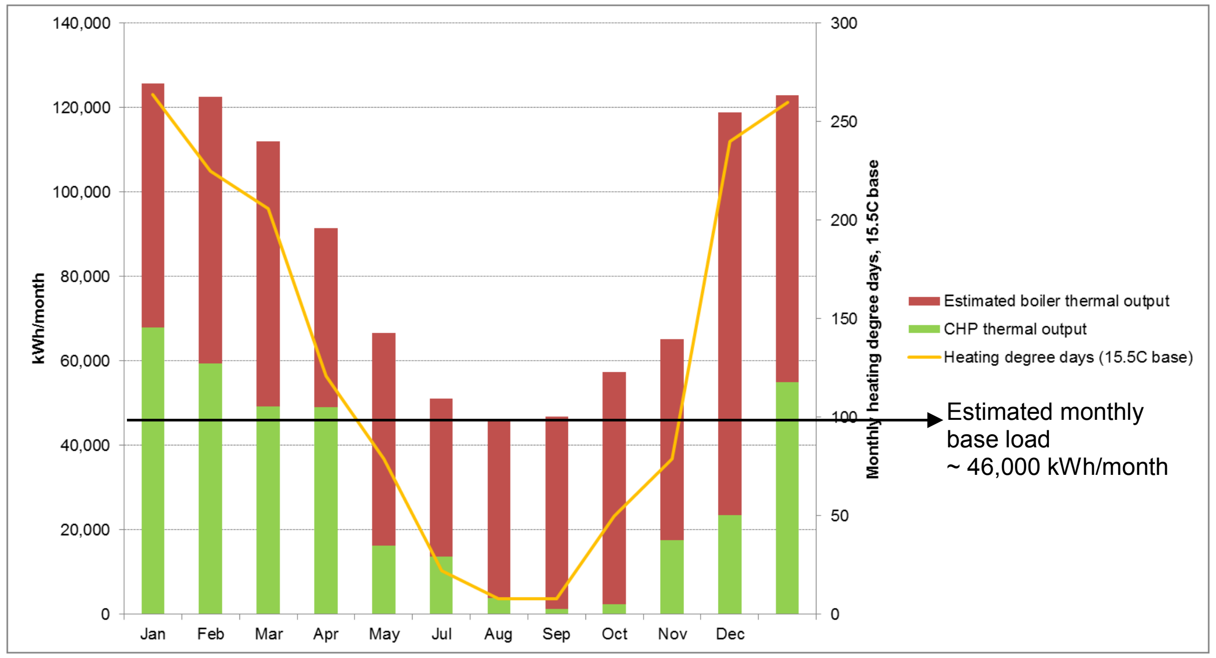


Figure 10.5 – Monthly estimated outputs from CHP and boiler, and heating degree days (July 2013 - June 2014, axis modified to show against Jan-Dec year)

The resulting gas consumption breakdown into space heating, hot water and catering was compared with the South Place 'composite' gas benchmark as follows:

- Hotel: benchmark breakdown as per CIBSE ECG 036
- Restaurant: gas use broken down evenly between space heating, hot water and catering.

The resulting comparison is summarised in Table 10.4, which highlights that space heating consumption is approximately that of the good practice benchmark (as may e expected in a recent building with higher fabric and plant efficiencies than those in the benchmark database, from 1999); hot water is however approximately twice that of the benchmark – this correlates with the building's high water consumption, in part attributed to luxury bathroom appliances. Catering gas is also much higher than benchmarks – see section 10.6 for the overall benchmarking of catering gas and electricity consumption per meal exercise.

Table 10.4 – Summary comparison of gas consumption with benchmarks

Reference		Total gas	Space heating gas	Hot water gas	Catering gas
South Place Hotel Gas consumption (13 July 2013 – 13 July14)	kWh/ m²/yr	316	88	135	92
Adjusted CIBSE Guide F Good Practice benchmark: hotel (ECG 036) + additional top floor 'restaurant with bar'	kWh/ m²/yr	306	171	77	58

10.4 Electricity Consumption

The estimated breakdown of electricity uses from TM22 'In Use' is show in the following figure., against benchmarks provided by the CIBSE TM22 benchmarks (good practice and typical), as well as the adjusted one to include an additional restaurant, as described in section 10.1.

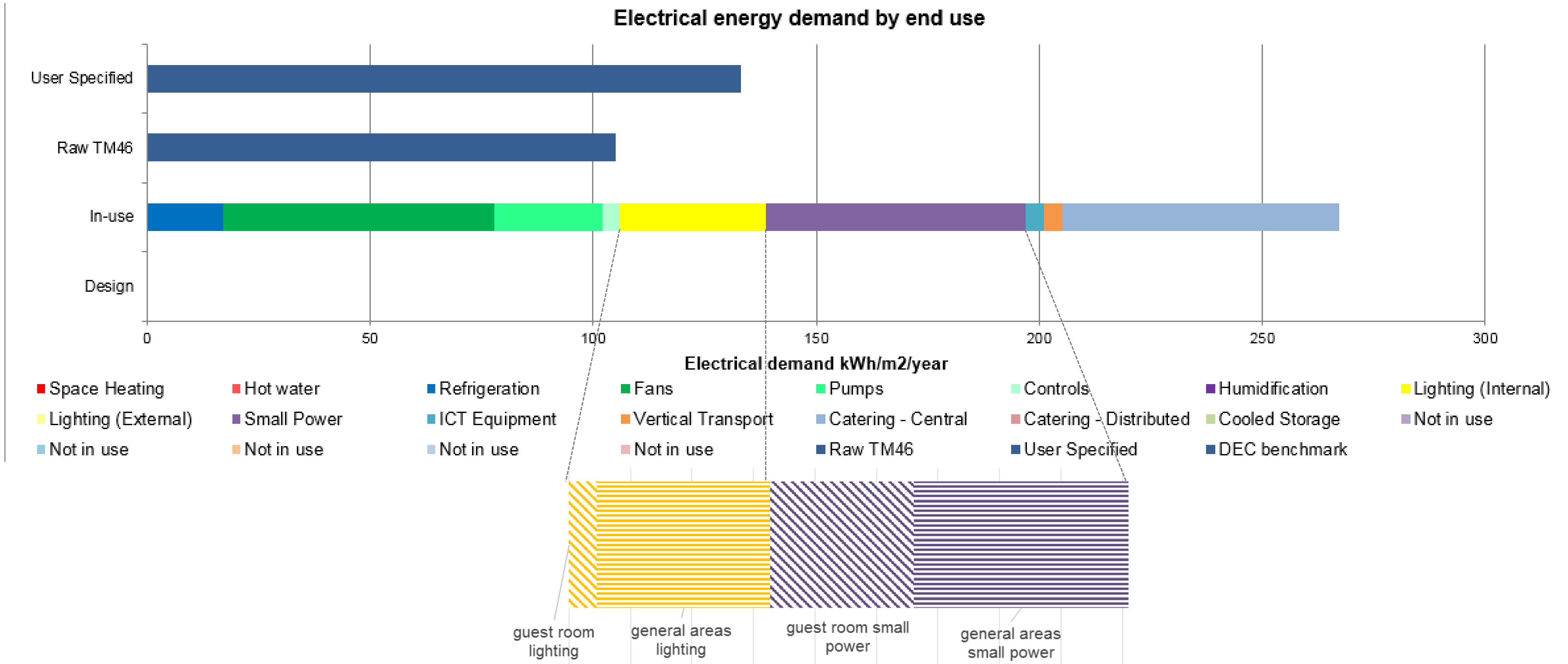


Figure 10.6 – Estimated annual electricity demand and breakdown against CIBSE benchmarks (CIBSE TM22), with additional breakdown of lighting and small power into guest rooms and general areas

The hotel's electrical electricity consumption is around 2.5 times more than a hotel building as defined by TM22 ("Raw TM46"), or around 2 times more than that of the "User Specified" composite CIBSE Guide F Good Practice benchmark for Type 2 hotels, accounting for additional restaurant.

The breakdown highlights the following:

- Un-regulated loads, especially appliances and cooking, represent approximately half of annual electricity consumption[4]. See section 10.6 for a benchmarking exercise of catering electricity per meal. As far as could be determined from approximate breakdowns of metered 'lighting & small power' into separate uses, small power is in majority attributed to general areas, but guest rooms also represent a large use (~40%). It should be noted that this also includes decentralised catering i.e. small fridges provided in each bedrooms, as well as small toasters provided on request[5].
- Fans and pumps consumption are a very high contributor to overall consumption. Initial factors have already been discussed with the team, including the following.
  - Single AHU serving both ground and top floor restaurants. The design initially included separate AHUs but this was modified at the construction stage for space and cost savings. The impact of this on energy consumption has not been quantified in this study, but has been commented upon by the facilities manager.

[4] Small power also includes, for part of the period analysed under CIBSE TM22, the outdoor heater retrofitted by the hotel operator. This was not individually itemised in the TM22 spreadsheet but would strictly speaking fall under 'space heating' uses.

[5] Kettles were only provided after the period analysed under TM22, following repeated requests by guests

   - Dense occupation of the hotel and high occupancy rates, contributing to high ventilation requirements
   - Constant MCC power use – see more in the following 'base load' section.
- Cooling consumption is only a small proportion of the total consumption, and in line with good practice benchmarks. This is despite the fact that the restaurants and all bedrooms are provided with cooling, and may in part be attributed to efficient chillers and controls such as those ensuring that fan coil units do not operate when bedrooms are unoccupied.

Base load

The building's base load occurs between 2 and 4am and was estimated on average at ~150kWe (~22W/m²), down to 100kWe, and is similar in weekdays and weekends. The main components of this base load are MCC power, general lighting and small power, kitchen equipment, fans, and guest room lighting & small power (20kW, i.e. 250-300W per bedroom). The large contribution of MCC to overall consumption is also reflected in the overall 'fans and pumps' allocation.

The pro-active energy management by hotel staff, high occupancy rates and long occupancy hours have all been noted previously in this report. While no simple opportunities for reducing the base load consumption were identified by the BPE team, this high load indicates however that this may be an area of potential energy saving opportunities.

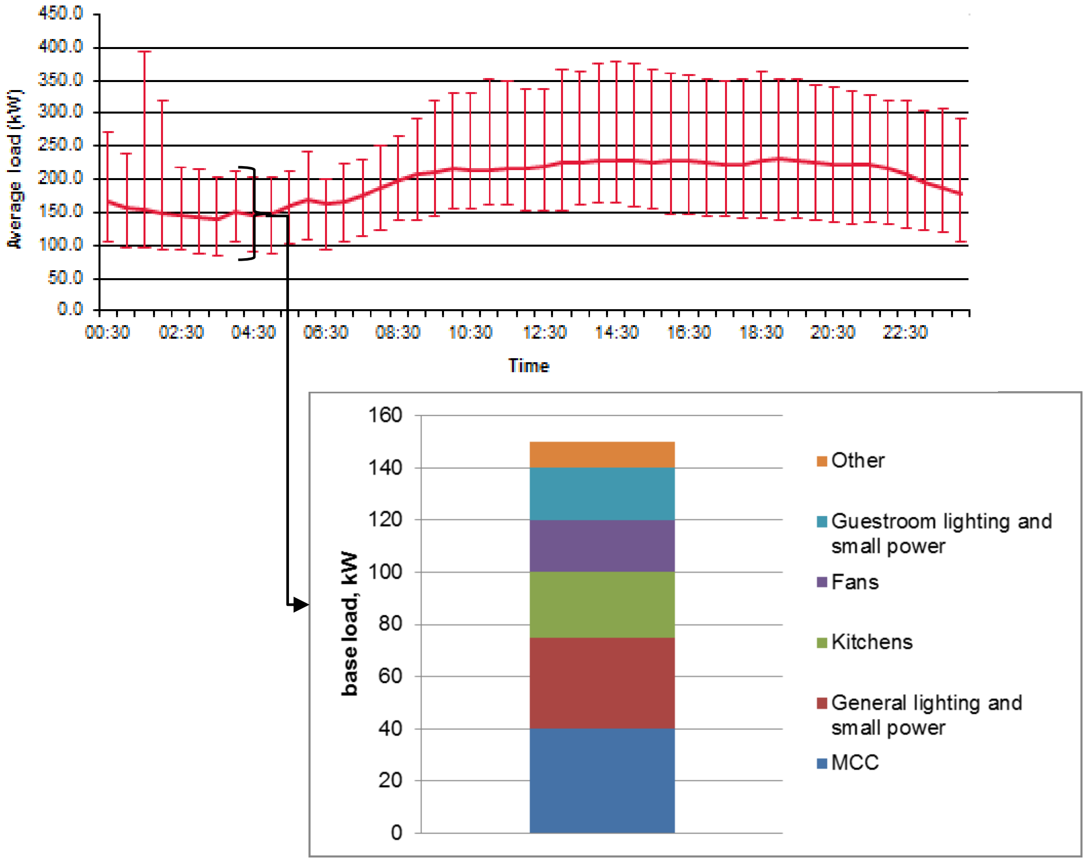


Figure 10.7 – Average weekday electrical load from main incomer (from TM22 half-hourly module), and breakdown of base load into main uses [July 2013 - July 2014]

In-Use Loads

The CIBSE TM22 'In Use' tab allows estimates to be provided of plant efficiencies at full load, and these are summarised in the following table.

Table 10.5 – Overview of calculated plant efficiencies and system hours (TM22 Sub Systems Analysis tab)

System	In-Use Full Load (W/m²)	In-use electricity consumption (kWh/m²/year)	System hours per year * (hrs/yr)	Initial commentary
Refrigeration	2.7	17.1	6,395	Full in-use load was estimated at ~18% of total capacity (using half-hourly data). Running hours are equivalent to ~ 50% of the time in the winter, 70% of the time in mid-season, and all the time in the summer, although this could be reviewed with further analysis over a summer season, given half-hourly profiles from chillers which show much reduced operation in the summer: see following paragraph
Fans	7.3	60.8	8,340	Running most of the time, as the hotel is fully mechanically ventilated and occupied 24/7
Pumps	2.8	24.4	8,760	Running all the time, as the hotel is occupied 24/7
Controls	0.4	3.8	8,760	Running all the time, as the hotel is occupied 24/7
Lighting (Internal)	6.3	32.7	5,234	Bedroom lighting occupied ~ 1/3rd of the time; communal areas lighting running ~ 2/3rd of the time, i.e. from early morning shift/restaurant opening to late shift / bar close
Small Power	12.0	58.3	4,859	Running ~ ½ of the time, related to bedroom, office, and BOH operations
ICT Equipment	0.5	4.0	8,760	24/7 comms room
Vertical Transport	11.1	4.1	367	Occasional use
Catering - Central	9.5	62.1	6,570	Equivalent to 17hr shift

* as estimated in sub-systems analysis tab in relation to in-use full load', not 'full load equivalent hours' from In Use tab, which relate to total capacity

Chiller consumption

As highlighted in the overall electricity breakdown, chiller consumption is a relatively small part of overall electricity consumption (~6%). Half-hourly data over the year analysed in TM22 is displayed below. This shows a very low consumption between October and February, which indicates a good response to cooler temperatures and a limited risk of simultaneous heating and cooling. This is also seen in daily profiles, with an example week below, showing afternoon peaks and much reduced consumption in the mornings and evenings / nights.

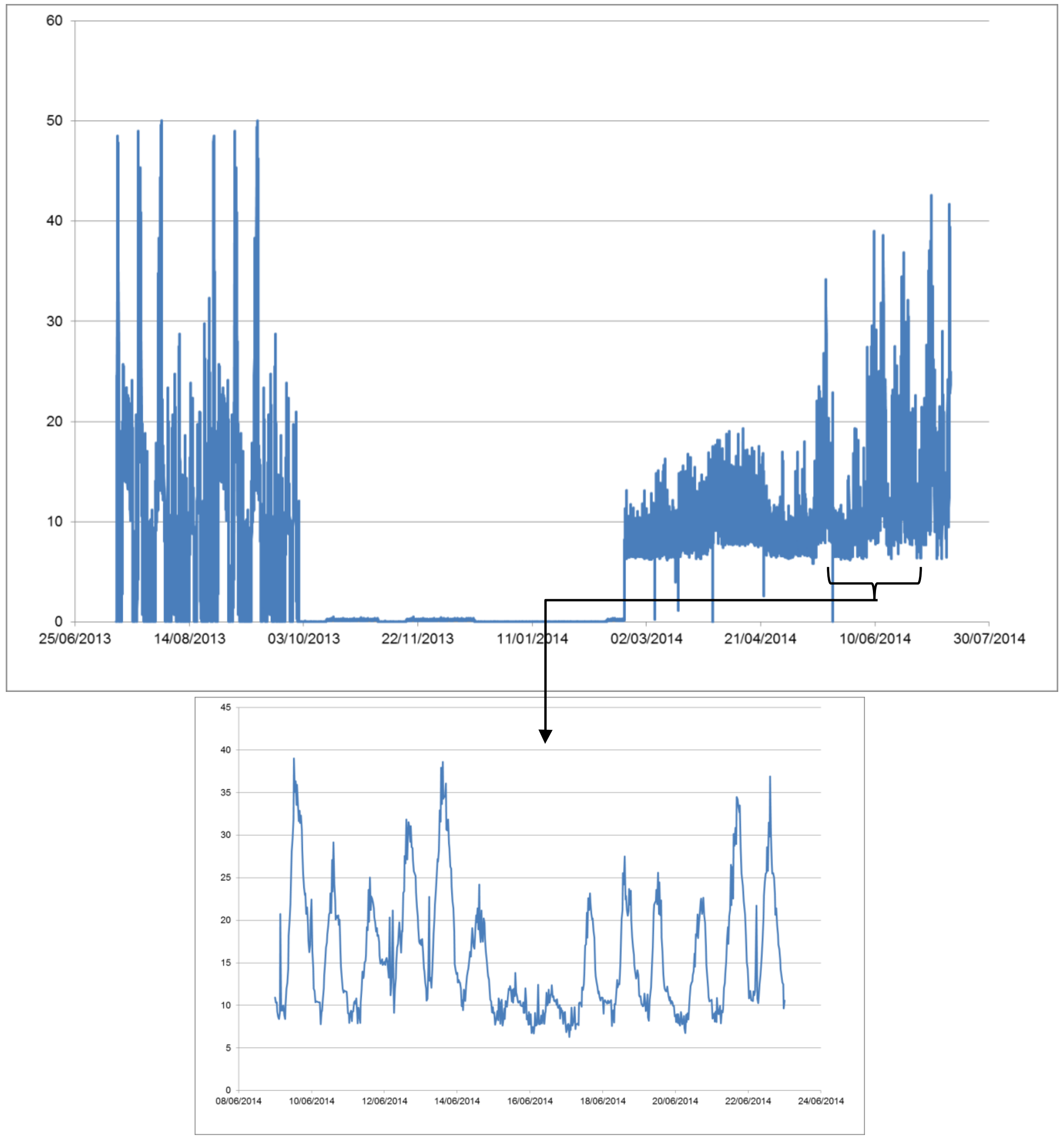


Figure 10.8 – Chiller consumption [July 2013 - July 2014], showing much reduced consumption in the winter

10.5 CHP contribution

Effect of CHP

An estimate was made of what the gas and electricity supplies to the hotel would be without CHP, i.e. assuming the same thermal output produced by boilers instead, and an additional import of electricity. This is summarised below. Note an assumption had to be made about the boiler plant efficiency, as no reliable data on its output is available covering that period – it was assumed at 85%.

Table 10.6 – Summary comparison of energy supplies with CIBSE benchmarks –with and without CHP

Reference	Gas	Electricity	Carbon
South Place hotel 13 July 2013 – 13 July14	2,162 MWh/yr	1,695 MWh/yr	1,352 tonCO_2/yr
	316 kWh/m^2/yr	247 kWh/ m^2/yr	197 kgCO_2/m^2/yr
South Place hotel 13 July 2013 – 13 July 14 *without CHP - theoretical*	1,839 MWh/yr	1,935 MWh/yr	1,421 tonCO_2/yr
	268 kWh/ m^2/yr	282 kWh/ m^2/yr	207 kgCO_2/m^2/yr
CIBSE TM46 hotel	300 kWh/ m^2/yr	105 kWh/ m^2/yr	122 kgCO_2/yr
Adjusted CIBSE Guide F Good Practice benchmark: hotel + additional top floor 'restaurant with bar'	306 kWh/ m^2/yr	133kWh/ m^2/yr	133 kgCO_2/m^2/yr

Using the carbon emissions factors (from TM22), it is therefore estimated that the CHP made the following contribution to the building during the 1-year period analysed in TM22:

- ~ 12% of the building's electricity consumption (i.e. reducing electricity supplies by 14%)
- ~ 35% of the building's thermal load
- Carbon emissions savings of approximately 5%.

The CHP was therefore able to meet a substantial proportion of the thermal load, even with remaining defects that reduced its operation. Its impact on carbon emissions in that year is beneficial but not substantial due to remaining issues which much reduced its operation.

As established from monthly thermal load profiles (see Figure 10.5), the base thermal load is estimated at 46,000kWh/month (excluding catering gas). This would in theory and with full thermal storage capacity equate to approximately 13hrs of full-load running hours from the CHP.

Due to installation issues described in more detail in section 7.3, the CHP unit operated long hours in winter (18-19 hours per day on average) but, until September 2014 when remediation measures were implemented, it operated at much reduced hours in the summer when hot water demand was highly intermittent.

The remediation measures were installed for a period of a few weeks and, while data is preliminary and conclusions will rely on the next summer (2014/2015), the modifications seemed to allow the unit's running hours to increase to 8-9 full load equivalent hours per day on average, i.e. closer to the estimated available 13 hours of full load operation. **Note the modulation kit was since removed and this remains a significant defect at the time of this final BPE report**.

10.6 Catering Gas and Electricity

Catering Gas

Gas consumption is sub-metered per kitchen (see section 5.3 for details) and a benchmarking exercise was therefore carried out for each of the three restaurants, using indicative 'meal served' data from the hotel's management team (as per section 3.2). The basement kitchen does food preparation for the other main kitchens and its gas consumption was therefore apportioned to the others, according to the number of meals served.

The ground floor restaurant serves more meals than both others combined (~5,500 per month against 2,500 and 1,000-1,500 for the first floor and Angler respectively), and is by far the largest consumer of catering gas. Benchmarking per meal served results in figures which are relatively close to each other, from 9.5 to 11.4kWh / meal.

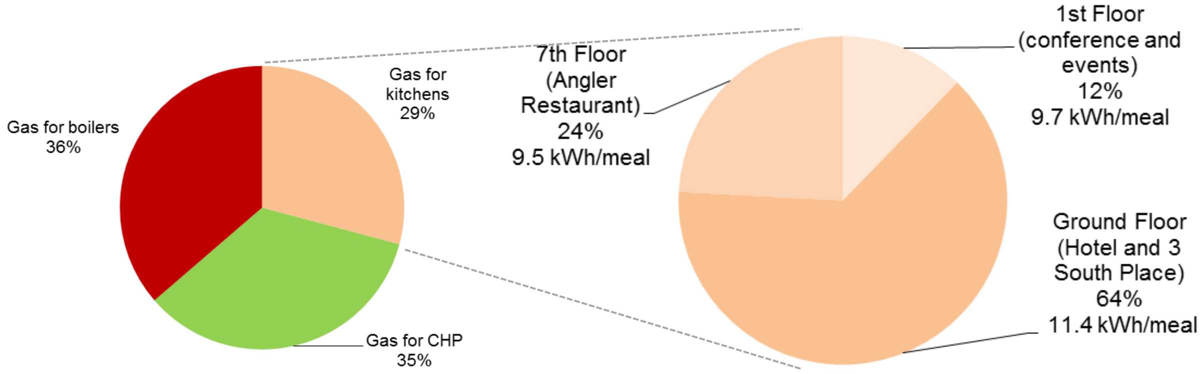


Figure 10.9 – Breakdown of catering gas and approximate benchmarking per meal

Catering Electricity

Catering electricity per meal was estimated using average meal data provided by the hotel (see section 3.2), and this resulted in an average value of 3.8 kWh/meal (no sub-meter data on the individual kitchens is available on the energy management software and therefore to the BPE, although meters are installed).

Benchmarking

A simple benchmarking exercise was carried out against CIBSE TM50 benchmarks (2009) [7].

The following important caveats should be noted:

- The benchmarks rely on assumptions about floor area per seat, and number of meals served per seat
- The benchmarks relate to the overall energy consumption of the food outlet, including other uses than simply direct catering use, e.g. lighting. This is compared to 'pure' catering gas and electricity consumption for South Place

Table 10.7 – Comparison of catering gas and electricity with CIBSE TM50 benchmarks

CIBSE TM50 benchmarks for food outlets (good – typical practice)		
Reference	Gas	Electricity
South Place Hotel - catering	9.5 – 11.4 kWh/meal	3.8 kWh/meal
Restaurant – fine dining	5.31 – 6.03 kWh/meal	3.14 – 3.52 kWh/meal
Restaurant – traditional (full service)	2.61 – 2.97 kWh/meal	1.54 – 1.73 kWh/meal

Overall, energy consumption for catering is high compared to benchmarks, particularly in the case of gas and particularly for the ground and first floor restaurants, for which the relevant benchmark consumption should be lower than for 'fine dining'.

Limited further analysis can be done due to the lack of more detailed information on the number of meals sold (i.e. actual data, and trends since opening rather than averages).[6]

[6] As the hotel operator owns a number of restaurants, a benchmarking exercise could be carried out to compare the restaurants within this hotel with others in their ownership – either overall or, if data was available, per meal served. Unfortunately these benchmarks from the operator were not available to the BPE team

11.0 Water Consumption

Importantly, the facilities management team have taken daily manual readings of the mains water meters from the opening of the hotel. This means that overall water consumption data is available from the opening, covering over two years.

As described in section 5.3, one of the mains water meters is not available on the BMS, and the data on cold-water sub-metering is not reliable (totals do not add up to that of the total cold water meter).

Conclusions are therefore difficult to draw on water consumption, and particularly benchmarking the hotel and restaurants separately,

11.1 Overview

The following represents total monthly water consumption, as per manual readings taken by the FM team.

After the initial 7 months from opening, water consumption has remained at 1,200 to 1600 m^3 per month, as illustrated below (data from manual readings). The hotel's management team implemented efficiency measures at the start of the 2nd year but there seems to be an upwards trend in consumption in that year, which without more accurate data on bedroom and restaurant uses cannot be explained.

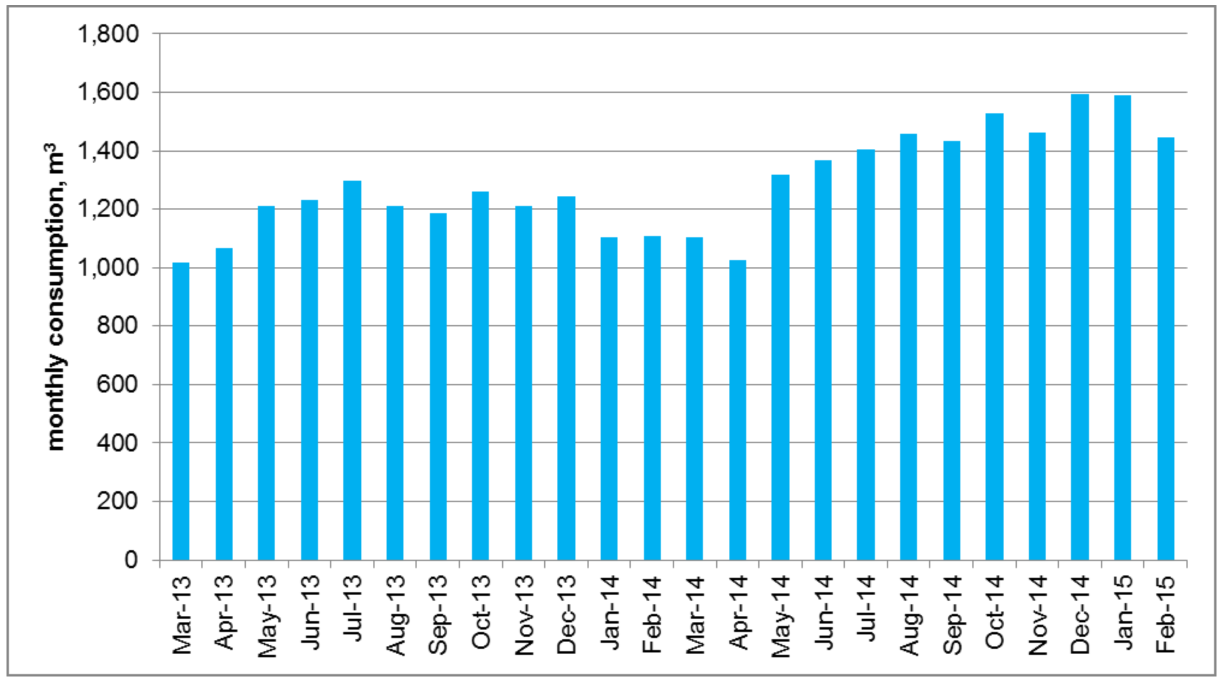


Figure 11.1– Monthly water consumption [March 2013 - March 2015]

Luxury hotels are known to have high water consumption but there are limited available benchmarks publically available. The BPE team is aware of the following:

- The hotel operator's facilities manager used, from previous operations, a benchmark of 300-450 litres per bedroom sold. This matches benchmarks from Green Hotelier [4]:
  - Excellent: 300l / overnight guest
  - Good: 450 l / overnight guest
  - High: 700l / overnight guest.
- A CIRIA report [5] established the following for 4/5 star hotels without swimming pool (note per bedspace, not room sold or actual occupancy):
  - Best practice: 15 m^3/bedspace/yr
  - Typical: 30 m^3/bedspace/yr
  - Above average: 65 m^3/bedspace/yr.

Translating the above benchmarks for South Place, with 80 double bedrooms (bar a small number that could be used with higher occupancy) and ~1,900 bedrooms sold per month (as advised by the hotel's management team):

Table 11.1 - Comparison of South Place water consumption with benchmarks

South Place Hotel, February 2013- February 2014		590 l / bedroom	14, 152 m^3 / yr
South Place Hotel, February 2014-February 2015		697 l / bedroom	16,727 m^3 / yr
Green Hotelier (from EMH) – also used by South Place FM team from previous operations	Excellent	300 l / guest	
	Good	450 l / guest	
	High	700 l / guest	
CIRIA	Best practice		2,400 m^3/yr
	Good practice		4,800 m^3/yr
	Above average		12,000 m^3/ yr

The water consumption figures are therefore well over CIRIA benchmarks, and high by the FM's team own benchmarks. This can probably be explained by two key factors:

- The high provision of restaurants must be a factor in this high consumption – given the restaurants' high contribution to overall gas and electricity, it is expected they similarly have a high impact on water consumption – see further discussion below.
- Provision of luxury water appliances in the guest rooms. As a luxury hotel, bathrooms are seen as a significant part of the offer to guests, and the quality of the water appliances is regularly commented on extremely positively in customer reviews (see section 8.2). This represents a particular challenge to the cost- and water-conscious designer and hotel operator.

11.2 Initial analysis of sub-metered data

Sub-metered data is available for the water meter capturing consumption from the calorifier, and for boosted cold water (total and broken down). This is illustrated in the following figure, capturing consumption since the installation of meters:

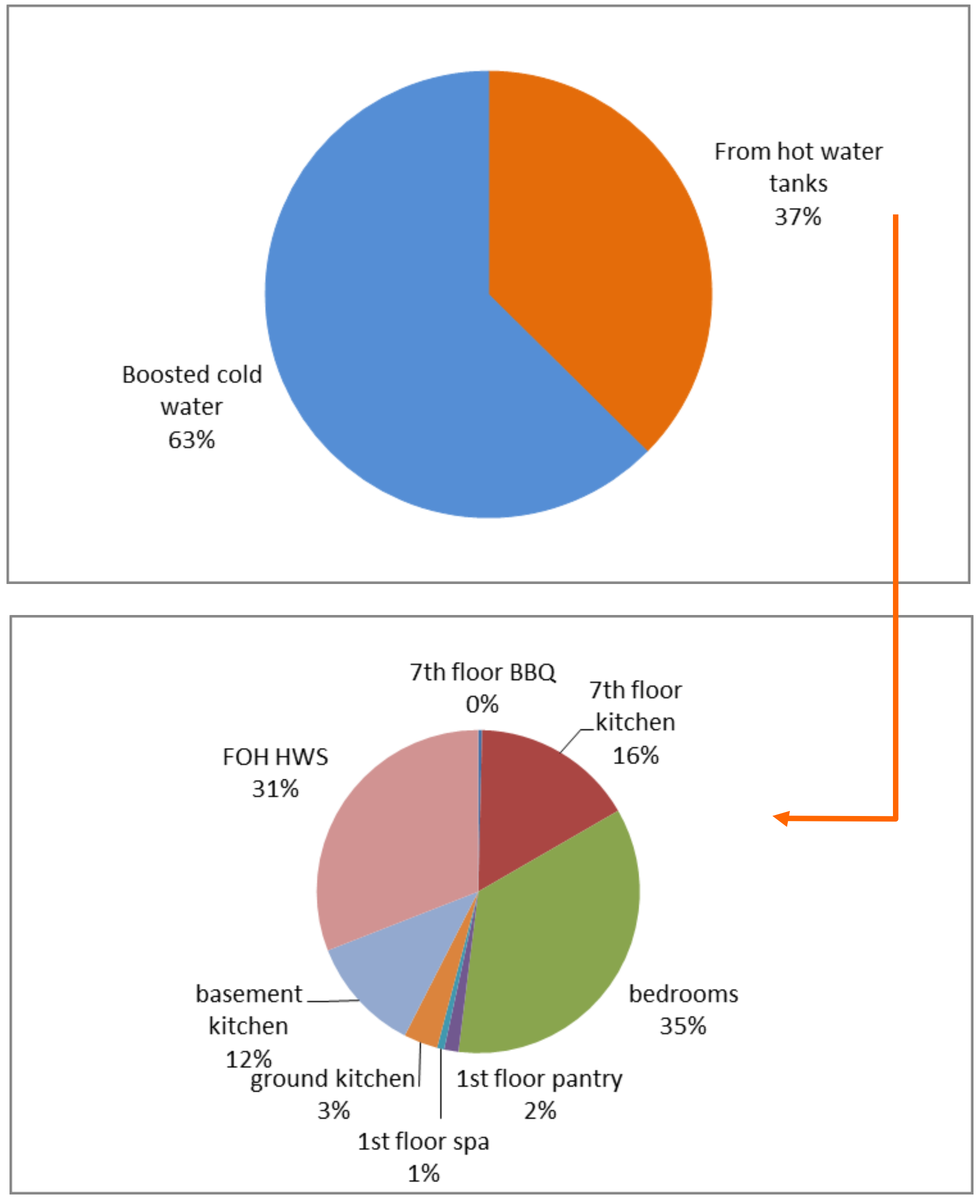


Figure 11.2 – Water consumption breakdown into hot and boosted cold, and breakdown for hot– based on sub-meter readings [from opening]

Water consumption from the hot water vessels is spread approximately equally between the bedrooms, kitchens, and front of house (toilets etc), which themselves serve both hotel and restaurant guests.

The spa is only a small contributor to the total consumption (~1%).

A further level of analysis was carried out on the assumption that the main inaccuracy in cold water meter readings on the BMS is attributed to the bedroom meter, and therefore notionally attributing all 'missing' water consumption to the bedrooms. An estimate was therefore carried out of overall breakdown, with the following assumptions and groupings:

- Basement kitchen water consumption attributed to the ground, first and 7th floor kitchens in order to keep the same proportionate uses
- FOH water consumption attributed to all other uses, in order to keep the same proportionate uses.

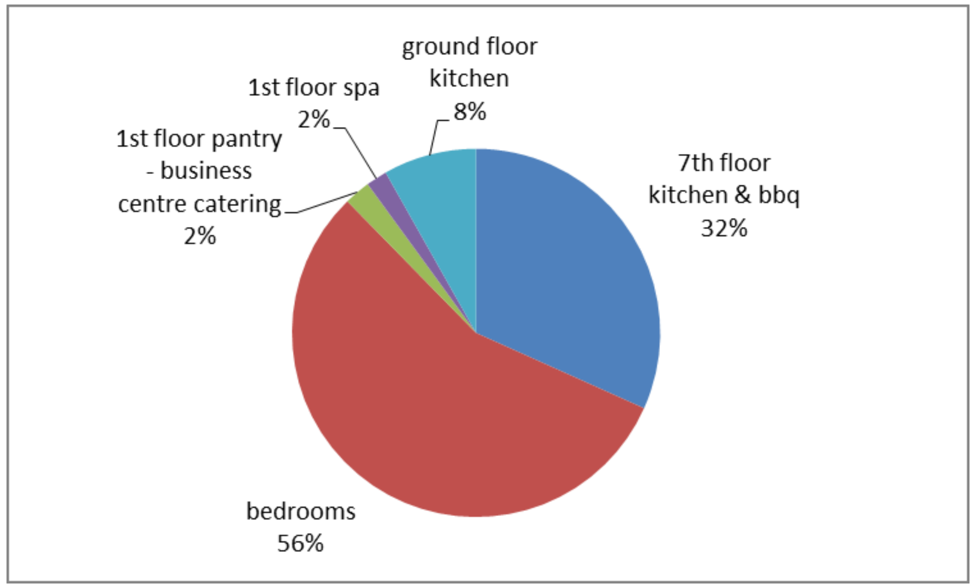


*Figure 11.3– **Estimated** Water consumption breakdown into uses– based on sub-meter readings and assumptions [from opening]*

On this basis, the water consumption from bedrooms would then just over half of the total, with the resulting benchmarks:

- Bedrooms: 390 litres / bedroom sold
- Ground floor restaurant: 17 litres / meal
- 7th floor restaurant: 150 litres / meal.

The wide difference in the estimated water consumption per meal between both restaurants is not explained and should be treated with caution due to the lack of reliable data and reliance on assumptions– see section 11 for details.

11.3 Initial commentary

As discussed in section 8.2, luxury water appliances are a significant part of the hotel's offering and it is expected to have a significant impact on the hotel's consumption.

A range of appliances were selected:

- Showerheads: from 9l/min (hand shower), 14l/min (bath / shower filler), 18 l/min (main overhead plate showerhead), and 4 No. 40l/min showerheads in the spa (for reference: 9l/min would be the limit for a BREEAM credit to be achieved)
- Bath tubs: capacity of 164 litres, 252 litres, and 301 litres (for reference: 100 litres would be the limit for a BREEAM credit to be achieved).

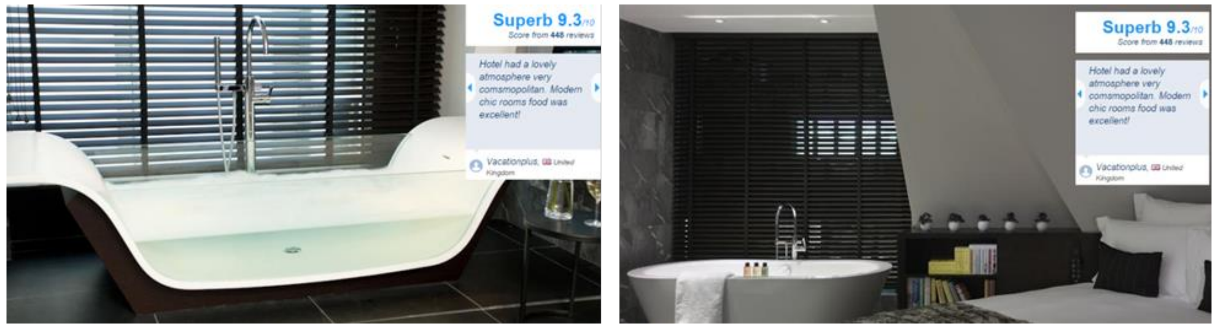


Figure 11.4 – Illustration of bathroom appliances

The estimated consumption of 390 litres per bedroom could therefore, in theory, be easily met through shower and bath use alone, e.g.:

- Large bath (301 litres) + 10 minute hand shower (at 9l/min)
- Small bath (164 litres) + 12 minute overhead shower (at 18l/min).

Water saving measures were implemented by the FM team over the course of a few weeks in the hotel's second year of operation, with the introduction of flow restrictors on showers and wash hand basin taps. This was carried out with incremental changes to the flow rates and starting on a small number of bedrooms only, while monitoring the feedback of guests (helped in this by the large proportion of repeat guests). This is expected to have led to savings, allowing the shower flow rates to be reduced by up to 15% (from 18-20l/min to ~15-17l/min).

Unfortunately due to the lack of sub-metering this has not been possible to identify in overall consumption data as there is no historic sub-metered data to compare with; in fact the hotel's water consumption shows an upwards trend, which may be due to increased occupancy rates but cannot be fully explained without more data on numbers of rooms and meals sold.

12.0 References

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