POST- OCCUPANCY EVALUATION OF SCHOOLS 2010-2011

CONTENTS

Appendices (separate files)

1 INTRODUCTION

Over the last 10 years, more than £34 billion has been invested in educational buildings and by the end of February 2011, 834 schools had been built or refurbished under the three major capital programmes (Building Schools for the Future (BSF), Academies and Primary Capital Programme). The Coalition Government has made clear its commitment to continuing investment in schools, where it is needed. It is essential that we evaluate past projects and feed what we learn into future school building programmes and projects, to ensure that public money is being invested effectively and will deliver whole-life value for money.

In 2010-11, Partnerships for Schools (PfS) carried out a Post Occupancy Evaluation (POE) of 25 schools. The schools include 9 primary schools, 14 secondary/sixth form schools and two Special schools, all of which have benefitted from a new build or major refurbishment project (over £500,000). This evaluation is a development of the pilot POE project completed in 2009-2010.

2 PURPOSE OF THIS POE

The purpose of this POE was to find out, from evidence, what contributes to a successful school environment and to recycle the lessons learnt back into the school capital programme in order to:

- improve the efficiency of capital investment;
- improve the quality of design in school buildings and grounds;
- inform support that's given to users with the aim of improving the performance in use of their school premises e.g. Soft Landings.

For the purposes of this report we have chosen to define a successful school environment as a place that meets the needs of the users by supporting effective teaching and learning; by being functional, comfortable and sustainable; and by being cost-effective over its lifetime. POE is a valuable way of determining whether the buildings and grounds meet these needs.

The intention of this POE was not just to collect data but to seek out the stories behind the data and to understand why the buildings and grounds were performing as they were. In this respect, this POE was a wide-ranging exercise and perhaps broader than might be carried out as part of a rolling evaluation programme.

3 EXECUTIVE SUMMARY

The evaluation had three parts:

- peer review by design, education, ICT and sustainability professionals;
- student and staff feedback;
- an assessment of environmental performance.

Of the 25 schools that were evaluated, 16 were given an overall score of 'pass' by the PfS review teams and nine were judged to be 'very good'. However, a breakdown of the scores showed that nine of the schools were judged to be 'unsatisfactory' in terms of sustainability and two as 'unsatisfactory' in terms of ICT. Review teams commented particularly favourably on the organisation of spaces and the provision of ICT but less favourably on ventilation, toilets and the ability of buildings to adapt to changing circumstances.

Staff and students were generally very satisfied with their school buildings and grounds. They responded most positively to questions of safety and the ease of movement around the buildings and grounds. Those aspects that received the least positive responses related to summertime temperatures and ventilation, and the use of the outdoors for learning (other than for PE and sport). The reasons that users felt hot or stuffy varied but were often linked to other issues such as acoustics, demonstrating inadequate integration of environmental design.

An analysis of the schools' annual energy consumption showed that most were performing poorly against benchmarks, especially in terms of consumption for heating. This was particularly the case for the secondary schools where all but one was consuming between 200% and 400% more energy than the benchmarks[1]. The variation in energy cost between the school using the least energy and the school using the most energy could be up to £85,000 per year - the cost of a member of the senior teaching staff. There was little difference in energy performance between the new build and the refurbishment projects.

The recommended courses of action, based on the lessons learnt from the POE, are summarised below. They are described in more detail in Recommendations (Section 7).

[1] The results were compared to DfE's publication 'Energy and Water Benchmarks for Maintained Schools in England 2002-2003'.

3.1 Making the most of space

The most successful schools managed their premises well and had a collaborative approach to the use of space. A good range of facilities was available to all when needed and spaces did not stand empty. This approach worked best where designers had organised space to facilitate collaboration between staff.

> ***Recommendation 1:*** *Key messages about collaborative use of space and good premises management should be included in any future guidance design professionals. Schools should be encouraged to share their experiences about optimising their available space.*

3.2 Making the most of school grounds

Most of the schools evaluated had very good facilities for PE and sports. However not many were making full use of the school grounds to support teaching and learning across the curriculum.

> ***Recommendation 2:*** *Designers and school staff should consider the potential of the whole school site and share good practice in the use of outdoor space.*

3.3 Improving ICT – infrastructure and access

Although most of the schools evaluated were very well equipped, the potential of ICT to support teaching and learning was often not fully realised.

> ***Recommendation 3****: ICT infrastructure needs to support current use and future educational and technological developments. Good practice in the use of ICT should be shared between schools.*

3.4 Improving environmental performance-in-use

Most of the schools in the evaluation were using considerably more energy in comparison with current benchmarks and much could be done to improve this.

Effective reductions can be informed through regular monitoring of energy use and comparison with benchmarks. Of the reviewed schools that were required to have a Display Energy Certificate (DEC), which helps to inform the energy efficiency of the school building, 37% did not have a current rating.

> ***Recommendation 4***: *Schools should comply with the regulatory requirement to have a current DEC to help inform their actions to improve energy efficiency.*

> ***Recommendation 5:*** *The DfE's current benchmark publication, 'Energy and Water Benchmarks for Maintained Schools in England 2002-2003', should be updated to include a statistical analysis of published 2010 DEC ratings for 5,000 schools. Schools should be encouraged to monitor and improve their annual performance against the benchmarks through a simple online toolkit.*

Many of the staff and students of the evaluated schools had problems with classroom temperature and/or ventilation. In some cases this was linked to noise disturbance.

Also there was a significant gap between the schools with the best and worst energy performance, illustrating best practice is achievable and that significant improvements can be made to poorly performing schools.

> ***Recommendation 6:*** *The design of environmental strategies must be appropriate for a school, taking account of the fact that school staff do not have the expertise, time or budget to manage complex systems. Using a 'Soft Landings' type approach to the building contract, a phased or extended aftercare can help to fine-tune the building and train technical and non-technical school staff and students, to help ensure the building's performance-in-use is aligned to meet the users' needs, as identified in the design brief.*

> ***Recommendation 7****: Evidence of performance-in-use should be collated to consider thermal comfort (particularly summertime overheating) and energy and carbon consumption (with detailed breakdowns of all energy uses such as ICT equipment, sports and security lighting and kitchens). This would help inform school climate change programmes and capital investment efficiency.*

Across the evaluated schools, the impact of low-carbon technologies was variable. Schools with low-carbon technologies e.g. photovoltaic panels (PV) had little understanding of the impact of their renewable technology and often had high energy consumption. Interestingly, the better environmentally performing schools had no low-carbon technologies. Instead, they adopted good energy management practices and staff and students had good understanding of the impact of their behaviour.

> ***Recommendation 8:*** *Evidence should be collated of performance-in-use of low carbon technologies to help inform school climate change programmes and capital investment efficiency. This should be aligned with CLG and DECC policies.*

3.5 Future of POE in schools

The value of the data collected and the conclusions drawn from this work demonstrate what POE can contribute to improving the efficiency of schools capital investment and performance in use.

> ***Recommendation 9:*** *POE should become a normal part of the capital spend review process, using a streamlined methodology that takes account of the current government priorities, and considering the lessons learnt from this evaluation.*

4 THE METHODOLOGY

4.1 How the schools were selected

To ensure an objective and representative evaluation, the 25 schools were randomly chosen (from a long list of around 35) using the following criteria (see Appendix F for the list of 25 schools):

- Opened at least one year and constructed to comply with Building Regulations Part L 2006, which marked the introduction of the first of the major steps towards achieving the UK energy reduction commitments.
- The schools distributed across each of the three PfS operational regions of England.
- A balance of major refurbishment and new build projects.
- Reflecting a range of capital investment programmes and procurement methods including: BSF (Design and Build and PFI), Academies, One-School Pathfinders, LA Devolved Capital and Voluntary Aided Capital.

4.2 How the schools were evaluated

The POE had three parts to provide a balanced, quantitative and qualitative assessment:

- A peer review by independent professionals – to assess the school buildings and grounds, considering design, education, ICT and sustainability.
- Student and staff feedback – qualitative data gathered to assess how the building supports the school users.
- Environmental performance – quantitative data gathered and compared against benchmark data, to assess the in-use environmental performance.

4.2.1 Peer review

For this review, the assessment was carried out by PfS. A team of four reviewers (with expertise in design, ICT, education and sustainability) visited each school and recorded their views on a standard pro-forma based on the 10 established criteria and scoring system used for CABE Design reviews:

- Identity and context – making a school the users and community can be proud of
- Site plan – making the best use of the site
- School grounds – making assets of the outdoor spaces
- Organisation – making a clear diagram for the building
- Buildings – making form, massing and materials work together

- Interiors – creating excellent spaces for teaching and learning
- Resources – deploying convincing environmental strategies
- Feeling safe – creating a secure and welcoming place
- Long life, loose fit – creating a school that can adapt and evolve in the future
- Successful whole – making a design that works in the round.

The reviewers were advised on assessing the design and use of external areas by Learning through Landscapes, the UK school grounds charity.

Through two visits, the teams evaluated how well the buildings and grounds met the school's current needs. No reference was made to the original design brief because it wasn't available and in any case it would have evolved during the design process. The educationalists were evaluating how well the environment met the schools' teaching and learning needs. They were not evaluating the schools' educational performance. The initial visit included a tour of the buildings and grounds and a meeting with senior staff, including the head teacher and building manager. The purpose of the second visit was to carry out workshops with the students and staff (see 'Student and staff feedback' below).

Each reviewer gave a score (1 poor, 2 unsatisfactory, 3 pass, 4 very good) against each of the 10 CABE headings and also for the school as a whole. These were consolidated into a single team score. Scores were moderated across all POE teams to ensure consistency.

4.2.2 Student and staff feedback

Gathering feedback from users was a two-stage process. Firstly, questionnaires were used to understand the views of students and teaching staff, based on the same 10 headings as the peer review. In consultation with schools during the planning stage of the POE, the questionnaires were designed to be paper based and completed within 20 minutes. An online survey was considered but decided against for the following reasons: return rates are usually low; students have said (on previous POE programmes) they mistrust online surveys as the information flow is one-way and does not allow them to be part of an ongoing solution; access to computers, particularly in primary schools, is not sufficient to make the process quick and effective for the schools.

The questions were all 'closed' with five options for answers to each question on a sliding scale from most positive response to most negative response with one 'don't know' option. (Questionnaire templates in Appendix *B*)

Questionnaires were completed anonymously by 30% of the students and 10% of the teaching staff at each school, which provides a very high sample rate. Schools completed the questionnaires within their own time and returned them to the review teams generally within a week of the first visit.

Questionnaires were adapted for Special school students using 'wingdings' software giving a graphic representation of the text, a tool regularly used by students through their learning. In most cases school staff or parents helped Special school students to share their views.

Following the processing and analysis of the questionnaires, workshops were held at the school with a small sample of the teaching staff and students who completed the questionnaire. This gave the opportunity to explore in detail the issues raised. The workshops were structured through discussion of the most and least positive responses.

4.2.3 Environmental performance

The two key environmental performance issues for schools are the environmental comfort of users in the learning spaces, particularly during the summertime; and environmental impact, measured through energy and water consumption and carbon production.

The POE evaluation included a combination of environmental measures. At each school a discussion with premises managers and staff and students gave an initial feel for the comfort issues. Findings on the environmental impact of the school were based on the quantitative measurement of:

- **Annual energy consumption** from meter readings for fossil fuels, electricity and renewable energy.
- **Annual water consumption** from utilities meter readings.
- Review of schools' **Display Energy Certificate** ratings (DEC).
- **Comparison of performance against benchmarks.** The results were compared to DfE's 'Energy and Water Benchmarks for Maintained Schools in England 2002-2003', in kWh/m^2/year and $kgCO_2/m^2$/year. Anonymous results will be reported on the Carbon Buzz website.
- Review of **BREEAM** assessment where available[2].

The tabulated data is shown in Appendix D.

4.3 Feedback to schools

All schools received individual summary reports including: summary results of questionnaires and workshop discussions; main points from the peer reviews; data on the school's energy and water consumption, compared to an anonymised list of the other schools; lessons learnt (see Appendix F). Several schools saw the POE exercise as a valuable contribution to their future plans.

[2] BREEAM, BRE's Environmental Assessment Method, assesses the sustainability of buildings. The method considers a wide range of sustainability issues within a single assessment. Since March 2005 it has been a DfE's requirement that all major* new school buildings and refurbishment projects above a threshold register for a BREEAM assessment and achieve at least a 'very good' BREEAM rating.

5 FINDINGS

The findings indicate that all the schools evaluated through the peer review process were acceptable overall (i.e. scored 'pass' or 'very good') and users were very satisfied overall with their school premises.

The results below draw out some of the common issues that came out of reviewers' evaluations, staff and students' questionnaires and workshops discussions.

5.1 Peer review

The overarching objective of the peer review was to form an independent expert view of the design of the school buildings and grounds.

Overall, all schools were considered acceptable (score of 3 or higher), although the findings showed there were differences between the assessor specialisms: design, education, ICT and sustainability. The conclusions of the education specialists' evaluations were the most positive, followed by the design and ICT specialists, with sustainability specialists the least positive.

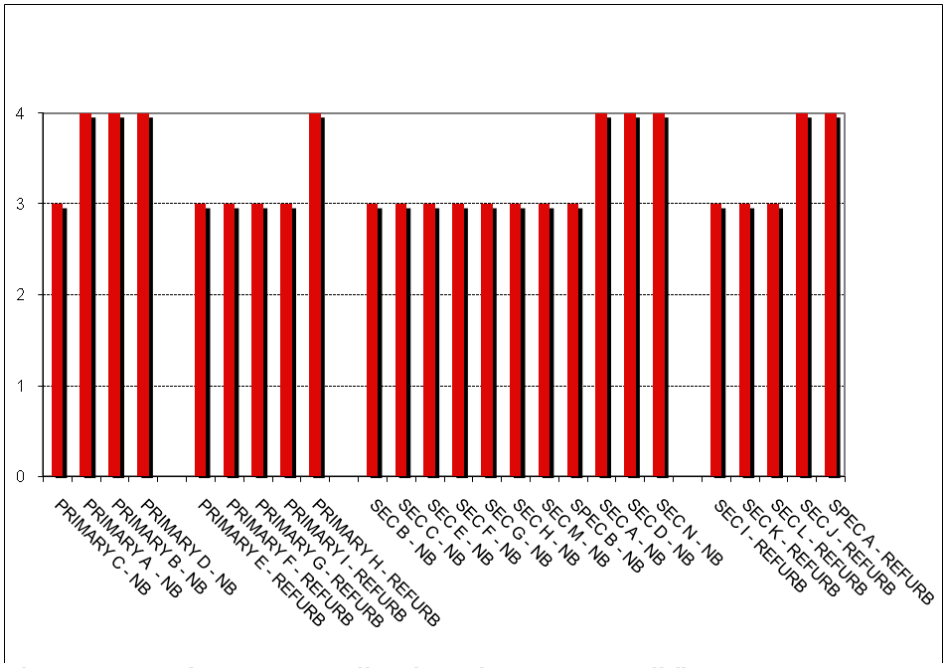

Fig 1: Peer reviewers' overall ratings (NB = New Build)

Overall, all 25 schools were evaluated as acceptable (figure 1).

- 36% were rated as 'very good', 64% 'pass'.

Primary schools were rated higher than secondary schools (note: the sample size between primary and secondary differed slightly).

- 44% of primary schools were rated as 'very good', compared to 31% of secondary schools rated as 'very good'.

Primary new builds were rated higher than primary refurbishment, whereas secondary refurbishments were rated higher than secondary new builds. There could be many reasons for this, e.g. primary schools are generally less complex buildings than secondary schools, therefore more straightforward to achieve a successful outcome; the secondary schools may have had more extensive refurbishments than primary school refurbishments.

- 75% of primary new builds were rated 'very good', whereas only 20% of primary refurbishments were rated as 'very good'.

- 27% of secondary new builds were rated 'very good', whereas 40% of secondary refurbishments were rated as 'very good'.

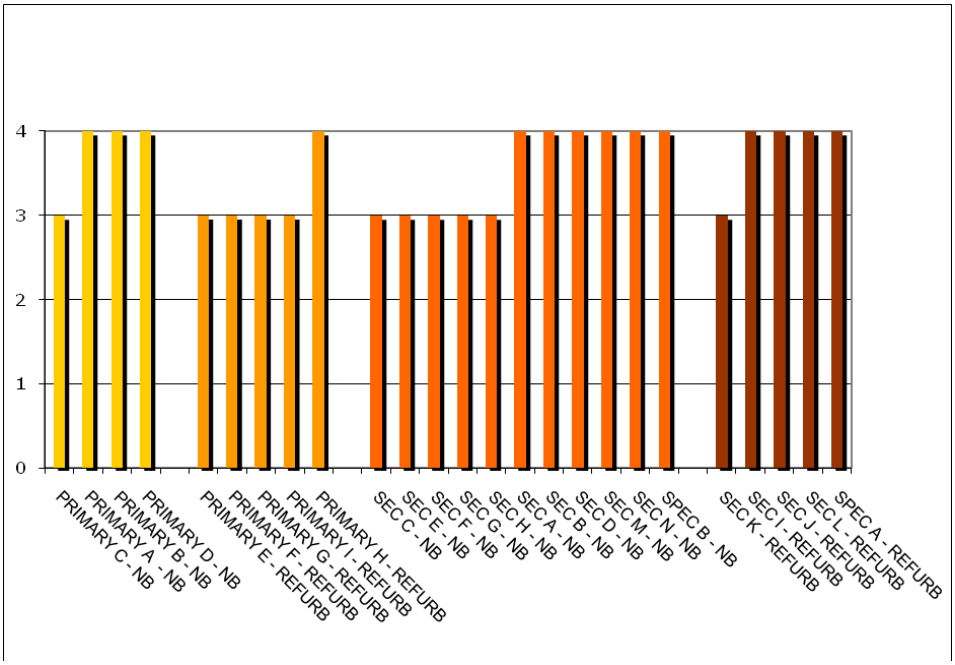

Fig 2: Peer review by education specialists

From the educationalists perspective, all 25 schools were evaluated as acceptable (figure 2). Their evaluations were the most positive.

- 56% were rated as 'very good', 44% 'pass'.

Secondary schools were rated higher than primary schools (the sample size between primary and secondary differed slightly).

- 44% of primary schools were rated as 'very good', compared to 62% of secondary schools rated as 'very good'.

Primary new builds were rated higher than primary refurbishment, whereas secondary refurbishments were rated higher than secondary new builds.

- 75% of primary new builds were rated 'very good', whereas only 20% of primary refurbishments were rated as 'very good'.

- 54% of secondary new builds were rated 'very good', whereas 80% of secondary refurbishments were rated as 'very good'.

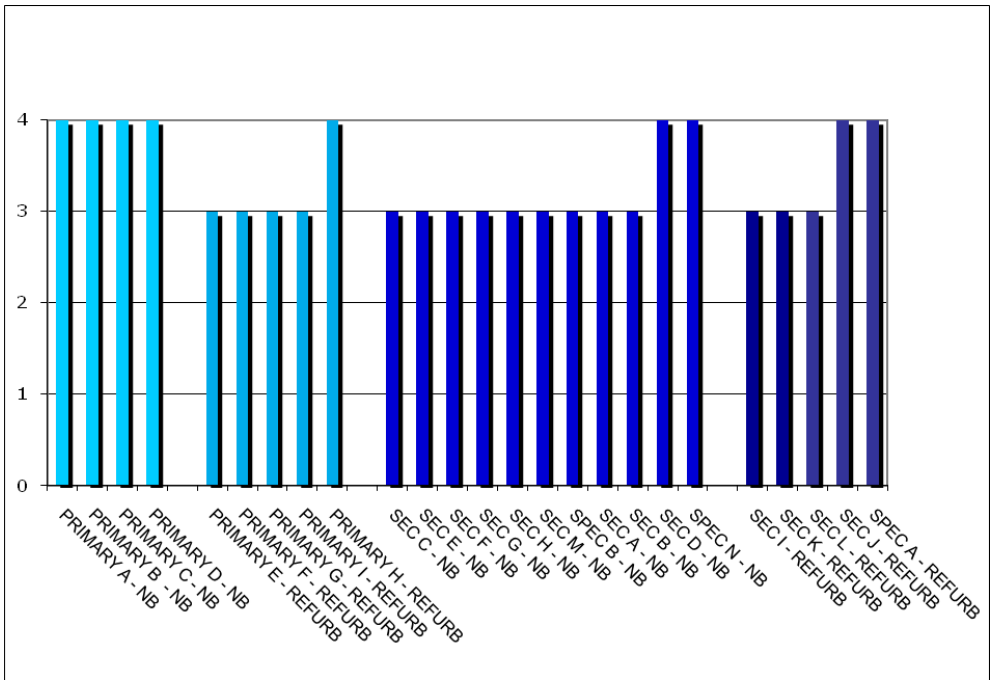

Fig 3: Peer review by design specialists

The design specialists evaluated all 25 schools as acceptable (figure 3).

- 36% were rated as ‘very good’, 64% ‘pass’.

Primary schools were rated higher than secondary schools (the sample size between primary and secondary differed slightly).

- 55% of primary schools were rated as ‘very good’, compared to 25% of secondary schools rated as ‘very good’.

Primary new builds were rated higher than primary refurbishment, whereas secondary refurbishments were rated higher than secondary new builds.

- 100% of primary new builds were rated ‘very good’, whereas only 20% of primary refurbishments were rated as ‘very good’.

- 18% secondary new builds were rated ‘very good’, whereas 40% of secondary refurbishments were rated as ‘very good’.

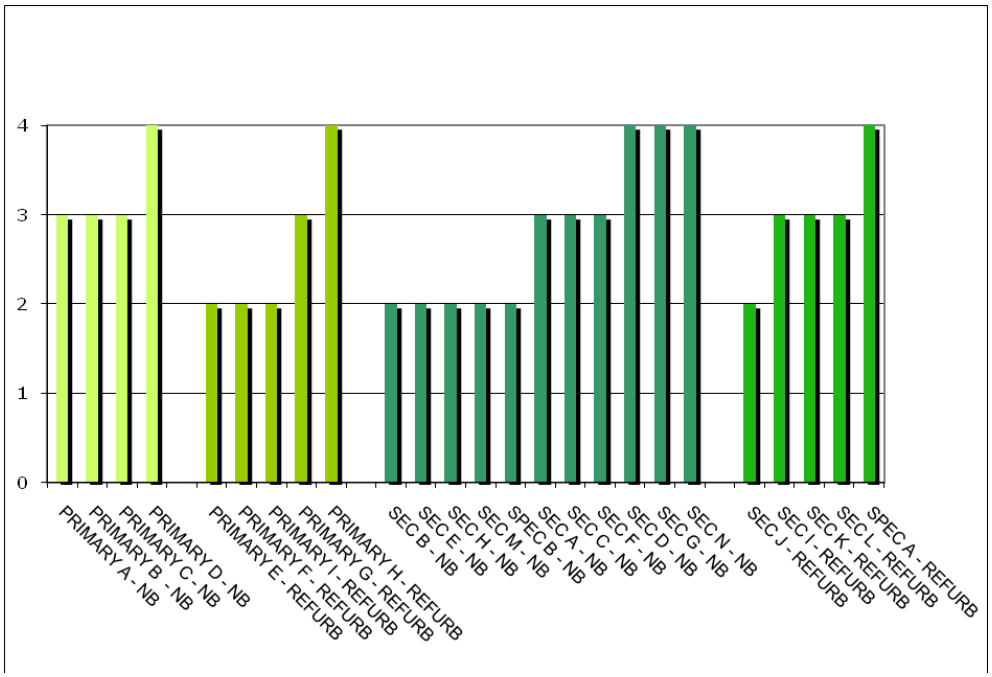

Fig 4: Peer review by sustainability specialists

The sustainability specialists rated 16 schools as acceptable, nine of the schools unacceptable (figure 4). Sustainability was considered the least successful aspect of the review criteria.

- 24% were rated as ‘very good’, 40% rated as ‘pass’, 36% rated as ‘unsatisfactory’.

Secondary schools were rated higher than primary schools (the sample size between primary and secondary differed slightly).

- 22% of primary schools were rated as ‘very good’, compared to 25% of secondary schools rated as ‘very good’.

Primary new builds were rated higher than primary refurbishment, whereas secondary refurbishments were rated higher than secondary new builds.

- 25% of primary new builds were rated ‘very good’ and 75% ‘pass’, whereas 20% of primary refurbishments were rated as ‘very good’, 20% ‘pass’ and 60% ‘unsatisfactory’.

- 27% secondary new builds were rated ‘very good’, 27% ‘pass’ and 45% ‘unsatisfactory’ whereas 20% of secondary refurbishments were rated as ‘very good’, 60% ‘pass’ and 20% ‘unsatisfactory’.

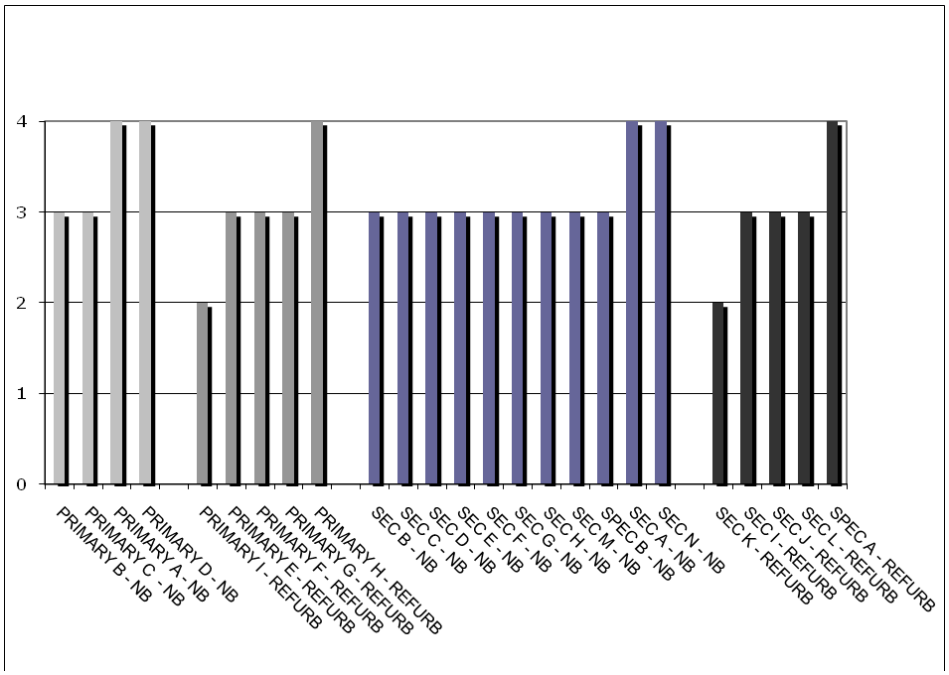

Fig 5: Peer review by ICT specialists

The ICT specialists rated 23 schools of the schools as acceptable, two of the schools unacceptable (figure 5).

- 24% were rated as ‘very good’, 68% rated as ‘pass’, 8% rated as ‘unsatisfactory’.

Secondary schools were rated higher than primary schools (the sample size between primary and secondary differed slightly).

- 33% of primary schools were rated as ‘very good’, compared to 18% of secondary schools rated as ‘very good’.

Primary new builds were rated higher than primary refurbishment, whereas secondary new builds were rated higher than secondary refurbishment.

- 50% of primary new builds were rated ‘very good’ and 50% ‘pass’, whereas 20% of primary refurbishments were rated as ‘very good’, 60% ‘pass’ and 20% ‘unsatisfactory’.

- 18% secondary new builds were rated ‘very good’, 82% ‘pass’, whereas 20% of secondary refurbishments were rated as ‘very good’, 60% ‘pass’ and 20% ‘unsatisfactory’.

Reviewers’ responses reflected many of the same views as the users, partly because they were judging the success of the school by the way it met the current needs of its users. However, the review teams also considered the design and management reasons behind the issues. The review teams’ professional view was informed by comparison with the different schools evaluated, considering a more strategic level of evaluation. This differed from the school users’ evaluations which were based on a longer period of occupation and encounters with issues on a more day-to-day level.

5.1.1 Common factors of success identified by peer reviewers

The schools to which the reviewers responded most positively had certain characteristics in common, which are described below. The schools rated most highly had all these characteristics.

- **Organisation of spaces and circulation**

Many of the successful schools had compact and simple floor plans with well-positioned spaces, which the review teams felt contributed to the smooth organisation of the school. Good features included: clear circulation routes (with uncomplicated plan shapes helping navigation); teaching spaces grouped together enabling good communication between staff; administrative offices grouped together, often with a good view of the entrance for passive surveillance; spaces used by the community after hours (e.g. sports facilities) located for easy and secure access.

Reviewers also noted the positive impact that a whole-school re-organisation made to the remodelling projects.

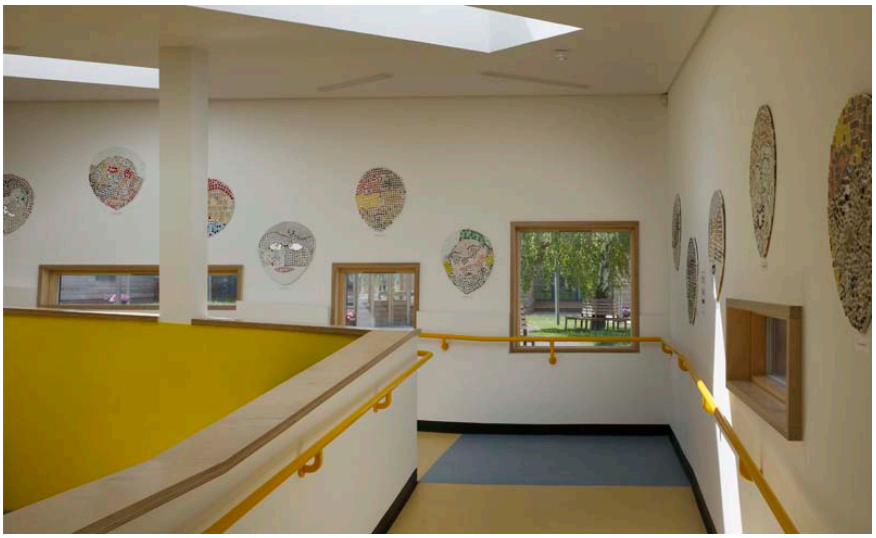

Fig 6: The remodelling of Ifield Special School brought together existing separate buildings and introduced a simple and clear circulation route - visually connected to the green central courtyard - providing a calm place and a better functioning school.

- **Internal learning spaces**

The most successful learning spaces provided a comfortable and attractive environment with views to the outside, a good level of daylight, calm atmosphere and good use of colour.

Fig 7: The classrooms at Water Hall Primary School are quiet, well day-lit from two sides and well ventilated.

- **ICT**

The schools were generally well equipped with a mixture of PCs, laptops and interactive whiteboards (in classrooms), as well as specialised equipment in areas such as music. Students with special educational needs were generally well provided with adaptive technology. In most cases, staff had the necessary skills to make good use of the equipment and all schools had technical support in place. Wi-Fi was provided in most schools but access was sometimes a problem (see ICT infrastructure paragraph below).

- **Long life, loose fit - flexibility**

Reviewers noted the schools that were designed to give staff and students flexibility in the way they taught/learnt. This was achieved in various ways, including: having spaces that could serve more than one function; dividing up available area into different kinds of space (some of which could be combined, if required, for larger gatherings); and making use of outdoor spaces for learning. In the best examples, flexible design was complemented by flexible and efficient management of space by the school.

Fig 8: Abraham Guest High School has an unheated atrium which provides an entrance hall for students, an overspill dining area, a wet weather play space, a place for installations for all the curriculum subjects, performances and large gatherings.

5.1.2 Factors often highlighted as not successful by peer reviewers

There were a few features of the schools that were frequently commented on negatively by the reviewers, these are described below.

- **School grounds**

The Special schools and some of the primary schools had a good variety of outdoor spaces for learning and social activities, appropriate to the age and needs of the students. Although most of the secondary schools had very good sports facilities, very few had developed their sites to provide suitable spaces for other learning activities across the full curriculum or to meet students' social needs.

- **ICT infrastructure**

Although the ICT provision was generally good, through the questionnaire and workshop discussions it was highlighted that many students felt they could not always use computers when they needed to and there were some difficulties with accessing wireless networks. Students expected to have access to robust ICT when and where they needed it to support their learning. In some schools, reviewers noted the lack of integration between the ICT systems for administration and learning.

- **Long life, loose fit - adaptability**

Many of the designs met a school's current needs but didn't allow for future change. Points made by reviewers included: not providing the ICT infrastructure to allow for technological innovation and not designing the structure or building shape to allow for straightforward reconfiguration or extension (if there were changes in student numbers or type of special need).

- **Environmental performance-in-use - thermal comfort in summer**

Many schools had some learning spaces that were described by both students and staff as hot and stuffy in the summer. Noise disturbance was also highlighted, sometimes linked to the ventilation issues.
The main findings first emerged in the student and staff questionnaires, and the workshops provided greater detail. Through further discussions with the premises managers, the full picture of the users' responses became clearer. No monitoring of indoor air quality took place as part of this POE.

The reasons students gave for feeling hot in the summer differed between primary and secondary school students. During workshop discussions, some primary school students explained that they became hot in the playground, as there was no shade and the tarmac felt hot, and when they came back into the classroom the room felt hot because the windows were closed. When asked whether the windows could be opened they said that the teacher kept them shut as they were preparing for the next lesson while the children played outside.

The same issue was described at another school where the windows were not opened during lessons to avoid the class being disturbed by the noise from a different class, working directly outside their window. The teaching assistants, who were the key adults outside with the students, said they thought lessons could take place outdoors in the summer, e.g. underneath the shade of a tree, but not directly outside the classrooms.

Each classroom at Burnham Copse Primary School had direct access to a covered outdoor learning space, both at ground and first floor, which also protected the room inside from overheating in the summer months. A Year 4 pupil said she liked learning outside because she could feel the air and it helped her to think. The educational vision for the school set outdoor learning as a key opportunity and learning all over the school, inside and outside was accepted as a normal part of the school day.

Fig 9: The outdoor learning spaces at Burnham Copse Primary School help to control the classrooms thermal comfort.

In secondary schools, the noise issue appeared to be due to a different set of issues. In some schools, students said they were disturbed by windows which opened automatically. They understood the need for the windows to open 'to help them to concentrate' but said the solution was wrong. In several schools the automated vents, which opened when the CO_2 levels in the class reached the level where air needed to be replenished, had been deactivated due to noise disturbance of the device in action. The noise issue appeared to be more prevalent where the windows were the device for controlling ventilation. Where ventilation was via ducted systems the issue was not highlighted. Staff said what they wanted was a visual device which would indicate when a window needed to be opened, but the action would be taken by them rather than technology. This was also mentioned in the primary schools where staff saw this as part of the students learning to take responsibility for their actions.

- **Sound insulation**

In a number of the new build secondary schools, noise disturbance was due to sound transfer through the structure or via services passing through the rooms. Students complained about hearing the toilets being used, for example where poorly co-ordinated service runs passed through classrooms. In the same school staff and students commented on poor sound insulation between classrooms, particularly between music practice rooms.

- **Environmental performance-in-use – high energy and carbon use**

Monitoring and measuring a school's energy and water consumption indicates how well the school's resources are being managed.

Many schools had high energy and water use, and high annual utilities costs compared to national benchmarks. This was often due to over-designed systems requiring precision management, a skill the schools did not have. In some cases the systems were perceived as too costly for schools to manage. The high annual utilities costs over the life of the school led to expensive waste.

- **Poor quality furniture**

The good quality of many of the school environments was impaired by furniture that was ergonomically unsuitable and/or of poor quality. Students often commented on the uncomfortable chairs and in some schools staff reported that furniture was easily broken.

5.2 Staff and student satisfaction

Staff and students were generally very satisfied with their new accommodation and thought it attractive and welcoming. This can partly be attributed to the fact that the facilities were a significant improvement on their previous circumstances. The differences between the schools that had been remodelled and those that had been newly built were minimal and on the whole both sets of users were proud of their schools.

In most cases there was no difference between the views of students and staff or between primary and secondary school students, although there were some. For example, primary-age students were more concerned about their outside spaces and with safety whereas secondary-age students were more interested in the availability of independent learning and social spaces.

Quantitative results

The following graphs draw out the headlines from the questionnaire analysis. They show, for each school type, the three questions that received the highest number of positive responses and the three questions that received the highest number of negative responses. Separate results are shown for staff and students and the total number of responses is indicated along the bottom of each graph.

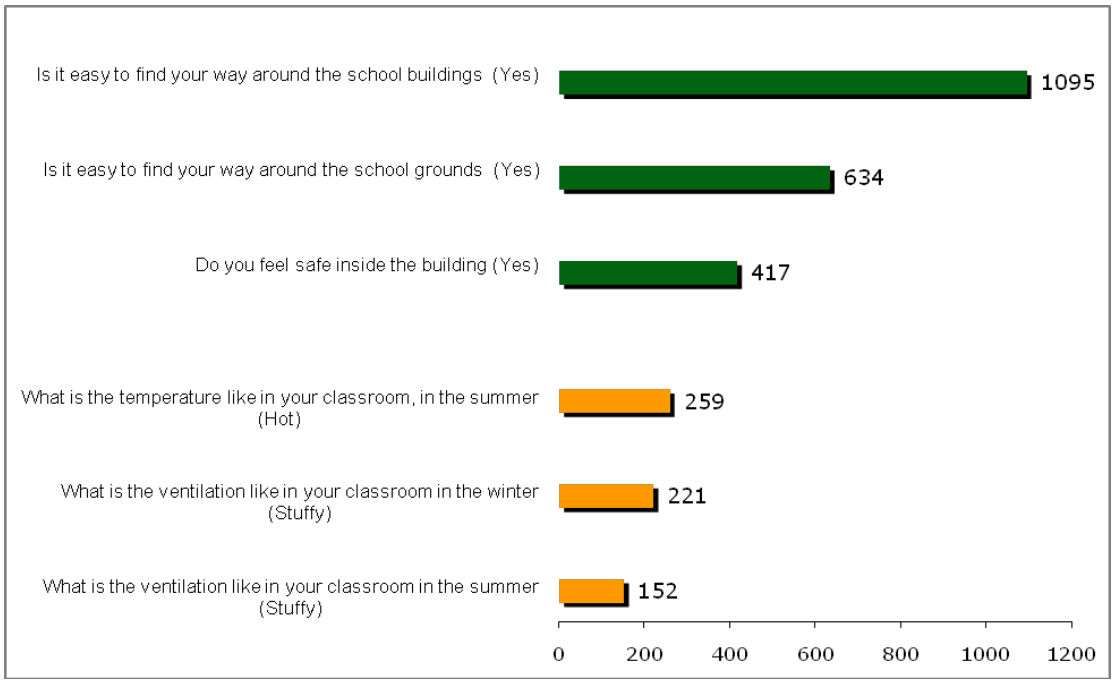

Fig 10: Top 3 and bottom 3 greatest responses from primary students

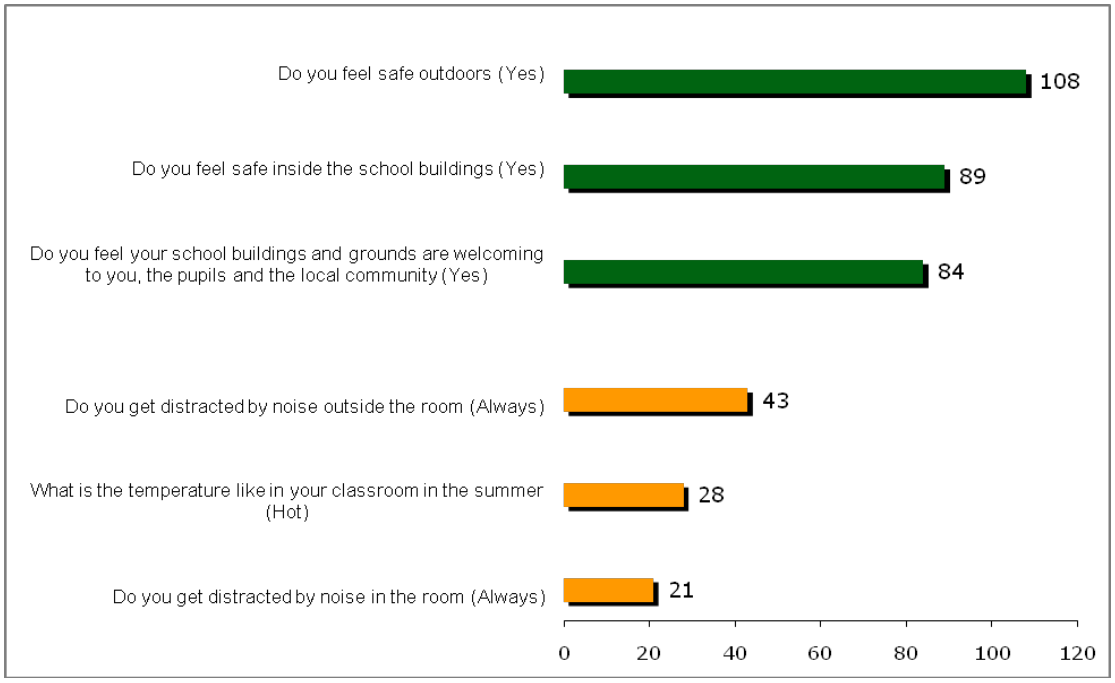

Fig 11: Top 3 and bottom 3 greatest responses from primary staff

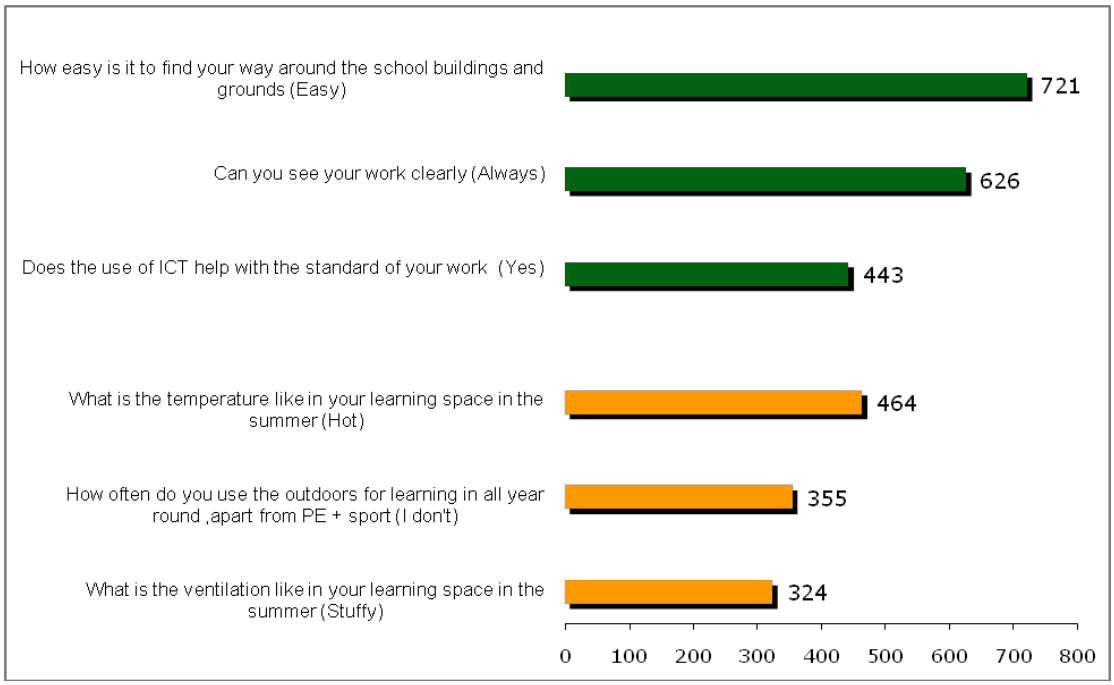

Fig 12: Top 3 and bottom 3 greatest responses from secondary students

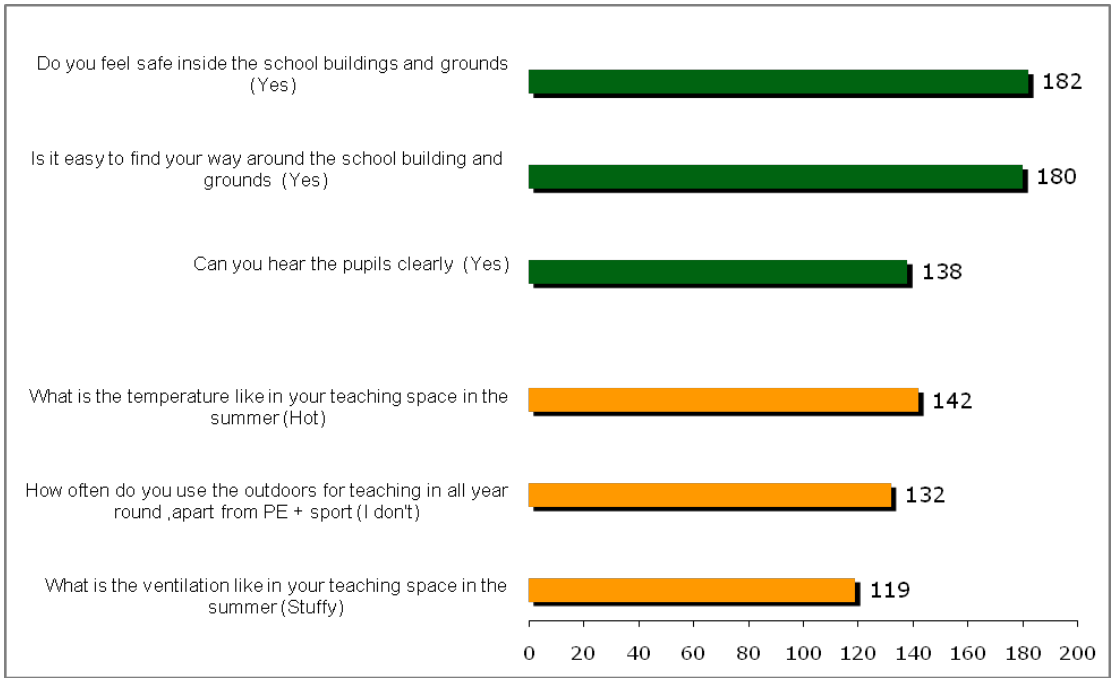

Fig 13: Top 3 and bottom 3 greatest responses from secondary staff

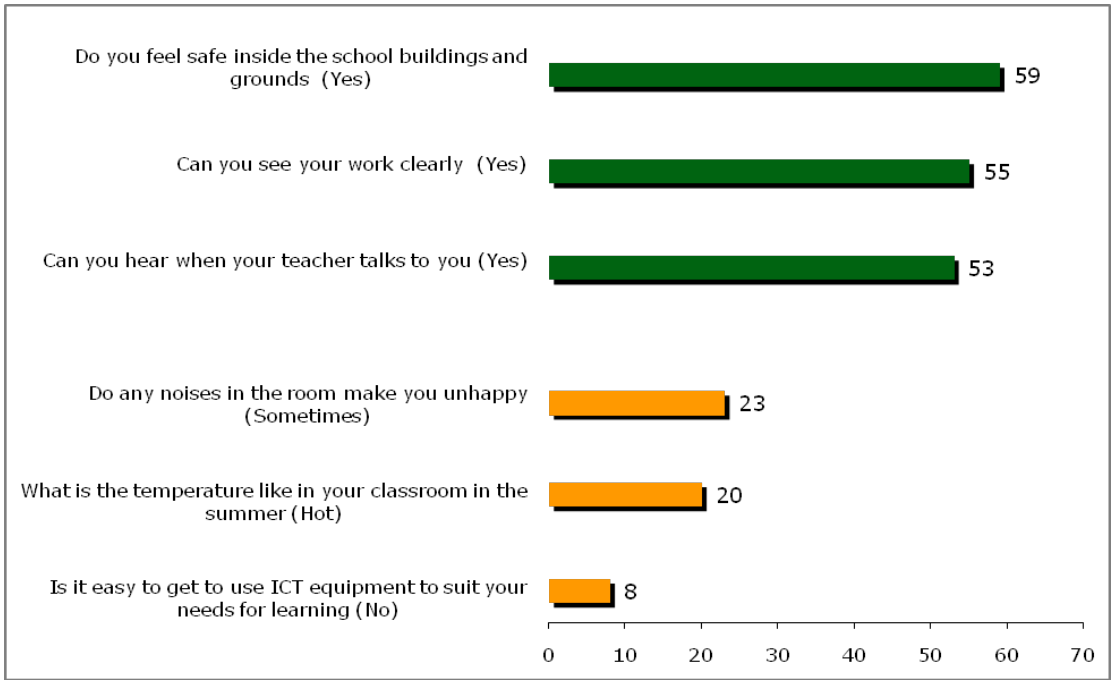

Fig 14: Top 3 and bottom 3 greatest responses from Special school students

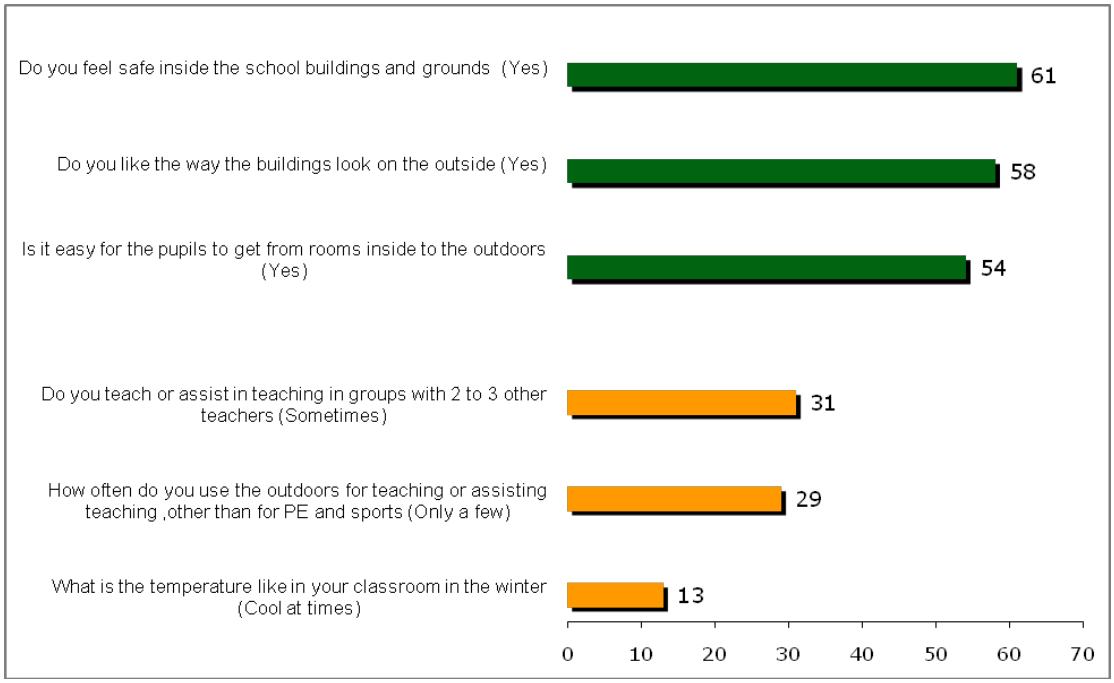

Fig 15: Top 3 and bottom 3 greatest responses from Special school staff

Workshop discussions

The workshops were an opportunity to have a broader discussion based on the ‘top 3 and bottom 3’ questionnaire responses from staff and students. The key topics that came out of these discussions give a more complete picture of what, in the view of the users, contributes to a successful school environment. These topics are described below. While not all these subjects are present on the graphs because they were not in the ‘top 3 and bottom 3’, the views reflect the overall questionnaire responses.

5.2.1 Factors often highlighted as successful by students and staff

- **A welcoming and well organised arrival at school**

An attractive entrance to the school site and its buildings seemed to have an important influence on staff and students, contributing to their feelings of pride about their school, raising morale and leading to a better engagement with their tasks. A welcoming entrance and clear access routes were also thought to encourage parents into the school. Good landscaping, a colourful facade, a pleasant reception area were all cited as contributing factors.

Fig 16: Staff at Kenton School thought the colourful curved façade drew people towards the entrance.

- **Good circulation**

Improvements in circulation were often highlighted, in remodelled and new build projects. Staff said that movement around the school was easier, behaviour better, and students arrived at their lessons on time and in a better frame of mind to learn. These successes were often combined with management changes such as doing away with the school bell.

Fig 17: At Temple Moor High School, roofing over the space between existing blocks to create a top-lit walkway allowed students to move between lessons without jostling, listening to music instead of a school bell.

In some of the remodelling schemes, one of the main tasks was to re-locate the main entrance to the centre of the school, ensuring students entered somewhere that was easily supervised and congestion was avoided. Some staff highlighted the fact that simple circulation routes, without hidden corners, made supervision easier. This was particularly the case in the two Special schools where it also allowed students to be more independent because they were less likely to get lost or to hide. 'The layout means you will always come back to your starting point' said one member of staff at Ifield Special School.

In many cases students cited the colour-coding of different areas and signage as ways to help them find their way around the school, particularly when they were new.

- **Light, colour and display**

Many users mentioned how ‘light and bright’ or ‘colourful’ their schools felt and they often contrasted this with the greyness of their old schools. Such changes seemed to raise spirits which can have a positive effect on both learning and behaviour. Users also talked about the new identity of their schools and this was the case equally in remodelled schools.

Most students said they could see their work clearly which suggests the lighting levels were suitable, and that they appreciated the increased levels of natural light (see figures 10 to 15).

- **Variety of spaces**

Students liked having access to different types of space. Primary-age students particularly highlighted having easy access to outside learning spaces. Secondary-age students liked having some places where they could work independently and others where they could socialise.

Fig 18: Students at Abraham Guest High School liked their 'Faraday' science suite which comprises fully serviced labs, smaller science classrooms and an open plan area for independent working (shown here).

Fig 19: Staff at Burnham Copse Primary School wanted outdoor learning areas to complement their indoor classrooms, an approach they felt would be of particular value to their students. The architects designed the grounds as a framework, which were developed by staff over time.

- **Safety and security**

The question about feeling safe in school was almost always answered positively. People were very happy to have CCTV in their schools and the only comments were suggestions for additional cameras where unsupervised places may get vandalised. Some younger secondary-age children were pleased that members of staff monitored outside areas at break-time.

Staff liked to be able to see visitors as they approached the school (for example by having some offices at the front of the building). They also liked

being able to close down parts of the school, for example isolating the sports facilities from the main teaching areas when used by the community. For some students the fact that the site was locked once everyone was in school made them feel safe in outside areas.

- **ICT**

Responses to questions about ICT provision were generally positive with students particularly enthusiastic about laptops and interactive whiteboards, some saying it made learning more enjoyable. Students were also very pleased to be able to access school material and submit their work from home. However, there were a few negative issues raised (see ICT paragraph below).

- **Acoustics**

Almost all staff said they could hear their students clearly even though some said they were sometimes distracted by noise inside or outside the classroom (see the paragraph on Noise below).

5.2.2 Factors often highlighted as not successful by students and staff

- **School grounds**

Responses to questions about outdoor provision were generally positive, in the sense that students and staff were pleased to have outdoor provision. However, the responses about frequency of use of the outdoors indicates that schools do not use the outside much for teaching and learning, other than for PE and sport. This was particularly so in the secondary schools.

- **Internal learning spaces – hot and stuffy in summer**

Many users answered the questions about room temperature and ventilation negatively, saying for example that classrooms were too hot and/or too stuffy in the summer. This was explored further in the workshops and although the reasons were varied and complex in most cases the problem seemed to be related to the ventilation and heating controls. Sometimes this was because the controls (whether for the heating or to open windows) were overly complex. In some cases staff had not been trained in using the controls. Sometimes the system hadn't been adjusted following handover and a period of settling-in. Problems were often links to other issues such as noise. In some cases windows weren't opened if blinds were down while projectors were in use.

- **Toilets**

Many students (particularly those of primary age) reacted negatively to the questions about toilets. Discussions in workshops drew out the causes of this which were generally to do with smell, not having free access and having to go too far to reach the facilities.

In Kenton School, for example, (secondary-age) students thought the toilets were unpleasant to use and they didn't like them being locked during lesson times (although they recognised there was a greater risk of vandalism if they were open all the time).

- **ICT Infrastructure**

Although responses were positive overall, a few problems were raised. The main concern was about not having wireless access throughout the school (and sometimes the grounds). Some (mainly students) raised issues around accessing the network from home and not having access to equipment whenever/wherever it was needed. Another problem that was often mentioned was the glare/reflection from daylight/sunlight making interactive whiteboards difficult to see.

- **Noise**

In response to the question about being distracted by noise, many students said they were distracted by noise to some degree inside or outside the classroom. However the same students often said they could still hear the teacher adequately (see paragraph on Noise above). Our conclusion is that some distraction is inevitable, in the majority of cases unavoidable and not a serious problem. However in some cases (revealed in workshop discussions), noise did seem to be a real concern. Examples of noise disturbance given by students included sounds coming from other classrooms when the corridor door was left open and noise of student activity outdoors when windows were open. This was consistent with the peer review discussed above (see Environmental performance in use - Thermal comfort in summer).

5.3 Environmental performance-in-use

Buildings should perform better and much more sustainably than they do currently - objectively evaluated evidence suggests that building performance is often poor compared to the original design intent.

Each school's annual energy consumption was considered as a breakdown of the heating demand (gas/fossil fuels/biomass) and electrical demand which covers lighting, small power, equipment etc.

The detail on the annual heating and electrical consumption was based on measured data obtained from the school, collected through their monthly meter readings, utilities bills, or from records of energy use collected by the school's LA energy manager. To provide comparison across the schools, the common metric kwh/m^2/yr, was used which describes the amount of energy consumed each year per square metre of floor area.

It was not possible within the scope of this review to include where energy was used in the school, or to give a detailed breakdown of which components were using what energy. This data would help to inform an approach to achieving energy efficiencies and an energy reduction strategy.

5.3.1 Annual energy consumption of evaluated schools compared to benchmark

The energy performance (for both heating and electrical consumption) of all the evaluated schools (apart from one) was high compared with current benchmarks - DfE's 'Energy and Water Benchmarks for Maintained Schools in England 2002-2003'. (See figures 21 and 22, and Appendix D, annual energy consumption of evaluated schools).

These benchmarks were based on the broad range of energy-in-use data of the existing school building stock, including schools of the two previous major UK school re-building programmes - Victorian and 1950s schools.

Heating demand was contributing by far the largest part of the energy demand in comparison to the electrical demand. This is worrying as it is the reverse trend of what has been seen recently in schools with low energy consumption where the heating component plays a much smaller part of the total energy consumption due to better performance of the building fabric and seasonal control of the heating system.

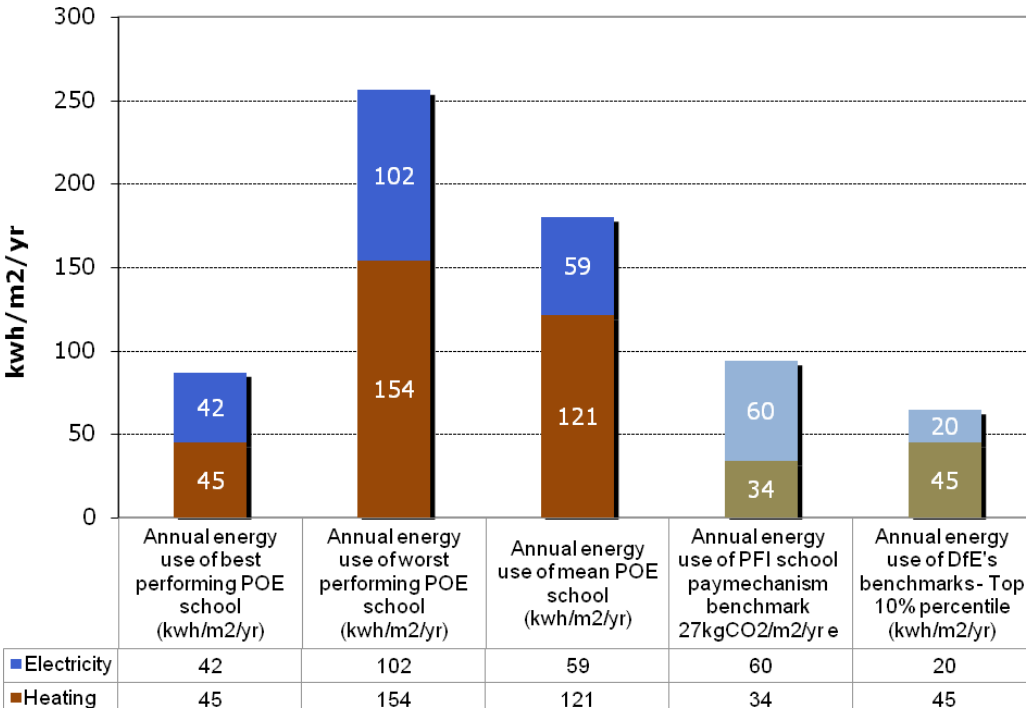

Fig 20: Benchmark comparison of POE schools with mean, best and worst energy consumption.

The annual heating use ranged from about 45 to 155 kwh/m^2/yr, whilst the electrical use ranged from about 25 to 100 kwh/m^2/yr compared to school benchmarks[3] , with an annual heating use of 45 kwh/m^2/yr and an electrical use of 20 kwh/m^2/yr. See figure 20. This shows a wide difference in the range of annual energy consumption between the highest and lowest consumptions of the POE schools. Most of the schools' energy consumption were clustered

[3] Top 10% of schools that used the least energy consumption across all UK schools (based on DfE's *Energy and Water Benchmarks for Maintained Schools in England 2002-2003'*),

around the higher levels, with the mean POE school being nearly 280% more than the benchmark.

All of the schools in this POE would have been designed and constructed to meet the minimum standards of the 2006 Part L requirements of the Building Regulations; however it is questionable that the minimum standards were being achieved.

Heating use

A school with a relatively low energy use sees an annual heating load of around 45 kwh/m^2/yr.

The schools in this study included a commendable refurbishment project where 'fabric first' was one of the key solutions as part of the environmental strategy. The existing external walls, windows and roof were upgraded to improve thermal performance (and thus the comfort of students and staff) and this played a vital role in reducing energy consumption. However, the majority of the schools had considerably higher heating demands, with 90% being from about 100 to 180 kwh/m^2/yr (for both new build and refurbishment projects).

Electrical use

In recent years, schools have experienced increases in electrical usage with the introduction of electrical equipment ranging from ICT, photocopiers printers, interactive whiteboards in classrooms through to external flood lighting for sports and security lighting. A school with a relatively low energy use sees an annual electrical load of around 30 kwh/m^2/yr.

The schools in this study ranged from about 25 kwh/m^2/yr to 100 kwh/m^2/yr, with the majority clustered between 40 and 80 kwh/m^2/yr (for both new build and refurbishment projects).

5.3.2 Comparison of energy consumption between primary, secondary and Special schools

There was little difference, in terms of total energy consumption, between the different types of school in the study. This reflects the findings in the DfE's benchmarks.

Heating use for the secondary schools, with a range of about 45 to 180 kwh/m^2/yr, was similar to the range for primary schools of about 45 to 150 kwh/m^2/yr. Heating use for Special schools were not the highest, but at the higher end of the range, despite the heat used to maintain the temperature of hydrotherapy pools.

Electrical loads of the secondary schools, with a range of about 40 to100 kwh/m^2/yr, were slightly higher than the range for primary schools at about 25 to 60 kwh/m^2/yr.

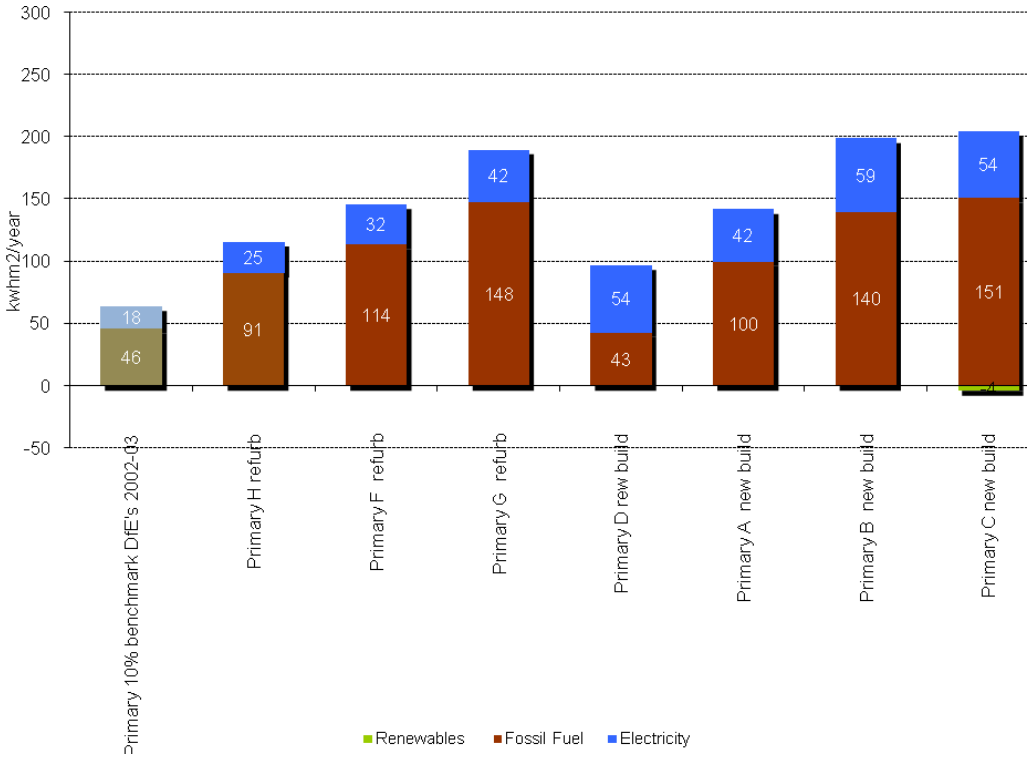

Fig 21: Benchmark comparison - annual energy consumption of primary schools

The energy performance of the primary schools

In the primary schools evaluated, the energy performance of a new build was similar to that of a refurbishment school. From the sample range the majority of both new build and refurbishment projects were using too much energy on heating; however, we do have two examples with a better performance, one a refurbishment and one a new build school.

The key point is that a better performing refurbishment can be achieved, demonstrated in this case where the first step was to improve the building 'fabric first'. The expectation is that all new builds can achieve good performance, driven by compliance with building regulations.

Two schools that had the lowest annual energy consumption were designed and constructed by local authority teams that had experience of good school design. These schools continue to be part of their local authority asset management where a more unified approach of continual improvement can be considered to achieve long term efficiencies, providing good value in looking after the public assets.

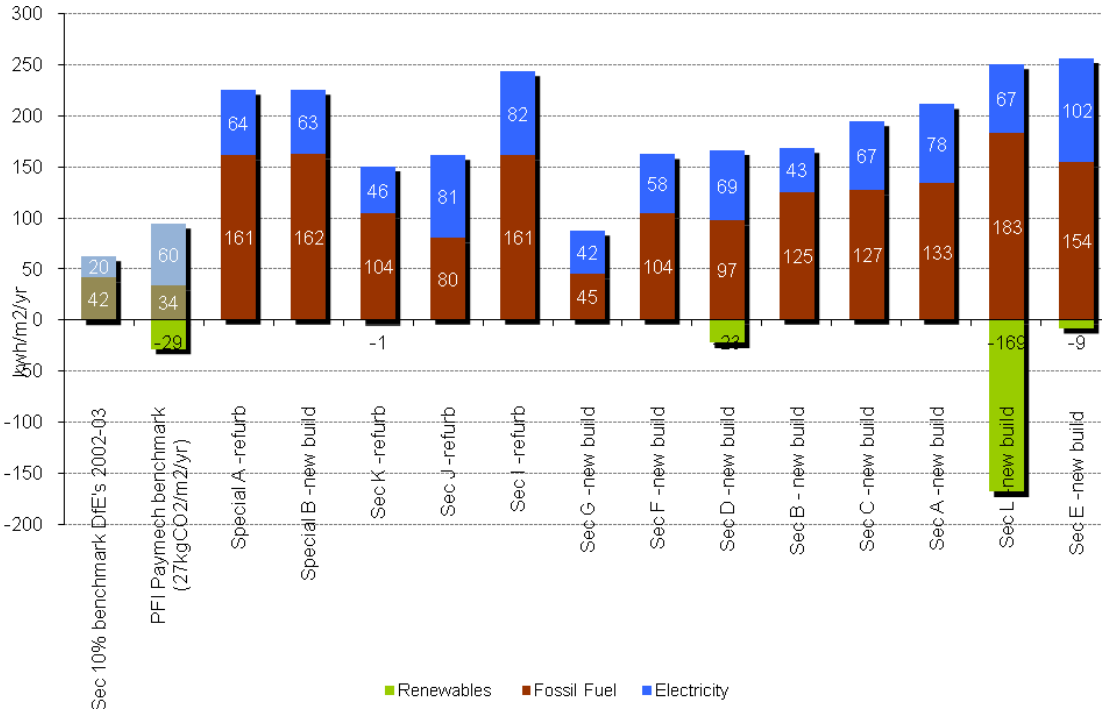

Fig 22: Benchmark comparison - annual energy consumption of secondary schools

The energy performance of the secondary schools

The energy performances of the new build and refurbishment secondary schools were similar to the primary schools. More importantly, all apart from one were annually consuming 200% to 400% more energy than they should be. The one good energy performing school was a local authority designed, procured and asset managed school.

Considering the energy performance of the schools against the current PFI payment mechanism benchmark (equivalent of 27kgCO_2/m^2/year), heating should account for roughly a third of the total energy use, and electrical use two-thirds. Excluding the one well-performing school, none of the evaluated schools reached the equivalent of the PFI benchmark. Heating caused the biggest concern as the discrepancy between actual energy use and benchmark was the greatest.

The POE heating use range was about 45 to 180 kwh/m^2/yr, compared to the PFI benchmark of 34 kwh/m^2/yr. The POE electrical use range was about 40 to 100 kwh/m^2/yr, compared to the PFI benchmark of 60 kwh/m^2/yr.

5.3.3 Schools' carbon performance

Carbon emissions from electricity and gas are an important aspect of schools' energy consumption. The main issue is the greater impact of electrical energy consumption compared to gas, as it has a higher carbon factor. Improvements made to schools' electrical energy performance would significantly reduce environmental impact.

To provide comparison across the schools, the metric $kgCO_2/m^2/yr$, has been used which describes the amount of carbon emitted each year per square metre of floor area. The table below shows the schools' current annual carbon emissions generated through fossil fuel use (brown) and electricity use (blue), and, to neutralise emissions, the offset contribution by renewable technology (green)

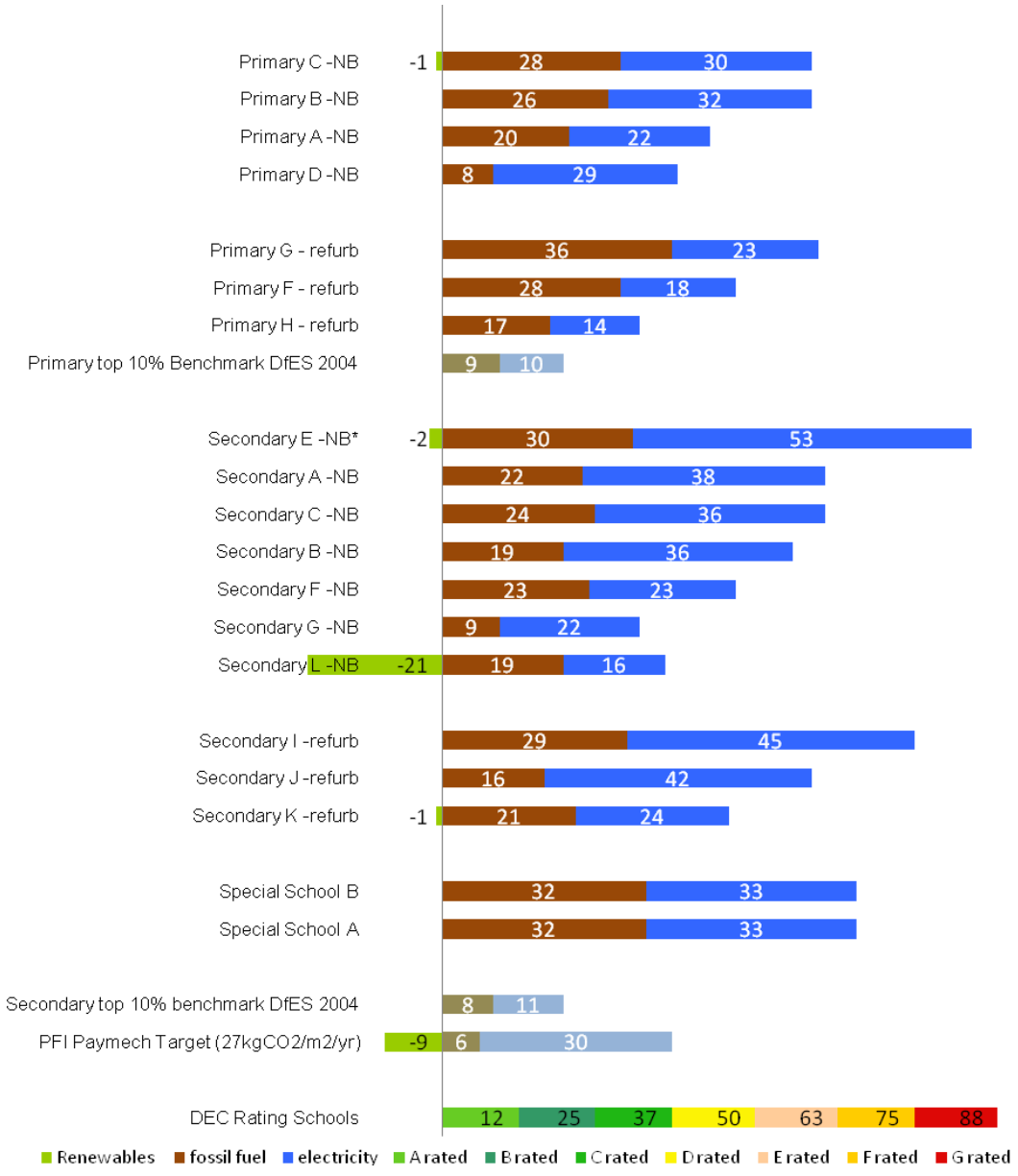

Fig 23: Benchmark comparison - annual carbon emissions $kgCO_2m^2/yr$

PfS's current carbon performance targets for PFI schools require a 27kgCO_2/m^2/yr benchmark to be met. The data collected from the one PFI school in this POE (school L - new build) shows the complex issue of carbon performance. While the carbon emissions off set by renewable technology meet the carbon performance target, the school still has one of the highest energy consumptions. The carbon profile of a well-performing school should have both low energy consumption and low net carbon emissions, after taking account of the renewable energy used.

5.3.4 Display Energy Certificates (DEC) ratings for schools

A DEC is a way of showing the energy efficiency of a building. It contains three main charts – the operational rating (a measurement of the energy efficiency of the building, on a scale from A to G where A is the most efficient and G is the least efficient); carbon dioxide emissions; and previous operational ratings from the last three years, which help to inform whether the energy efficiency has improved. Since October 2008, regulations require occupiers of school buildings with floor areas of more than 1000m^2 to have a DEC, based on the actual measured annual energy consumption.

All but one of the eligible POE schools (open a full calendar year) held a DEC certificate. However 37% of the DEC ratings were not current, but were for the school prior to being rebuilt or refurbished.

The range of current ratings was from B to F, with the majority being a D rating. This is against a current benchmark of B rating, based on the current PFI payment mechanism (equivalent of 27kgCO_2/m^2/year). During discussion with the head teacher of the best performing B-rated school, she said they were working towards improving the rating, further evidence of the school's 'energy literacy' by using measurement to inform improvement.

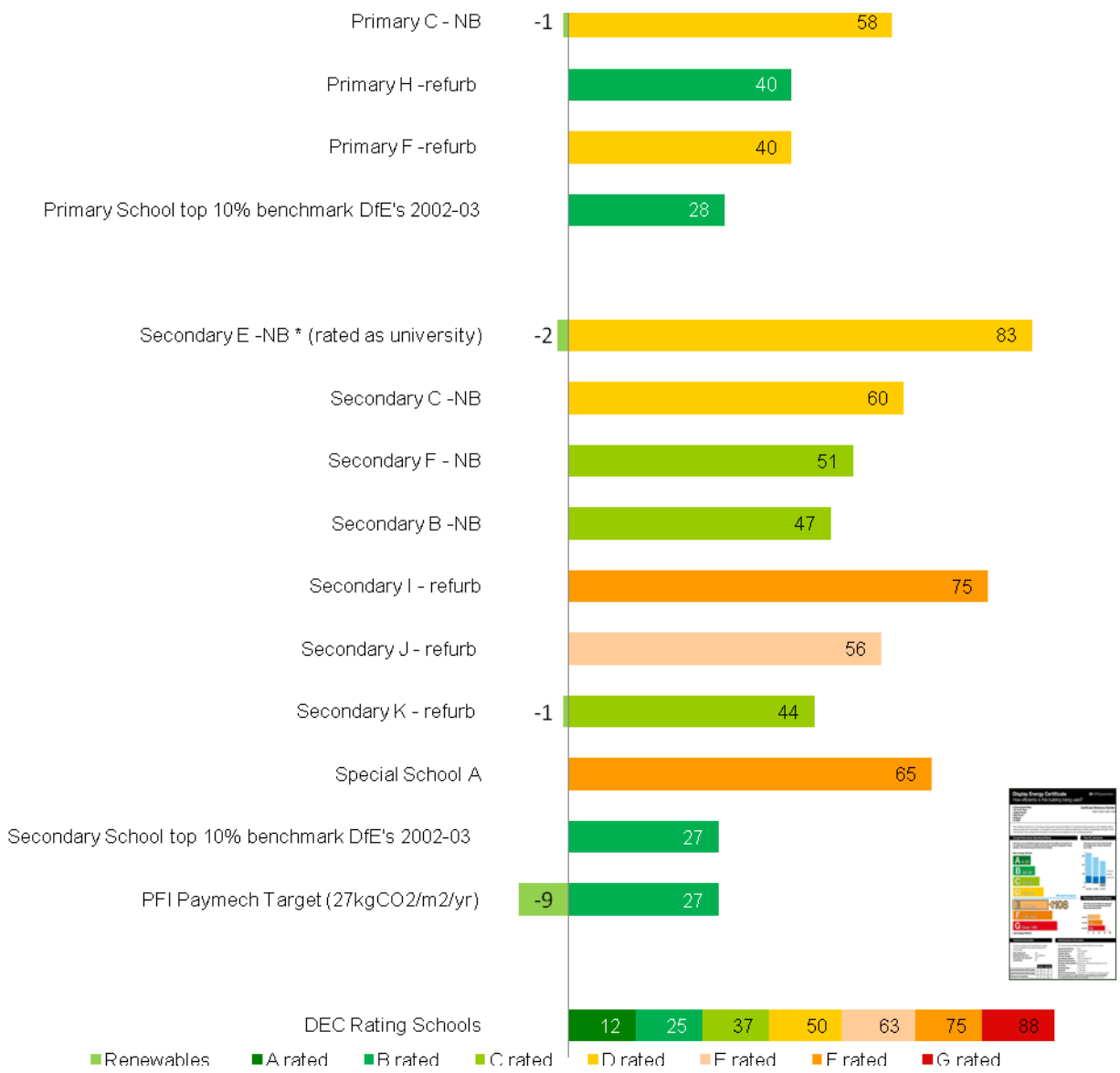

Fig 24: Benchmark comparison of DEC Ratings (Benchmarks use 2003 conversion factors)

5.3.5 BREEAM Assessment

In March 2005 it became a DfES requirement that all major new school buildings and refurbishment projects above a threshold register for a BREEAM assessment and achieve at least a 'very good' BREEAM rating[4].

[4] projects valued at over £500 000 for primary schools and £2 million for secondary schools, and involving rebuilding or complete refurbishment of more than 10% of the floor area of a school. As part of the wider Capital Review, the application of BREEAM assessments to school buildings is currently being evaluated to assess whether the benefits can be justified in relation to the burdens they impose on project delivery.

The OGC's 'Common Minimum Standards for the Built Environment' require BREEAM Excellent ratings, 'unless site constraints or project objectives mean that this requirement conflicts with the obligation to achieve value for money'. The requirement for school buildings is to be 'very good' rather than 'excellent' until the technical and financial implications of the higher standard are known. All of the POE schools met the requirement to register for a BREEAM assessment; however the findings and conclusions varied across the different school types.

- For the primary new builds, around 75% of the schools were registered for BREEAM 2006 Schools; however no results have been confirmed yet.
- For the primary refurbishments, none of the schools were registered.
- For the secondary new builds, 10 of the 11 schools were registered for BREEAM 2005 Schools, BREEAM 2006 Schools or BREEAM Bespoke 2005. About 70% of the schools have no results confirmed yet. One school had received a 'good' rating and two schools 'very good'.
- For the secondary refurbishments, 2 of the 5 schools were registered for BREEAM 2005 Schools; however no results have been confirmed yet.

The BREEAM requirement on these schools covers the design and construction process. As the majority of the schools have been open for more than 12 months since the completion of the build process, the expectation would be for the BREEAM process to have been completed too.

As very few results have been confirmed the findings of this evaluation are not sufficiently conclusive to give an understanding of the impact of BREEAM assessments.

6 POE LESSONS LEARNT

The most successful schools (i.e. those that scored highest in the peer reviews and were judged most favourably by the staff and students) supported effective teaching and learning and had buildings and grounds that were functional, comfortable and sustainable.

There were a number of common factors to this success which are outlined below, in two parts: 'Design and procurement' - issues to take into account when providing schools in the future, and 'Schools in use' – issues for schools to consider to help them to get the best from their premises.

6.1 DESIGN AND PROCUREMENT

6.1.1 Considering the whole school site

The most successful schools were those where the design was based on a consideration of the whole school site, not just the buildings. Good features included:

- An attractive approach to the school with clear zoning of public and 'school only' access routes; secure boundaries; safe pedestrian routes and accessible (but not dominant) parking.
- Making use of the building form and the site's natural typography to provide shelter to external spaces and encourage natural surveillance.
- Imaginative, varied and accessible outdoor spaces that supported learning as well as social activities, suitable for the age and needs of the students. For example, food growing areas, quiet places for relaxation, wildlife areas.
- High quality robust materials used for landscaping and outdoor furniture.

6.1.2 Making the most use of space - designers

The buildings that best supported an efficient and effective school had spaces arranged to suit the learning, social and administrative activities taking place, but with the capacity for future change. The most successful remodelling projects gave priority to rationalising the school's circulation and links between spaces.

Successful approaches included:

- Simple linear teaching blocks that would be straightforward to re-configure or extend.
- Simple rectilinear classrooms that could accommodate a range of furniture layouts and future changes of use.
- Spaces grouped together to reflect curriculum departments, encouraging teachers to work together.

- Clear and efficient circulation, minimising travel distances, maximising available space and helping to create an orderly, calm ambience.
- Spaces most likely to be used by the community positioned in a way that provided easy access whilst ensuring security.

There was not a single solution to the distribution of available space. In some schools, space was concentrated into classrooms allowing staff to re-arrange furniture to suit different activities. In other schools, there were smaller classrooms, supported by small breakout areas for independent learning.

6.1.3 A good sustainability strategy to support environmental performance in use

Ventilation and heating were common problems in many of the evaluated schools and in some sound insulation between spaces was also an issue. It is important to have a robust environmental strategy.

There was a wide variation in energy consumption between the schools, many of which employed similar environmental strategies. This implies that the variation was likely to be due to one or more and often the sequence, of the following:

- **Ineffective environmental design strategies**: designs may have been too complex for schools
- **Poor design and installation co-ordination**: taking more account of evidence of performance-in-use during the design and construction phases could have helped to establish the necessary sequence of design and construction steps rather than the piecemeal approach
- **Poor handover and aftercare from design or contracting team**: the commissioning of the services systems often did not take account of the school buildings once occupied with the students and staff and all their equipment.
- **New complex systems and controls and lack of aftercare**: systems and their controls may have been new to the schools and created a challenge to manage on a day-to-day level. Premises staff may have been required to deal with a new approach to managing the systems, requiring a completely different set of skills. The initial aftercare may have been based on training the staff who had no feel for how the building and the systems would respond across the seasons. Technical training is usually given directly at the time of moving in, generally at the beginning of the academic year in September, rather than in the winter and summer seasons, which raise the greatest heating management challenges.

Some environmental strategies, considering the relationship of building services and architectural designs, can make it difficult to save energy in use. Spatial volumes within schools add challenges, e.g. large volume atria are

difficult to heat. Buildings which are designed to a high level of energy efficiency, and with particular goals of sustainability, offer the potential for lower energy consumption. However, this reduction in energy consumption can be outweighed by the variation in consumption as a result of user behaviour and management.

An important point to consider with refurbishment projects is that the existing building fabric is thermally less efficient than modern materials, so to achieve a high performance the parts that are added need to work harder at achieving a performance equivalent to new builds. It is still a common trend in the UK that the construction of new buildings is poor. This is contrary to expectation given the level of detail on thermal performance in the Building Regulations.

The construction industry has often been guilty of designing school buildings that are too complex for their users, leaving a gap between the expectations of the designers and constructors and the ability of the users to run the buildings and their systems. However, a little effort expended in an expert review of the energy consumption in a school can very quickly reveal how users and managers can be helped to reduce energy consumption and improve internal conditions. Users can be helped to learn good habits at school which can stay with them at home and through their entire lives.

6.1.4 A comprehensive brief and clear responsibilities

The projects that delivered the best solutions resulted from a committed client, designer and procurement team where all parties were clear about their responsibilities towards the project from the outset and communication was good throughout. Characteristics of the successful schools included:

- A comprehensive brief that reflected a good knowledge of school buildings and educational needs, with sufficient detail (in particular for specialist spaces such as science laboratories) to ensure suitable accommodation. A detailed brief was particularly important for the Special schools where the students had varied and specific educational, therapeutic and medical needs.
- A balance between the specific needs of the school and a broader approach, for example considering the possibility of future changes to the number or special needs of students, or to school personnel. And taking account of future developments in ICT.
- Good communication and coordination between contractors and suppliers to avoid inefficiencies or conflicting solutions.
- A collaborative approach to handover. A 'Soft Landings' approach[5] can be extremely valuable, whereby design and construction teams stay involved beyond practical completion (possibly with a phased handover) helping fine-tune systems and work with the users.

[5] 'Soft Landings', a process to improve the operational performance of buildings, can be used for new build and refurbishment. It is designed to smooth the transition into use and to address problems that POEs show to be widespread. It supports clients to be involved pre-handover and designers and constructors to remain involved beyond practical completion. www.softlandings.org.uk

6.2 THE SCHOOL IN USE

6.2.1 Making the most use of space - users

The schools that made the best use of their accommodation for teaching and learning had a flexible and imaginative approach. Ways in which they ensured success included the following, all of which worked best when supported by good design:

- Managing premises so that spaces were available as much as possible (for example making the dining space available all day for informal learning and meetings).
- Teaching staff sharing a group of spaces rather than owning their own space.
- Making use of the outside as a learning space.

The schools that had a calm and positive atmosphere had thought carefully about the experience of a school day and making the school 'belong' to staff and students. Actions that can be taken include: playing music instead of ringing bells to indicate lesson changes; working with students to create displays that reflect students' talents and interests; being flexible about where students can go on the school site (for example having toilets open at all times, allowing students inside as well as outside during break times).

6.2.2 Good management and maintenance strategies

Once handed over it is important that a school is well maintained in the short and long term, helping staff and students to feel valued and ensuring a longer building life. This includes ensuring toilets are regularly cleaned (i.e. after periods of high usage not just at the end of the day) and having a regular decorating and repairing cycle.

Energy consumption and environmental operation in school buildings are not at all well understood by many building managers and users, and many schools are neither aware of their level of energy consumption, nor whether this is higher than might be expected.

It is important for schools to be aware of their building's energy requirements and to take steps to minimise energy and water use through good building management, including a clear recycling strategy.

6.2.3 Annual energy consumption and cost variations

Significant reductions on energy, carbon and cost could be made across the majority of the schools considered in the POE.

Considering the energy used each year, by applying the actual energy consumptions of the best and worst performing schools to some current metrics of typical school sizes and cost of energy, you get a feel for the potential variation of year on year energy costs between the best and worst performing schools. This is without considering the trend of increasing annual cost of energy. For primary schools the variation between best and worst

could be £15,000 each year, which alternatively could be spent on maintaining a number of support staff. For secondary schools the variation between best and worst could be £85,000 each year, the cost of a member of the senior teaching staff.

Typical Primary School floor area of 2-form entry (m2)	Usage/fuel type	Energy consumption of POE primary schools (kwh/m2yr)		Annual energy consumption (floor area x best or worst energy consumption)		Typical energy cost	Energy cost per year		**Cost difference of energy each year of best and worst schools**
		best	worst	best	worst	cost p/kwh	best £/y	worst £/r	
3,400	Heating with gas/biomass	43	151	146,200	513,400	0.04	£5,848	£20,536	
3,400	Electricity	54	54	183,600	183,600	0.07	£12,852	£12,852	
							£18,700	£33,388	**£14,688**

Fig 25: Primary school energy cost difference per year between best and worst energy performance of schools

Typical secondary school floor area of 1000 pupil (m2)	Usage/fuel Type	Energy consumption of POE Secondary schools (kwh/m2yr)		Annual energy consumption (floor area x best or worst energy consumption)		Typical energy cost	Energy cost per year		**Cost difference of energy each year of best and worst schools**
		best	worst	best	worst	cost p/kwh	best £/y	worst £/r	
10,000	Heating with gas/biomass	45	154	450,000	1,540,000	0.04	£18,000	£61,600	
10,000	Electricity	42	102	420,000	1,020,000	0.07	£29,400	£71,400	
							£47,400	£133,000	**£85,600**

Fig 26: Secondary school energy cost difference per year between best and worst energy performance of schools

6.2.4 Steps towards carbon reduction and schools' energy management

Most of the schools visited appeared to be carrying out a monthly recording of their meter readings, to coincide with the introduction of requirements for schools as part of the Carbon Reduction Commitment (CRC).

Consistently well managed schools have been measuring and monitoring their annual energy consumption over a number of years.

Low utilities bills are a reflection of a well managed school, where usually there is a competent premises manager supported by either an interested SMT member or business manager. Measuring the energy is the first step towards energy reduction. Significant benefit would be made when the schools start to understand what the data is telling them about their consumption to help to inform how it could improve.

A simple energy profile can inform the diagnosis of when energy is being used in schools throughout the year. It would show how much energy is being used when the school is in use and out-of-hours use (the energy base load). An energy profile can easily be created and carried out by the schools themselves by asking their utilities supplier to provide them with a spreadsheet of their half-hourly consumption via the meter readings. The data could then be turned into a graph giving a clear visual understanding of where significant reduction in their daily energy consumption could be made.

6.3 POE methodology

Overall, we believe the POE exercise worked well. We gathered some valuable data and have been able to draw worthwhile conclusions. The following worked particularly well:

- The multi-disciplinary team carrying out the peer review included people with a sound knowledge of education, ICT and buildings, resulting in a broad and well-informed evaluation.
- The workshops with staff and students were an excellent way of exploring the questionnaire responses and gave users an opportunity to share other views that may not have come out of the questionnaires.
- Collecting monthly utilities bills and monthly meter readings from the schools provided invaluable data without over-burdening staff.

If this is to become a routine part of the capital process it would be worth considering the following refinements to the process, based on our experience:

- Allow at least half a day for independent external reviewers to gain a complete picture of the school.
- Questions put to users are best grouped under familiar headings such as ‘the appearance of the building’ or ‘circulation’. The CABE headings are very useful for peer reviews but less appropriate for staff and students. Questions should be short and simple; more complex issues can be discussed in workshops.
- Ideally, those who complete the questionnaires should attend the workshops.
- If a scoring system is used as part of the peer review, it must be straightforward but refined enough to provide a clear and fair assessment.

7 CONCLUSIONS AND RECOMMENDATIONS

Many of the schools involved in this POE were working well, reflecting good design and sound premises management. They were light, spacious, safe and secure, and well used. However, the evaluation revealed a number of shortcomings that if addressed would ensure more successful school environments and therefore more effective use of schools capital investment.

We include here recommendations to improve the design and performance-in-use of school buildings. Common to all these suggestions is the need for all those involved in school buildings to be aware of, and act upon, their responsibilities as premises providers/ managers.

We also include here recommendations about the future of schools POE, based on our experience of this project.

7.1 Design, procurement and premises management

We recommend that the lessons learnt from the POE, as well as the best examples of design and management that were seen, are shared more widely. This will help to improve the quality of design in school buildings and inform any support that's given to schools so that they make the most effective use of their premises. We give specific recommendations for action below, the headings reflecting the key issues emerging from the POE study.

7.1.1 Making the most of school accommodation

The most successful projects were designed to give users flexibility and they were managed so that optimum use was made of the available accommodation. These schools worked well because:

- Schools had a collaborative rather than territorial approach to the use of space, so that a good range of facilities were available to all when needed and spaces did not stand empty. For example, all science staff had access to a suite of differently equipped spaces, by mutual arrangement.
- Designers organised the available area so that linked activities were grouped together and there were opportunities for staff to use spaces flexibly. For example, a centrally positioned dining area with good acoustics was used for informal learning and meetings throughout the day, not just at lunchtime.
- Schools had confident approaches to using their facilities which were clean, well maintained and enlivened by artworks and current displays of students' work.

Recommendation 1: *Ensure that the key messages about good management and collaborative use of space are included in any future support given to schools and any future guidance given to design professionals. Encourage schools to share their experiences about optimising their available space.*

7.1.2 Making the most of school grounds

Most of the schools had very good facilities for PE and sports, especially the secondary schools. However not many of the primary schools and very few of the secondary schools were making full use of the school grounds to support teaching and learning across the curriculum or for social activities.

> ***Recommendation 2:*** *Designers should consider the potential of the whole school site as a learning environment, providing weather protection, durable outdoor furniture and storage; and locating activities to minimise disturbance to indoor classes.*
>
> *Good practice in the use of outdoor space should be shared between schools, to increase teachers' confidence and creativity.*

7.1.3 Improving ICT – infrastructure and access

Although most of the schools were very well equipped and students were very keen to make extensive use of IT (as most did out of school), the potential of ICT to support teaching and learning was often not fully realised.

> ***Recommendation 3:*** *The ICT infrastructure needs to provide whole-school access and be able to support future educational and technological developments, so that a school's facilities do not fall behind student's learning needs and expectations.*
>
> *Good practice in the use of ICT should be shared between schools, to increase staff confidence in using ICT as a learning tool (and in being more flexible about student access).*

7.1.4 Improving environmental performance-in-use

The schools evaluated were using considerably more energy in comparison with current benchmarks. The annual saving achieved by reducing a school's energy consumption from the worst to the best performance in this evaluation could pay for a new teacher. Generally, much can be done to reduce the amount of energy a school consumes. Effective reductions can be informed through regular monitoring of energy use and comparison with benchmarks. Of the reviewed schools that were required to have a Display Energy Certificate (DEC), which helps to inform the energy efficiency of the school building, 37% did not have a current rating.

> ***Recommendation 4***: *Schools should comply with the regulatory requirement to have a current DEC to help inform their actions and to take steps to improve energy efficiency*
>
> ***Recommendation 5:*** *The DfE's current benchmark publication, 'Energy and Water Benchmarks for Maintained Schools in England 2002-2003', should be updated to include a statistical analysis of published 2010 DEC ratings for 5000 schools; schools to be encouraged to monitor their annual performance against the benchmarks through a simple online toolkit, to help inform their improvement.*

Many staff and students at the evaluated schools had problems with the temperature and/or ventilation in their learning spaces. In some cases there were links between problems of ventilation, noise disturbance and lighting. These problems were typically due to one or more of the following: ineffective environmental design strategies; poor design and installation coordination; poor handover and aftercare and over-complex controls or users not knowing how to control their spaces.

> ***Recommendation 6:*** *The design of environmental strategies must be appropriate for a school, taking account of the fact that school staff do not have the expertise, time or budget to manage complex systems. Thorough commissioning of services is to take account of the building in use, once occupied with staff, students and their equipment. An extended or phased aftercare, a 'Soft Landings' approach, should be embedded within the contract, to help ensure that the building's performance in use is aligned to the users' needs, which were identified in the design brief.*

> ***Recommendation 7****: Evidence of performance-in-use should be collated, considering thermal comfort (particularly summertime overheating) and energy and carbon consumption (with a detailed breakdown of all energy uses such as ICT equipment, sports and security lighting and kitchens). This would help inform the schools capital and climate change programmes and the efficiency of schools capital investment.*

The evaluation showed that the extent of the impact of low-carbon technologies was variable. Schools with low-carbon technologies e.g. photovoltaic panels (PV) had little understanding of the impact of their renewable technology and often had high energy consumption. Interestingly, the better environmentally performing schools had no low-carbon technologies. Instead they adopted good energy management practices and the staff and students had a good understanding of the impact of their behaviour.

> ***Recommendation 8:*** *Evidence should be collated of performance-in-use of low carbon technologies to help inform the schools capital and climate change programmes and the efficiency of schools capital investment. This should be aligned with CLG and DECC policies.*

7.2 Future of POE in schools

We believe that POE helps to ensure that school buildings and grounds perform as effectively as possible and meet teaching and learning requirements, thereby improving the efficiency of schools' capital investment.

For individual schools, POE would give staff a better understanding of their buildings in use, helping them to make more effective use of their space and reduce revenue costs over the life of the building.

For school building designers and procurers the lessons learnt from a POE could be fed into future design typologies, improving fitness for purpose and cost effectiveness.

We therefore recommend that POE becomes a normalised part of the capital spend process (at the moment schools can refuse to engage in the process).

> ***Recommendation 9:*** *POE should become a normal part of the capital spend review process, using a streamlined methodology that takes account of the current government priorities, considering the lessons learnt from this POE.*