King's College London

Small steps pave the way for energy savings fit for King's College London

CARBON TRUST
Making business sense of climate change

Carbon Management

3,000t

the amount of CO_2 the College cut in the first year of the programme

£4.4m

potential cumulative savings of Carbon Management plan

One of the first institutions to sign up to our Higher Education Carbon Management service, King's College London has built on its achievements, progressing from small-scale action to challenging refurbishment and renewable energy projects.

As a result, the College cut its CO_2 emissions by over 3,000 tonnes within the first year of implementing its Carbon Management Programme and now factors energy efficiency into every estate management decision. These savings helped it become one of the first 12 organisations to achieve the Carbon Trust Standard, win a Green Gown award and support its aim of working towards achieving BSI EN16001.

The business focus

With 23,000 students spread over five campuses and two further residential sites, and buildings ranging from a Grade I listed library to 21st century state-of-the-art laboratories, King's College London is an energy efficiency challenge.

Driven by cost considerations in the face of rising energy prices, university expansion and reputational as well as regulatory concerns, King's had recognised the need for strong action on energy management by the early 2000s. By the end of 2004 it had undertaken most of what it saw as quick and cost-effective tasks. However, by 2005, its energy bills had reached over £3.7 million and annual carbon emissions were exceeding more than 48,000 tonnes. King's therefore wanted to take its activity to the next level of sophistication.

So when in 2005 the Carbon Trust Higher Education Carbon Management (HECM) service was launched, intended to help universities develop strategies towards greater energy efficiency, King's leapt at the chance to join the pilot programme.

"We first heard about the service at a meeting of London University energy managers in 2005, facilitated by the Carbon Trust," says Keith McIntyre, Energy and Environment Manager at King's. "We had already decided that measuring CO_2 output would be a good way to compare the performance of our different buildings, so working with the Carbon Trust seemed like a good fit."

King's initially identified projects within its Carbon Management Plan which would result in a 12.5% reduction of its CO_2 emissions from the 2004/5 baseline by 2011-2012. If achieved this would equate to a cumulative total reduction of more than 19,000 tonnes and a £4.4 million saving in energy costs.

Funded by a series of Salix loans, King's has now met this goal by exercising increasing control of its buildings' energy consumption, principally through new controls on lighting and temperature. The Salix Energy Efficiency Loans scheme provides funding for public sector organisations who want to invest in energy saving technologies.

"If we hadn't taken these actions, our revenue spend would have been £2 million to £3 million higher. And as from 2011 money from the Higher Education Funding Council for England (HEFCE) for capital projects is going to be linked to our carbon performance, the better we get the more funding we have the potential to achieve."

> The CRC has made a significant impact on how this work is perceived internally. At the end of the day the FD is responsible for managing the financial implications, the Principal's Central Team is responsible for signing-off the footprint and ensuring full compliance with the regulations. This has helped bring it home to the wider organisation that it is not just an estates issue but a college issue.

Keith McIntyre
Energy and Environment Manager,
King's College London

The technical approach

To reach its targets, King's College London, in partnership with us, identified a number of actions that it could undertake to address its energy use and spend.

The first significant investment was the replacement of a leaky, inefficient 40 year old boiler system within a teaching and research area. By comparing their efficiency with our benchmark data, King's realised how urgent the project had become.

With £100,000 of Salix funding, a modern, modular boiler system was fitted to a research/teaching building. Further work on downstream circuits and the introduction of a Building Energy Management System (BeMS) has resulted in further heating circuits being added to the system during refurbishment of other areas, giving more efficiency and removing the need to replace additional boilers. "This has meant we have got more savings from the initial investment than first planned," reveals Keith.

Perhaps surprisingly, some of the most up-to-date solutions can be more sympathetic to the architecture of the older buildings than the technologies they replace. This was the case when it came to replacing the metal bay lighting in the Grade 1 listed, neo-Gothic Maughan Library.

"The Maughan Library has high, vaulted ceilings," says Keith. "We have been able to strip out the metal bays and halogens and replace them with compact fluorescents. Not only have we gone from 200w per light to 40w, but you can actually appreciate the vaulting far better than before."

Exploring new options

Age and architecture are not the only factors demanding consideration. As 60% of King's focus is research, it operates many highly intensive laboratories, whose temperature, humidity levels and air change rates are all dictated by strict Home Office criteria.

"Because we can't change the settings, it's forced us to look instead at how the power is generated," says Keith. "The knowledge we have gained from starting small means we are not frightened to try something new in our building and refurbishment projects."

As a result, the College has taken an imaginative approach to energy generation for its newest building. The Cicely Saunders Institute, the first dedicated palliative care research centre in the world, has its under-floor heating and chilled beams powered by a ground source heat pump, while its hot water is created by solar power. In other areas King's is looking at photo-voltaic and combined heat and power (CHP) solutions.

Pushing BeMS boundaries

"We are now a really big user of BeMS," explains Keith. "Five years ago, we didn't really have any. Now, we are not just putting in bog standard models any more. We know what we want and have tweaked them beyond what the manufacturers offer."

The College's control settings now all align to building opening hours, and are linked to a central web enabled control software system. The College has also put in meters to provide valuable data on where it is using most energy, so that it can identify and reduce areas of energy wastage. For example, metering can highlight when lights are left on throughout the night.

Making the most of chilled beams

The College has also embraced the idea of chilled beams, a relatively new technology.

"We recently upgraded three floors of a 1970s building," says Keith. "It is made mainly of concrete and we were restricted in what we could do. One thing we did was to improve the thermal envelope; the other was to put in chilled beams."

As part of this work, the College engineered a passive sensor into the chilled beams and also selected to incorporate an innovative Pressure Independent Characterised Control valve. Through the BeMS this could not only accurately regulate the thermal input into the rooms, in this case offices, within the building but also allowed accurate measurement of the thermal load.

"The passive sensor within the chilled beams operates both the lights and temperature. This means that we can have very tight control of energy usage in the room," highlights Keith. "Users have control within a tight control band of their own environment. If no one is detected within the working space the BeMS regulates down the chilled beam and also ramps down the main ventilation plant."

How does it work?

Chilled beams provide space cooling, and sometimes heating, and are primarily an alternative to ceiling-mounted fan-coil terminal units. Instead of using an electric fan to induce a flow of room air across a cooled or heated coil, chilled-beam units are supplied externally with a small volume of primary air which is discharged at high velocity through nozzles, entraining typically four times the volume of room air. Energy savings arise partly from reduced fan power and partly because slightly higher chilled-water temperatures can be used, reducing refrigeration power.

383t

the amount of CO_2 saved by the refurbishment of the Strand campus

Refurbishing for the future

When, in 2007, the College began the extensive refurbishment of its Strand campus, sited in an 1829 Grade 1-listed building, it decided to adopt a sustainable approach to the task.

"We needed to make the most of the existing estate through better use of space and refurbishment, and at the time we wanted in part to prove there could be environmentally positive refurbishment. We've had proof that we've achieved these goals by winning the Sustainable Construction Green Gown award," says Keith. "These recognise exceptional initiatives being taken by universities and colleges across the UK to become more sustainable."

Initially King's was going to put in air conditioning. But while waiting for the plans to go through, there was a new directive on sustainability, and as a result, the plans were re-engineered. Now the building makes the maximum use of natural light and solar heat and the windows can be opened, reducing the need for air conditioning.

The building will reduce electricity by 830,000 units a year, saving 383 tonnes of CO_2 – and £77,000.

People power

Getting staff and students on board with the need for greater efficiency has also been crucial to the new focus. The College worked collaboratively with Guy's and St Thomas' NHS Trust, with whom it shares its campuses, on an early awareness raising campaign. This highlighted the difference made by switching off computers and lights, not overfilling kettles, and other everyday examples of responsible energy use.

"Our biggest challenge is still behavioural change," admits Keith. "We can always find the technical fixes, but getting the message across is much harder. I can still walk around the buildings and find lights left on, or receptions lit up like a Christmas tree. It's about putting the message into context, for example highlighting to students that their actions are wasting their fees."

Part of the challenge is that the turnover of students is so rapid; no sooner has one cohort absorbed the thinking, than they have been replaced by a new intake. More broadly however, energy efficiency has become central to the way the College functions.

"One area where we have been hugely successful is with our estate managers. They now automatically think 'Is there an energy efficient way of doing this?' and consider it a key part of procurement and building projects," Keith says. "It's factored in from the start in a way that would never have happened before. In fact the biggest problem now is that it's become so instinctive they don't think to tell me about it!"

> "By definition, sustainability is important – if something is unsustainable, it will eventually collapse. When this is applied to whole cities and civilisations, it becomes a very serious matter."
>
> **Professor Rick Trainor**
> King's College London

In 2008, King's became one of the first 12 organisations to be awarded the Carbon Trust Standard - a mark of excellence that recognises organisations for measuring, managing and reducing carbon emissions.

"Getting the Carbon Trust Standard has given us a great way to demonstrate to our employees and students that we are committed to reducing our carbon impact," says Colin Bushnell, Assistant Principal (Estates). "It is also a great testament to their efforts. The Standard has given us the independent endorsement for the actions we have taken and the reductions we have made."

Collaboration

King's has adopted a very collaborative approach to working. In part this is due to its proximity to Guy's and St Thomas' NHS Foundation Trust, King's College Hospital and South London and Maudsley NHS Foundation Trust. "We do work together on a lot of things, which is great as it helps share and build a diversity of knowledge."

King's also works closely with one of the Public Private Partnership (PPP) providers of facilities maintenance for two of its buildings, which it has worked with since 1999 as part of a 25-year PPP contract.

"We completed some further Carbon Trust audits of two of our PPP buildings, as part of this collaborative working," explains Keith. "The aim is to identify energy saving initiatives which our partner will implement. The aggregated savings from the measures identified could represent a 24% reduction in energy consumption.

A couple of years ago this type of working would have been unheard of and would have required changes to contracts. The facilities management team has been very cooperative, to the extent of actually driving the project."

> "Working with the Carbon Trust was integral to the success of our activity. They gave us the numbers that informed our strategy and then the guidance to help put it into place. Without that we would probably still be stumbling on. We would still have a strategy but wouldn't have felt as comfortable and confident in this work as we do now and probably wouldn't have gone for BSI EN16001."

Keith McIntyre
Energy and Environment Manager, King's College London

Higher Education Carbon Management (HECM)

The Carbon Trust is working with universities to help them produce carbon management plans, complete with business cases and senior management approval. Each plan contains a full carbon emissions baseline, plus a series of carbon saving projects to meet ambitious cost and carbon saving targets. Success is achieved through a structured programme which includes workshop support for staff and senior managers to improve their awareness of energy efficiency and help them to share best practice.

The HECM service helps to deliver improved energy management of academic, accommodation and leisure buildings and vehicle fleets. The scheme is supported by a series of bespoke software tools that give detailed guidance on the carbon management process as well as technical advice.

Read more about HECM