Carbon Trust – Results of the Low Carbon Buildings Programme

Over the last four years. The Carbon Trust has tracked closely the progress and lessons learnt from 28 low carbon new or refurbished building projects. The new build projects all received funding under the Low Carbon Buildings Programme.

The project was funded by The Department for Energy and Climate Change (DECC) and covered many sectors including: retail, education, offices, mixed use and residential buildings.

The projects were tracked from early design through to monitoring the buildings in operation. The design predictions, key decisions and actual operational energy use were captured and analysed. The findings and the lessons that were learned are summarised into a series of 'sharing our experience' booklets and case studies available here.
[http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/pages/buildings.aspx]

AECOM was involved from the start of this project. AECOM's low carbon advisors were directly involved in four projects and the team were appointed to manage the dissemination phase of the project, which included writing three of the booklets outlined below. Therefore, from this work AECOM has gained a unique insight into which factors help deliver a new or refurbished building that is actually low carbon in operation and not just on paper.

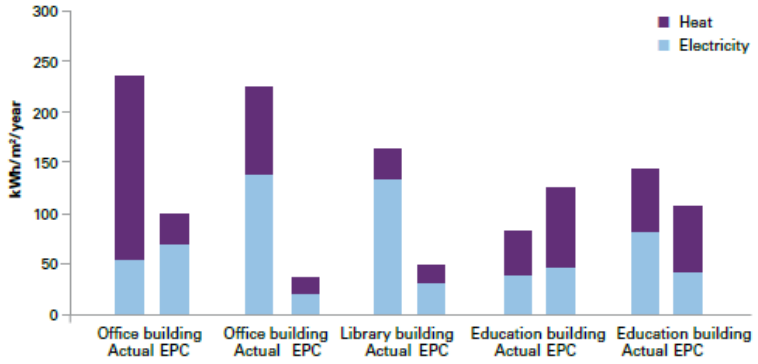
The findings also provide valuable insights and lessons that should take on board as building designers and when acting as sustainability advisors or project managers to our clients.

A list of these guides is given below, accompanied by a brief summary of what is covered by each guide and the key points.

Four of the booklets covered key themes that came out of the research:

Closing the gap – the gap between design and performance

Figure 2 A comparison between actual regulated energy consumption and the output of modelling, used to generate the EPC rating for five case study buildings

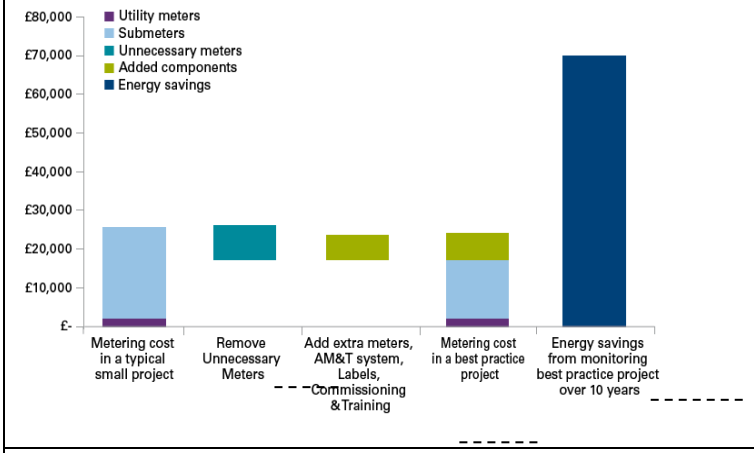


Key points:

There was a significant gap between design energy calculations and actual operational performance, including the predicted contribution from renewable energy technologies and the energy demand of lighting, small power etc. Design teams need to undertake better informed predictions of energy use.

The buildings with less technologies and simple ventilation strategies generally performed better. Aiming for stretching low carbon renewable targets sometimes led to over-complex strategies that can be difficult to control and operate.

Green Gauges – metering and monitoring systems



Key points:

Energy metering: systems need to provide useful information on where energy is being used and how technologies were performing. Most of the projects had poor metering that was installed simply to comply with building regulations. Some low carbon technologies were not fully metered. Successful projects used a specialist metering and data collection system procured on a turnkey contract.

Taking control – control systems

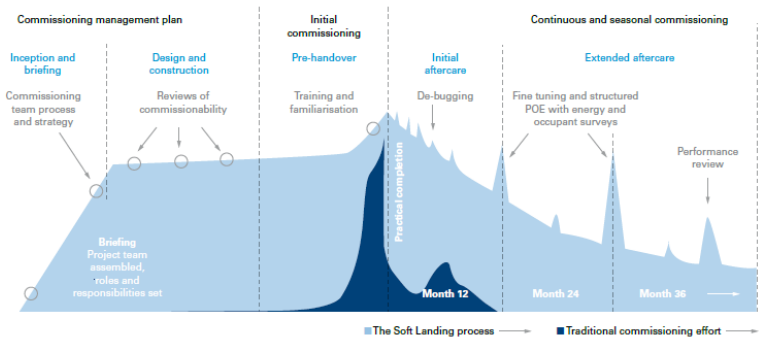
A 'good' control set-up – appropriate controls with clear instructions

A 'bad' control setup – numerous unlabelled switches that may all get turned on – and left on – as nobody knows which switch controls what.

Key points:

Controls interfaces and systems have to be designed more with the users in mind. Over-complex or unintuitive controls systems often led to poor performing buildings, both in terms of occupant comfort and energy/carbon performance. Common problems were value engineering and poor integration of low carbon technologies into the overall controls strategy.

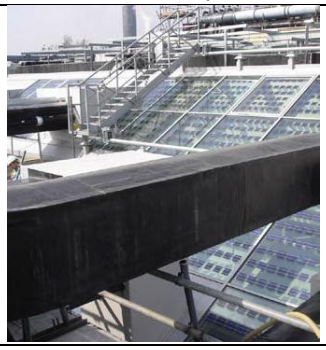
Making buildings work – commissioning and handover management



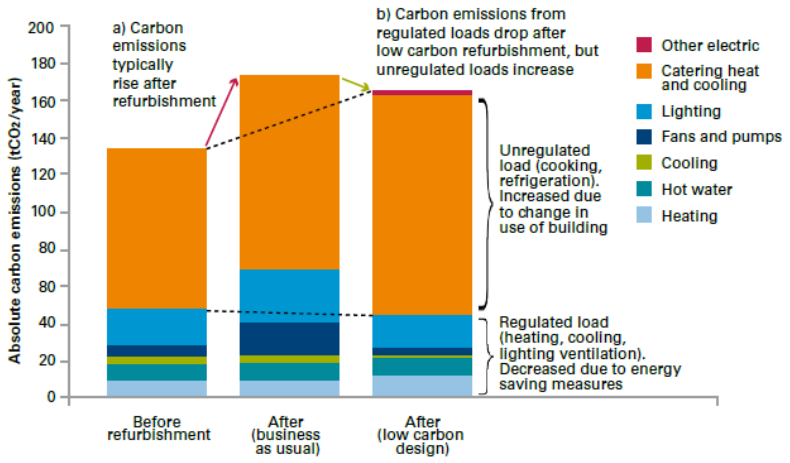
Key points:

Commissioning: The projects that included comprehensive commissioning and a graduated handover process (e,g. Soft Landings) often resulted in better-performing buildings. Soft landings included acting on occupant feedback and energy monitoring results to fine tune the building and optimise performance.

Three of the booklets findings from buildings that incorporated the following low carbon technologies or techniques:

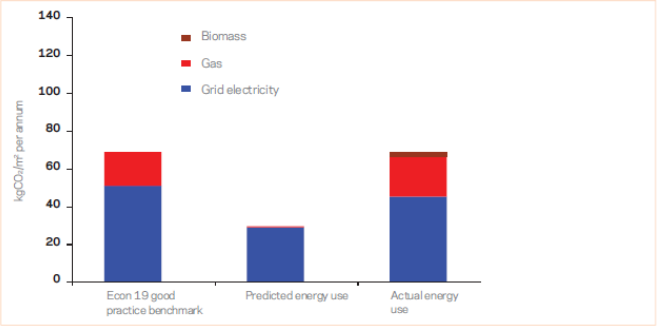
Down to earth – ground source heat pumps	
	Key points: Ground source heat pumps: savings were achieved when this technology was correctly applied (e.g. fully integrated with other heating technologies and controls) and it was important to involve the contractors early and manage construction quality;
A place in the sun – photovoltaics	
	Key points: Photovoltaics: panels performed as expected, or better, when correctly installed, but partial overshading from poor design co-ordination led to significant reduction in performance in one project. Bespoke solutions and ancillary items can add considerable cost.
A natural choice – natural ventilation	
	Key points: Natural ventilation: This approach has to integrate the building fabric, orientation, internal conditions, heating, lighting, consideration of likely internal heat gains and how the occupants will use the building. A mixed mode approach was also successful in reducing energy use..

Two booklets cover the lessons learned from the low carbon refurbishment projects:

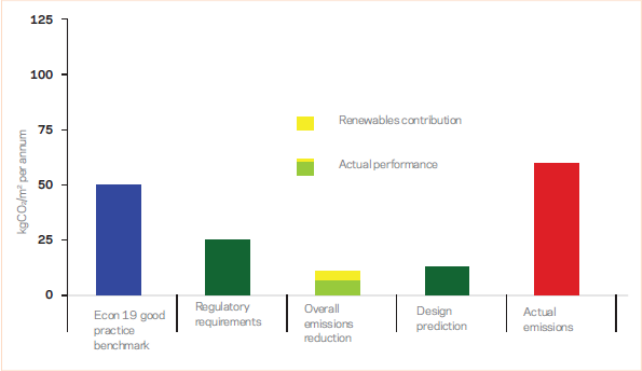
Refresh and Reduce – internal low-carbon refurbishment ***Low carbon refurbishment of buildings***, a management guide	
	Key points: Internal refurbishment: the greatest opportunity is at the planning stage, by challenging standard specifications and equipment selections. It is essential to understand the existing building to identify where energy savings can be made. Low carbon refurbishment: Low carbon refurbishment can result in an increase in energy use, compared to performance before the work. This can be due to things like changes in the use of the building or increased lighting levels. However, low carbon refurbishment reduces energy use, compared to the 'business as usual' scenario, where energy efficient design is not considered.

Two case studies of projects have been published in Building Magazine:

Canolfan Rheidol: A mixed mode office in Aberystwyth, with a biomass district heating system, solar thermal hot water heating and a 6kW wind turbine.



West Suffolk House: a naturally-ventilated office in Bury St Edmunds, with an open loop ground source heat pump, and solar thermal hot water heating.



The case studies provide a critical review of the actual operational performance of the buildings and the lessons learned which can be used to inform other projects. There are also video case studies on the Carbon Trust website.

A booklet on retrofitting renewables in existing buildings was published:

Power Play – Guidance on retrofitting renewable technologies

Blown woodchip delivery
[Photo courtesy of G & VAM Downing]

Key points:

Carefully choose the renewable technology by doing the research, using independent advice and considering how much effort will go into operating the system.

It was found to be important to prepare a written brief and specification and carefully select the installer. A checklist to help write a brief and specification is appended to the booklet.