

Single Building Retrofit

Transport for London carried out a major fit-out of its new flagship Head Office in Southwark, the **Palestra building**, to dramatically reduce running costs and improve its environmental performance. This saw the installation of the UK's largest, building-integrated fuel cell Combined Heat and Power plant, helping to cut the building's CO₂ emissions by up to 40%.

> Situation

When Transport for London (TfL) acquired the head lease for the Palestra building in 2007, it set out to dramatically cut running costs and improve the building's environmental performance.

A key part of the brief was to raise the BREEAM sustainability rating from Very Good to Excellent.

This was part of the organisation's efforts to support the Mayor of London's targets to cut CO₂ emissions by 60% by 2025 and have 25% of energy from local sources.

TfL's move to the striking building, designed by Will Alsop and winner of two RIBA awards, was part of an accommodation strategy designed to consolidate multiple sites and cut costs.

TfL joined the London Development Agency (LDA) as the first occupants of this speculative commercial development, which was completed in 2006 by Blackfriars Investments and Royal London.

More than 3,000 staff are now housed across the building's 12 floors.

> Actions

Before any low or zero carbon technologies were looked at, the building was optimised for energy efficiency to reduce demand.

A pioneering aspect of the project saw TfL install the UK's largest, building-integrated fuel cell Combined Heat and Power (CHP) plant into an already operational building. This forms a central part of the building's 1MW Combined Cooling, Heat and Power (CCHP) tri-generation scheme.

The state-of-the-art hydrogen fuel cell now supplies electricity and hot water to the building, providing heating and hot water in the winter, as well as converting heat into cooling through an absorption chiller. The tri-generation system has also been designed to form part of a future district-heating network.

A 74,000-litre thermal cylinder stores surplus heat generated on site to make it available when it is required through the day, to maximise CO₂ savings. An innovative solution to locating the thermal store was found by half burying it in a disused cellar, with the above-ground element creating a striking piece of public art.

To communicate the benefits of fuel cell technology, TfL also created a permanent multimedia exhibition on the ground floor.

Other sustainability measures included:

- Upgrading around 4,000 light fittings and installing sensors that dim the lights when there is sufficient daylight
- Connecting 130 utility meters to a new, advanced metering system
- Replacing boiler burners with new, low-NOx versions
- Reducing the need for cooling on the floor by using a thin client PC system, and sharing multi-function devices across up to 50 users
- Fitting fresh air controls, with presence detectors enabling shutdown when areas are unoccupied
- Upgrading building management software to control temperature, heating and cooling systems more efficiently
- Installing rainwater harvesting for 500 dual-flush toilets and fitting tap aerators to save water
- Retrofitting a living roof to encourage biodiversity and improve insulation
- Using recycled materials, such as plasterboard and worktops made using waste glass
- Introducing 150 new bike spaces and more facilities for cyclists.



Palestra

"The work done at Palestra proved that a range of technologies could be retrofitted to even the most modern of buildings, designed to meet building regulations, ranging from high tech to simple solutions, delivering real cost and CO₂ savings and making a better, more productive workplace."

Andrew Stanton, Head of Sustainable Buildings at Transport for London

Challenges

Technical

How to integrate all the retrofit equipment, including the CCHP plant, and where to put it in an already congested building?

Through innovative use of space, TfL successfully integrated the CCHP plant and rainwater tanks into the building. The conventional CHP engine and thermal store were 'squeezed' into unused cellar space, the absorption chiller and cooling towers were positioned on the roof, the rainwater tanks went into the basement, and the fuel cell CHP engine was sited in a former reception area, partly to enable it to become part of a public display on the ground floor.

Behavioural change

How to motivate building management and occupiers?

TfL has a well-established network of around 220 volunteer Environmental Champions who have helped to roll out campaigns since 2006, liaising closely with building management. An extensive advanced metering network, made up of 120 utility meters, provides information on performance. This is used to produce reports to give feedback to occupiers, for instance on equipment left on at night, with monthly energy and waste league tables further encouraging efficiency.

Minimising disruption

How to carry out the retrofit whilst areas of the building were occupied?

Careful planning helped to reduce disruption, with phased and out-of-hours working, particularly over weekends, and much work taking place in unoccupied areas.

Achievements

Benefits

By mid-March 2011, the CCHP plant had been operational for more than 14,000 hours, delivering more than 2,400 MWh of power.

Overall, the sustainability measures have resulted in:

- 25% of power generated at times of peak energy use, rising to 100% off-peak
- 30% better CO₂ efficiency than Building Regulations 2006 Part L2A and up to 40% long-term CO₂ emissions reduction
- Less pollution, as the hydrogen fuel cell does not produce pollutants or noise; the only waste product is water, which is used to flush the building's toilets
- Less waste energy, as waste heat from power generation is pumped into an absorption chiller on the roof which converts it into cooling for the offices during the summer
- Greater public awareness, as the permanent multimedia exhibition helps to explain fuel cell technology and other CO₂ saving measures
- A glowing endorsement of the building in a post-occupation evaluation study, even highlighting increased productivity.

Financials

The payback period for the environmental improvements at Palestra is around 10 years, well within TfL's 20-year lease on the building.

The installation of the £2.4 million fuel cell was funded by TfL's £25 million Climate Change Fund. It is estimated to save around £90,000 each year on energy costs, as well as generating £25,000 revenue from exported electricity and £25,000 of Climate Change Levy rebate.

In its first year of operation, it scored 125 on the Government's CHP quality assurance (CHPQa) scheme, 25 points above the threshold of 100, enabling TfL to claim under the enhanced capital allowances scheme and reduce gas costs through exemption from the Climate Change Levy.



Fuel Cell CHP display