The projects that broke new ground

So, what about the fruits of services engineers' labours? We asked a panel of sector leaders and academics to name 30 projects that have reshaped the built environment over the three decades since *BSJ's* inception in 1978

Gateway 2, Basingstoke

When Wiggins Teape occupied Gateway 2 in 1983, it was one of the first examples of a business moving from a fully air-conditioned office into a naturally ventilated building. Arup used computer simulation to model the stack effect of heat rising in the building's central atrium, drawing fresh air in from the perimeter through the offices. The need for summer cooling is avoided through Arup's use of fixed summer shading and the thermal mass in the exposed concrete of the office ceilings.

The Ark, Hammersmith

Architect Ralph Erskine created a landmark for motorists driving in and out of London on the A4. His office building, which derives its name from the hull-like profile, was completed in 1992 and underwent an extensive refurbishment 15 years later at a cost of about £20m. Almost half of the budget was allocated to building services, designed by RYB Konsult. The main change was the replacement of the air supply and return system, which had failed to meet the requirement of operating separately on each floor to suit individual tenants. Other features of the refurbishment included the creation of a double-height atrium on the ground floor. Each floor can now be subdivided into two spaces and the open balustrade has been replaced with partially glazed partitions.

Scottish Parliament, Edinburgh

The briefing for this project put environmental concerns at the heart of the design. The stated aims were a BREEAM excellent rating and the "good practice" benchmark under Econ 19. RMJM used natural ventilation in most areas, even where the depth of plan would normally preclude it, plus low-velocity displacement ventilation and comfort cooling, partly through the use of boreholes inherited from the previous site owner, brewer Scottish & Newcastle. Solar panels and a combined heat and power boiler also reduce energy use.

Innovate Green Building, Leeds

This scheme is included not only because it attained the highest ever BREEAM score of 87.5%, but because it is a great example of what can be achieved, both environmentally and commercially, when engineering is allowed to lead the design process. Engineer King Shaw Associates was involved in the selection of construction components based on their contribution to the overall building performance. This gives a more holistic, sustainable solution than is provided by simply adding green bling. Completed in 2007, the building's carbon emissions are predicted to be at least 80% less than for a typical office building.

Apollo theatre, Victoria

The refurbishment of the Apollo Victoria in London makes the list for exploiting the potential of LEDs on a scale not previously seen in the UK. The auditorium, dating from 1929, previously had 3500 GLS lamps. The new scheme, designed by Hoare Lea, replaced them with 84000 LEDs to recreate the original design, which sought to give the illusion of an underwater palace. The LEDs save energy to boot.

30 The Bond, Sydney

This was the first office building to achieve a five-star rating from Australia's Green Building Council, equivalent to a BREEAM excellent rating in the UK. The design includes concealed passive chilled beams – the first large-scale installation of this technology in Australia – and a "single- pass" fresh air system. The building incorporates an exposed rock wall, hewn by convicts in the 1800s, which is the longest and oldest sandstone cutting in Sydney. The piece of history is given a good display but also assists in the radiant cooling of the atrium. Moist airflows coming off the wall are engineered to minimise the risk of humidity and condensation. Environmental design was by Bovis Lend Lease, mechanical engineering was by Lincolne Scott and electrical design by Connell Mott MacDonald. Despite being met with great scepticism by the building services industry during the design and construction phases, it has operated for more than four years without problems, staying within +/-6% of the original bold energy estimate of 50% below the Sydney average.

Le Centre Pompidou, Paris

The arts complex, opened in 1977, warrants inclusion for literally putting the work of the building services engineer on view. The architects, Renzo Piano and Richard Rogers, came up with a design that not only showcased Arup's services scheme but allowed the creation of vast uninterrupted interior spaces.

Eden Project, Cornwall

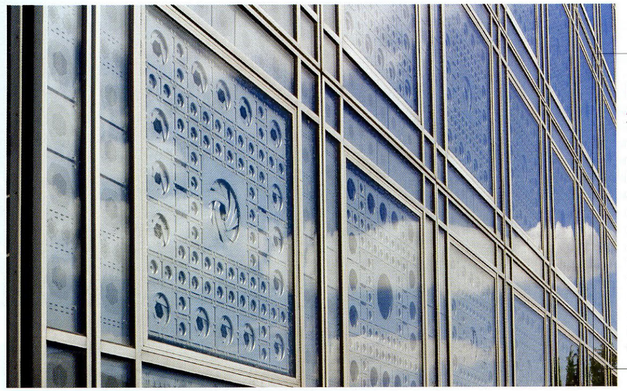
The Eden Project, by Nicholas Grimshaw with services by Arup, makes the list as much for its ethos as its design. One expert describes it as a "simply joyful place", but says it is challenging from an engineering perspective because of the difficulty in ventilating it without upsetting the plants. Plans are in the pipeline for a new building, called The Edge, which will look to examine and tackle the issues of climate change.

Emirates Stadium, London

Arsenal's football stadium was a popular nominee, while its counterpart along the North Circular Road in Wembley wasn't even close to making the list. Perhaps it was something to do with the well-publicised problems during construction of England's national stadium and the fact that the Emirates came in on time and within budget. Where the Emirates scores over Wembley is the construction of the services in modules, so that the stadium can operate in zones when it hosts smaller events.

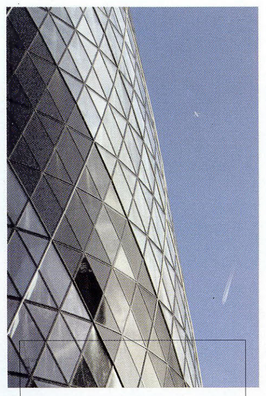
Masdar, Abu Dhabi (design stage)

The construction of Masdar is a sign of the Middle East's increasing commitment to



L'Institut du Monde Arabe, Paris

The Arab World Institute, designed by Jean Nouvel, is a mixed-use cultural centre near Notre Dame. Its impressive south-facing facade is an example of how innovative engineering can enhance an architectural concept. The facade is constructed of more than 200 aluminium panels that have a variable diaphragm, like a camera iris, to control the intensity of light filtering into the building's interior.



30 St Mary Axe, London

Arguably London's first green tower, the 180m high "Gherkin" has dominated the City skyline for four years. The 2004 Stirling Prize winner was designed by Foster + Partners with services by Hilson Moran. Cigar-shaped, it has spiralling atriums with opening windows to allow the floors to be naturally ventilated when wind speed is below 10mph and external temperature between 20°C and 26°C.

produced on site. The solution, developed by consultant Max Fordham in 2003, involved the installation of a wind turbine (unsurprisingly), a combined thermal and photovoltaic solar panel system, ground water cooling and a large thermal heat store. The building also features a biomass boiler supplied with fuel grown on the surrounding land. Some elements worked better than others, but overall the project has been a success.

Sainsbury Millennium Store, Greenwich

The low-energy food store on the Greenwich peninsula is the only retail building to make it on to the list. It is nominated for being a pioneering low energy design in a traditionally energy intensive sector. In addition to the wind turbines that generate power to illuminate advertising hoardings, other low energy features include earth berm walls, a naturally lit sales floor and wall panels in the toilets made from recycled plastic bottles. M&E was by the then-named Oscar Faber.

Burj, Dubai (under construction)

The Burj is included simply for being the tallest building in the world – although quite how tall it will end up is a closely guarded secret. This megastructure is effectively a small town with retail, commercial, hotel and residential. Its peak cooling load is estimated at 53MW by the MEP team at architect SOM. Greener features include using condensed water from the air-conditioning system's cooling coils – estimated to be over 50 million litres a year – to irrigate the planting. Other key statistics include a 45MVA electrical load and a 18m/s (40mph) lift to whisk people up to the viewing gallery. The lifts form part of the fire evacuation system.

Dongtan eco-city, China

Dongtan is China's first eco-city, designed by Arup. The aim is to create a development that is as close to carbon neutral as possible and sustainable environmentally, socially, economically and culturally. Dongtan will produce its own energy from wind, solar, bio-fuel and recycled city waste. Clean technologies such as hydrogen fuel cells will power public transport and there will be a network of cycle and footpaths.

Hearst Building, New York

As energy efficiency for tall buildings becomes a hot topic, the Foster + Partners-designed 46-storey Hearst Building has raised the standard in New York by being the first tower in the city to achieve a Gold Rating under the US Green Building Council's LEED scheme. The services design, by engineer Flack + Kurtz (part of the WSP Group), uses 26% less energy than a conventional tower built to standard building codes. The building also collects rainwater from the roof and uses this to help cool and humidify the huge ground-floor atrium. ■

Agree or disagree?

This list was compiled with the help of the votes of leaders from within the building services industry. Like anything subjective, the results are open to debate. Do you agree with their choices? Are they too UK-focused? Tell us what you think. Email bsjeditorial@cmpi.biz