BRILLIANT BUILDINGS

DELIVERING SUSTAINABILITY

Leaving a sustainable legacy

A guide to some of our most energy-efficient buildings – and how we're closing the performance gap through careful design, construction and comprehensive monitoring

TIME TO DELIVER

The UK's target of reducing greenhouse gas emissions to net-zero by 2050 is ambitious and only possible if the buildings being delivered reach this exacting performance expectation.

Meeting tough energy and carbon compliance targets written on paper may satisfy project energy ratings, but unless that translates into actual performance, the net-zero emissions target will forever be an aspiration.

We have to prove ourselves equal to this challenge by ensuring that both new-build and refurbished properties achieve reduced energy in use, banishing the gap we often see between what is promised in design and what happens in operation. Simply specifying renewable energy generation as part of a building's make-up will not be enough.

Our future is about embracing new ways of doing things: Passivhaus, Better Buildings Partnership's Design for Performance, the UK Green Building Council's net-zero approach, the Building Services Research and Information Association's Soft Landings framework and our own Energy Synergy™ building performance improvement strategy all have a role in making the 2050 target deliverable.

Only then will the built environment be part of a solution to arrest the climate emergency that we and our future generations face.

The following pages set out how we can use our experience as a leading sustainable building contractor to help our customers explore and deliver their sustainability goals. I, or any of the team listed on the back cover, would be happy to discuss your ideas.

Alasdair Donn, head of building performance, Willmott Dixon

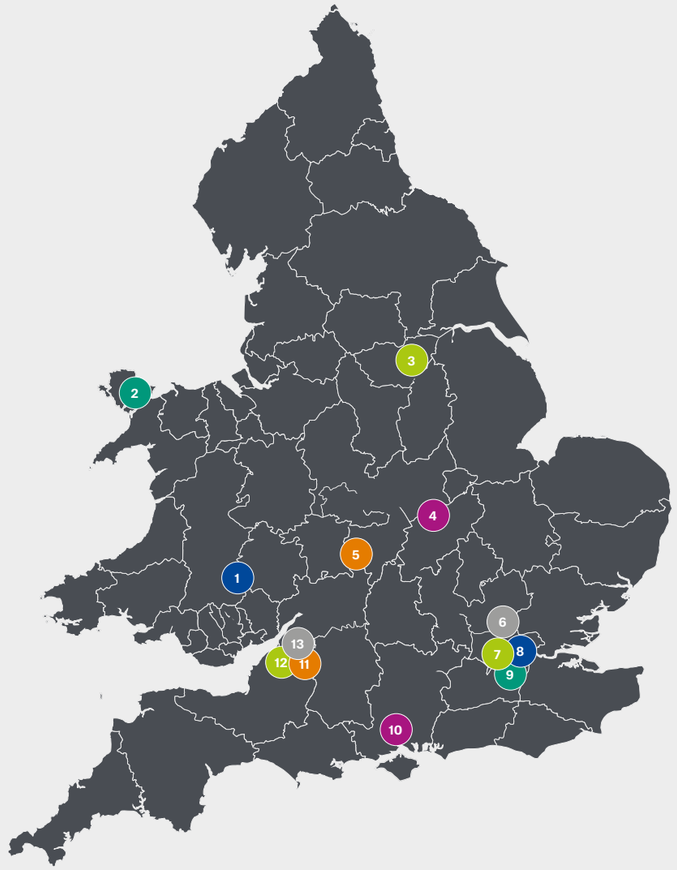
WILLMOTT DIXON
SINCE 1852

For further information on our range of sustainable projects, please visit our website:
www.willmottdixon.co.uk

BUILDING A SUSTAINABLE FUTURE

From Passivhaus designs and renewable technologies to reducing costs through Energy Synergy™, we are playing our part in making property resilient to climate change

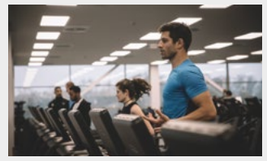
1 Powys Schools
Following the building of five schools for Powys Council, our Energy Synergy™ process modelled predicted energy use and identifed areas for reduced consumption to achieve over £4,000 per year of savings.



2 M-SParc – Menai Science Park, Anglesey
Completed in 2018 and designed to Passivhaus principles, this award-winning £20m BREEAM Excellent office, laboratory and workshop space for 700 people is Wales' first dedicated science park.

3 National College for High Speed Rail, Doncaster
This BREEAM Excellent college won the RIBA's Yorkshire Sustainability Award and BREEAM Public Sector Project Award. Delivered in 2017, its design prioritises natural ventilation and solar shading.

4 George Davies Centre, University of Leicester
Delivered in 2015, this was the UK's largest non-residential Passivhaus building. We achieved further reductions in heating and electricity costs through the Soft Landings process.



5 Sports and Wellness Hub, University of Warwick
Opened in 2019 and one of the UK's most advanced sports facilities, our Energy Synergy™ process helped make further savings of more than £40,000 within the first year of operation.

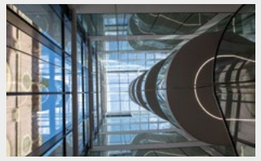
6 Oaklands College, St Albans
Handed over in 2020, the residential building benefits from natural ventilation alongside sustainable underfloor heating, which uses a ground-source heat pump.

7 London Screen Academy
This innovatively refurbished, 1930s warehouse was delivered to the BREEAM Non-Domestic Refurbishment and Fit-Out 2014 standard, embedding a range of sustainable heating technologies and biodiversity features.

8 Hackbridge Primary School, London
Delivered to meet the Passivhaus Plus standard, this state-of-the-art primary school has solar PV renewable energy generation that is equivalent to 100 percent of its designed energy usage.

9 Harris Academy Sutton, London
This is the UK's first secondary school built to Passivhaus standards, reducing energy by 80 percent in comparison to a standard new building.

10 Winchester Sport and Leisure Park
Opening in 2021, this will be one of the greenest leisure facilities in the UK, designed to be BREEAM Excellent and targeting an A-rated energy performance certificate. Its photovoltaic array will deliver most of its energy needs renewably.



11 Aurora, Bristol
We created Bristol's first office block to be built to the BREEAM Outstanding standard. This created a modern office that benefits from the maximum amount of natural light being distributed throughout the building.

12 Ashton Rise, Bristol
This 133-dwelling residential development, delivered in partnership with Bristol City Council, will use communal ground-source heat pumps as a route to fossil fuel-free heating.

13 Halo, Bristol
Due for completion in 2022, the Halo office development will be BREEAM Outstanding, with features including heating from ground-source heat pumps.

1. ADOPTING A SUSTAINABILITY STANDARD

Ensuring your building has a low-carbon specification means adopting a recognised standard during the design that can be delivered at construction.

The BREEAM methodology is perhaps the most recognised certification, having been integrated into building practices since the early 1990s and since used by more than 2.5 million buildings. However, the ultra energy-efficient Passivhaus standard is increasingly sought to achieve a high sustainable benchmark on new buildings.

The Passivhaus approach

Developed in Germany in the late 1980s, the use of Passivhaus has started to increase in the UK as an international standard for buildings that deliver super-high energy efficiency and impressive occupant comfort.

Crucially, to achieve certification, everything must be built exactly as designed to ensure performance in use mirrors the design model and targets.

What makes Passivhaus unique?

The Passivhaus methodology embraces a "fabric first" approach to design and construction, to optimise the building's fabric so that energy efficiency is achieved passively without artificial intervention.

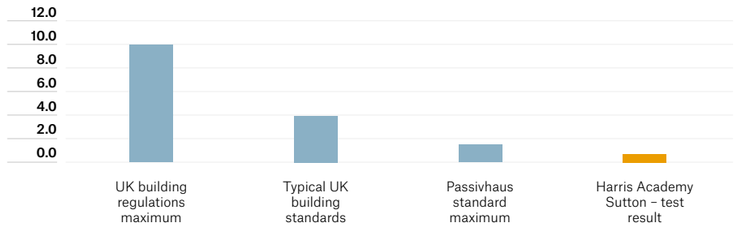
Typical fabric elements include extra-thick insulation in walls, floors and roofs; triple glazing on windows and doors; and an exceptionally airtight envelope – approximately 14 times the requirements of building regulations. This exceptional insulation and airtightness means heat leakage through windows, walls, floor and roof is prevented.

Other fabric elements include careful orientation and sizing of windows, together with selective shading to optimise solar gain in winter and prevent overheating in summer.

Further Passivhaus qualities

Another aspect of the standard is air quality and thermal comfort. Each Passivhaus building must have a highly efficient mechanical ventilation heat recovery (MVHR) system, which controls and optimises internal air quality and temperature. In addition, all 'free' heat – such as from daylight, people and equipment – is recovered and used to heat incoming, cooler, fresh air (in winter mode). This means the heating systems should only be needed on the coldest of days, keeping energy consumption extremely low.

Air tightness results ($m^3/m^2.hr@50Pa$)



Passivhaus in numbers

1990

World's first Passivhaus residences built in Germany

1,000-plus

Projects now certified in the UK

1

Willmott Dixon builds UK's first Passivhaus secondary school at Harris Academy Sutton

2. PASSIVHAUS IN PRACTICE

Harris Academy Sutton, London

Key facts

First UK secondary school to be built to stringent Passivhaus standards

—

Up to 80 percent energy savings in comparison to a standard new building

—

Superb air quality for better learning, health and wellbeing

—

£38m project value

Completed in 2019, Harris Academy Sutton takes sustainability to new heights. As the UK's first secondary school built to Passivhaus standards and the largest Passivhaus school, it sets the sector standard for exceptionally low energy use and superb user comfort.

Minimal operational carbon

The four-storey, six-form entry school accommodates 1,275 pupils and 95 staff. Sutton Council's ambition was to create a school with minimal operational carbon, certainty of energy savings and an excellent indoor environment. This translates into energy consumption that is typically 80 percent lower than a standard new building, saving significant amounts on operating costs and carbon emissions.

Thanks to a mechanical ventilation and heat recovery system (MVHR), which controls and optimises internal air quality and temperature, fresh air from the outside is drawn in, filtered and used to replace stale air from inside. It also supplies cool or warm clean air at a consistent, comfortable temperature to all areas of the building.

Amazingly, the boiler needed for heating is the same size as one used in a standard four-bedroom house, even though the school is around 70 to 90 times bigger.

Air tightness

The academy achieves an airtightness of 0.3 air changes per hour (equivalent to $0.7m^3/m^2.hr@50Pa$). As shown on the graph opposite, this is lower than the Passivhaus maximum requirement of 0.6 air changes per hour and over ten times more efficient than a typical building. Graham Thompson, construction manager for Willmott Dixon at Harris Academy Sutton, explains: "If all the holes through the facade and roof were larger than the equivalent of five one pound coins, the building would have failed the air test."

This page: Energy consumption at Harris Academy Sutton is typically 80 percent lower than a standard new building.

Opposite: At Hackbridge Primary School, we have created the UK's first school built to the ultra energy-efficient Passivhaus Plus standard.

3. SUSTAINABLE DEVELOPMENT IN HIGHER EDUCATION

George Davies Centre, University of Leicester
Key facts

UK's largest non-residential Passivhaus project

—

Awarded 2018 Project of the Year for Public Use by the Chartered Institution of Building Services Engineers (CIBSE)

—

Passivhaus Non-Residential Award Winner 2018

—

£42m project value

In 2018, world-renowned higher education specialist Quacquarelli Symonds stated that "sustainable development is the biggest challenge to universities in the 21st century". As many higher education institutions look to maximise energy efficiency while driving down their environmental footprint, a key example of this is the pioneering George Davies Centre.

Completed in 2015 and driven by a need to help the client to reduce its carbon emissions by 60 percent before 2020, the £42m, 12,836m² medical teaching centre is the UK's largest non-residential project built to Passivhaus standards.

A highly sustainable building

The building was designed to an airtightness of 0.6 air changes per hour, which meant creating a tight envelope around the building. Features included large windows to allow as much sunlight into the building as possible, with the sun effectively acting as the building's radiator. To future-proof against temperature rises, brise-soleils, louvre bars and automating shutters were installed to provide shade and minimise demand for cooling during the summer.

Further saving through Soft Landings

To make sure the building would be able to operate efficiently and effectively for the next century, the Soft Landings approach developed by the Building Services Research and Information Association (BSRIA) was adopted. This post-occupancy evaluation process was delivered over three years in collaboration with the University of Leicester and helped to unlock savings that will continue to pay-back throughout the building's lifetime. More than 90 sub-meters were installed throughout the building to monitor output, allowing analysis and improvements to be made. Using this process, adjustments have been made to:

- reduce heating bills by 20 percent
- reduce electricity use by 20 percent
- reduce costs by 18 percent
- reduce carbon emissions by 18 percent.

By building to the Passivhaus standard and applying a rigorous post-occupancy energy evaluation, the building has achieved the desired A+ rated energy performance certificate and an A-rated display energy certificate in its first year of operation.

"I FEEL HONOURED TO WORK IN THE LARGEST PASSIVHAUS BUILDING IN THE UK. THE GEORGE DAVIES CENTRE PROVIDES ME AND MY COLLEAGUES WITH A COMFORTABLE, LIGHT AND AIRY ENVIRONMENT."

DEBBIE OLDHAM, DEPARTMENTAL MANAGER, UNIVERSITY OF LEICESTER

4. REFIT TO INCREASE EFFICIENCY

While refurbishing and reconfiguring the interior of an existing building for modern use, there is an opportunity to embed a wealth of sustainable building practices to improve the energy performance of the building, lowering the lifetime costs for the user.

An example is the London Screen Academy. Completed in 2019, Willmott Dixon's Interiors business created a new headquarters in a rejuvenated 1930s, north London building, providing a school for world-class vocational film and industry training for 17 to 19 year-olds.

Retaining existing design features

Combining refurbishment with new-build elements, the project carefully repurposed as much of the existing structure as possible and incorporated elements that retained its heritage as well as enhancing energy performance.

The design of the external facade was changed without compromising the unique characteristics of the original building. For example, the external windows were specially selected to meet technical requirements for energy performance and thermal comfort, while retaining the authenticity of a 1930s warehouse.

Implementing sustainable technologies

Simon Tranter, head of sustainability at Willmott Dixon Interiors, says: "Refurbishment projects are an ideal opportunity to embed sustainable technologies. At London Screen Academy, we used the BREEAM Non-Domestic Refurbishment and Fit-Out 2014 standard."

A key aspect was a heating system that makes use of passive heat recovery, using outdoor air to cool the building where possible. Further low-carbon technologies include 100 percent LED lighting throughout the building, with additional daylight dimming functionality and presence detection. Extensive electricity, water and gas metering was installed and is monitored by the building management system so that data can be analysed to further optimise energy use.

The building's roof has a green area to enhance biodiversity and solar PV panels to generate renewable electricity and export back to the national grid. This achieves cost savings and improves occupancy wellbeing, all while retaining the building's existing character.

"IF YOU TALK TO THE TRUST, THEY HAD A VERY SPECIFIC VISION FOR THE PROJECT. THAT VISION HAS BEEN DELIVERED VERY EFFECTIVELY WITHIN THE SPACE. THE RELATIONSHIPS HAVE BEEN VERY GOOD AND THE RESULT HAS BEEN EXCELLENT."

WILL MUMFORD, ASSOCIATE DIRECTOR – DEVELOPMENT, LOCATED

London Screen Academy
Key facts

A modern building, retaining original 1930s features

—

Built to the BREEAM Non-Domestic Refurbishment and Fit-Out 2014 standard

—

Benefits from passive heat recovery

—

Encourages biodiversity by incorporating green space

5. THE IMPORTANCE OF POST-COMPLETION COLLABORATION

Research from CIBSE states: "There is significant evidence to suggest that buildings do not perform as well as anticipated at design stage, with the gap between modelled and actual energy performance sometimes exceeding twice the initial prediction." With the built environment contributing nearly 40 percent of the UK's total carbon footprint – half from energy use – developing energy-efficient buildings has never been so critical.

Reducing costs through Energy Synergy™

Alasdair Donn, head of building performance at Willmott Dixon, says: "To address the issue of creating lower-carbon buildings, we launched Energy Synergy™ to bridge the performance gap and drive down energy costs."

The Energy Synergy™ process can be applied to any building once in operation and involves gathering regular, detailed measurements of energy performance. The process provides visibility by comparing the building's actual performance with modelled target data for a period of two to three years after handover.

Evaluating this data regularly ensures that property owners' new facilities operate as designed, providing them with complete transparency in performance and delivering cost savings through optimised energy use. The Energy Synergy™ process is an integral part of the BSRIA Soft Landings approach, delivering a simple and effective way of meeting operational energy performance objectives.

What is Energy Synergy™?

Our Energy Synergy™ process gathers ongoing, detailed measurements of a building's in-use energy performance and compares it to our modelled energy performance target data. From this, we compare target with actual performance for a period of two to three years after handover to ensure energy-efficient standards are met.

This page: Working with Powys Council across the five schools pictured here, our Energy Synergy™ process has achieved total energy savings of over £4,000 a year for the council.

6. REDUCING ENERGY COSTS

The University of Warwick's Sports and Wellness Hub is another example of a building that has reduced energy use through extensive monitoring after it has become operational.

A world-class user experience

Opening its doors in 2019, this 40,000m^2, state-of-the-art facility boasts 15,500m^2 of indoor space, including: a multi-functional sports hall; the biggest gym in the higher education sector; a 25m-long, 12-lane swimming pool; 17m-high indoor climbing walls; fitness suites; and squash courts.

User comfort and reconfiguration of the space were at the heart of the project and it has benefited from smart climate controls and user customisation technologies. These include coolant technology to provide the right temperature for any given sport, automatically adjusted lighting in key rooms to create the optimal ambience and an adjustable swimming pool boom at the touch of a button.

Achieving ambitious sustainability targets through Energy Synergy™

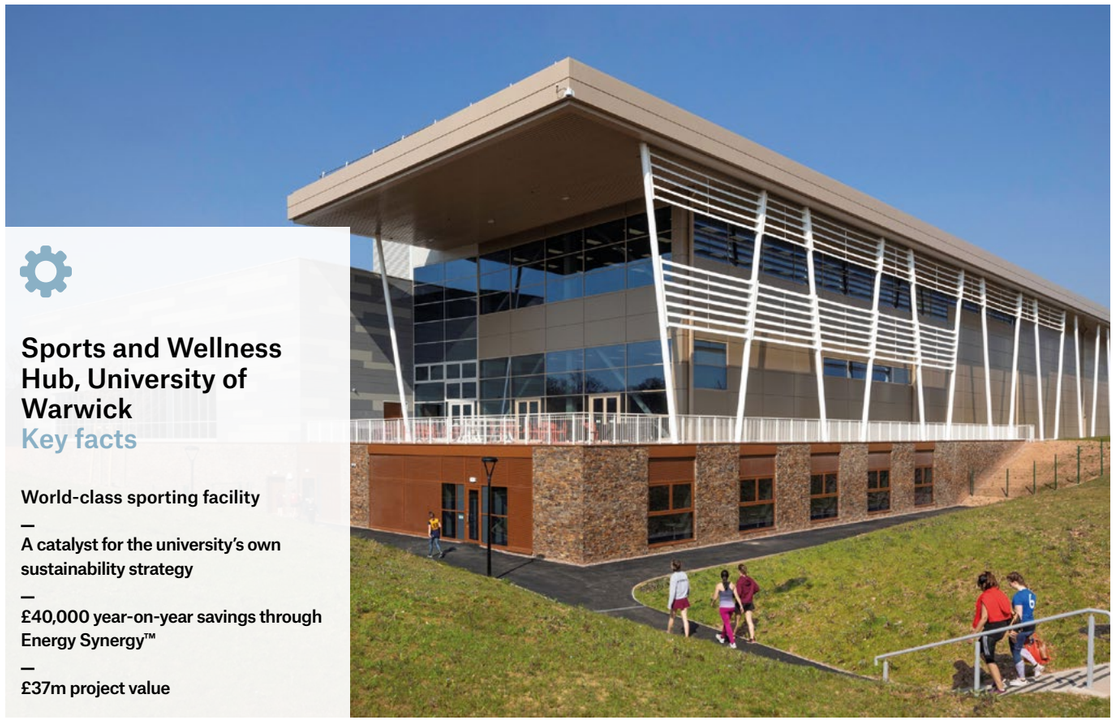
Exceptional energy efficiency was a critical aspect of the Sports Hub. Nick Preedy, operations manager for Willmott Dixon, says: "To achieve the university's ambitious goals for the facility, extensive in-house monitoring was required once the building was opened to identify further energy savings.

"We embedded our Energy Synergy™ process into the after-build service. This involved monitoring operational use across 12 categories from heating, ventilation and pumps, through to domestic hot water. Within the first year, Energy Synergy™ was delivering energy savings of £40,236 and a carbon saving of 98,520kgCO_2e."

Energy Synergy™ has enabled the Sports Hub to become the most energy-efficient leisure centre in the UK, performing 27.5 percent better than CIBSE's Energy Benchmark.

"WILLMOTT DIXON'S ENERGY SYNERGY™ PROCESS IS VERY COMPREHENSIVE. OVER THE LAST 10 YEARS WE HAVE REDUCED OUR OVERALL ENERGY BY 46 PERCENT ACROSS OUR CAMPUS. IF WE HADN'T HAD A GOOD RELATIONSHIP WITH WILLMOTT DIXON, OUR BUILDINGS WOULD CONSUME MORE ENERGY AND WE WOULD HAVE NOT ACHIEVED THAT REDUCTION."

JOEL CARDINAL, HEAD OF ENERGY AND SUSTAINABILITY, UNIVERSITY OF WARWICK



Sports and Wellness Hub, University of Warwick
Key facts

World-class sporting facility

—

A catalyst for the university's own sustainability strategy

—

£40,000 year-on-year savings through Energy Synergy™

—

£37m project value

7. HEATING BEYOND FOSSIL FUELS

As well as creating highly energy-efficient buildings, the use of low-carbon, fossil fuel-free energy sources is critical to the UK's reduction in carbon emissions. A great example of this is the use of ground-source heat pumps at Ashton Rise in Bristol.

Ashton Rise consists of 133 homes, of which 40 percent will be affordable social rent council homes. The project has been designed not only to provide essential housing, but also to incorporate a range of energy-efficient practices to reduce energy bills and achieve a route to zero-carbon.

Communal ground-source heat pumps

After an extensive evaluation of sustainable heating technologies, Ashton Rise is using communal ground-source heat pumps for sourcing heating and hot water at each of the properties. Created using a series of boreholes to extract low-grade heat stored in the ground, the heat pumps deliver a sustainable alternative to gas and eliminate the need for fossil fuels.

Once the housing development is complete, it is anticipated that the innovation will deliver considerable efficiency savings. Ground-source heat pumps produce 3-4kWh of heat energy for every 1kWh of electricity used, making them 300-400 percent efficient, in comparison to a typical boiler which achieves a maximum efficiency of around 90 percent.

A blueprint for the future

Martin Bennett, construction manager for Willmott Dixon at Ashton Rise, says: "Given the high energy efficiency, coupled with lower CO_2 emissions than any other type of heating system and the removal of fossil fuels, ground-source heat pumps are a blueprint for future residential and commercial developments – where conditions allow for it. This form of heat source, coupled with other building methodologies, can lead to significantly lower energy costs for residents and occupiers."

Ashton Rise, Bristol
Key facts

133 homes

—

40 percent affordable social rent council homes

—

Uses ground-source heat pumps as a route to zero-carbon heating

—

£21m project value

"I'M VERY GRATEFUL TO BRISTOL CITY COUNCIL AND WILLMOTT DIXON FOR BEING SO ACCOMMODATING IN FULFILLING MY WISHES. I WOULD DEFINITELY RECOMMEND BUYING A HOME WITH WILLMOTT DIXON AGAIN, EVERYONE HAS JUST BEEN SO GREAT."

JANE BROWN, ASHTON RISE'S FIRST RESIDENT (PICTURED ABOVE), JULY 2020

8. CREATING SUSTAINABLE PLACES TO WORK

The Aurora building for Cubex in Bristol is the first commercial office space outside London to be awarded the BREEAM 2014 Outstanding certification.

Upon handover, the 8,825m^2 development was also the first in office in Bristol to meet or exceed the British Council for Offices design guide criteria, incorporating the maximum amount of daylight possible, uniformly spread throughout the building.

Reviewing every detail

John Boughton, deputy managing director of Willmott Dixon in Wales and West, explains: "To meet the rigorous BREEAM Outstanding requirements, we had to review every detail of the build. One key decision was to move from a steel frame to concrete. Making this change allowed us to reduce embodied carbon by 20 percent over the building's life cycle."

Reducing energy usage

Aurora's design has provided a 37 percent reduction in carbon emissions and 59 percent less water demand than a typical office building. Furthermore, at the time of delivery, Aurora was one of just eight offices to achieve the BREEAM Outstanding rating.

This number is set to increase as Willmott Dixon and Aurora developer Cubex are currently working together to build a follow-on office development. Also situated in Bristol, Halo is being built to the BREEAM 2018 Outstanding specification and is set to open its doors in 2022.

"AURORA HAS SET THE STANDARD FOR BREEAM OUTSTANDING IN A CITY THAT WAS EUROPEAN GREEN CAPITAL IN 2015. WE WORKED HARD TO ENSURE IT BENEFITED THE BRISTOL ECONOMY, PARTNERING WITH LOCAL COMPANIES AND SUSTAINING JOBS FOR LOCAL PEOPLE."

NEAL STEPHENS, MANAGING DIRECTOR OF WILLMOTT DIXON IN WALES AND THE WEST

Aurora, Bristol
Key facts

First office outside London to achieve BREEAM Outstanding

—

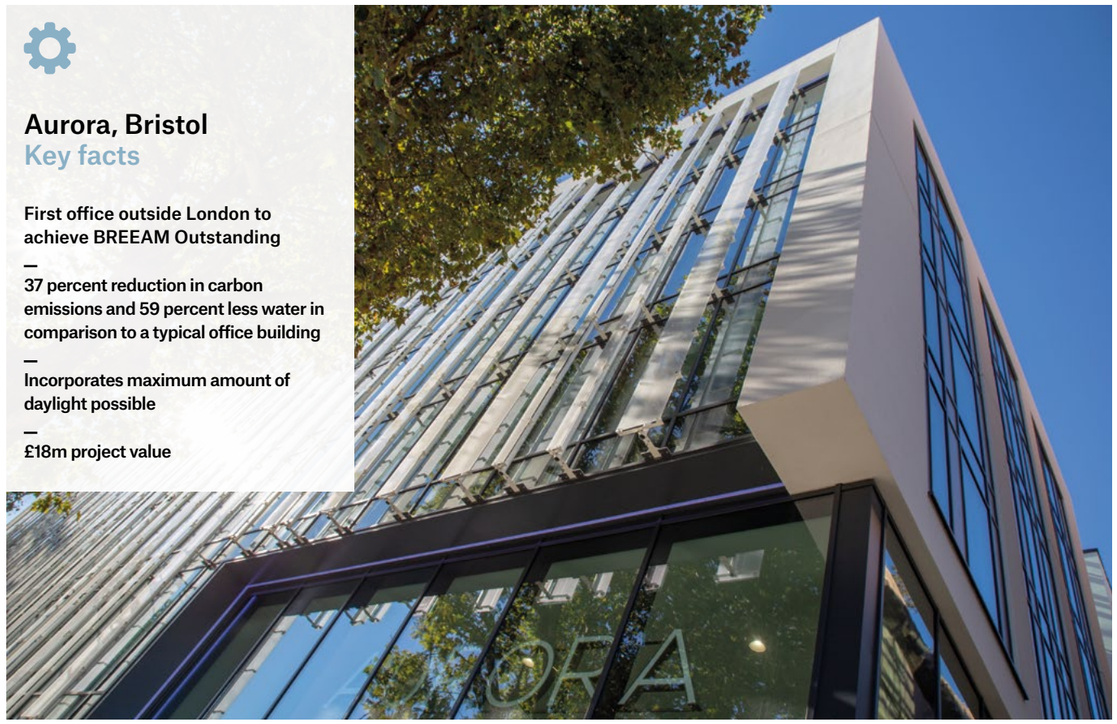
37 percent reduction in carbon emissions and 59 percent less water in comparison to a typical office building

—

Incorporates maximum amount of daylight possible

—

£18m project value



WILLMOTT DIXON

SINCE 1852

BRILLIANT BUILDINGS

Willmott Dixon is a privately-owned contracting and interior fit-out group. Founded in 1852, we are family-run and dedicated to leaving a positive legacy in our communities and environment. Being a large company means we can create a huge and lasting positive impact on our society. This is not only done through what we build and maintain; it's achieved through the fantastic efforts of our people who make a major contribution to enhancing their local communities.

www.willmottdixon.co.uk
@WillmottDixon

If you want to find out more about how Willmott Dixon can help your project deliver highly sustainable outputs, please contact:

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