George Davies Centre

A Passivhaus record-breaker for University of Leicester

WILLMOTT DIXON
SINCE 1852

PUSHING THE BOUNDARIES TO DELIVER FIRST-CLASS UNIVERSITY FACILITIES

At a time when the awareness of climate change is at an all-time high, most major organisations are making commitments around their drive to net-zero carbon. However, one thing that sets the University of Leicester apart is the scale of its ambitions, with its 'net-zero plus' plan committing to reaching net-zero carbon across all scopes by 2040 (1).

As is the case with all carbon commitments, buildings play a significant role in reducing overall emissions and, with more than 100 non-residential buildings covering 200,000m^2, the challenge for the University of Leicester is vast.

It's against this backdrop that plans for the £42m George Davies Centre – a new home for the university's Centre for Medicine – were conceived.

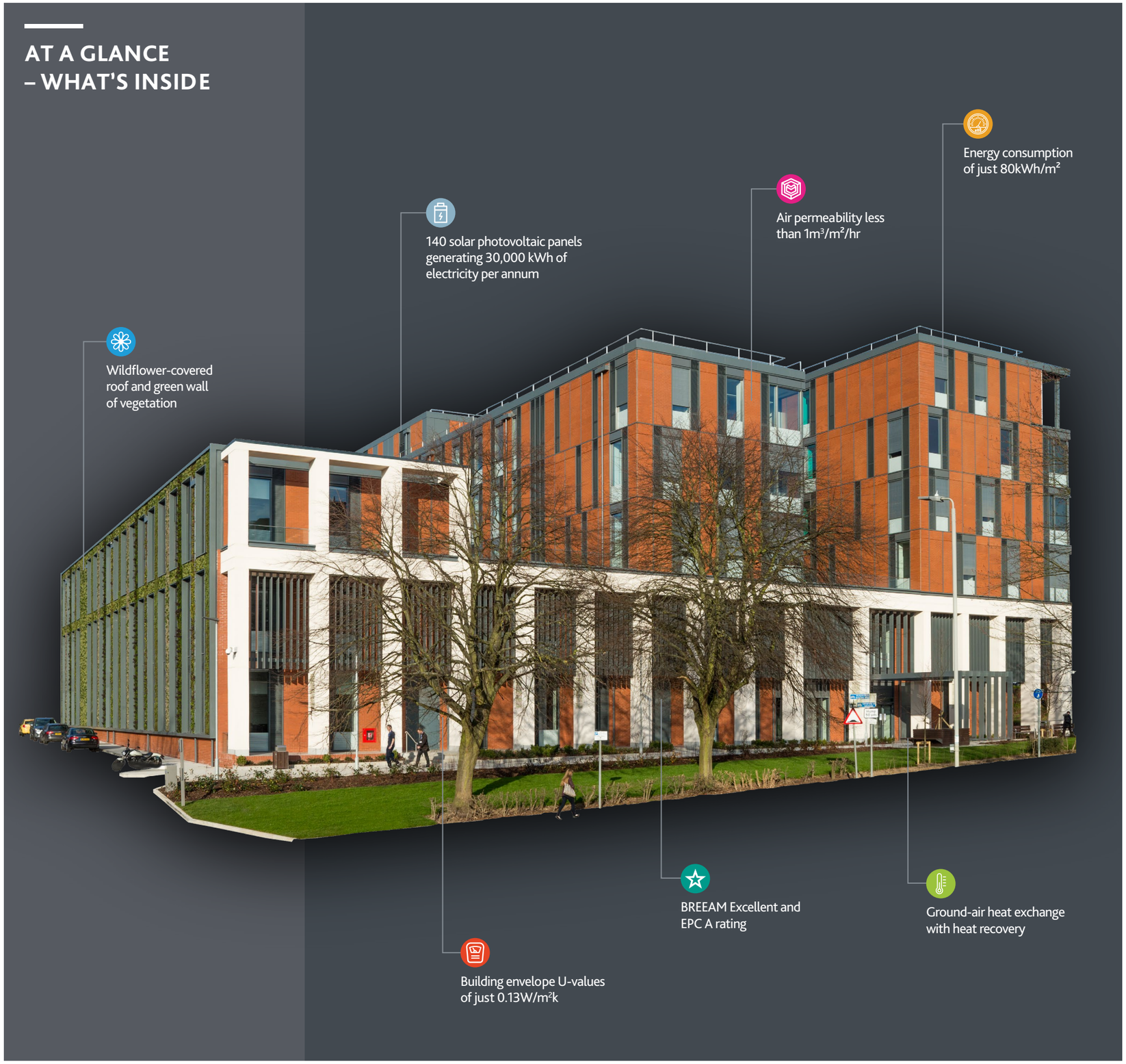
Radically ambitious in its scope and driven by the need to be low energy and low-carbon in operation, rather than just on paper, the decision to work to the Passivhaus energy certification was a significant one. At the time of its construction, it was the largest non-residential facility designed to the standard in the UK.

This Brilliant Buildings explores how the building was designed to achieve these rigorous targets, the drivers behind it and how Willmott Dixon worked with the university on this bold project.

Nick Gibb, Deputy Managing Director, Willmott Dixon

(1) University of Leicester's net-zero plus plan

AT A GLANCE – WHAT'S INSIDE



THE VISION

In the early 2010s, the University of Leicester's colleges for medicine, psychology and biological sciences were housed in 19 disparate buildings, many of which were either at the end of their usable life or inefficient.

The university's vision was for a combined centre for medicine that would bring together three colleges. As well as creating a collaborative space that would house 2,350 students and staff, the new building would also provide an important milestone in the university's ambitious climate targets.

"The dual drivers of sustainability targets and the desire to bring together world-leading medical research and medical education under one roof were undoubtedly the catalyst for the George Davies Centre," says at the University of Leicester.

"There is a pressing need to produce doctors who can deliver high-quality care effectively and compassionately in a rapidly changing environment, and the centre has been designed to help meet the demand for capable and caring doctors.

"Alongside this, by having a combined centre that also houses applied research, our doctors can now be exposed to innovations that will be at the forefront of improved patient safety and the fight against chronic disease."

The centre represented the largest investment in medical teaching and applied research by any UK university that decade, making a clear statement that the University of Leicester was striving to deliver progressive facilities.

This – combined with the university's previous carbon emission reduction targets – set a clear vision for a comfortable, modern location in which to teach, learn and work, but one that needed to be built with a low-carbon future in mind.

"OUR DOCTORS CAN NOW BE EXPOSED TO INNOVATIONS THAT WILL BE AT THE FOREFRONT OF IMPROVED PATIENT SAFETY AND THE FIGHT AGAINST CHRONIC DISEASE."

UNIVERSITY OF LEICESTER [2]

(2) https://le.ac.uk/about/history/campus-history/george-davis

THE DESIGN

Over the past three decades, Passivhaus has emerged as the pre-eminent standard in the drive for net-zero carbon. Its stringent requirements for energy efficiency, air quality and other environmental factors were first devised in the late 1980s, with the Passivhaus Trust established in 1996 to promote the standards and award certification to projects that meet them.

The vast majority of large Passivhaus projects are residential buildings, but when plans for the George Davies Centre were drawn up, it was clear that the designs for the envelope would have to be pushed to meet the desired levels of air tightness for the project.

With nearly 13,000m² of teaching facilities, offices, laboratories, and support spaces required for the 2,350 staff and students that would need to be based there, the George Davies Centre would be the largest non-residential Passivhaus building in the UK and required a design befitting of this lofty goal.

Alongside Willmott Dixon, charged with this task were Associated Architects, Passivhaus consultant WARM, and engineers Ramboll and CPW.

Key to achieving the Passivhaus standard was the implementation of a ground-air heat exchanger (GAHE) and air-handling units (AHUs) throughout the facility. The GAHE - a labyrinth of subterranean pipes more than a kilometre in length – utilises fresh air passing through the system to provide ventilation – cooling the building during summer, and warming it throughout winter.

The AHUs were designed specifically for this project, as suitable units that could meet the needs of a building of this size and complexity – not to mention Passivhaus requirements

– simply didn't exist in the standard market. Situated at the top of the two atria, the AHUs capture rising heat during the winter and redistribute it to cooler parts of the building.

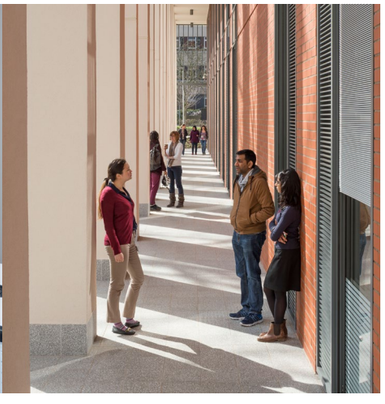
Alongside these innovations, external, concealed, automated blinds maximise solar shading while allowing outside views. The large, triple-glazed windows also provide excellent thermal insulation and, combined with the two atria, allow plenty of daylight to penetrate the building.

Situated on the building's roof, 140 solar panels generate around 30,000 kWh of electricity every year and the building is also connected to the city's low carbon, gas-fired, combined heat and power system.

The roof also features a section covered with wildflowers that, along with a green wall on one side of the building, has a designated planting regime to attract wildlife, help pollination and promote biodiversity.

"DELIVERING A PASSIVHAUS BUILDING ON SUCH A LARGE SCALE IS NOT WITHOUT ITS CHALLENGES AND WE EMPLOYED SEVERAL ENERGY-EFFICIENT MECHANISMS TO ENSURE THAT THIS STANDARD WAS MET. WE INSTALLED SOLAR PHOTOVOLTAIC PANELS ON THE ROOF, PART OF THE ROOF IS COVERED IN WILDFLOWERS AND THE BUILDING HAS A GREEN WALL OF VEGETATION – ALL CONTRIBUTING TO THE BUILDING'S SUSTAINABLE CREDENTIALS."

JAMES ELLIMENT, OPERATIONS MANAGER , WILLMOTT DIXON



THE DELIVERY

With expertise in the higher education sector and significant Passivhaus projects across the UK, Willmott Dixon was chosen to deliver the George Davies Centre.

Working in lockstep with the customer's requirements, the Willmott Dixon team set to work alongside Associated Architects, CPW and Ramboll.

Digital and offsite

Due to its complexities, the project relied heavily on digital design coordination, as well as offsite manufacturing on the upper storeys to deliver high levels of quality and precision. This was particularly important in ensuring that the airtightness and thermal performance of the walls met Passivhaus standards.

Site constraints

With its network of underground pipes, the GAHE required some creative approaches to ensure it was able to function fully while being tightly fitted between foundation piles, pile caps and other underground services. Due to this, the system was installed after the piling, preventing any risk of the GAHE pipes being damaged while also maintaining the carefully laid out gradient pattern to allow the discharge of any condensation in the summer months, as well as periodic cleaning.

Alongside this, the location of the site – situated on the edge of a conservation area and near listed buildings and protected views – meant that it was a sensitive area in terms of planning and logistics. To address this, the finished design has a stepped-down shape and is split between three main blocks. While this was a deviation from the ideal form factor and orientation for Passivhaus, the difference was remedied elsewhere with better airtightness and higher fabric thermal performance.

Airtightness

Achieving an airtightness of 0.33 ach (1.0 $m^3/m^2.hr$) was crucial in meeting the desired energy criteria and required a new approach to be developed. Sectional air tests were carried out on small parts of the building and lessons learned were applied to other areas.

The sequencing of different trades to finish the external envelope in specific areas was a challenge due to the size of the building. While the target for achieving Passivhaus is 0.6 ach, the non-compact building form required more stringent airtightness and thermal performance targets to make the Passive House Planning Package [3] figures work. With this in mind, the 0.33 ach target was set and met through the implementation of a robust air tightness strategy.

(3) The PHPP is an easy to use planning tool for energy efficiency for the use of architects and planning experts.

THE LEGACY

The George Davies Centre has become an iconic addition to the University of Leicester's campus architecture and at the time of completion was officially the largest non-residential Passivhaus building in the UK.

With the building designed to make use of body heat, energy efficiencies are at their peak when students and academics are occupying the building. Energy consumption of just 80kWh/m^2 delivers substantially fewer operational carbon emissions, resulting in an EPC A rating – something that was achieved well ahead of the three-year post-completion deadline.

A key part of achieving the rating was working to a soft landings framework, ensuring that the building's users understood how to best use the building's energy-saving and retention features. This has led to excellent feedback from staff on the building's thermal performance in comparison to other buildings on campus.

The building envelope's U-values sit consistently below 0.15 W/m^2k while the space heating demand is just 15 kWh/m^2. The energy usage throughout the building is consistently tracked and monitored, with controls for corrective action as required.

The knowledge, skills and learnings gained by Willmott Dixon across this project have been taken forward onto other major Passivhaus projects, including Spelthorne Leisure Centre, which is set to be the UK's largest wet and dry leisure centre to achieve Passivhaus certification.

For the university, the benefits of the new facility are plentiful.

Primarily, the George Davies Centre provides a high-quality set of laboratories, research spaces and lecture halls for the medical professionals of tomorrow, furthering its reputation as one of the UK's top medical schools.

Secondly, the facility brings significant energy savings, an area of spend that increased by 43% across university estates according to the latest AUDE EMR report [4].

However, the building's greatest legacy will be its contribution to the University of Leicester's pioneering net-zero carbon goals, putting it firmly on course to achieve its targets by 2040 – all while training the next generation of world-leading doctors and researchers.

"THE GEORGE DAVIES BUILDING IS A FANTASTIC PROJECT TO HAVE BEEN INVOLVED WITH; I WAS INVOLVED WITH THE BUILDING TOWARDS THE END OF CONSTRUCTION AND HAVE BEEN WORKING INSIDE THE BUILDING SINCE HANDOVER. THE OUTCOME IS TRULY SOMETHING SPECIAL, A BUILDING THAT WE LOOK AT AS THE FUTURE OF UK CONSTRUCTION AND INTUITIVE IN OPERATION."

MATT BOYLAND, FACILITIES MANAGER, UNIVERSITY OF LEICESTER

(4) https://www.aude.ac.uk/news-and-blogs/emr-report/

WILLMOTT DIXON

SINCE 1852

BRILLIANT BUILDINGS

GEORGE DAVIES CENTRE

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.

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If you'd like to find out how we can help you to deliver pioneering projects and first-class higher education facilities, get in touch with:

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