



**INNOVATION INSIGHTS:  
REDUCING OPERATIONAL CARBON**

# Foreword

All change requires a transition, and the journey to net zero is both urgent and complex. We must look at how we're going to get there, and what we can do within the built environment to accelerate that change. And we need to figure this out - fast - which is why UKGBC has a renewed focus on solutions identification.

To achieve the biggest change possible, we need to create a situation where  $2+2 = 5$ . UKGBC is in a unique position to bring together a diverse range of stakeholders to maximise the potential of innovative solutions and the cross-pollination of ideas. We need to come together, collaborate, and use all of our collective resources to their full potential: intellectual, creative, mental, emotional, and physical. Speed is of the essence and this work helps us identify solutions as quickly as possible and communicate these effectively to the wider industry.

For innovative start-ups, this is an opportunity to get solutions noticed quickly, and disseminated to a wide audience and adopted at scale. For larger stakeholders, this is a chance to learn quickly, plug into the most effective solutions out there, and make swift progress on the journey to net zero.

So, please: read, absorb and act. Spread the word about the UKGBC solutions work; the more people involved, the more effective it will be in addressing the climate crisis. Encourage creative and innovative minds to engage and contribute. And finally, think big! The climate crisis is one of the biggest issues affecting our generation, but the resources and tools are there to solve it. As long as we work together and take action; net zero is within our reach.

**Lorna Walker, Co-founder - COO and Head of ESG at Modomo, and a UKGBC Trustee.**



# Introduction

## The project

This document provides an overview of a pilot solutions crowdsourcing project run by UKGBC over the latter half of 2020, focused on supporting the achievement of net zero carbon buildings. We also present an introduction to our ongoing work to address sustainability challenges across the built environment through increasing solution identification, dissemination, and adoption.

## Objectives

Through our work on solutions and innovation, UKGBC aims to:

- Identify and share high quality, innovative and commercially viable sustainability solutions
- Enable a culture of innovation and collaboration
- Help innovative start-ups to scale

## Background

Amongst all the chaos of 2020, two things kept happening: the world kept warming and organisations kept making net zero carbon commitments. Over the next nine years, we need to halve both the energy use of the UK's buildings and global carbon emissions. Meeting this challenge requires an innovative approach to finding and adopting solutions to ensure swift and radical transformation across the built environment industry.

The World Green Building Council's (WorldGBC) [Advancing Net Zero](#) campaign promotes and supports the acceleration of total sector decarbonisation by 2050. As part of this campaign, in 2019, the UK Green Building Council (UKGBC) published '[Net Zero Carbon Buildings: A Framework Definition](#)' to provide the industry with clarity on how to practically achieve net zero carbon in construction and operation, supporting those who align with [WorldGBC's Net Zero Carbon Buildings Commitment](#) (The Commitment). The Commitment challenges signatories to reach net zero operating emissions in their portfolios by 2030 and to advocate for all buildings to be net zero in operation by 2050. By January 2021, 94 business and



organisations, 28 cities and 6 states and regions have already signed this commitment, including 42 UKGBC members. These numbers are rising rapidly.

Addressing the climate and ecological crises, and their associated social impacts, is too great a challenge for any one organisation to tackle alone. To make ambitions like The Commitment truly achievable requires collaboration and knowledge-sharing to increase both awareness and adoption of sustainability solutions across the built environment industry. So many of the solutions for net zero already exist but are often not common knowledge or well understood. UKGBC is uniquely positioned to convene our membership and the wider industry towards this common goal.



# Identifying challenges and solutions

UKGBC is establishing a new proactive and collaborative process for identifying and disseminating solutions to shared sustainability challenges. To inform the development of this process, last year, we launched two pilot challenges to the built environment industry using a publicly accessible, web-based, ideation and innovation management platform – UKGBC's 'Pilot Solutions Portal'. The challenges centred around the topic of 'how to achieve net zero carbon buildings in operation' and solutions were crowdsourced from 24th August until 25th September 2020.

# Challenge Identification

To assist with our pilot project, a group of UKGBC members – experts in net zero carbon and innovation - were convened for our Solutions Steering Group. The role of the group was to:

- Define two specific challenges to use for the pilot (within the main theme of net zero carbon buildings).
- Encourage industry to engage with the challenges.
- Advise on how best to evaluate the solutions we gather.
- Help analyse the lessons learnt from the pilot to identify how to create ongoing action and impact.

In collaboration with the Solution Steering Group, we defined two challenges, intentionally giving one a tight focus, and one a broader scope, to assess the impact this had on the type of solutions we gathered.

## CHALLENGE

### 01

How can a building owner improve their existing buildings, with as little physical intervention as possible, to achieve net zero operational carbon by 2030?

## CHALLENGE

### 02

How can office owners and occupiers improve the connection between live building occupancy and the control of building services, to reduce operational energy consumption?

#### Steering Group

**Alex Edds**, Director of Innovation and Digital Consulting, JLL

**Andy Doyle**, Major Projects Director, Grosvenor Britain & Ireland

**Bev Taylor**, Director of Energy and Environment, Bruntwood

**Claudine Blamey**, Head of Sustainability and Digital Strategy, Argent (Property Development) Services LLP

**David Price**, Executive Director – Head of Investment Management, Federated Hermes

**Edwin Wealend**, Head of Research and Innovation, Cundall

**Helen Newman**, Head of Sustainability, CBRE

**Lorna Walker**, Co-founder – COO and Head of ESG, Modomo Ltd

**Maria Smith**, Director, BuroHappold Engineering

**Michael Cross**, Head of Partnerships and Innovation, Willmott Dixon

**Mina Hasman**, Associate, Skidmore, Owings & Merrill (Europe) LLP

**Sam Carson**, Director of Sustainability, Carbon Intelligence

**Sunand Prasad**, Senior Partner, PPRIBA, Perkins & Will

# Solution Identification

UKGBC members and the wider industry were invited to participate in these challenges by proposing their solution suggestions via the Pilot Solutions Portal. The portal was set up using the third-party crowdsourcing platform Microsoft Teams Ideas Ideation. Solution providers could request access to the portal by submitting their details on the UKGBC website. We also held a virtual 'solutions crowdsourcing workshop' in September 2020, convening a group of UKGBC members to put forward solutions in real-time for discussion by the whole group.

In the following sections, we summarise a selection of the solutions received, which were deemed to best address the pilot challenges.

Throughout the pilot project, our aim was to avoid being overly prescriptive with regards to the type of solutions we were seeking. However, we did set some broad criteria to guide submissions:

## **Solution submission criteria**

- Solutions could be from anywhere around the world
- Solutions must be possible to implement now (we were not looking for hypothetical ideas and concepts)
- Solutions did not need to be 'new', and could be a novel application of an old product or principle
- Solutions could be a technology or product, but also a service, a process, an operating or financial model, or government policy
- A solution could be part of a bigger picture-suite of solutions that come together to solve a challenge (if so, we asked the solution provider to clarify how)

## **Solution evaluation criteria**

An evaluation matrix methodology was applied by the Solutions Steering Group to appraise the solutions we received, based on performance against the following factors:

- How significantly the solution contributes to solving the specific challenge
- How well the effectiveness of the solution can be measured and verified
- How scalable the solution is
- How easily the solution can be implemented
- The financial investment required, and anticipated return on investment
- Demonstrable proof of impact, for example case studies demonstrating that the solution has been successfully implemented

*UKGBC and the Steering Group undertook the assessment based on information supplied to UKGBC by the solution providers. No further due diligence was undertaken and UKGBC offers no commercial endorsement of individual solutions mentioned.*

Challenge

01

# Making existing building net zero operational carbon

How can a building owner improve their existing buildings, with as little physical intervention as possible, to achieve net zero operational carbon by 2030?

## Challenge Context

The global Net Zero Carbon Buildings Commitment requires companies, cities, states, and regions to reach net zero operational carbon emissions in their buildings by 2030. For the UK, this translates to halving average operational energy use within the same timeframe. Through this challenge we wanted to uncover what owners of existing buildings can do right now to significantly reduce operational energy use and carbon emissions with minimal physical intervention and disruption.

## Solutions

The solutions received in response to this challenge ranged from whole house retrofits to smaller more specific interventions. Five of the solutions we received, which were deemed to address this challenge well, are highlighted over the next few pages.

# Biogen Systems

[www.biogensystems.co.uk](http://www.biogensystems.co.uk)

**Solution Type:** Technology/product; service

**Number of projects:** 20

**Applicable project types:** Office, retail, industrial, residential, new build, refurbishment



## What is it?

Biogen Systems involves a modular Combined Heat and Power (CHP) system housed within 20 ft shipping containers fuelled by virgin or waste biomass. The system is deployed to site with complementary technologies that support and reflect the requirements or opportunities of individual sites e.g. microgrid, battery storage, solar, wind and cooling. Their goal is to provide bespoke Biomass CHP configurations to deliver power, building processes, heat and cooling.

## How does it address the challenge?

Biogen Systems are currently working with Carbon Footprint Ltd to assess and then offset Scope 1, 2 and 3 emissions to achieve formal carbon neutral accreditation. The system itself produces a biochar that results in its operation being carbon negative. The technology does require sufficient space for fuel storage (typically 15m by 5m), which would preclude some sites. However, it does not require changes to typical heating systems i.e. it is a "2 flange system", feeding hot water into conventional systems via one flange and receiving the return water via a second flange, as a typical fossil fuelled boiler would. Biogen Systems would carry out all installation work, making the process no more complex than installing a conventional system.

## What is the return on investment?

The modular CHP system is available to developers either via a Power Purchase Agreement (i.e. zero capital cost) or through purchase and associated service/support agreement. The capital cost is dependent on individual site specifics and power requirements. However, Biogen Systems state that a standard 50 KWe and 120 KWth system with thermal store and fuel storage would offer a return on investment of circa 15 to 20%.

## Case study

Biogen Systems has been operating a local rural distributed heat and power system, providing energy to a Hamlet of 10 homes in Devon using fuel from surrounding woodland, for over 2 years.

# Energiesprong UK

[www.energiesprong.uk](http://www.energiesprong.uk)

**Solution Type:** Operating/ financial model

**Number of projects:** ~50

**Applicable project types:** Residential (social housing), new build, refurbishment

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## What is it?

Energiesprong is a whole house refurbishment or new build standard and funding approach for social housing providers. Developed and proven in the Netherlands, where thousands of homes are retrofitted each year, Energiesprong UK aims to scale this approach in the UK market. An Energiesprong retrofit uses money that would normally be spent on energy bills and maintenance to pay for the works, ensuring the cost of living does not increase. Installers must ensure the retrofit is net-zero energy over the year, with performance guaranteed in the long-term and verified by real life monitoring.

## How does it address the challenge?

Energiesprong can deliver a whole-house retrofits in just 10 days, providing minimal disruption to residents. The retrofits are guaranteed to be net zero energy, including real life monitoring, and targeted at social housing. Therefore, if scaled, this solution alone could significantly contribute to making UK housing net zero operational carbon by 2030.

## What is the return on investment?

When the market is at scale, Energiesprong retrofits produce a positive business case compared to 'business as usual', assessed over a 30 or 40-year period. Maintenance and energy bill savings, backed by Energiesprong's long-term guarantees, provide income and savings to the social landlord, which offsets the cost of financing the installations. Instead of tenants paying energy bills, they pay a portion of their post-retrofit bill directly to the landlord. The social landlord is expected to finance an upfront cost equal to the 30-year savings and income anticipated for the property, with grant funds making up the difference.

As the market is not yet at scale, Energiesprong retrofits on individual properties are not yet financially viable and the minimum project size is currently 40-50 properties. When the market scales, Energiesprong expect different financing options to be available and for private tenures to be possible.

## Case study

Nottingham CityHomes used Energiesprong UK to become the first housing association to pilot net zero retrofits. The first 10-home pilot project and 17-home continuation was delivered by Melius Homes. It included clusters of homes with communal energy centres, ground source heat pumps fed by electricity generated from solar panels on the roof as well as battery and thermal storage which ensures that the solar energy produced is stored on site.

Photo by Tracey Whitefoot

# Etopia Uplift

[www.projectetopia.com](http://www.projectetopia.com)

**Solution Type:** Technology / product

**Number of projects:** 15

**Applicable project types:** Office, residential, new build, refurbishment

## What is it?

Etopia Uplift, developed for existing housing stock, is where net-zero builder meets tech giant, Etopia powered by Samsung and Isla. Following on from the partnership signed between Samsung and Etopia in 2020 for new builds, they are now turning their attention to the decarbonisation of existing housing stock, releasing a technology-led solution to the industry with favourable costs and installation packages. The solution is made up of an air-source heat pump (ASHP), Smart home technology - 'Isla', and renewable energy technologies.

## How does it address the challenge?

A technology-led approach provides opportunity to prevent a full fabric intervention when increasing the energy efficiency of homes. Once the ASHP, upgraded radiators and Isla tech has been installed, Isla uses sensors to diagnose any fabric requirements. For instance, identifying which rooms are causing the most heat loss, targeting the issue and reducing costs. Isla can monitor and manage the energy usage across all technology, including the ASHP, to ensure maximum efficiency is met whilst giving a lifestyle smart home function, interoperable with existing smart tech. Tests on various house types indicate this system could increase the average EPC rating from 60 (D) to up to 90+ (A) without requiring any fabric intervention, depending on building construction.

## What is the return on investment?

Cost packages vary based on aesthetics and additional elements that can be incorporated depending on requirement and preference, such as batteries. Currently a funding structure and payment programme is being organised that helps ensure this product is accessible for anyone. This sees an external party cover the upfront capex cost of the solution and installation, with a payback period, which will look to use incentives that installers will receive for increasing the energy efficiency of their home to cover the costs on the payback.

## Case study

Etopia's house built at the BRE Innovation Park in Watford, albeit is a new build, shows how powerful this solution can be in operation. The house includes Isla, Samsung ASHP, water exchange cylinder and solar which are the key components of the uplift package. The house was monitored at a temperature of 21C for 24 hours over the timeline of a week, and on a peak day the house generated 43.7Kwh whilst only using 4.07 kwh (for space heating/cooling, hot water and lighting), which is a result of over 10x energy positive. Uplift is being rolled out across a number of properties aging from 1890 – 2000, during Q1 2021.

# Radbot

<https://www.radbot.com>

**Solution Type:** Technology / product

**Number of projects:** 2 projects (125 homes)

**Applicable project types:** Office, residential, new build, refurbishment

## What is it?

Radbot is a novel 'smart' thermostatic radiator heating control. It uses a combination of sensors and an embedded learning algorithm to detect and predict room occupancy. It then heats each room to a set temperature when it is in use and automatically reduces the temperature when it is empty. This enables automated room-by-room zoning that reduces unnecessary overheating and saves energy in unoccupied zones without impacting occupant comfort. Radbot does not require scheduling via an app or WiFi connectivity.

## How does it address the challenge?

Radbot takes minutes to install with no specialist skills required, resulting in a low-cost product that has the potential to be retrofitted to existing UK homes at scale. To achieve net zero this solution would need to be considered as part of a suite of solutions, but as a standalone product it can be installed quickly with minimal physical intervention and substantial energy and carbon savings, as exemplified by the case study below.

## What is the return on investment?

The average home requires 4 or 5 Radbot units. No maintenance is required except for battery replacements (2 AA with 2-year lifetime) over an anticipated 12-year lifetime. Average savings based on Radbot's field trial results are 10-15% of space heating cost per annum with some homes saving as much as 25-30%, giving a typical return on investment of 1-2 years.

## Case study

An installation was undertaken on a three storey, three-bedroom new build house that had issues with maintaining consistent comfortable temperatures. After installing Radbot the occupants found the temperature much more consistent across the home, and improved energy efficiency. In April 2018 they owed the utility company £23.57, but by March 2019, six months after installing Radbot, they were in credit to the sum of £182.95.



**radbot**



## What is it?

Roofit.solar modules are building integrated photovoltaic construction elements that replace conventional roofing and facade materials. Electricity is produced in a thin photovoltaic layer that covers the metal sheet. The series connection of modules is made under the roof sheeting between the battens.

## How does it address the challenge?

Roofit.solar can provide on-site electricity via system installation that is as easy as installing any standard seam metal roof. The traditional aesthetics of the roof also aim to encourage more homeowners to consider solar energy. Environmental impact analysis undertaken by Roof.solar has shown a single 10kW roof will avoid emitting 300 tons of CO<sub>2</sub>, and approximately 80 million houses in Europe are suitable for installation. Roofit.solar aims to reduce CO<sub>2</sub> emissions by 200,749 tons annually by 2025.

## What is the return on investment?

Based on installations performed in Germany, a 10kW Roofit.solar system (including panels, inverter and cables) is quoted, over its circa 30 year lifetime, to provide a payback time in of around 7 years, depending on the power consumption of the household. In most cases Roofit.solar have found that the payback time of their roofing solution is 2-3 times less than its operational lifespan.

## Case study

On Roofit.solar's first project in 2017, 60m<sup>2</sup> (7,7kW) of solar roofing material was installed. During 2019 the house produced 7,357kWh of energy, from which 6,414kWh was used, the rest being sold to the grid. Instead of paying for the electricity used during the year, the client was paid an extra 125€ (~£111) for the supplementary green electricity produced.

# Linking building occupancy to energy use

How can office owners and occupiers improve the connection between live building occupancy and the control of building services, to reduce operational energy consumption?

## Challenge Context

Our pilot challenges were launched amid the ongoing coronavirus pandemic, during which a large portion of the UK population unexpectedly found themselves working from home. As a result, office spaces across the country were left empty or with very low levels of occupancy. However, it has been anecdotally reported that the new levels and requirements of occupation have not resulted in the expected reductions in energy use. This challenge sought to uncover solutions that building owners and occupiers can use now to ensure that reduced and varying building occupancy translates into corresponding reductions in energy use, carbon, and cost.

## Solutions

The solutions we received to address this challenge were mostly well established and technology focused. They fall largely into two categories: demand control or monitoring and analysis solutions. Nine of the solutions we received, which were deemed to address this challenge well, are highlighted over the next few pages.

## What is it?

Aircuity offers sensing and control solutions that reduce building energy and operating expenses and improve indoor environmental quality. Aircuity optimises ventilation using a patented demand control technology which continually samples a variety of parameters in the air. It relays this to the central building management system to increase or decrease ventilation rates.

## How does it address the challenge?

By combining advanced real-time building sensing technology with continuous web-based building performance data acquisition and analysis, Aircuity has developed a building energy and indoor environment information platform that delivers cost effective knowledge on ventilation performance. Continuous data analysis helps building owners and facility managers reduce their energy consumption and carbon footprint while still maintaining a healthy indoor environment for occupants. The Aircuity system can be integrated with any existing Building management system/ LCS via BACnet or hardwired communications.

## What is the return on investment?

Aircuity quote that, for a typical one sensor suite installation (25-35 rooms), the average return on investment is 4-5 years (depending on energy costs).

## Case study

Bristol Community College was the first net zero lab in the USA. Aircuity's solution helped Bristol Community College achieve net zero while enhancing safety in the lab. Aircuity enabled the reduction of air change rates, optimised the amount of fresh air ventilation in the labs and enhanced the overall environment for staff and students.

2:56

## Monitor

✓ Room 109 Andrew Hall

Tue Dec 01 07:28 PM



90

Air Quality Score

# Carbon Intelligence

## Smart Building Optimisation Services

<https://carbon.ci/services/optimisation/>

**Solution Type:** Technology/product

**Number of projects:** 140

**Applicable project types:** Office, retail, industrial, residential, new build, refurbishment



### What is it?

Carbon Intelligence's smart optimisation services combine data expertise and 'smart building' technology, to unlock maximum value for businesses, people and buildings. Carbon Intelligence deploy secure, non-invasive technology to continuously monitor key performance data across entire building portfolios, helping owners to understand and optimise energy performance to create an enhanced environment.

### How does it address the challenge?

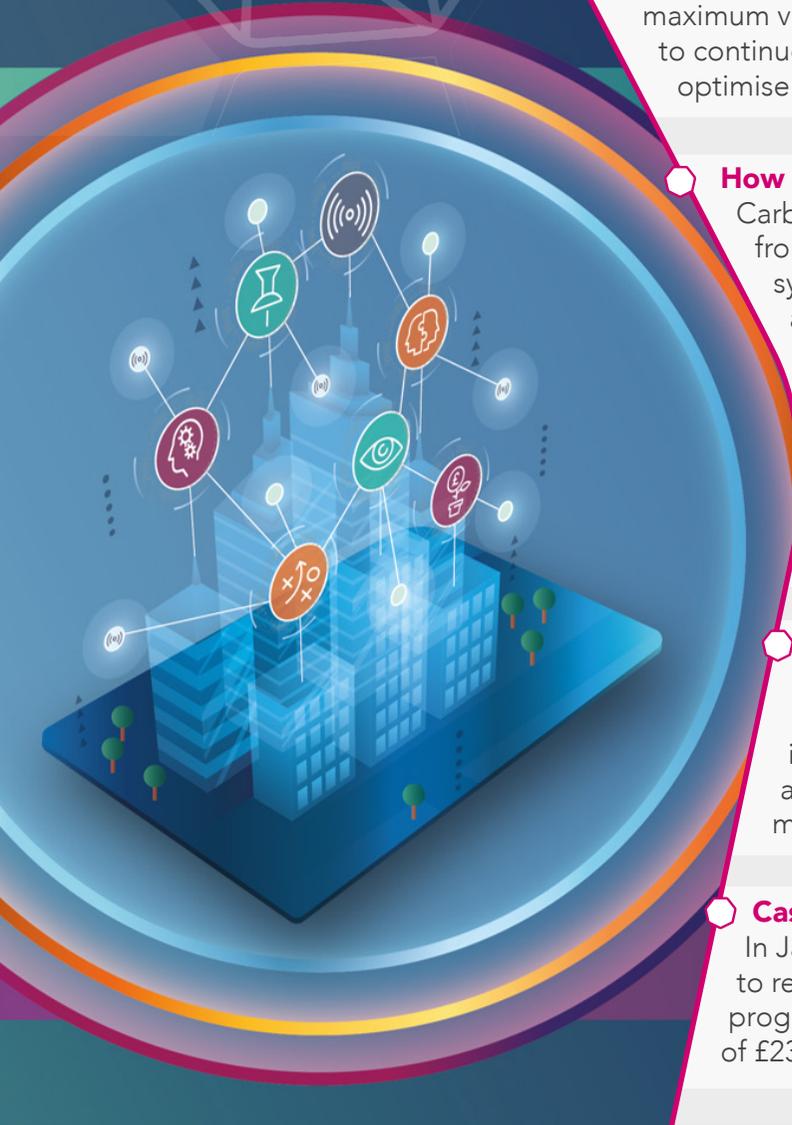
Carbon Intelligence 'Smart Programmes' optimise performance by capturing and analysing granular data from a building's building management system and /or wireless sensors, to tune their performance. The system reduces operating costs, energy spend and carbon impact as well as improving health, wellbeing and productivity through enhanced internal environmental conditions. It also offers a single solution for different assets across a portfolio and enables greater visibility over plant operations resulting in more informed maintenance plans, consequently increasing the life space of the plant. The Smart Optimisation Programme has also been designed to support demand reduction ambitions within net zero carbon pathways by reducing consumption to align with benchmark and intensity targets. To achieve long term optimisation, Carbon Intelligence deliver an ongoing managed service with detailed analytics, collaboration and verified energy savings through the industry recognised International Performance Measurement and Verification protocol (IPMVP) standard.

### What is the return on investment?

The Smart Optimisation Programmes take place over a 3-year contract, with a 'Diagnostic and Implementation' phase over the first 3 months and a 'Managed Service' the remainder. Financial investment is dependent on the building size and complexity, but typically, the programme delivers a 14% annualised reduction in energy spend, which equates to most programmes being paid for in less than 12 months.

### Case study

In January 2018, Aviva brought Carbon Intelligence into their St Helens head offices in central London to reduce the energy consumption of the building, which was higher than the rest of their portfolio. The programme resulted in 11% electricity savings and 24% natural gas savings, which equates to annualised savings of £230,000 and 720 tonnes of carbon. As a result, the programme was rolled out over 12 additional sites.



# Demand Logic

[www.demandlogic.co.uk](http://www.demandlogic.co.uk)

**Solution Type:** Technology/product

**Number of projects:** 200+

**Applicable project types:** Office, retail, industrial, residential, infrastructure, new build, refurbishment



## What is it?

Demand Logic is a software tool which provides actionable intelligence to property managers and building contractors. Demand Logic accesses thousands of operational data sets, by connecting directly to the building management system network and curating the information into an easily accessible web-based platform. Users can see how a building is operating, with particular focus on HVAC systems, utility meters and internal environmental sensors for temperature, CO2, air quality, humidity, and occupancy.

## How does it address the challenge?

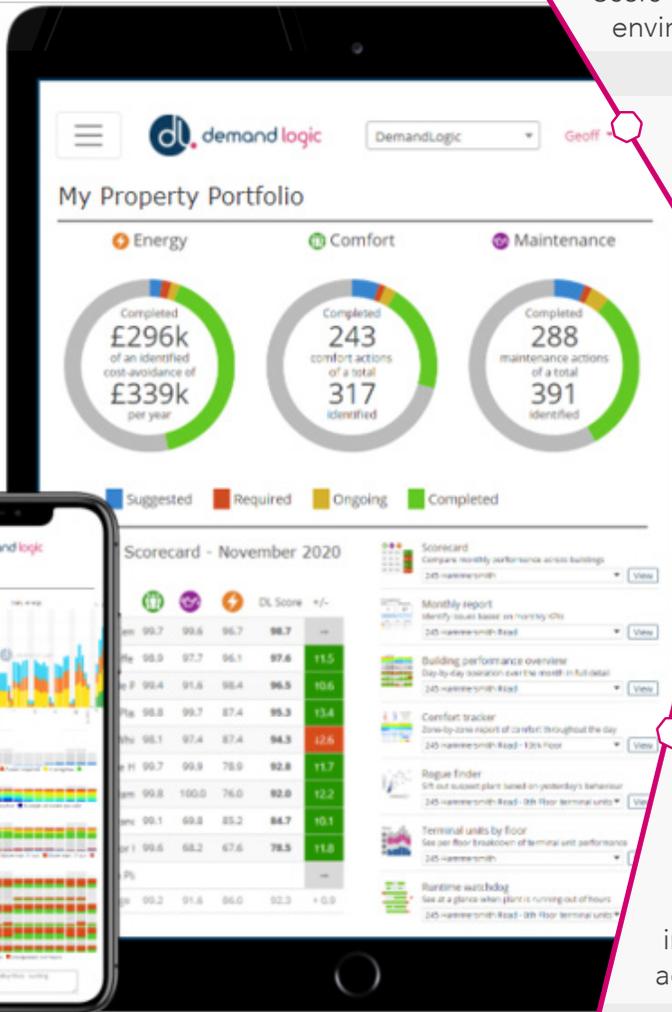
Installation requires just a single Data Acquisition Device gateway to connect an existing building management system to a secure internet service. The connection can be completed in a single site visit which will take no more than 3 hours. The intention is that easy access to resulting data will enable quick identification of any systems, processes or procedures resulting in energy wastage. Demand Logic is also able to pinpoint the exact piece of plant causing any problems. The platform can enable monitoring of individual buildings or entire portfolios and is quoted to result in saving of 10% – 30% on energy costs & reduced carbon emissions.

## What is the return on investment?

The actions provided by Demand Logic towards cost-avoidance are largely CAPEX free, with most usually completed by the existing maintenance, or building management system contractor as part of their existing service provision. The cost avoidance and savings for energy alone are quoted to typically provide a return of investment of 6-9 months, with some properties having seen this in as soon as 2 weeks.

## Case study

Demand Logic was implemented at a 120,000 sqft commercial office to support Legal & General Investment Management (LGIM) and JLL on identifying optimisation opportunities. Following the success of the trial, Demand Logic was introduced as part of LGIM's 'Mercury' operating model for the management of their portfolios, intending to further incorporate innovations and customer service into the heart of their offering to occupiers. Demand Logic has now been deployed across 9 properties to improve and optimise performance. There has been energy cost-avoidance identified of over £308,000 across the 9 properties, resulting in an average return on investment of less than 5 months.



# Fabriq OS

<http://fabriq.space>

**Solution Type:** Technology/product

**Number of projects:** 100+

**Applicable project types:** Office, retail, industrial, residential, infrastructure, new build, refurbishment

## What is it?

Fabriq is an energy and resource data platform for the built environment, using Internet of Things technology to reduce consumption, save costs and meet sustainability targets. It provides the ability to track and manage all building related performance metrics in a single online system. Users can benchmark buildings to identify savings potential, manage projects, track the impact of efficiency measures, create reports, and share the results with various stakeholders.

## How does it address the challenge?

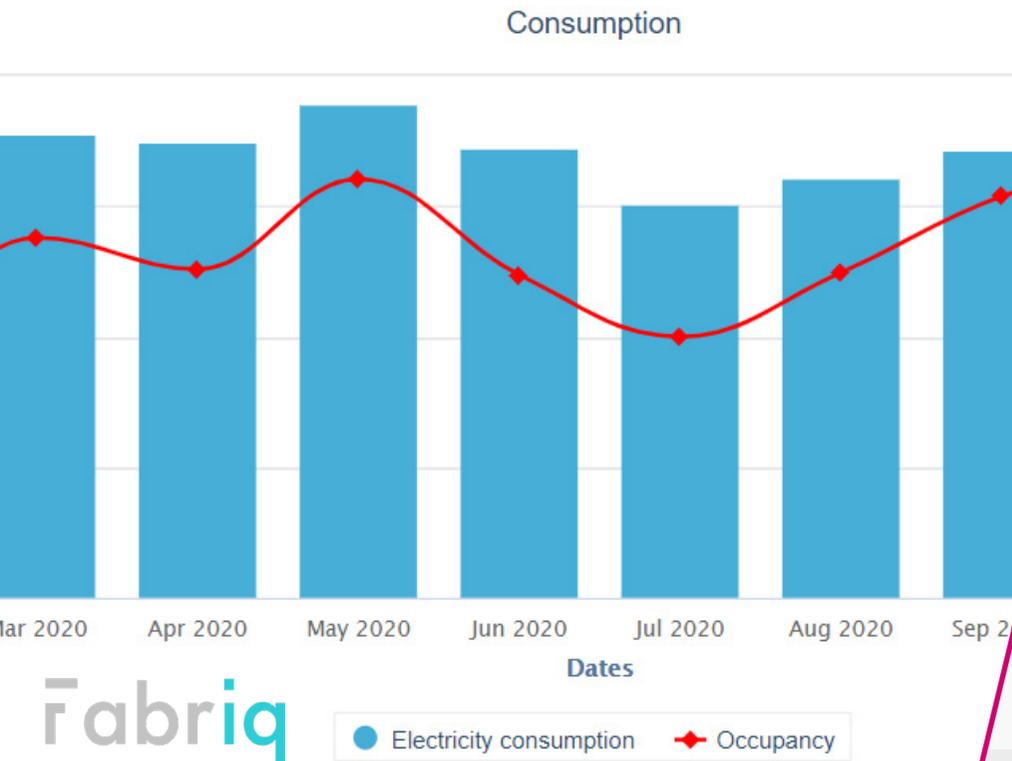
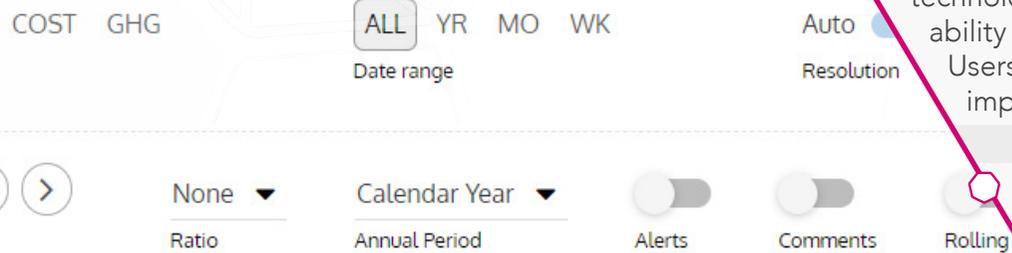
Fabriq is a fully integrated web based Internet of Things platform to track energy and resource consumption across built assets. The platform is designed to gather data from a variety of sources including building management system and Internet of Things sensors enabling in-depth visibility of energy-use patterns, operating statuses of building systems and utilisation levels of buildings.

## What is the return on investment?

The Fabriq OS platform is offered via a subscription model. Typically, the cost of subscription is dependent on modules selected, amount of data to be accounted for per site or portfolio, as well as number of data-acquisition connectors and interfaces required to centralise data on an automated basis. On average, energy-conservation measures conceived based on findings that are uncovered via the use of the Fabriq OS platform result in energy savings of at least 10-25%.

## Case study

Fabriq OS has been in-use to minimise the energy-consumption footprint of a portfolio owned by a UK-based commercial real-estate company since 2017, consisting of 30+ office buildings. The platform is being used to monitor or track the following for each building: total energy and water consumption; electricity consumption of building services or equipment (e.g. chillers, pumps, AHUs, lighting, lifts, etc.); operational parameters such as temperature, operating hours, and occupancy levels; and basic building information (e.g. type of building, size, location, etc.). As of April 2020, savings of as much as £18,000 per site per year had been identified.



Fabriq

# Grid Edge

<https://gridedge.ai/>

**Solution Type:** Technology/product

**Number of projects:** 9

**Applicable project types:** Office, retail, industrial, new build, refurbishment

## What is it?

Grid Edge has created an energy, carbon and cost saving platform to optimise energy use in commercial buildings and support organisations on their journey to net zero. The solution is built around creating a digital twin of a building that brings together the customer's building management system, metering, sensor, and environmental data onto one smart, digital platform.



13Mph

71% Hum

OUTSIDE TEMPERATURE

-10

## How does it address the challenge?

The platform's algorithms detect inefficient and unusual energy performance with automatic notifications for rapid resolution. Live data, analytics and automated insights rendered in a bespoke 3D Digital Twin allows real-time optimisation of a building's energy performance to reduce energy and carbon costs by as much as 20%. Hardware installation can be completed in a single visit, with any remaining commissioning done remotely. AI predictions are then made using building & contextual data.

## What is the return on investment?

Grid Edge's technology is provided as Software-as-a-Service, with a monthly fee but no upfront costs. Discounts to the monthly fee can be available for those who deploy the technology across multiple sites within their portfolio. Case studies from Grid Edge have shown that a positive return on investment can be achieved within the first 12 months of deployment.

## Case study

Kent County Council's Energy and Estates team has been working with Grid Edge to support their ambition to create a resilient and smart energy system. In Invicta House Grid Edge integrated solar power generation data with the building's energy profile and created a digital twin and predictive model. The system discovered the HVAC system was running sub-optimally and there was inefficient out-of-hours consumption. A new HVAC strategy was deployed along with targeted energy strategies and energy demand management at peak solar levels, which all resulted in approximately 60% energy savings and an annualised cost saving of c.£30k. The return on investment was achieved within 12 months.

OCCUPANCY (PEOPLE)

QUIET

COMFORT (%)

0

SPACE TEMPERATURE

14

AIR QUALITY (CO2)

300

Grid Edge

# Lightfi

<http://www.lightfi.io>



**Solution Type:** Technology/product

**Number of projects:** 50+

**Applicable project types:** Office, retail, industrial, infrastructure, new build, refurbishment, schools, libraries

## What is it?

LightFi is an Internet of Things solution that uses WiFi radio to measure occupancy count and retrofit buildings. LightFi design occupancy sensors with optimising energy efficiency in mind, as well being able to monitor CO<sub>2</sub> levels, air quality, temperature and humidity. The data from their sensors is available on an online portal for monitoring and analysis.

## How does it address the challenge?

LightFi provide direct integration to a building's building management system, with no rewiring required and retrofit mini-HVAC-version equipment with relevant strategies to automate commercial and public buildings. Responsive HVAC capability based on real-time demand reduces energy use when space is under-occupied. LightFi automatically reduces the HVAC loads when demand starts to fall, to make sure air is not cycled unnecessarily. The more dynamic the occupancy patterns, the more energy LightFi saves by allowing the building to "breathe" in sync with live usage patterns.

## What is the return on investment?

Costs include sensors, 'Software as Service' subscription, travel for installation and, if required, building management system integration and control. The costs vary depending on the size of the project but the approximate return on investment is 1.5 years.

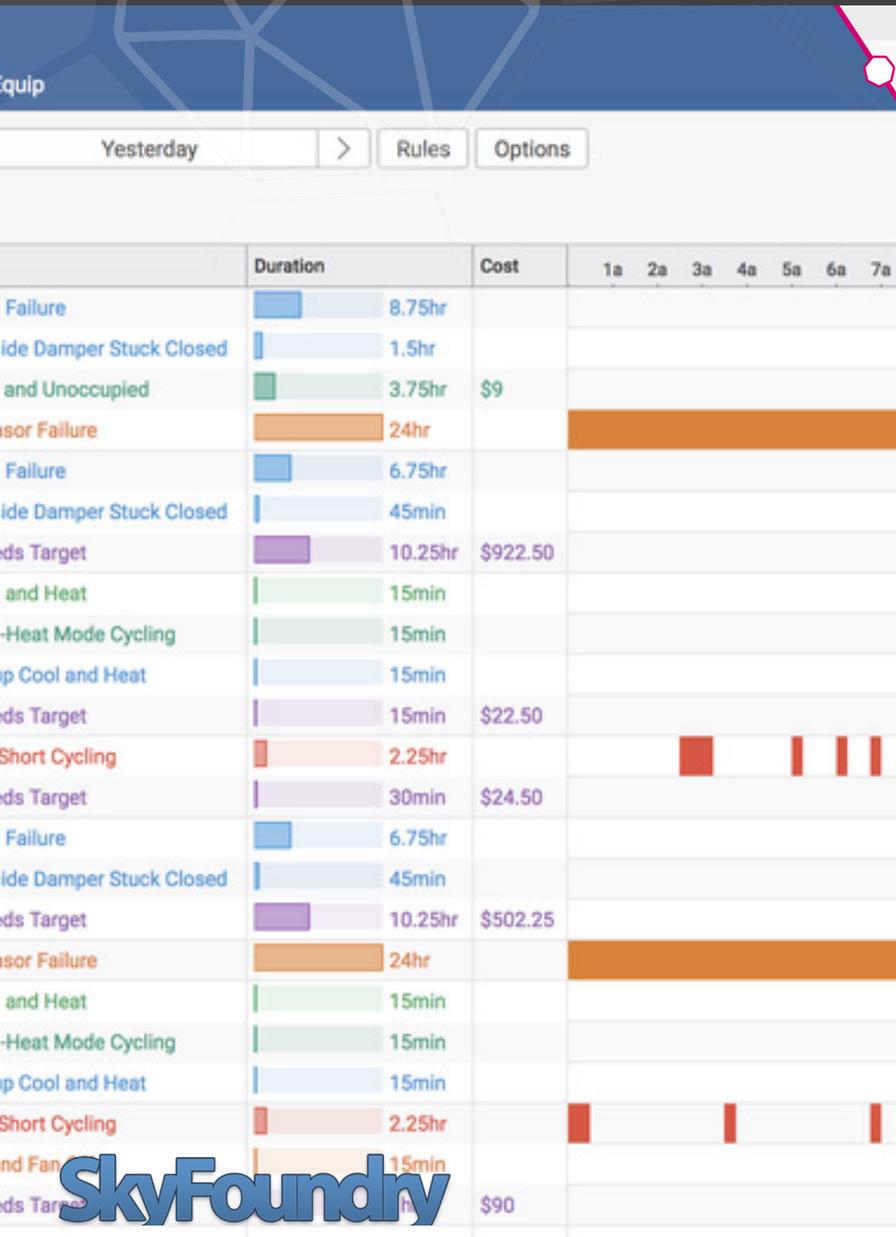
## Case study

LightFi worked on a 10,000m<sup>2</sup> office building in Leicester in 2019 to detect occupancy levels accurately, securely and anonymously, in all variety of spaces, to enable real-time demand-based HVAC control. Only 18 sensors were needed and cabled-in throughout the building. This made the installation quick, cost-effective, and non-disruptive. The LightFi system is saving 2,500 kWh per week on the mechanical load, equivalent to approximately £18,000 annually. Phase 2 of the project (where LightFi will work to allow more granular control of AHU speed for the building) is projected to provide estimated energy savings of £60,000 per year – approximately 22% of the building's annual HVAC energy bill.

**Solution Type:** Technology/product

**Number of projects:** Circa 15,000

**Applicable project types:** Office, retail, industrial, residential, infrastructure, new build, refurbishment



### What is it?

SkySpark by SkyFoundry automatically analyses data from smart devices and equipment systems to identify issues, faults, deviations, and anomalies enabling improved performance, reduced downtime, and operational savings.

### How does it address the challenge?

SkySpark analyses data from automation systems, metering systems and other smart devices to identify issues, patterns, deviations, faults and opportunities for operational improvements and cost reduction. SkySpark provides a comprehensive suite for analysis of energy resources including electrical demand, consumption, cost, as well as water and gas usage. The platform automatically aligns energy usage data with equipment operational status showing exactly how equipment systems are affecting energy use.

### What is the return on investment?

The SkySpark software pricing follows an incremental model that makes it possible to deploy the technology in a phased approach. The software is sold as a permanent license with ongoing maintenance and is also offered as Software as a Service based on required capacity. According to Sky Foundry ROI can be as little as one month in some cases, but is regularly under 2 years.

### Case study

In 2012, the building management team for a 700,000 Sq Ft office tower located in Denver embarked on a major initiative to reduce energy consumption in the building. The improvements were verified to save over \$180,000 (~£131,706) in annual operating costs and also contributed significantly to achieving the USGBC's LEED-EB: O&M Gold certification.

# Smart Spaces App

<https://www.smartspaces.app/>

**Solution Type:** Technology/product

**Number of projects:** 50+

**Applicable project types:** Office, industrial, new build, refurbishment



## What is it?

The Future Work  
Slough SL1 1

Architectural34642-0

The Smart Spaces App is a secure, cloud based Internet of Things platform that enables users to directly control their heating, ventilation, air conditioning and lighting. Smart Spaces use Bluetooth beacons, PIR sensors and access control integration to monitor building occupancy and adjust the HVAC and lighting accordingly.

## How does it address the challenge?

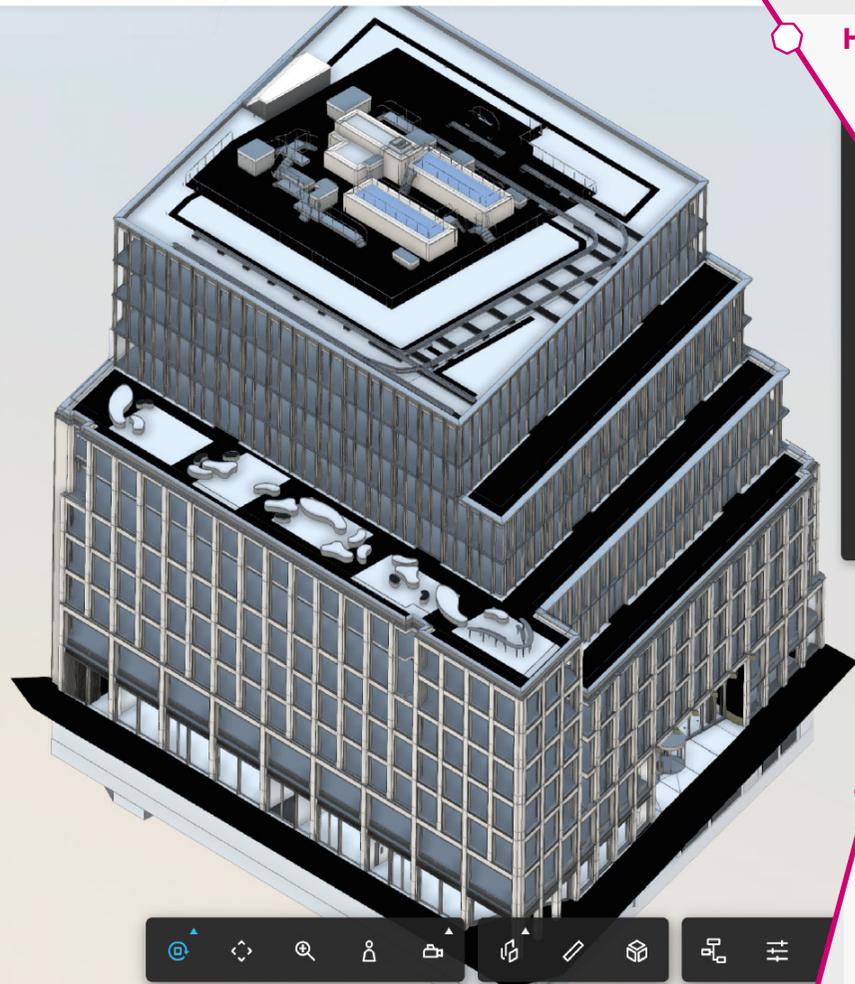
The Smart Spaces building automation platform flexibly integrates leading-edge smart technologies to the legacy building management system of a portfolio. Using a single app – accessible on smartphones, desktops and tablets – users benefit from real-time view and control over space utilisation, including space density management. Having control of lighting, climate and energy consumption allows occupiers and owners better understand their smart building. Moreover, using insights gained by the anonymised aggregated data collected by the platform, real-time efficiency levels are constantly monitored and set against target KPIs. This analysis translates into effective use of resources and valuable improvements in the long run.

## What is the return on investment?

Smart Spaces quote a circa 10-20% reduction in energy use, with associated financial returns, in addition to a range of more qualitative gains. For landlords, this pertains to attracting and retaining occupiers initially, moving then to evidencing increased satisfaction, reduced energy usage through optimisation strategies and, longer term, driving asset value. For occupiers, workplace productivity can be measured by comparing historical building use data to that of a healthier smart building that offers greater indoor air quality, granular control of workspaces, contactless access, and integrated bookable facilities such as meeting rooms and desks on demand. The reporting and metrics from this can also help occupiers to evidence their own investment in ESG, people and sustainability.

## Case study

Smart Spaces technology was used on the Great Portland Estates Plc development which won both the Refurbished/Recycled Workplace Award and Innovation Award at BCO 2020. This was achieved using Cause & Effect relationships to drive energy optimisation based on real-time occupancy and demand. Smart Spaces also provided users with the ability to disable their AC and switch off the HVAC or control the temperature while showing them their real-time energy use.



# Ubiqisense

<http://www.ubiqisense.com>

**Solution Type:** Technology/product

**Number of projects:** 100+

**Applicable project types:** Office, retail, infrastructure, refurbishment



## What is it?

The Ubiqisense smart sensors solution provides actionable insights on behavioural patterns and space utilisation. Smart vision-based Internet of Things sensors are installed inside buildings to detect people and objects. High granularity and precision enable the collection of data on room occupancy and utilisation. In the cloud, data is stored and analysed, then can be accessed and visualised via a cloud-based analytics portal or pulled into external systems where it can be leveraged and operationalised.

## How does it address the challenge?

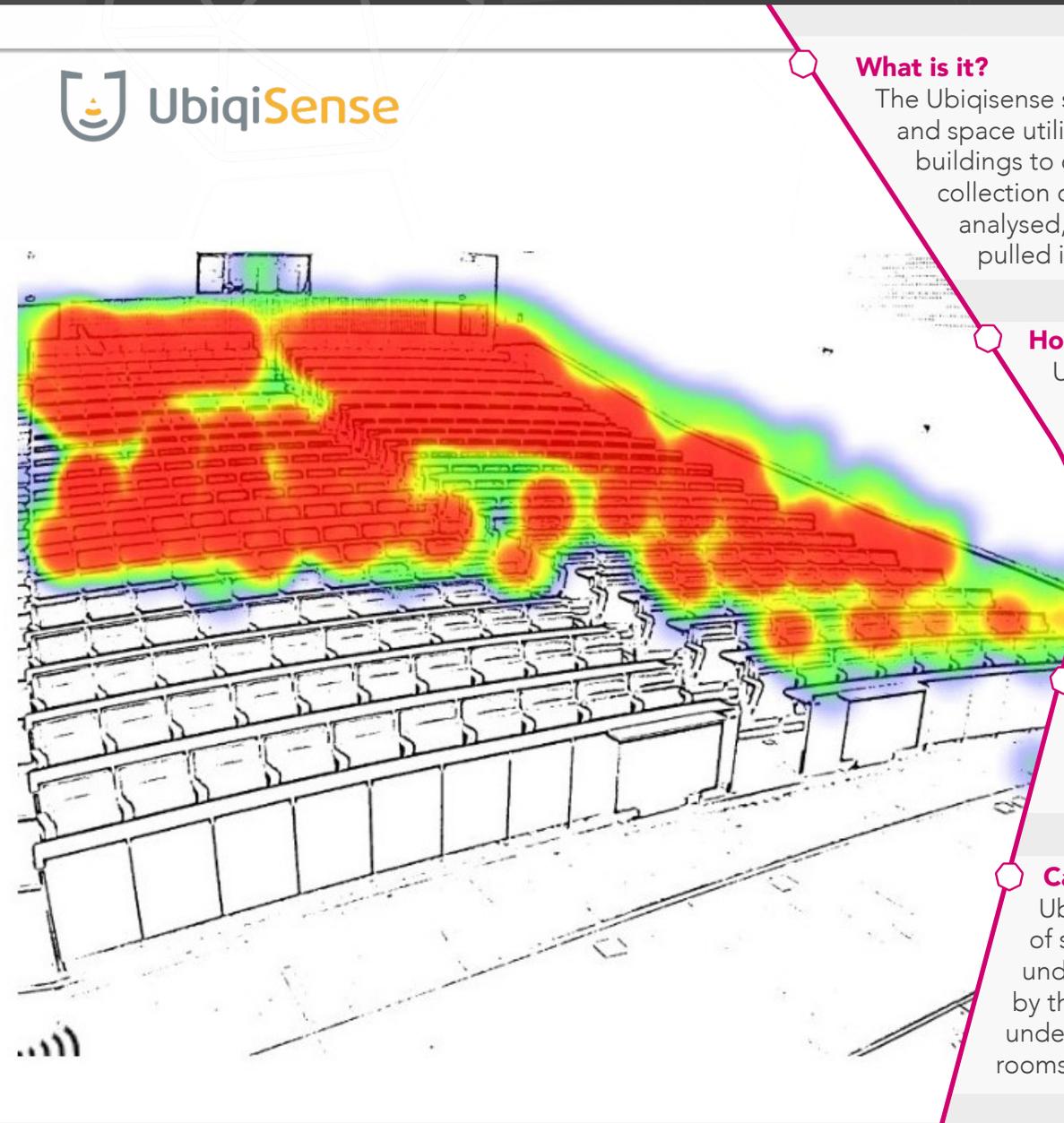
Ubiqisense monitors building occupancy to inform services such as lighting and HVAC, while enabling greater control over the building using Internet of Things technologies. Data findings can therefore be used to determine whether a property could be more energy efficient. By integrating UbiqiSense into existing systems, it is possible to locate any energy-saving potentials, such as where heating or air-conditioning systems are being used unnecessarily, perhaps in infrequently used meeting rooms.

## What is the return on investment?

Ubiqisense employs a sensing-as-a-service business model and typically quote a space optimisation of between 15-25%, and potential energy savings of 25%, with return on investment depending on cost per m<sup>2</sup>.

## Case study

Ubiqisense worked with Aarhus University in Denmark to monitor the use of staff meeting rooms, study rooms, project rooms and auditoriums to understand utilisation patterns, occupancy, and demand. This data was used by the university to feed directly into their management strategies by better understanding demand for space, as well as to optimise energy use by releasing rooms where occupancy was not as expected.



# From insight to action

UKGBC's solutions crowdsourcing pilot project highlighted industry demand for, and eagerness to contribute to, a digital space and process through which challenges and solutions can be collaboratively identified, created, and shared.

UKGBC hopes that the solutions presented here help inspire further innovation and action to reduce the operational carbon of our built environment. This is just one part of our work on solutions, and we hope to see many of our members and wider industry collaborate on our future challenges and work to help accelerate the transition to a more sustainable built environment.

This report covers solutions that are available today, but the success of their application and tomorrow's innovations are up to you.

## Here is what you can do now to contribute to a sustainable future:

- Show this document to colleagues, clients, and suppliers, as a snapshot of innovation today
- Contact those solution providers who are relevant to you and your organisation
- Share further solutions and innovations with us so that we can actively help promote and profile
- Suggest future challenges we can run based on the barriers you experience in your work
- Consult and deploy our [Open Innovation Levels Framework](#) to help create a culture of open innovation in your organisation
- Use our [Sustainable Innovation Manual](#) to create new concepts and solutions
- Look out for UKGBC's future challenges and innovation workshops to collaborate and share ideas
- If you are an innovative start-up, [apply](#) to become a UKGBC member to raise your profile and expand your network

# Next steps

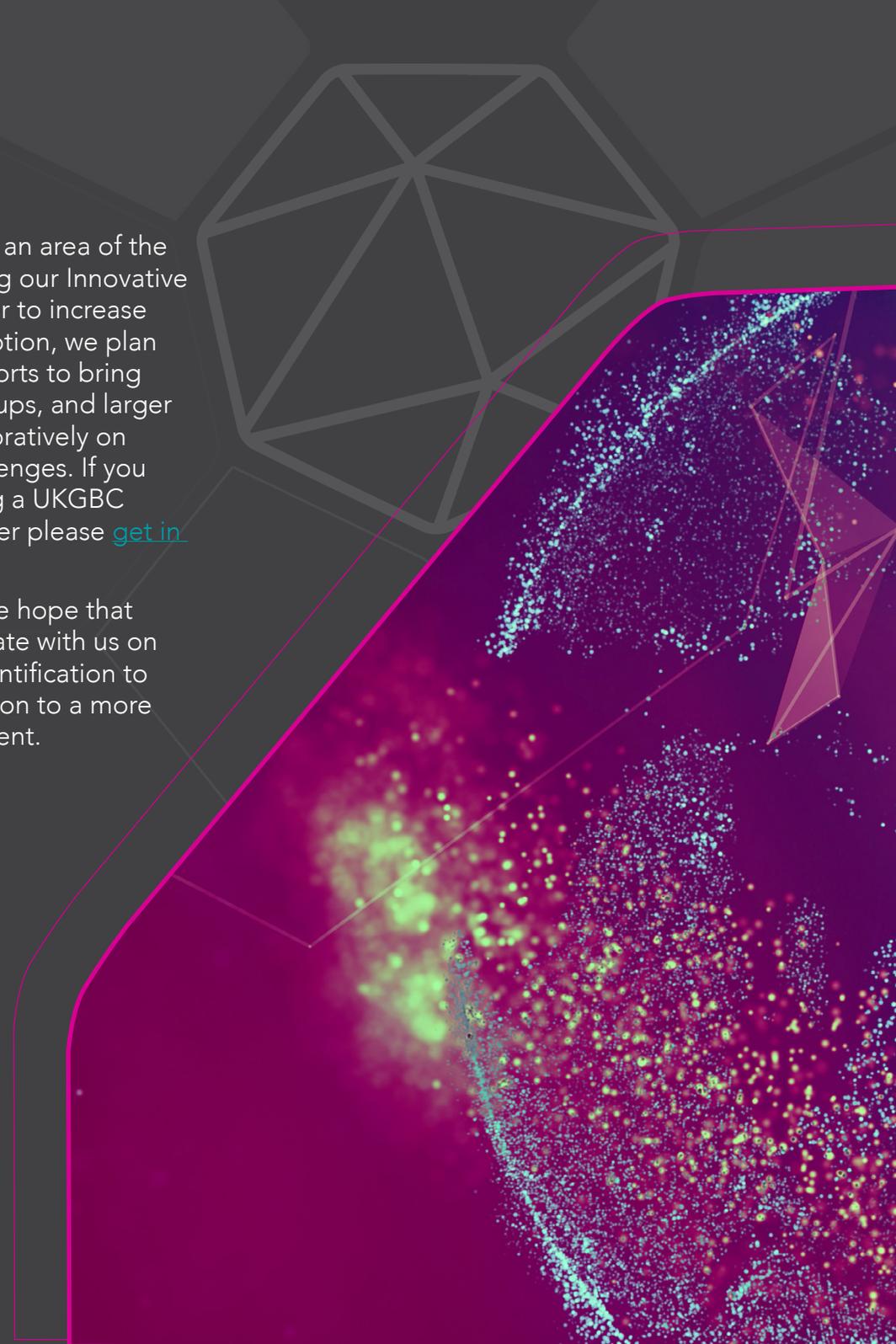
A step change in the sector's environmental and social impact is required to achieve UKGBC's vision for a sustainable built environment. This requires collaboration and knowledge-sharing to increase both awareness and adoption of sustainability solutions across the built environment industry.

The next stage of our work on solutions will be launching in mid-2021, based on the learnings from this pilot project. We will create ongoing opportunities for innovators to share ideas and collaborate, not only by running further challenges, but also by creating an online and ever-expanding 'library' of innovations and solutions, hosted on the UKGBC website.

Challenges will be run in a revised and easily accessible format, with solution submissions occurring directly on the UKGBC website. We will also continue to leverage our convening power to facilitate collaboration around these challenges. We will ensure that they are underpinned by events and workshops that promote sharing and discussion of existing solutions, and perhaps even spark the creation of new ones. UKGBC members will have the opportunity to set and evaluate challenges and help shape the direction of these discussions.

We will also be dedicating an area of the UKGBC website to profiling our Innovative Start-Up members. In order to increase solution creation and adoption, we plan to radically expand our efforts to bring together innovators, start-ups, and larger companies to work collaboratively on specific sustainability challenges. If you are interested in becoming a UKGBC Innovative Start-Up member please [get in touch](#) or apply [here](#).

In this decade of action, we hope that our members will collaborate with us on challenge and solution identification to help accelerate the transition to a more sustainable built environment.



# UKGBC Innovative Start-Up Members

## UKGBC's Innovative Start-Up Members (at time of publishing):

- [Airex](#)
- [Akustak® \(Cusp London Limited\)](#)
- [Bang The Table UK Pty](#)
- [Biogen Systems](#)
- [Biohm](#)
- [BlockDox](#)
- [Building for Humanity](#)
- [Built-ID](#)
- [DriWay UK](#)
- [EcoTree](#)
- [Energy Positive Assets](#)
- [Fabriq](#)
- [Grid Edge](#)
- [iOffset Ltd](#)
- The Pallet LOOP
- [Project Etopia](#)
- [Modomo](#)
- [NatureMetrics](#)
- [Proofshield](#)
- [Qualis Flow](#)
- [Sero](#)
- [Square Mile Farms](#)
- [Ssassy Property Limited](#)
- [Storm Board LLP](#)
- [Urbanomy UK](#)



# Further reading

UK Green Building Council, 2019. Net Zero Carbon Buildings: A Framework Definition, Available at: <https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition/>

UK Green Building Council, 2020. Open Innovation Levels Framework. Available at: <https://www.ukgbc.org/ukgbc-work/open-innovation-levels-framework/>

UK Green Building Council, 2019. Sustainable Innovation Manual and Templates. Available at: <https://www.ukgbc.org/ukgbc-work/sustainable-innovation-manual/>

UK Green Building Council, 2019. Innovation Insights: Making space as agile as Technology. Available at: <https://www.ukgbc.org/ukgbc-work/innovation-insights-making-space-as-agile-as-technology/>

UK Green Building Council, 2020. Circular Economy Innovation Insights: Reuse and Products as a Service. Available at: <https://www.ukgbc.org/ukgbc-work/circular-economy-implementation-packs/>

UK Green Building Council, 2020. Delivering Social Value: Community Engagement Hacked. Available at: <https://www.ukgbc.org/ukgbc-work/delivering-social-value-community-engagement-hacked/>



**UKGBC offers  
no commercial endorsement  
of individual solutions  
mentioned.**

The selected examples are provided as a source of inspiration, and we do hope that you follow up with the innovators to find out more.

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