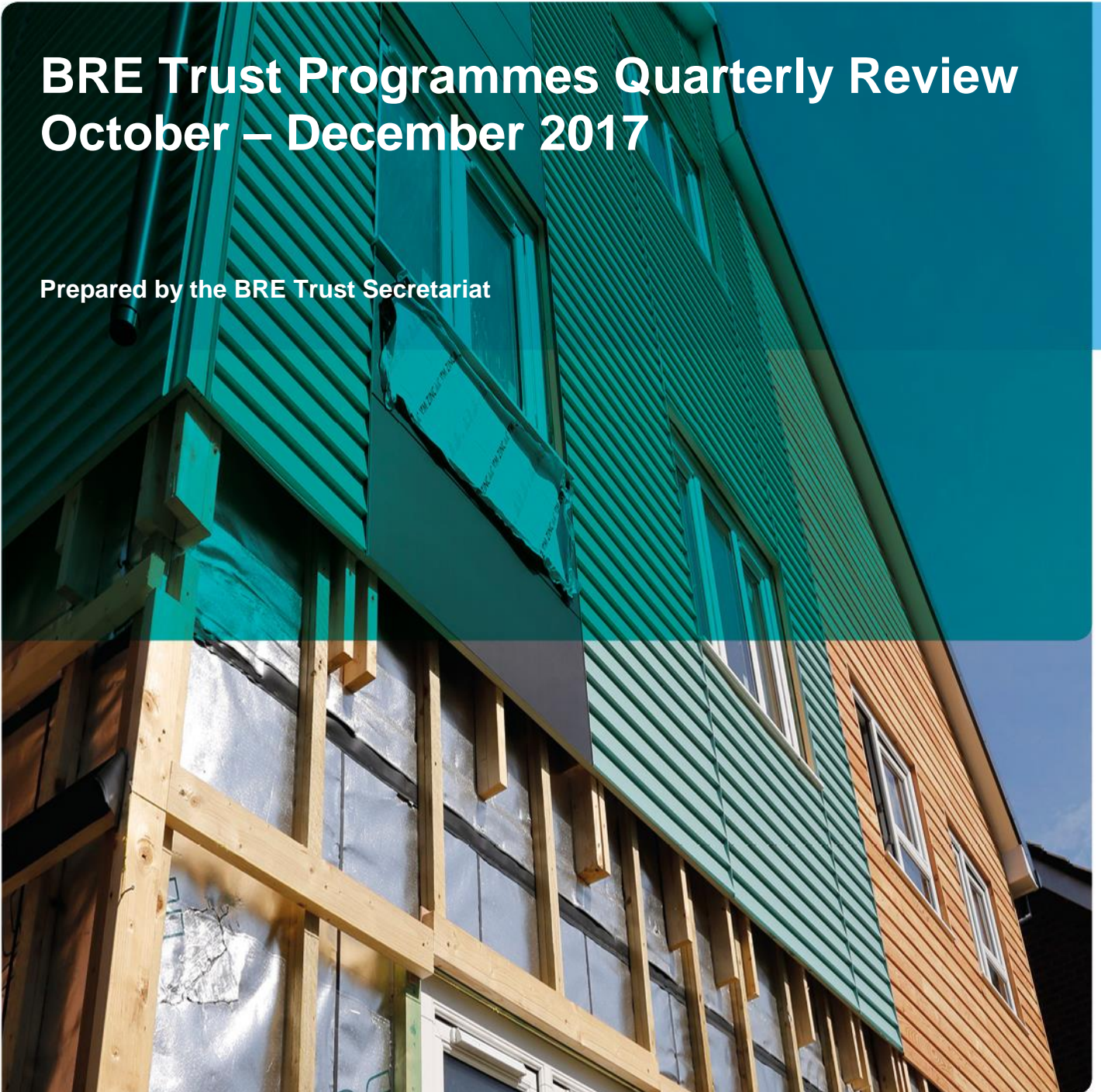# BRE Trust Programmes Quarterly Review October – December 2017

Prepared by the BRE Trust Secretariat

Executive Summary

This report summarises the progress of the BRE Trust Programme during October – December 2017, including the research, dissemination, skills and university projects. Also included are related activities including wider promotion of the Trust outputs via articles, publications, presentations and events. The outreach of these various platforms in sharing content are tracked and quarterly stats also included.

In summary, there are currently 14 live projects in the Programme with £300k of Trust funding now committed, also attracting over £1.5m cash and in-kind funding from other sponsors and partners, with 3 new projects started in this quarter.

This report particularly focuses on projects with a Digital theme. Also included is a feature on the BRE Digital team's activities since their inception 4 years ago.

New projects approved include:

Lancaster Grange: Living legacy £15k Trust funding; where BRE and partner, Crest Nicholson, will capture technical aspects of the project – which includes not only the chronological process of selling, developing and occupying of land, but also the application of a number of evaluation methods. This will form the basis of a knowledge summary which will be shared during and post-project, forming a key part of a learning legacy dissemination platform.

Life-long health effects of poor indoor air quality £15k from the BRE Trust, is another collaborative project including partners such as; Royal College of Paeditricians and Child Health (RCPCH); Dyson; British Heart Foundation and Allergy UK. After a number of working parties the a final report will aim to raise awareness of the issues affecting health

of children exposed to indoor air pollution and develop evidence based solutions focused on a number of criteria.

Determining the optimum replacement period for smoke detectors £12.5k from the BRE Trust, £37.5k from partners, is looking in to the fact that in the U.K. there is no recommendation in codes or regulations for the replacement time for smoke detectors in domestic or commercial environments. The creation of a repeatable test method and the collation and analysis of a dataset of the mean and spread of smoke detector sensitivities with age will enable U.K codes and guidance to be updated with replacement periods for smoke detectors.

Further information on these and other digitally related projects which are progressing or have been completed can be found within this report. These include:

People

Multi-sensor detector capabilities & comparative performance of smoke detectors **£20k from BRE Trust, £163k other contributions**

Property

Clouds 4 Coordination, **£75k from BRE Trust, over £1m other contributions**

Circadian Rhythms, **£35k BRE Trust, £45k other contributions.**

UK Centre for Moisture in Buildings

Places

RESILIENT

Article 25 – Myanmar

Contents

Focus on Digital

BRE Digital was created almost 4 years ago with the remit to create quality, bespoke commercial digital products for BRE, and to drive forward BRE's Digital Strategy in becoming 'Digital by Design'; maximising our use of data and digital tools, and creating new and innovative digital products through research and development. With over 20 members of staff, and in the 4 years since inception, BRE has gone from 1% of our turnover being through online and digital transactions to now over 30%.

Innovation: Data Creation and Exploitation

While our main purpose in BRE Digital is to help departments create and deliver online Digital delivery of their products, BRE Digital has also advanced the innovative capabilities of these offerings, through our capture, utilisation and exploitation of the data these tools create.

For instance, it is now possible to see at a glance the number of BREEAM assessments, registrations, assessors and much more. In Academy, trends in sales can be viewed, courses can be targeted to students based on their previous course history, and industry trends in the education delivered by BRE can be identified. In SMARTWaste, even more detailed and valuable reporting on waste and materials can be provided to clients, giving further insights and making the tools delivered more useful.

APIs: Information Gateways and Data Sharing

A major part of BRE Digital's innovation comes through sharing and connecting our data. APIs, or Application Programming Interfaces, are technologies to share services and data between distinct software products and services. APIs are a way to make some parts of a company's digital services and data available to other 3rd party developers so that tools can be built upon and extra services can utilise those applications and data.

The great advantage of APIs is that the access to services and data can be limited and measured (via API 'keys'), meaning that we can give access to all or some of the services and data, or limit the number of times a 3rd party can access the services and data. This key access can be given to trusted partners, or as a commercial offering alongside the main products.

BRE Digital have been developing these APIs to share data and services within BRE as well as externally. Most notably, BRE Digital have developed the following:

The BREEAM API: BREEAM 3rd party apps can now use our algorithms and create and manage BREEAM assessments for users, via the BREEAM API. This has been put into use by two major environmental companies, who use their own tools in conjunction with BREEAM projects.

The SmartWaste API: SmartWaste now provides a commercially available API for clients to access their data in a machine-readable way. This has been developed in conjunction with a major commercial organisation,. and is now a commercially available additional service for SMARTWaste customers.

The GreenBook API: The BRE GreenBook Live is BRE's major listings portal for all our environmental products and services. The GreenBook API allows 3rd party tools to query these listings based on rating, location and a number of other factors. This has already been used by BRE for the UK BREEAM Finder app (available for iOS and Android), a mobile app that allows users to find the nearest BREEAM rated building or BREEAM assessor, based on location. We also have a large environmental and real estate benchmarking organisation utilising this API to verify buildings in their system as BREEAM rated to help customers and to validate the quality of their data.

The main goal is to develop these technologies further as a viable commercial service, while provide free access for academic research and development purposes.

BRE Digital is now a growing, mature department within BRE, contributing to a major part of BRE's continued revenue and growth. BRE's Digital capabilities as an organisation will be the main factor in this future growth, and the digital strategy of building new and innovative products and services from BRE data and products will be key in this growth going forward.

BRE Digital helped BRE business areas develop a number of major online flagship products, including:

BREEAM: All of BRE's BREEAM schemes are now interactive online tools as opposed to the historical spreadsheet and email based processes. While this improves customer access and ease of use as well as the value of the product, it also provides opportunities for further product innovation, as the data can now be collected from assessments in a reusable, structured format.

SMARTWASTE: BRE Digital helped take and revamp the free SmartWaste waste management tool into a tiered paid-for digital product. SmartWaste has now expanded into a modular system including transport and materials reporting.

BRE Academy: The bre.ac academy online training platform has been developed. This platform now serves all the online and classroom training for BRE's learning sector; allowing the recording and management of attendee's continuous professional development (CPD) records.

BRE LIMS: The development of the Laboratory Information Management System (LIMS) is in its final stages, which will digitise BRE's testing and certification processes, giving improved data gathering and reporting capabilities as well as improving efficiency and throughput of our testing facilities.

BRE Group: In conjunction with marketing, the BRE Group website has been completely revised (both technically and in terms of marketing focus). www.bregroup.com is now BRE's flagship brand, with bre.co.uk being retired towards the end of this year. The underlying digital platform has been completely revised which enables the use of modern web technology (using Wordpress, the platform used by over 30% of all websites).

As well as furthering our technical skills, BRE Digital have also trained our staff in Agile project management and now work closely with senior management to prioritise product development based on business, technical and commercial factors. A six stage process is now employed for all product development, giving BRE stakeholders the opportunity for review and input at each stage in the product development lifecycle.

Project Progress – People

The social interaction of citizens with the built environment, exploring health, productivity, safety and wellbeing. Considering the impact of demographic changes and cultural differences on future assets.

Current portfolio: Trust - £71.5k, Cash £515k, In-kind - £852k

New Project - Determining the optimum replacement period for smoke detectors

£12.5k Trust, £25k cash contribution, £12.5k in-kind

In the U.K. there is no recommendation in codes or regulations for the replacement time for smoke detectors in domestic or commercial environments. In previous BRE Trust funded research it has been recommended that further investigation was needed to identify the replacement period of smoke detectors, particularly as in recent years other European countries have been adopting replacement periods without sufficient research to support this.

Creation of a repeatable test method and the collation and analysis of a dataset of the mean and spread of smoke detector sensitivities with age will enable U.K. codes and guidance to be updated with replacement periods for smoke detectors. This research will also influence other countries in and outside of Europe to adopt a more appropriate replacement period based on scientific findings.

Completed Project - Multi-sensor detector capabilities & comparative performance of smoke detectors

£20k Trust, £63k cash contribution, £100k in-kind

The early detection of fire is necessary to allow occupants of a building more time to escape and allows for interventions to protect property. Getting the balance right of early detection without false fire alarms in a broad range of applications in the service environment is a challenge. Detection of smoke-like phenomena such as steam, aerosols and dust can trigger smoke detectors contribute to unwanted false alarms. Multi-sensor detectors, in theory, should perform better than standard smoke detectors as the former provides greater confidence of a fire condition by detecting more than one fire phenomena and are considered more resilient to false alarms from sources that do not produce heat. This has been claimed from anecdotal accounts of false alarm causes as investigated during the previous BRE Trust funded research.

Thirty-five different optical heat multi-sensor detector modes, representing the full range of those available in the marketplace today were tested alongside 2 reference optical smoke detectors to a series of 10 test fires and 5 false alarms. Critically during the 5 false alarm tests the multi-sensors on average operated after the reference smoke detectors. This false alarm immunity increased between categories with advanced detectors demonstrating the greatest immunity.

This research has demonstrated that multi-sensor technology has the potential to reduce certain categories of commonly encountered false alarms. However, the potential to which this can be realised depends on the sophistication of the technology. The implications of this research should enable BRE to produce a product standard that would enable multi-sensor detectors to be graded according to their resistance to specific, commonly encountered phenomena that result in unwanted alarms. Codes of practice, such as BS 5839-1 could give advice to users on selection of detectors for specific applications.

Project Progress – Property

The delivery of assets which are built and operated efficiently and sustainably, increasing value to businesses who occupy them. Resource efficiency, renewable and efficient energy and adaptability to future changes of use and critical factors.
Current portfolio: Trust - £200k, Cash - £152k, In-kind - £120k

New Project – Lancaster Grange: Living Legacy

£15k Trust, £25k In-kind

In the selling and development of the north field of our Watford site, BRE and the developers (Crest Nicholson) have been presented with a unique opportunity to not only document the process – which includes not only the chronological process of selling, developing and occupying of land, but also the application of a number of BREs tool and certifications – but also the opportunity to create a learning legacy to benefit multiple stakeholders and individuals. This project addresses this later opportunity through the capturing of the processes, products and experiences involved with the creation of Lancaster Grange, through from the planning process and the development, to the post-occupation of the completed community.

Currently, the study, review and dissemination of property/community is lacking. Using an innovative web-based platform, a learning legacy will be created that uses multiple media platforms to engage with professionals and academic students, sharing with them the learning created from this development. In doing so this platform will follow the key objectives of this project to showcase, inform, develop and preserve industry learning. Not only will the platform support, graduate and professional CPD learning, and inform ourselves and a wide variety of stakeholders but its creation will also lead to the pioneering of new methods of project evaluation and creation of 'living legacies'.

Completed Project – C4C

£75k Trust, £660k Cash contribution, £584k In-kind

Clouds for Coordination (C4C), a collaborative research project running for two years from 2014, aimed to address industry challenges associated with the increasing adaptation of computerised Building Information Modelling (BIM). A collaboration between AEC3, BRE, Cardiff University, IBM, Lee Wakemans, and RIBA Enterprises focused on BIM 'Level 3' and the challenges associated with ownership, trust and liability for the parties involved throughout the construction and property management sectors.

The issue of trust is addressed through the C4C project by the development of an approach that enables each party to create and store their own BIM information themselves. This contrasts to the standard approach of uploading data to a central dataset. This new data-creation and storing method is facilitated through the mapping of the individual party 'nodes' using a technology that connects these individual data models. By connecting these multiple 'clouds' of BIM data the technology allows for a complete BIM model to be realised without altering how or where the original material is kept or who is responsible for it, while simultaneously maintaining the ownership, status levels of reliability and accountability. In doing so the common problems accredited to shared BIM models are addressed, while the purpose and use of a shared BIM model is maintained.

Ongoing Project - Circadian Rhythms

£35k Trust, £15 Cash contribution, £30 In-kind

The following publications have been produced as a consequence of the Circadian Lighting project that has been part funded by the BRE Trust and enabled a collaboration with the University of Cambridge, University of Oxford and CIBSE, Society of Light and Lighting.

Previous BRE research has shown that lighting can have significant impacts on occupants' health and wellbeing. A key benefit of this work is an improved understanding of circadian lighting effects leading to the provision of optimal lighting control schemes that can improve occupants' health and wellbeing. The aim of the project is to deliver fundamental research with direct benefits for the built environment by providing evidence based knowledge and recommendations for improved health and wellbeing. The way in which some this information has been shared is in the 3 publications that were released in this quarter.

Control of Solar Shading

A wide range of dynamic shading systems are now available on buildings and the way in which these systems are controlled can have an important impact on building energy efficiency and on occupant comfort and wellbeing. This Information Paper gives guidance on whether to use automatic or manual control or a mixture of the two, and describes control strategies and ways to implement them. This is aimed towards building designers, service engineers, shading manufacturers and installers.

Retrofitting Solar Shading

Solar shading can have an important benefit on the environment in buildings by reducing glare and overheating, and can provide valuable savings in cooling energy. This paper describes the shading systems commonly used in retrofit applications, and gives guidance on their selection and design. The main beneficiaries of this are building owners looking to make improvements, facilities managers, energy auditors and architects.

Solar shading of buildings: Second edition

Careful choice of solar shading is required in buildings to allow good use of winter solar gain and daylighting without summer overheating. It may be needed to stop a building overheating, reduce cooling costs, prevent glare (particularly where computer screens are used), or provide privacy for building occupants.

This report describes the commonly used shading devices and some new developments. It gives the advantages and disadvantages of each kind of shading device. A decision table is included to help find the best solution for a particular building application. The guidance focuses on shading requirements in the UK and similar climates and latitudes.

On-going Project – UK Centre for Moisture in Buildings

The UKCMB is an independent, not for profit organisation run by University College London, BRE, Heriot Watt University and the London School of Hygiene and Tropical Medicine. The primary aim of this centre is to develop a moisture-safe built environment in the UK, preventing damage to fabric, services and appearance from moister effects and which have minimal moisture-related adverse impacts on human health. Buildings should be moisture-beneficial, providing comfortable environments for occupants.

This project reviews global research on the effects of moisture in buildings upon occupant health. A gap analysis and critical assessment will also be performed to be followed with recommendations for essential research work. A 2 year knowledge transfer partnership has been formed between The Property Care Association and UCL Institute for Environmental Design and Engineering.

The purpose of this collaboration is to carry out a comprehensive study in to the problem of excess moisture in buildings. Using the expertise of the PCA and its members UCL will collect, analyse and develop the data. An increase in understanding the role moisture in building design and performance will be obtained and lead to new integrated processes of procurement, design, construction and use of buildings.

A guidance to homeowners will be produced on how to avoid moisture problems in existing homes. This guidance will be available in 2 formats; a short video that provides an introduction and explains with images what damp is, where the moisture in buildings comes from as well as introducing the notion of balance and how this can be achieved. The second format being an interactive web-based tool that will show how different measures or problems can push a building out of balance in a particular way and how the balance can be restored. A highly visual interface will collect information from the user and will provide summary advice for particular problems.

Project Progress – Places

The robustness and resilience of communities and cities to natural and man-made external environmental influences. Climate effects, biodiversity and the interaction between buildings and their surroundings are a priority.

Current portfolio: Trust - £12k, Cash - £21k, In-kind - £24k

Completed Project - RESILIENT

A collaboration of 13 partners (including BRE), the RESILIENT project focused on developing a new system of interconnectivity between buildings, distributed energy resources and grids, as part of a means for addressing increasing worldwide energy consumption and increasing variety in energy sourcing (namely the increasing proportion of renewable/low-carbon energy). Through three pilot projects, in Belgium, Italy and the U.K. an integrated management concept was demonstrated.

Development and piloting of various ICT frameworks have resulted in a series of tools aimed at improving low-carbon district level energy management. These included: District Information Model for energy efficient applications, a District Simulation Model so simulation of thermal and electric grids, a Multi Agent System optimisation tool for grid management, and a replication tool. BRE, alongside Cardiff University and CSTB, worked on the creation of the replication tool, designed for the efficient transfer of project outputs into further district heating networks.

RESILIENT demonstrations have indicated annual energy demand in buildings, collated at a district level, can be decreased by 20% compared to expected energy performance through the use of the developed systems.

On-going Project – Article 25

In November 2017, Tim Wiseman, Scheme Manager of BREEAM Domestic Refurbishment, along with 13 other built environment professionals from other organisations, took part in a 9-day 550km charity cycle ride around Myanmar, and raised over £35k for Article 25, an architectural NGO who provide buildings for healthcare, education and housing in the developing world. The main aim of this cycling trip was to visit and audit ten rural health centres in the Myanmar countryside with a view to write a design guide for Myanmar Government's Ministry of Health to advise them on the best way to refurbish and rebuild them in terms of sustainability and operations.

The BRE Trust sponsored Tim and a Burmese architecture student, Kyel Sin Lin, to join the expedition.

Kyel Sin's attendance was essential to the project with the translation of all interviews with the rural health centre staff due to little or no English spoken in the rural areas of Myanmar. This trip was also very beneficial to Kyel's course and future career.

Since coming back from Myanmar, the group have submitted their findings from the rural healthcare centre visits to Article 25 who have compiled it in a document. In January 2018 the team, along with other healthcare architects and engineers, had a workshop with a view to come up with proposed solutions to help improve the rural health centres in terms of operations, hygiene and sustainability. The draft design guide will be available by Spring 2018 for further comment, and a further workshop arranged to discuss our findings and proposed solutions further. The final version of the guide will be delivered to the Ministry of Health in Myanmar for their views.

Photograph by Tom Dollard

Outreach & Dissemination Activities

2017/18 outreach – Year to Date

Publications – 10 Titles   Sales – 3,460 units   Downloads – 116,355   Events – 10   New Articles - 123

Sales & Downloads

This is the first time since Grenfell that fire titles have not dominated the downloads and sales Top 10. Titles in the Top 10 generally relate to core design guidance on building elements, soakaways, radon protection and designing quality buildings. Author support continues to contribute to consistent sales of BR 209: Site layout planning for daylight & sunlight and BR 211: Radon guidance. The same could be said for FB 78: Performance of exemplar buildings in use: bridging the performance gap, as Andy Lewry from the BREEAM In Use team chaired an expert panel to discuss the performance gap in November 2017. Old perennials such as DG365 Soakaway design, BR470 Working Platforms, SD1 concrete and BR453 Recognising wood rot & insect damage and DG 245: Rising Damp in Walls; continue to sell steadily.

These figures tie in to the conclusion of the report 'Fit for purpose - Big data reveals the construction knowledge gap' that states the industry is reading about design and management more so than sustainability and products. Further information on this report can be found in the Designing Buildings Wiki section of this report.

The number of IHS Press and BRE Bookshop direct sales was 1,124 in this quarter, an increase of 6% compared to the last quarter (1,053) and the total number of downloads from CIS for the last quarter was 42,308, a significant increase of 17% from both the last quarter (35,926) and the same quarter last year. Looking at more external factors for inspiration on what the industry wants to read about and delivering this information would improve the figures for our downloads and sales.

Outreach

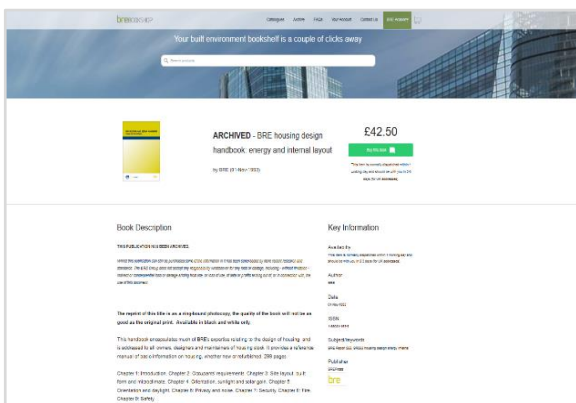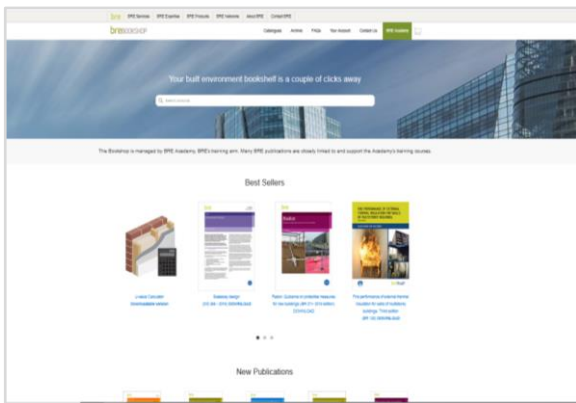### BRE Bookshop

Staying consistent with last quarter there were nearly 35,000 hits on the BRE Bookshop website, although this is a drop of 53% on the same quarter last year. This was the quarter that Peter Bonfield's 'Each Home Counts' review was published and putting BRE more in the public eye. As part of gathering evidence of attitudes and experiences of householders the BRE Trust commissioned a Home Improvement customer survey which ended in that quarter. This would have been a draw to the website and explain the hikes in 2016 whereas the figures in 2017 are similar to those of 2015
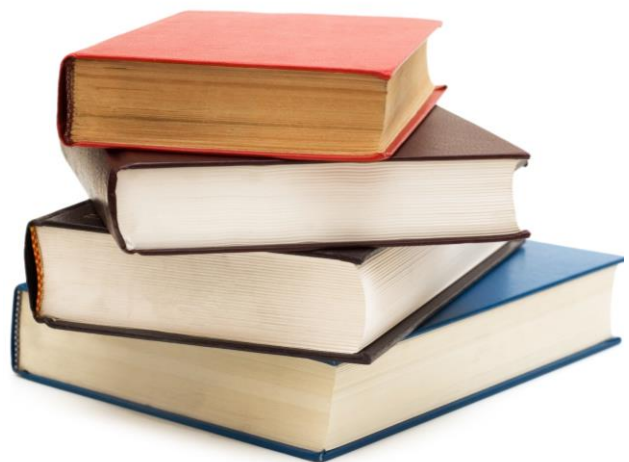
The Bookshop re-skin has now been launched with the look and feel of the new site mimicking bre.ac. It is better integrated with the academy website, for example; publications related to specific courses are highlighted and linked. The re-launch has worked well with very few problems. Any changes in customers' usage patterns will be investigated over the next quarter.

With support from IHS, a major archiving activity of older publications has been completed where some of the information within them does not fully reflect current codes and standards. When an archived publication is searched a message comes up to state that although the publication can still be bought the information within has been superseded by more recent research and standards.

Twitter

The @TheBRETrust Twitter account has been used for various promotions this last quarter, from elevating the BRE Trust's vision and mission to helping publicise the great work our colleagues are doing within our industry. The University students are using this platform enthusiastically to promote their work in industry.

Social Value

The Constructing Excellence Social Value Sub-Group, provided an overview of the group's work on a Constructing Excellence Social Value Roadmap. The group has analysed much information around social value and how it relates to the built environment and practical guidance for how it can be applied in the built environment. The tool kit is currently being finalised and Constructing Excellence should launch the roadmap in Spring 2018.

APRES

The APRES (the Action Programme for Responsible & Ethical Sourcing) which joined BRE in 2016 and recently integrated with Constructing Excellence. The programme was originally set up by Loughborough University through EPSRC funding and has gained momentum to be influential in raising awareness of the issues surrounding responsible sourcing in the built environment. Most recently APRES launched a white paper on Eight pathways to best practice:
https://www.bre.co.uk/filelibrary/events/BRE%20Events/APRES-White-Paper-2017.pdf

Constructing Excellence is now looking at how it aligns with its work around Procurement as well as the work Constructing Excellence is doing on Social Value.

Designing Buildings Wiki

By the end of the 3rd quarter there were 6,095 articles on Designing Buildings Wiki of which 258 of these are from BRE. 43 new articles were published in the last quarter and cover topics such as timber, solar shading, daylighting. During the 3rd quarter Designing Buildings Wiki was visited by 978,920 unique users, with 8.8% increase in the number of page views compared to the same quarter of 2016/17.

In September 2017, Designing Buildings Wiki published 'Fit for purpose - Big data reveals the construction knowledge gap'.

The report analysed the behaviour of the 3.5 million people who create, access and share construction knowledge on Designing Buildings Wiki, and identified a worrying gap between the knowledge practitioners need and what the industry actually provides.

Visualisation of 6 million pieces of data generated a series of never-before-seen maps of construction knowledge and revealed a strong industry bias towards creating knowledge about traditional 'academic' subjects, such as theory, research, innovation and case studies. However, in contrast to this, the data shows practitioners are interested in reading about practical 'project' subjects such as construction management, appointments, procurement, contracts and payment.

This leaves practitioners with an unsatisfied demand for straight-forward guidance about how to do everyday activities. If the industry could mobilise to supply this knowledge, there would be direct, and immediate improvements in practice.

The report calls for strategic leadership to tackle this problem, co-ordinating industry-wide collaboration to identify and plug gaps in practitioner's knowledge.

Other findings of the report include:

- The emergence of the internet has fundamentally changed the way practitioners access knowledge, but the industry has not kept up.
- Knowledge that is difficult to understand, buried in long documents or locked behind pay walls will not be used - even if it is critically important.
- BIM remains a specialist subject, disconnected from other industry knowledge.

The report can be read in full at https://www.designingbuildings.co.uk/wiki/Fit_for_purpose_-_Big_data_reveals_the_construction_knowledge_gap
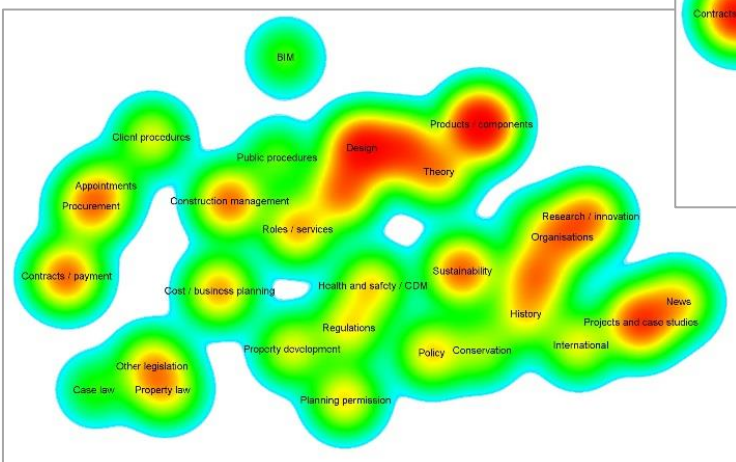

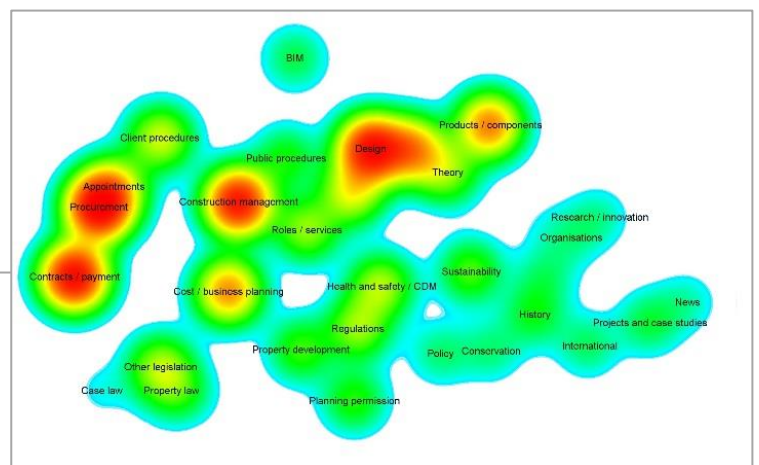**Figure 2. What the construction industry reads about**

Figure 1. What the construction industry writes about

BRE Buzz

The online platform has been utilised to extend the outreach of BRE's articles and blogs. In the last quarter there were 45 articles, 10 of which being Trust related either with past or current funding. These articles alone attracted over 1,143 viewers, an increase from the last quarter. However, with only 12,083 site visits, this is a decline of 13% since last quarter (14,000) but equal to the same quarter last year. Looking month to month the December figures are lower, probably due to company's shutting down for the festive break and no new articles being published in this week.

The articles covered topics such as:

Series of Breakfast Briefings - In order to engage with clients, investors and developers across the UK, BRE is running a series of briefings on key topics for the property world. The first event was held against a backdrop of glorious, green foliage at the Whitworth art gallery in Manchester. The attendees were there to listen to presentations from BRE on our emerging work in health and wellbeing. One of the key presentations was delivered by Ed Suttie, a key member working on the Biophilic Office project that the BRE Trust has committed £15k towards.

The infographic summary of the event can be downloaded from here; HR_1156BRE-INF-Health-and-Wellbeing-Infographic-AW.pdf

Another subject of the Autumn breakfast briefings took place in Birmingham and brought together representatives of a range of organisations from across the country. Gilli Hobbs, who has lead several Trust funded projects relating to circular economy gave a presentation that discussed challenges and opportunities for new circular economy thinking from the property and construction sector. Gilli also gave an overview on the BAMB project – Buildings as Material Banks – a 3.5-year EU funded project that BRE is actively involved with.

Changing attitudes to property flood resilience – The Association of British Insurers (ABI) produced an article showing that while the 2013/14 flooding resulted in a typical claim for flood damage to a home of £31,000, these figures had risen significantly by 2015/16 to around £50,000 on average. As a response to these flood events, the recognised approach for protecting homes and businesses within the UK is shifting to focus on the need for a resilient built environment. The BRE Trust has helped fund projects towards the research in to flood resilience with BRE Group pushing forward on a certification scheme for flood risk surveyors and accompanying training.

Awards

In collaboration with The Engineers Trust, the Trust fund of the Worshipful Company of Engineers, the BRE Trust are involved with administering and judging The Hawley Award, which was established in 2006. It is awarded annually for the most outstanding Engineering Innovation that delivers demonstrable benefit to the environment with the winner benefiting from a cash prize of £5,000 to use in furthering their career. The competition closes in April 2018 with an awards dinner in July; the application form for the Hawley Award can be found here

Schools Programme

The Schools Programme was approached by EDT, Engineering Development Trust, to host the launch of their EES Project. EDT is an independent registered charity whose mission is to encourage young people to fulfil their potential through careers in science, technology, engineering and mathematics (STEM). Established in 1984, the EDT is a leading national provider of work related learning programmes and annually involves over 40,000 students.

The Engineering Education Scheme is a 6 month programme which links teams of four Year 12 or S5/S6 students and their teacher with local companies where they work on real, scientific, engineering and technology projects. The scheme provides students with an in-depth experience that will enable them to make an informed decision about their future studies and career.

The launch was held on 13th October 2017, BRE entered a project and have subsequently been working with Stanborough School in Welwyn Garden City.

The scope of the project is to design and develop a prototype wall system (including a door and 2 windows) which needs to join onto a roof system with integrated Photovoltaic panels, both of which meet current structural and insulation performance standards but which can be constructed in a factory and be assembled onsite using automated technologies with the additional help of no more than 2 unskilled workers. This project ends with a celebration and assessment day where all the projects are viewed and assessed. As EES STEM projects are accredited by the Industrial Cadets framework, all students will graduate as Industrial Cadets at Gold Level. Industrial Cadets is a national standard for workplace experience, inspired by HRH The Prince of Wales - to ensure that young people develop skills by taking part in these accredited experiences.

Advances have also been made with the collaboration with the Armourers and Brasiers pilot scheme to create a better science programme at Duncombe Primary School, London. Neil Paterson, Head of Site Redevelopment at BRE, went along to the school to meet with some of the staff to discuss ideas on what they could do with the space that they have. The school have been requested to provide a business plan in order to take this project forward.

Events

Engineering in Education Scheme

Held on the 13th October at BRE, all the schools and businesses involved in the EDT Engineering Education Scheme came together for the launch of the 6-month project. After meeting their business partners, the teams were tasked with making the slowest marble rollercoaster out of paper, card, string and Sellotape. They were given a budget to spend on the construction of the rollercoaster and could 'buy' additional supplies from the 'shop' but they had to ensure they had a certain amount of money left over successfully built the slowest ride. The teams really got involved in this team building experience before joining back up with their business partners to discuss the projects they would be working on together. The day finished with a tour of the BRE Innovation park by the Schools Ambassadors, a beneficial end to the day, especially for those working on property based projects.

BRE Trust Christmas Sparkle

To mark 20 years of privatisation from a government body, the BRE Research team directed 6 videos. These videos went live on the BRE Trust website mid-December and have had over 250 views and covered the following research talks:

- Biophilic Office Design
- Low Impact Materials
- False Fire Alarms
- Flood Resilience Database
- LENDERS
- Living with Dementia

International Forum on Innovation & Emerging Industries Development (IEID)

Chinese Academy of Engineering (CAE), Shanghai Municipal Government (SMG), Ministry of Industry and Information Technology of China (MIIT), and National Development and Reform Commission(NDRC), together with the Ministry of Science and Technology, Ministry of Commerce, Chinese Academy of Sciences, China Council for the Promotion of International Trade and United Nations Industrial Development Organization (UNIDO), jointly initiated and sponsored the very first session of the IEID in 2016, with the theme of "Technical Innovation - Empowers Emerging Industries". The second IEID 2017 was hosted in Shanghai, China in November 2017.

Dr Deborah Pullen, BRE Group Research Director was invited to be the key note speaker present in Green and Low-Carbon Technology & Industry panel session. This session covered topics such as plurality of energy, environmental protection, urban planning, construction and other industries that relate to being green & low carbon. World-renowned academies and experts gathered to exchange advanced knowledge in low-carbon technology and promote global scientific and technical innovation. In the presentation, Dr Pullen addressed BRE'S recipe for success is to carry out research with our research partners which support our standard, products and services which then support changes in industry. Dr Pullen also used materials innovations, future integrated systems, and smart home lab as examples to further disseminate and demonstrate BRE's approach on achieving low carbon building solutions.

BRE Trust Christmas Sparkles 2017

Thermal Energy Challenge Advisory Workshop – 1st November 2017

The Thermal Energy Challenge Network is funded by the Research Council UK (RCUK) Energy Programme to address improved energy utilisation in building and industry sectors. The Network is led by Professor Tony Roskilly, Director of the Sir Joseph Swan Centre for Energy Research, supported by Professor Savvas Tassou from Brunel University and Dr David Reay from Newcastle University. The aim of the Network is to support the dissemination and impact of RCUK Energy research projects, together with other national and international research aimed at improving utilisation and efficiency of thermal energy, through stakeholder engagement and knowledge transfer. This Workshop was the first Network event targeting the built environment and was jointly badged with the BRE Trust. Some 40 delegates from academia and industry gathered in the Conference Suite to hear three 'keynote' presentations tackling:

- The energy performance gap (BRE's Dr Andy Lewry)
- The impact and importance of ventilation (Dr Peter Rickaby), and
- Energy efficiency in retrofit following the Energy Company Obligation (Gearóid Lane)

Each topic was then discussed in workshop mode, with good engagement from all delegates and with results collated by an IT-based logging system.

About 20 of the participants then took a tour of the Innovation Park. A fuller report of the event is being prepared by the organisers.

50 Years of Housing Survey

In October, the BRE Trust funded an event to celebrate '50 years of UK national housing surveys'. The first national sample house condition survey in the world was the 'House Condition Survey of England and Wales' in 1967. Since then, surveys have been carried out at regular intervals in England, Scotland, Wales and Northern Ireland to inform government housing and energy policies and our progress in delivering a better national housing stock. BRE has been involved in these surveys for all of this time and BRE Housing and Energy is the recognised centre of excellence for design, complex data modelling and analysis. Back in 1967 a quarter of all UK homes lacked an inside bathroom or WC. Many were in very poor repair and destined for clearance. Government housing renewal policies, informed by the national surveys, have helped to improve the situation enormously since then, but the UK still has the oldest housing stock in the world and faces many challenges to make it fit for the future.

Presentations on the value and continuing role of the surveys were delivered by representatives of all of the UK nations, and the day was finished with a debate on what our housing might look like in another 50 years' time.

CE Annual Conference – The 4th Industrial Revolution – Towards Industry 4.0

The Constructing Excellence Annual Conference took place on 12 December 2017 at the Tower of London. It was produced in collaboration with G4C with Ben Pritchard from Invennt leading the G4C input. The conference and was attended by approximately 150 people from 165 registered.

Initial Outputs

There was overwhelming support for the new vision in the room with 95% of participants being strongly supportive or supportive of the vision and the Words into Action campaign. Influence and Measure were given highest priority for Constructing Excellence to focus its work. On the subject of the Industrial Revolution almost 69% of participants felt it was just getting started.

Will traditional delivery methods become obsolete?

61% of respondents were positive that their organisations were in a good position to exploit the full benefits of offsite manufacturing and technology, whilst only 11% felt negative. This may reflect the positive and forward-thinking organisations that engage with Constructing Excellence rather than the industry as a whole.

On the topic of whether traditional delivery methods will become obsolete the participants were less convinced, with just 38% believing they would become obsolete and 37% thinking they would be around for a while.

What needs to change for the built environment to reap the full benefits of offsite manufacturing and technology?

Is data the currency of the future?

Participants were overwhelmingly positive about data being the currency of the future with 83% of participants agreeing or strongly agreeing with the statement, just 5% disagreed. 70% of participants felt their organisations were well placed to take advantage of the digital revolution, although this might be more representative of the organisations who are part of Constructing Excellence rather than the industry as a whole.

This panel considered the role that the younger generation can play in delivering data and data-based solutions, including the potential for them to influence at board level, perhaps through 'reverse-mentoring'. Transparency and visibility were seen as key benefits of data with participants seeing the potential to enable better decisions, bring them closer to their customers and give them a much clearer picture of the impact of interventions. Participants were clear on the need to change their business models to ensure they were able to embrace the true value of data. Concerns were raised around emerging legislation such as the GDPR and also the potential for too much data leading to data overload and an inability to extract actionable knowledge.
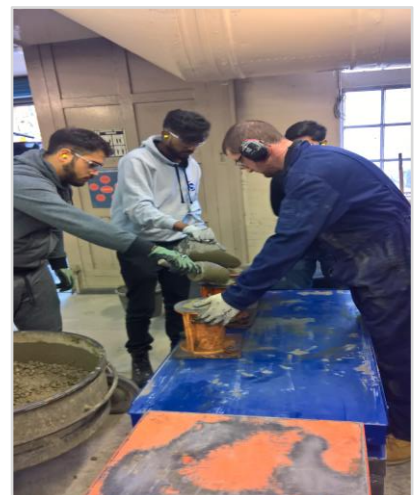
Partnership Programme

University of Hertfordshire
Connected Systems
No. of active PhD Studentships: 3

The BRE Trust has now partnered with the University of Hertfordshire in the delivery of its Civil Engineering degree (BEng/MEng). It aims to improve the knowledge surrounding the principle of sustainable design, civil engineering materials, structural analysis and building information modelling (BIM). In November/December the first cohort of students visited BRE for a week to undertake laboratory preparation and testing of concrete, as well as the tensile testing of steel. The week also involved lectures on BIM, BREEAM, CEEQUAL and on timber which included use of the timber library.

The university has been closely involved in the Innovated UK funded Service Aggregation for smart home projects and Smart Meter into Smart Homes project since early 2010. These projects have been developed into joint work on smart and future cities. BRE Trust has been sponsoring several PhD students since early 2013.

Students in the timber library, mixing concrete, performing slump tests, creating test samples and strength testing

Smart Meter Data Analytics for Efficient Energy Management, Anthimos Ioannidis

This PhD project aims to develop a strategy for electricity load analysis and exploitation by looking into existing clustering techniques and methodologies and propose new ideas and approaches. Furthermore, an attempt in revealing causal relations between residential demand and external factors such as occupancy information and building construction features will also be made. Such relations are intended to be ultimately used for optimisation and validation of building energy models, reducing the modelling energy performance gap and contributing to the advancement of the relevant fields.

In the last quarter, time has been dedicated to further investigate and test the clustering of techniques and their combinations, using R programming language, in an effort to optimise the results. Furthermore, the use of energy data analysis for the validation of building energy modelling was also examined. Anthimos has successfully progressed in the university's internal Progression Assessment; acquired and pre-processed consumption data of the Low Carbon London project (5,567 London Households) and have started the preparation of a journal paper on the comparison of clustering techniques.

Intelligent Signal Processing for the use in Device Identification using Smart Sockets, Al-Azhar Lalani

This project considers the physical and control interfaces between devices and between power consumption and communication. It aims to reach an outcome that is a control envelope relating device/ appliance functional performance to electricity demand, and ultimately generation sources and carbon performance, it links closely with **Emilio Mistretta**'s research project (listed below) which enables the control approach to be put into the context of user need and location in the building, it also seeks to produce novel intellectual property. **Al-Azhar** has changed from full time study to part time study since April 2017, and has been working on his final thesis and carrying out implementation based on the feedback from the school.

Device free Indoor occupant localization system for smart buildings utilizing wireless signal interference to enable homes to intelligently adapt to their Occupants, Emilio Mistretta

This project is a global positioning system for buildings, a building positioning system. A key aspect of this research programme is to research and develop a 'tag-less' location system that does not require the occupant to wear any form of tag. It also considers the indicators of habit and trends that could be used to construct a location preference to allow the building and energy consumptions are managed accordingly. The final stages of research have been reached and have resulted in the below publications to present the results. This is in addition to the on-going production of the final thesis. Further programming of the applications have taken place which have made the localisation system more accurate. This involved the development of a fingerprinting training program which will enable the system to know where people are whilst in the centre of a room and not just when they are near a node.

The direct publications from the sponsored research students are:

Williams, A. Lalani, E. Mistretta, J. Siau. *Developing system intelligence for optimizing building electricity networks*. BRE Buzz 2015

C. Yang, E. Mistretta, S. Chaychian, J. Siau. *Smart Home System Network Architecture*. Springer Smart grid inspired future technologies conference 2016.

A. Lalani, E. Mistretta, J. Siau. *Intelligent signal processing for the use in device identification using smart sockets*. Smart grid inspired future technologies conference 2017.

E. Mistretta, A. Lalani, J. Siau. IEEE SpliTech International Multidisciplinary conference on Computer and Energy Science 2017

Cardiff University
Sustainable Engineering
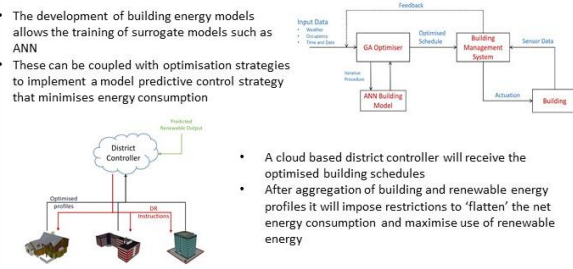## No. of active PhD Studentships: 4

Real-time and Semantic Energy Management across Buildings in a District Configuration, Jonathan Reynolds

This research aims to develop and make the case for more context aware building controllers. Building controllers need to become more predictive and adaptable in nature to take advantage of an increasingly changed energy landscape that may include local renewable resources or dynamic pricing tariffs. Furthermore, building controllers need act at not only a building level but also a district level to take full advantage of energy aggregation, energy sharing and load aggregation. During last quarter, Johnathan has been heavily involved in the EU project PENTAGON. It included writing a comprehensive literature review of modelling of energy conversion and generation technology in district energy systems. This work has formed the bulk of deliverable 2.6 which has been submitted to the commission. He also converted the deliverable review into a paper form, and this review manuscript has become to the 3rd journal that he has submitted to the journal 'Energy and Buildings'.

Key Facts and Research Gap
- Buildings are responsible for 40% of global energy consumption
- Introduction of new renewable energy sources adds instability and control challenges
- Limited research into building control has been carried out at a district level

Research Aim
- To comprehensively model a chosen district pilot site
- To produce a building level energy optimisation strategy
- To incorporate a higher level, cloud based, district controller to implement demand response strategies
- Find the most appropriate control architecture for different sites

Research Approach

- District modelling has been achieved using a Faro 3D laser scanner to aid the creation of as-built BIM and energy models
- These have been incorporated into our own Computational Urban Sustainability Platform which engagingly displays relevant information to the user
- The development of building energy models allows the training of surrogate models such as ANN
- These can be coupled with optimisation strategies to implement a model predictive control strategy that minimises energy consumption
- A cloud based district controller will receive the optimised building schedules
- After aggregation of building and renewable energy profiles it will impose restrictions to 'flatten' the net energy consumption and maximise use of renewable energy

Thesis Title: Real-time And Semantic Energy Management Across Buildings In A District Configuration

Supervisors: Prof. Y. Rezgui, Prof. A. Kwan

Oaklands College

The BRE Academy is helping Oaklands college, St. Albans, on its Construction Management BSc. Last year the BIM module was delivered, in addition the partnerships programme has also::
- delivered laboratory experience by demonstrating tensile testing of membranes and rebar plus thermal conductivity testing of brick and mortar samples, and,
- supported delivery on a construction innovation and technology module using the Innovation Park.

Professional Membership bodies

BRE Academy has recently developed new partnerships with the professional membership bodyIStructE (Institution of Structural Engineers).
BRE and IStructE have launched a new webpage on the Institution's website that showcases the Academy's e-learning courses through an RSS feed. Members can book courses and secure a discount. IStructE has been promoting the courses to its members across the world and BRE have negotiated a 'finder's fee' for each member who takes Academy courses. The training page can be found at: https://www.istructe.org/cpd-courses/bre-courses.

Appendix A: Project Status

People

Research

- Fire Protection: Digital Technologies & Personal Wellbeing. **Trust Contribution** - £12.5k. **Other Contribution** - £60k. **Status** – In progress
- Biophilic Project. **Trust Contribution** - £15k**. Other Contribution** - £985k. **Status** – In Progress
- Multisensor detector capabilities and comparative performance with smoke detectors. **Trust Contribution** - £9k. **Other Contribution** - £35k. **Status** – In Progress
- Life-long health effects of poor indoor air quality. **Trust Contribution** - £15k. **Other Contribution** - £135k. **Status** - Approved - requires updating to incorporate requirements from Committee

Demonstration & Dissemination

- Home for Life**. Trust Contribution** - £15k. **Other Contribution** - £135k. **Status** – In Progress
- Healthy Cities Case Studies. **Trust Contribution** - £5k. **Status** – Completed

Property

Research

- Suppression of Biomass Fires. **Trust Contribution** - £5k. **Other Contribution** - £35k. **Status** – In Progress
- Centre for Smart Homes. **Trust Contribution** - £53.5k. **Other Contribution** - £81k. **Status** – In Progress
- Blockchain Feasibility and Opportunity Assessment. **Trust Contribution** - £15k. **Other Contribution** - £15k. **Status** – In Progress
- Circadian lighting effects on health and wellbeing & Solar shading. **Trust Contribution** - £35k. **Other Contribution** - £45k. **Status** – In Progress
- 3 Resilience- Tackling overheating in urban dwellings. **Trust Contribution** - £40k. **Status** – Postponed until early 2018/19
- Optimum replacement of detectors. **Trust Contribution** - £12.5k**. Other Contribution** - £37.5k. **Status** – In Progress
- Lancaster Grange: Living Legacy. **Trust Contribution** - £15k. **Other Contribution** - £25k. **Status** – Approved - requires updating to incorporate requirements from Committee

Demonstration & Dissemination

- BIM Case Studies. **Trust Contribution** - £24k. **Other Contribution** - £46k. **Status** – In Progress
- BIM AG Chinese Translation. **Status** – Completed

Skills & Learning

- Disseminating knowledge through digital training. **Trust Contribution** - £40k. **Other Contribution** - £20k. **Status** – Not approved - requires more in depth information before re-submitting to the Committee

Studentship

- Building Energy Environment: measurement, data, analysis & interpretation. **Trust Contribution** - £30k. **Status** – Not approved - requires more in depth information before re-submitting to the Committee
- Live BIM' - Real time Building Information Management. **Trust Contribution** - £30k. **Status** – Not approved - requires more in depth information before re-submitting to the Committee

Places

Demonstration & Dissemination

- Building Resilience to Natural Disasters. **Trust Contribution** - £12k. **Other Contribution** - £45k. **Status** – In progress

Studentship

- Digital Built Environment and Big Data**. Trust Contribution** - £30k. **Status** – Not approved - requires more in depth information before re-submitting to the Committee

Appendix B: Current Studentships

People (Health, productivity, safety and wellbeing)	Business Area
Hybrid coupled modelling of heat and smoke movement through complex buildings, Ben Ralph, University of Edinburgh	Fire Engineering
Modelling indoor environmental quality in low energy housing, Maria del Carmen Bocanegra-Yanez, University of Strathclyde	Energy /stock modelling
Measuring and modelling overheating in domestic buildings, Kostas Mourkos, University of Loughborough	Energy /stock modelling
Places (community resilience, climate affects)	
Social innovation systems for building resilient communities, Donagh Horgan, University of Strathclyde	Resilience
Measuring the resilience of communities, Madeleine Edgeworth, Loughborough University	Resilience
Holistic and semantic decision and policy-making model for resilient and sustainable urban infrastructures, Giulia Cerè, Cardiff University	Resilience
Development strategies for future cities to ensure energy resilience, Ciaran Higgins (Part time), University of Strathclyde	Resilience
Eco-cities – Towards energy positive districts enabled by BIM Level 3 Semantics, Corentin Kuster, Cardiff University	BIM
Future City Transport Strategy Development, Konstantina Bimpou, University of Strathclyde	Smart/Future City
Property (efficiently and sustainably, resource efficiency, further proof, house quality)	
District heating and cooling optimization and enhancement, Yu Li, Cardiff University	Energy/stock modelling
Low cost approach for characterization of Residential Building stock for energy labelling, Ioanna Vrachimi, University of Strathclyde	Energy/stock modelling
Bringing big data into building energy modelling - building energy focused geodemographic classification, Steven Zhang, Loughborough University	Energy/stock modelling
Dynamic energy analysis for the built environment, Valentina Bonetti, University of Strathclyde	Energy/stock modelling
Ignition of solid fuels exposed to transient incident heat fluxes, Simon Santamaria, University of Edinburgh	Fire Engineering
Embedding a circular economy in the building sector, Katherine Adams, Loughborough University	Resource efficiency
Traceability in the construction supply chain (productivity), Asselya Katenbayeva, Loughborough University	Resource efficiency
Flood resilience: Improving building drying times, Fiona Gleed, University of Bath	Resilience
Real-time and semantic energy management across buildings in a district configuration, Jonathan Reynolds, Cardiff University	Smart/Future City
Smart Meter Data Analytics for Efficient Energy Management, Anthimos Ioannidis, University of Hertfordshire	Smart/Future City
Whole-Timber Structural Systems, Aurimas Bukauskas, University of Bath	Materials
Next generation natural fibre reinforced geopolymers, James Bradford, University of Bath	Materials
Optimising phase change material use for energy- efficient buildings, Ahmad Wadee, University of Bath	Materials
Automatic Generation of BIM Models by Semantisation of Building Data, an application in the energy retrofitting domain, Matthew Courtney, Cardiff University	BIM