

ZCSP Report – Buildings

WORK IN PROGRESS - This document may be incomplete and not peer reviewed.

Comments and corrections are welcome.

Smart controls / technology

- Current Situation

Emissions from homes and from commercial and public sector buildings account for 19% of total UK greenhouse gas emissions ^{*1} It is widely known that improperly designed and implemented control sequences can increase energy consumption by 20-30%^{*2} In the UK we have a fragmented and unconnected level of smart control with standalone measurement and visualisation of energy consumption. Most buildings will have some level of smart control, whether it is a residential dwelling with a thermostat and TRVs to a large commercial building with a Building Management System (BMS) that controls lighting and HVAC by software. Take a step within the building and you can find equipment and software differing in age which ultimately renders them incompatible.

Many supposed benefits of smart technologies overlap under the themes of convenience, control and safety. Many customers evaluate the benefits of smart control products without connecting them to the concept of smart management. Many look at smart control as a process to save time, remotely control their home and to be convenient. This is true, but it must be linked to an increased awareness of usage, spending, the environment and what the data means for our trajectory to a decarbonised world. Smart control cannot be isolated and we need to connect the dots to deliver a holistic approach.

- Shared Vision for 2030

A holistic integrated view of decarbonisation, smart energy, zero-carbon networks and Industry 4.0 to bridge the physical and digital worlds. On a granular level we need a systematic approach to handling raw data from sensors, meters and building management systems. Combine this with a high-level comparison of metered data with simulation results (Digital Twins) to long term monitoring post occupancy - of trends, patterns and correlations. A Digital Twin is 'a realistic digital representation of something physical'. A digital twin not only looks like the building, but behaves like the real building, responding to operational conditions and building occupancy. Creating an invaluable operational asset! ^{*3}

Sitting alongside smart control are smart tariffs. Octopus currently have a tariff call Agile which is a 'time-of-use' tariff, giving consumers half-hourly electricity prices which are updated daily. In this scenario when energy prices drop so do bills. Prices when demand is low fall into 'negative' - meaning that consumers can be paid to use energy during that period. Consumers could be paid to charge their electric vehicle helping to manage demand and avoid paying during expensive peak periods. This tariff process needs to become common place.

- Helpful strategies so far identified towards achieving ZCS Vision

Case Study – Trent Basin, Nottingham^{*4}

145+ low-energy homes with Real-time data in an interactive 3D Energy Model Digital Twin. Allowing measurement of energy consumption, generation, and occupant comfort and behaviour.

The Trent Basin-Community Information Model (TB-CIM) is a 3D model of the entire site overlaid with real data from the buildings, the PV array and the onsite electrical storage battery. The TB-CIM acts as an interactive online platform that displays historical and real-time energy data of the Trent Basin community with the aim of engaging residents and informing them of the ‘performance’ of the scheme at an individual building and a site-wide level.

Alongside energy consumption and generation, occupant comfort can be assessed

Internal temperatures, relative humidity and CO2 levels within individual apartments can be viewed and compared against other dwellings on the site

Interaction with the interface can be via a smart phone app or the 147inch touch screen interface within the community hub. The interface and content is digestible and accessible to residents of all ages

- Recommendations for action

Industry 4.0 has accelerated a digital transformation with the industry at the early stages of automation, cyber-physical systems, Internet of Things (IoT), big data, and digital visualisation and communication ^{*5}A holistic approach to smart control to provide real-time data needed to engage stakeholders, improve asset performance, influence future building design, and decarbonise at scale. Technology often leapfrogs policy therefore it is vital that the approach goes hand in hand. Ultimately smart technologies, enabled by our increasingly digital world, offer new products and services which help us to take control, and reduce, our energy use, and reduce bills.

^{*1} BEIS analysis of BEIS (2020), ‘Final UK greenhouse gas emissions national statistics: 1990 to 2018’

^{*2} Improving Controls Design and Delivery - CIBSE ASHRAE Technical Symposium, Glasgow, UK 16-17 April 2020

^{*3} Digital Twins, BIM and the Future of Sustainable Analysis in the Built Environment- CIBSE ASHRAE Technical Symposium, Glasgow, UK 16-17 April 2020

^{*4} SCENe (Sustainable Community Energy Network) is part of a £100 million regeneration project in Nottingham

^{*5} <https://www.i-scoop.eu/industry-4-0/#:~:text=Industry%204.0%20is%20the%20current,called%20a%20%E2%80%9Csmart%20factory%E2%80%9D.>

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