WHY SHOULD WE EMBED BUILDING PERFORMANCE INTO SMART HOME TECHNOLOGY?

BUILD TEST SOLUTIONS

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Introduction

Smart home technology is transforming the way people interact with and understand their homes. Whether to provide better security, control over energy usage, or improvements to our health, the industry is only set to grow over the coming years.

In Europe, the average household has **17.4 devices connected to the internet**, according to Forbes. From intelligent lighting systems that adjust based on natural light levels to thermostats that learn our preferences and optimise energy usage, smart home technology is becoming more accessible, integrated and commonplace in our daily lives.

Rather than only having the ability to use an app to control an individual aspect of your property, the data from smart devices can be used to **unlock more value and understanding about our buildings**, such as mould risk, overheating issues, energy efficiency, heat loads, air leakage rates and ventilation system effectiveness.

The purpose of this guide is to help both those engaging with and those developing smart home technologies to see the possibilities smart technology offers from a building performance standpoint, and how the data it collects could help to improve our buildings and general quality of living.

Split into three sections, the guide covers:

1. Current smart home technology capabilities
2. Empowering occupants with measurement
3. The future of smart home technology

1.

Current smart home technology capabilities

According to the Data Communications Company (DCC), at the time of writing there are almost 33 million smart meters connected to the energy market in Great Britain. These devices form the backbone of the nation's transition to smart, low-energy homes.

In-home displays, supplied alongside smart meters, allow customers to easily access and **assess their live energy and gas consumption** data. This helps users understand the appliances that are using the most energy, allowing them to tailor usage around tariffs and incentives by avoiding peak times for energy usage. There are also many apps that help householders get further benefits from their smart meters, like comparing available tariffs and participating in dynamic load-shifting events.

Investing in energy-efficient appliances, coupled with real-time monitoring and control, enables users to take further steps to **reduce both costs and their carbon footprint**. For instance, smart electric vehicle chargers and smart plugs can capitalise on low tariff signals.

Smart thermostats and heating controls also support carbon emissions reduction by helping to optimise heating and energy use. They typically help use less energy by learning your occupancy patterns or only targeting the delivery of heat into rooms when it's needed.

Temperature and humidity data from smart thermostats or other proprietary sensors can also inform people about comfort levels, help further optimise heating schedules and proactively determine mould and condensation risks before they impact homes and health. There are also a host of air quality sensors that can track air pollutant levels and link with existing ventilation systems to provide additional insights and advice.

Current technology shortfalls

Smart home devices are currently harvesting more building data than ever before, but this brings with it privacy considerations. If personal data is treated safely and combined with a larger data set, the data can provide a valuable oversight, without risking the personal privacy of the residents. Fortunately, the Smart Energy Code (SEC) defines the rights and obligations of energy suppliers, network operators and other relevant third parties to protect against any misuse. There are also many personal data protection regulations and requirements that apply to smart home appliances, EV chargers and smart heating controls.

Despite this extensive quantity of data, technology tends to use the data for a sole purpose, such as metering electricity usage or optimising heating schedules. Many technology platforms rarely allow residents and homeowners to access the data streams being collected or use that data for other purposes. Without this flexibility, **residents can't fully understand the energy efficiency of their property**, the effectiveness of heating and ventilation systems or how their energy use behaviours affect running costs or health and wellbeing.

However, by improving data accessibility, standardising communication and thinking outside the box there is additional value that can be unlocked. Households need to be shown the value of building performance data and insights in order to engage them more with the possibilities that come with having an understanding of their property. Only then can meaningful actions be taken to improve property thermal performance and comfort levels.

2.

Empowering occupants through measurement

The UK must dramatically scale up its efforts to improve building energy efficiency and decarbonise the grid. The UK Green Building Council estimates that nearly 29 million homes need to be retrofitted before 2050 and without household engagement, this will be a tough target to meet.

Occupants need to first understand whether their building is above or below average thermal performance levels, before making any commitments.

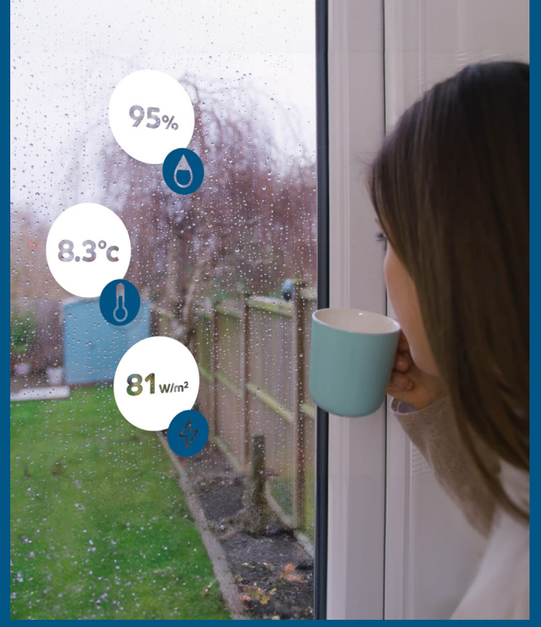
Smart home technologies are capable of providing some key building performance insights including but not limited to:

- **Thermal performance –** to identify both overall efficiency as well as key problem areas in a building
- **Peak heat demand –** so the correct size low carbon heating solutions can be identified and installed
- **Mould and condensation risk –** so occupiers can understand the health risks and required actions
- **Indoor air quality –** to assess air quality levels and the effectiveness of existing ventilation levels
- **Air leakage rates –** to help improve energy efficiency and reduce draughts

These data points can provide guidance around the most effective energy efficiency improvements for the individual property, along with the best order to complete them. Each building will require a different approach depending on occupant budget and motivations – such as lower bills, improved home comfort, or lowering carbon emissions.

Data, such as internal ambient temperature and 30-minute interval gas and electric energy usage assessments, can be used to drive building performance insights. These insights can in turn **help households to understand their home** and what the most suitable retrofit strategy could be for their unique situation. Upgrades identified from the insights gathered are likely to include some of the main issues that need solving first, such as cavity wall and loft insulation, draught proofing and other lower-cost building fabric improvement measures. Depending on the measured fabric performance, other recommendations may include the adoption of low carbon heating solutions, smart controls, PV and battery storage, ventilation or perhaps deep fabric retrofit where internal or external wall, floor insulation and room-in-roof insulation are required to achieve optimum energy efficiency.

Smart tech-enabled data gathering can also support energy and retrofit assessors and other independent advisors in obtaining historical data from months or even years before. They can use this to **provide a more accurate assessment** and reduce the number of performance assumptions required.



Educating homeowners

Education about smart home tech and its features and benefits is critical to homeowner empowerment. If homeowners hear about success stories and the financial impact new technologies can have on their lives, the demand for these products will increase.

Government subsidies and grants are helping to support the decarbonisation of homes in certain cases, but without effective education, the wider market such as homeowners and private landlords could be sceptical about whether these innovations are needed, the difference they will really make, or whether they will suit their homes and lifestyles.

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>
> **Luke Smith, managing director at Build Test Solutions**

The impact on tenants

Smart home technology has applications across a wide range of market segments. In the rental sector, it can **support landlords** by providing insights remotely, but this must be done with resident consent and in a way that doesn't compromise resident privacy.

Smart home technology should allow landlords and social housing providers to gain an overall insight into their properties. However, it should not show them access to the granular data that could impact tenants' privacy, such as temperature and energy data that can determine occupancy patterns.

Luke Smith, managing director at Build Test Solutions, commented: "IoT or smart home energy management systems can be installed to help landlords proactively manage their housing portfolios, address poorly performing properties and find properties with the greatest mould, condensation or overheating risks."

Landlords can use the data and building performance insights to better **target the most effective retrofit solutions to improve living conditions for residents**, such as boosting the thermal efficiency of the building or increasing ventilation. By using data, building owners identify problem areas and tailor their approach before poor thermal performance or moisture imbalance issues manifest as mould or wider building defects within the property. Landlords can also use temperature and energy data to assess a property's suitability for heat pumps or insulation upgrades, without having to cause disruption with numerous in-person surveys.

Data-led measurement also **improves the relationship residents have with their landlords** or social housing providers. It provides them peace of mind that their buildings are safe to live in and that any issues will be confronted before living conditions are impacted. Having open conversations with residents about the insights will also allow social housing providers to educate tenants about specific actions that could make issues worse, like using a clothes hanger to dry clothes or having the heating or ventilation turned off during colder months.

Smart home energy management systems can also be used by tenants to send messages to the housing provider, asking for specific maintenance, which can be **backed up by the data** that is being received.

3.

The future of smart home technology

Use the technology available

Luke Smith explained: “The algorithms to enable smart home technology integration already exist. Our mould risk and overheating risk indicators can be integrated into smart thermostats and sensor-based Internet of Things (IoT) platforms to present a risk score for mould, condensation and overheating concerns in individual rooms.

Thermal performance measurement algorithms, like **SmartHTC**, offer a **low-cost, scalable test methodology** that provides a definitive measure of the thermal performance of a building. It simply requires average internal temperature and energy consumption data to provide insights into both the effectiveness of existing insulation and draught stripping, as well as determining the peak heat load of the building.”

Smart home product manufacturers need to consider the positive impact data science, building physics expertise and software capabilities can have on their products. They must explore these options to remain competitive, as the construction and retrofit industries become more measurement-focused.

Where is technology going

There are already businesses creating products that could significantly impact future building data collection:

geo

SeeZero is a ground-breaking home energy management system developed by Geo. It serves as a smart meter display and smart thermostat that **moderates how and when a home draws from the grid**. It then provides guidance of the householder that helps them find energy bill savings and reduce their peak energy demand.

hildebrand

Energy technology and data analytics company, Hildebrand, has been working with the DCC and the University of Salford to develop and trial a means of **temperature and humidity sensing** that utilises the existing smart metering communications network. The company also offers its **Glow platform** for householders and installers to bring together smart meter and temperature data for the purposes of heat pump sizing and performance evaluation.

switchee

A technology business focusing on smart thermostats in social housing is **Switchee.** Their devices act not only as a heating controller but also provide **real-time data about temperature, humidity and occupancy** to social housing providers to help support residents and manage their buildings. It can also provide actionable insights that can be passed on to residents about how they can **reduce energy costs and improve comfort**.

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There are also companies focussing specifically on standalone low-cost sensors and gateways that can offer a discreet, versatile means of tracking building environmental conditions and performance. Companies in this space include the likes of **Purrmetrix**, **Aico HomeLink**, **iOpt** and others.

In support of this innovation, we are also increasingly seeing improved interoperability between devices. Businesses, like **Matter**, are working on open-source standards for devices to allow end-users to get data transmission between all smart devices and control them in one centralised location, even if they are from different manufacturers.

Scope for future innovation

Innovation must continue to ensure smart home technology is as useful to its end users as possible. Data and building performance measurement algorithms can be readily integrated with existing devices or incorporated into dashboards by manufacturers to provide live updates about buildings and rooms that lose the most heat and, most importantly, how they can be fixed.

Actionable insights can help **advise residents and homeowners to contact a retrofit assessor** or other independent experts, who can provide more specific insights and start an energy efficiency journey. Multiple insights from the data can help pinpoint the key interventions for the householder, so issues are not only flagged but also solved.

Wireless and Bluetooth devices have been commonplace since the early 2000s, and they have created a boom in accessible devices and consumer choice. This technology also allows for easier adoption and installation of smart devices through the DIY market. This places less onus on installers and enables data to be captured across as wide a range of applications as possible.

As the smart home technology industry continues to **develop and innovate**, manufacturers and the wider retrofit supply chain need to look at how existing technology can be integrated and made the most of, to keep their businesses competitive and informed.

Learn more about Build Test Solutions’s thermal performance, mould and air-tightness measurement technologies on the website buildtestsolutions.com

Contact

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