

## International Conference on Sustainability in Energy and Buildings

### Invited Sessions

**Title of Session:**

How much user control is a good amount? - user interaction and smart controls in low energy and passive buildings

**Name of Chair:**

Dr. Jing Zhao, University of Lincoln, U.K.

Dr. Kate Carter, University of Edinburgh, U.K.

**Description:**

The increase in Passivhaus and ultra-low energy buildings needed to tackle the climate emergency is accompanied by an evolution in the heating and ventilation systems, sensors and controls at the heart of homes. Heating and cooling systems, including: mechanical ventilation and heat recovery; PV and solar thermal systems; heat pumps; and integrated HVAC systems, are accompanied by increasingly sophisticated sensor and controls (mobile and off-site control, digital monitoring system to full Home Automation systems and Smart IoT sensors). With the fine balance of energy, building fabric and systems in these houses, Le Corbusier's '*machine for living in*' seems to be an emerging reality. What role does the human have in this world of controlled environments? Where is the thermal delight in a free-running building so eloquently expressed by Heschong (1979)? In other words, how much user control is a good amount?

Lack of familiarity and awareness of systems to heat, cool and control the spaces may contribute to a performance gap in Passivhaus. The array of solutions in new build homes, and retrofit of existing buildings create a largely uncharted socio-technical landscape for occupants to navigate comfort (Ellsworth-Krebs et al. 2019). Moreover, depending on the user's age, gender, cultural background, physical and mental abilities, as well as their opinions, attitudes and beliefs, the idea of 'controlled environment' or 'smart homes' represent very different practice in their everyday energy management. Research from a socio-technical perspective has shown close relations between user interaction with control system and energy use. Recent paper by Zhao & Carter (2020) advocates that user control should not be designed out of the operation of built environment technology. Yet, not enough evidence exists to address the inevitable digitalisation and automation of the built environment and its effect on user's interaction, satisfaction and sustainable behaviour in passively designed buildings.

This session focuses on recent research and development of new and smart building technical and control systems in the use of improving operational energy performance, as well as building user's attitudes, opinions and interactions with these systems. Different to standard Post Occupancy Evaluation methodologies, this session embraces interdisciplinary examination of energy use and smart control of buildings designed to a high energy performance standard.

Papers submitted under this track falls under following themes:

1. Energy behaviour and practice in low energy and passive buildings, with a focus on a specific demographic or cross-demographic examination.
2. Retrofitting smart buildings/homes to improve energy efficiency, with a focus on user interaction and lived experience.

Heschong, L (1979) Thermal delight in architecture. Cambridge, Mass.: MIT Press.

Zhao, J & Carter, K (2020), 'Do passive houses need passive people? Evaluating the active occupancy of Passivhaus homes in the United Kingdom', *Energy Research & Social Science*, vol. 64

Ellsworth-Krebs K, Reid L and Hunter C (2019) 'Integrated framework of home comfort: relaxation,

companionship and control' *Building Research & Information*, (2019), 202-218, 47(2)

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