

Introduction to Panel 8

Buildings: technologies and systems beyond energy efficiency

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Introduction

The building sector plays a crucial role in international carbon and energy reduction targets as well as in the quest to a renewable energy system. New buildings are designed with minimum energy requirement to approach the nearly-zero energy building (nZEB) standard, however technologies and systems going beyond energy efficiency is often overlooked as they are not part of legislation or a minor part thereof. Such systems and technologies can create added values for consumers, building owners and often help the designers to reach their targets. The legislation for existing buildings is often based on single performance of products and here the challenge is to facilitate the cost-effective transformation of existing buildings into nearly zero-energy buildings. Renovating existing buildings towards nZEB levels could facilitate the reach of ambitious goals of decarbonising the building stock, as 2050 targets used in the long-term renovation strategies drawn up in the application of EPBD. Many technological solutions are currently available, but reaching an optimal implementation and control remains a major challenge.

How to combine building energy demand and energy supply system to reduce CO₂

Traditional energy supply to ZEB buildings can be a major challenge as the distribution costs often can be above the cost for the energy used. The panel discusses different solutions for low temperature district heating, battery storage, implementation of price signal for optimised use of energy.

One case study focusses on supplying low temperature district heating energy to 550 new dwellings at nZEB standard in the Ranagård district. The low energy demand of nZEBs (low

mean U-value of building envelope), mechanical ventilation with heat recovery allow the implementation of a sharp network configuration with low-temperature based on renewable, recovered, and stored heat. Another case study focusses on the optimization of user appliances and battery storage charging and discharging to respond to real-time price schemes and the eventual availability of self-generation, without discomfort for the consumer. The study seeks to evaluate the situations in which load flexibility could allow a renewable energy system to be cost-effective.

The findings show the options and a pathway, but they also indicate that traditional energy systems need to be further developed towards the new demand from new and existing nZEB buildings.

ABSTRACTS AND PAPERS

- 8-149-21 'Ranagård with new 4GDH technology' by Heidi Norrström (peer-reviewed paper)
- 8-150-21 'Optimized scheduling of battery storage and appliances for demand response' by Luís Neves & Luca Zampighi (peer-reviewed paper)
- 8-198-21 'How far can building energy efficiency bring us towards climate neutrality?' by Diana Úrge-Vorsatz et al (extended abstract)

Nudging consumers to create good indoor comfort at low use of energy

The human behaviour is a factor not to be underestimated in the transition towards a zero-carbon society. Several studies show a rebound effect (based on among others higher indoor

temperature in renovated buildings) and lack of actions to reduce energy use in new nZEB buildings. Nudging consumers to act is a potential tool to use in the transition.

The panel discusses a highly relevant study on how low rents and low ancillary costs can be combined by applying concepts for reducing these costs in “low rent” residential buildings in Germany. Another discussion is an experiment to gather early insights on building performance by monitoring the change in energy use, indoor temperature and relative humidity profiles before and after installation of heat pumps and smart controls in social housing dwellings in UK.

The findings show that information to consumers can optimize the energy use in the buildings and by integrating knowledges on the indoor comfort, people can be nudged to avoid the use of energy in peak periods and nudge them to save energy.

ABSTRACTS AND PAPERS

- 8-058-21 ‘Laboratory testing of residential heat pump controllers for demand response using pricing profiles’ by Ammi Amarnath et al (peer-reviewed paper)
- 8-101-21 ‘Consume and pay less – a budget approach for running costs in social housing’ by Marc Großklos & Tobias Loga (peer-reviewed paper)
- 8-137-21 ‘Natural experiment to measure change in energy use and indoor environment in dwellings with smart heat pump retrofits’ by Sahar Zahiri et al (peer-reviewed paper)
- 8-180-21 ‘Indoor summer comfort: a study into the practical useability of sustainable cooling systems’ by Thomas Wuyts et al (peer-reviewed paper)

How to accelerate the route to climate neutral building stock

In order to reach a Nearly Zero society by 2050, the IEA recommends the construction sector to grow the renovation rates to 2.5 % and implement Net Zero Carbon ready buildings by 2030 in all legislations for new built.

One of the debates revolves around homeowner motivation and the development of a good business model for energy renovation of single-family houses. A good business model should make it easier for individual homeowners to implement relevant measures which contribute to a sustainable energy system. Another debate is about carbon taxes implementation on the cost effectiveness of energy efficient measures applied to an existing multi-apartment building. The debates also include focus on the design, the use of materials with low CO₂ content and the needed optimizations in the energy supply to meet the 2030 targets.

The discussions show many options to move forward, but it also indicates that there are still actions to take to motivate building owners.

ABSTRACTS AND PAPERS

- 8-051-21 ‘The European heating system at a tipping point’ by Mélissa Zill et al (peer-reviewed paper)
- 8-067-21 ‘Accelerating the energy-efficiency renovation of single-family houses’ by Hanna Westling & Agneta Persson (peer-reviewed paper)

- 8-107-21 ‘Energy efficient measures for thermal envelope of a multi-apartment building in Sweden: analysis of cost effectiveness with respect to carbon abatement costs implementation’ by Youcef Boussaa et al (peer-reviewed paper)
- 8-209-21 ‘SMARTWARE – certified low energy – passive house office building’ by Marius Soflete & Dragos-Ionut Arnăutu (extended abstract)

Methodologies for better decision and quality towards carbon neutrality in buildings

The decision process for consumers, homeowners, and landlords who want to renovate their home or built with minimum impact on the environment is often filled with gaps and information that leads the decision process in different direction.

The debates include how social housing is managed to identify factors linked to low-carbon retrofit which may increase overheating risks, and mitigation strategies that could be adopted by landlords to manage them. The debate also includes the construction processes, how LCA can be used for decision processes, how thermal cameras (thermography) can support on site operatives’ awareness towards defects, as well as solutions to tackle the challenges with lack of knowledge regarding how the products and systems have been tested.

ABSTRACTS AND PAPERS

- 8-078-21 ‘Low-carbon retrofit of UK social housing and overheating risks: causes and mitigation strategies’ by Daniel Kerr & Andrew Reeves (peer-reviewed paper)
- 8-091-21 ‘Visualising defects via thermography (DeViz): a combined technological, behavioural and quality systems approach to achieving near zero defect buildings’ by Julie Goodhew et al (peer-reviewed paper)
- 8-095-21 ‘Hot air or real solution? What role can decentralized ventilation systems play?’ by Agneta Persson & Sanna Börjeson (extended abstract)
- 8-151-21 ‘A novel approach for assessing the multiple benefits of energy efficiency technologies’ by Marcos Tenente et al (peer-reviewed paper)

Combining smart building features for energy efficient buildings

The “Smart Readiness Indicator” concept include several intelligent and technical solutions for use of energy to control of indoor comfort and human behaviour.

The panel mainly focuses on areas such as implementation of smart technologies to optimise energy use and to take the buildings partially off-grid, as well as debates around the readiness of the Smart Building Indicator to provide the needed flexibility to make it attractive. It also includes how intelligent solutions can be used in cost-effective efficiency upgrades of technical systems on and off site. Legacy gas boilers with a combination of home-IoT with digital interfaces and nudging interventions that can help meet the updated EED requirements by

preparing the energy providers and the supporting ecosystem to deploy the offered solution to consumers.

ABSTRACTS AND PAPERS

- 8-037-21 'User engagement analysis for smart buildings based on social trend tracking' by Jiao Jiao et al (peer-reviewed paper)
- 8-093-21 'Evaluation of smart energy solutions in a multi-family apartment building in Småland, Sweden'

- by Katarina Rupar-Gadd & Krushna Mahapatra (peer-reviewed paper)
- 8-144-21 'On the smart buildings–smart grid interactions' by Álvaro Gomes et al (peer-reviewed paper)
- 8-205-21 'Nudging the delivery of the EED through home-IoT and digital user interfaces' by Stratos Keranidis & Filippos Anagnostopoulos (extended abstract)