Presentation of the IEA-EBC Annex 86 and ST4-smart ventilation subtask

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SUMMARY

IEA-EBC Annex 86 "Energy Efficient IAQ Management in residential buildings" aims to propose an integrated rating method for the performance assessment and optimization of energy efficient strategies of managing the indoor air quality (IAQ) in new and existing residential buildings. Our goal is to work in an international collaboration so that the different approaches to design and operation of ventilation in different countries are accounted for. The work includes collection and systemisation of existing knowledge and data regarding pollution sources in residencies, turning performance based evaluation methods into practice as well as exploring the opportunities brought by IoT connected sensors. Rather than conducting new laboratory research and tests, we want to study current use cases representing innovative IAQ management strategies and based on them, develop road maps to ensure the continuous performance of the proposed solutions over their lifetime.
The project gathers experts from different fields including mechanical engineering, building science, chemistry, data science and environmental health, who will work together with other stakeholders. We divide our work into six subtasks. One of them, subtask 4, has a direct focus on ensuring performance of smart ventilation. This means a focus on practical conditions that assure reliable, cost effective and robust implementation of smart ventilation.

KEYWORDS

Smart ventilation, residential ventilation, IAQ, energy efficiency

1 INTRODUCTION AND OBJECTIVES

This paper deals with the introduction to the Topical Session: "Smart ventilation strategies for residences - practical applications". The energy performance of new and existing residential buildings needs a radical improvement in order to meet ambitious climate change goals. Residential buildings are by far the largest component in the total building stock. A central boundary condition in constructing energy efficient buildings is doing so while maintaining a healthy, acceptable and desirable indoor environment. Indoor Air Quality (IAQ) is one of the vital parts forming such environment. Ventilation is the main strategy usually adopted for IAQ management and there is a large number of different ventilation strategies. There are also other technologies influencing IAQ, for example air filtration, or air cleaning. There is, however, no coherent assessment framework to rate and compare the performance of such IAQ management strategies. The IEA EBC Annex 86 will therefore focus on assessing the performance trade-off between and identifying the optimal solutions for maximizing energy savings while guaranteeing a high level of IAQ in new, renovated and existing residential buildings.

2 METHODS AND RESULST

The project scopes on residential buildings because they generally represent the largest section of the building stock. They are occupied by variety of users who use them in different ways and conduct a broad range of activities. These influence the IAQ as well as building construction. As the same time, there are fewer studies focused on residencies, than on other types of

buildings (e.g. offices and schools). Additionally, residential building projects often lack the funds for extensive bespoke engineering and therefore require robust cost-effective standardized solutions that can be implemented at large scale.
For the study of specific IAQ management strategies we will mainly focus on the use of smart materials and smart ventilation (Durier et al., 2018), since these are the strategies that have a notable energy efficiency potential. Air cleaners are already studied in a separate project (IEA EBC Annex 78, 2022) and are therefore not studied in detail in this annex. The Table 1 presents the project's six subtasks.

Table 1- Subtasks of the project

Subtask 1	Metrics and development of an IAQ management strategy rating method
Subtask 2	Source characterization and typical exposure in residential buildings
Subtask 3	Smart materials as an IAQ management strategy
Subtask 4	Ensuring performance of smart ventilation
Subtask 5	Energy savings and IAQ: improvements and validation through cloud data and IoT connected devices
Subtask 6	Dissemination, management and interaction

The present topical session focuses on smart ventilation strategies for residences and their practical applications. That is the focus of Subtask 4 of the project. The subtask deals with practical conditions that assure reliable, cost effective and robust implementation of smart ventilation. A poor performance of smart ventilation systems cannot only lead to waste of energy and aggravated IAQ. It can also create a bad reputation of smart ventilation among relevant stakeholders - designers, installers as well as occupants. This, in the end, can lead to adoption of more primitive, less efficient (in terms of energy use) and less effective (in terms of IAQ) forms of IAQ management. The subtask has four activities covering different aspects related to ensuring the correct performance.

Table 2 – Activities in the Subtask 4- Ensuring performance of smart ventilation

Activity 4.1- Rating existing smart ventilation strategies	Overview of existing strategies as well as performance based approaches to their rating. Common exercise gathering knowledge about advantages, barriers and challenges. Proposal of a generic and broadly applicable rating strategy.
Activity 4.2- Quality control of implementation	Based on the information collected from real application cases of smart ventilation strategies, this activity will propose quality management schemes and inspection protocols for securing performance of smart ventilation systems.
Activity 4.3- Durability of smart ventilation systems and components	This activity will collect feedback from laboratory studies as well as real case studies, in order to address the issue of durability of the sensors and other components.
Activity 4.4- Occupant interaction	This activity will focus on data about the impact of interactions between the occupant and the system on the (perceived) performance and acceptability.

3 REFERENCES

Durier, F., Carrié, R., Sherman, M. (2018). What is smart ventilaiton? Ventilation Information Paper nr. 38, Air Infiltration and Ventilation Centre (AIVC), *INIVE EEIG, Brussels – Belgium*

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