SUPPORTING EFFICIENT NATURAL VENTILATION WITH OPEN WINDOW DETECTION – PUBLIC SUMMARY

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Residential heating accounts for a tenth of the global energy consumption (IEA, 2020). Increasing its energy efficiency is impactful in the combat against climate change. During natural ventilation, warm air is replaced with cold air from outside through opened doors or windows. The ventilation rates in a room are influenced by window type, room geometry, wind characteristics, temperature difference, opening size and location of openings. The only general approach regarding the progress of natural ventilation can be found in the temperature behaviour, as wind characteristics and cross ventilation cause ventilation rates to be unstable. Short, frequent airing prove to be more energy efficient than longer periods of airing, as much of the heat stored in the building and furniture is conserved. The optimal ventilation time can be determined based on the temperature behaviour.

Open Window Detection (OWD) is the function of a heating system which detects increased ventilation caused by open doors and windows. Bosch' state of the art OWD analyses the temperature gradient for internal detection and allows the use of contact sensors for external detection. When a positive detection occurs, the heating is turned off. Competitors use similar detection methods and measures, varying in internal or external detection and heating shutdown time. Due to the variable characteristics of rooms, the accuracy of OWD in a system relies heavily on its ability to adapt to its unique location. This adaption can be achieved at low cost by adding window contact sensors to the surroundings, or by allowing the system to analyse temperature behaviour in order to learn about its environment. Bosch' OWD allows custom configuration of a threshold. However, this action is too difficult for a regular user.

While natural ventilation is closely related to the energy efficiency of heating and necessary for users to uphold their indoor air quality, little knowledge and support is provided to minimise the heat loss it causes. For a more responsible use of energy with regard to residential heating, an efficient collaboration between natural ventilation and heating systems is essential. Because natural ventilation is rarely an automated process, supporting users in their ventilation behaviour is key. Where current systems only notify users, additional support should be offered in the form of suggested actions and knowledge.

Every room provides different temperature behaviour in the case of an open window. Therefore, a custom temperature gradient threshold is needed to accurately detect ventilation. A foundation for this adaptive threshold can be established using a calibration run. The calibration is a system function that is used to familiarise the system with its surroundings. It can be conducted by an installer or a user shortly after installation of the heating controls.

Concluded can be that for a more responsible use of energy with regard to residential heating, an efficient combination of natural ventilation and heating systems is essential. Because natural ventilation is rarely an automated process, supporting users in their ventilation behaviour is key. Where current systems only notify users, additional support should be offered in the form of suggested actions and tips. Implementation of support functionalities like the calibration run and the other concept functions described in this report have the potential to steer user behaviour towards a more sustainable path without them experiencing decreased comfort. The overall impact of a more energy efficient user behaviour regarding residential heating could be significant in the decrease of global energy usage.

IEA, "Energy Efficiency Indicators 2020", IEA, Paris, 2020.