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Yangmin Wang: Sustainable retrofit solutions for European residential buildings
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Sustainable retrofit solutions for European residential buildings

Global warming is mainly caused by greenhouse gas (GHG) emissions coming from human activities, and energy consumption accounts for 75 % of total GHG emissions. As an important energy consuming sector and GHG emissions contributor, buildings consume about 40 % of primary energy and share 17.5 % of total GHG emissions. Therefore, several building energy efficiency regulations were introduced to boost energy performance of the buildings. Nevertheless, new constructions built according to the energy efficiency regulations only account for little more than 1 % of the building stock per annum, while existing buildings with lower energy efficiency share the majority of the building stock. Thus, rather than just focus on new buildings, it is more important to implementing energy renovations in existing buildings towards lower energy consumption and CO2 emissions.

This study aims at providing feasible retrofit concepts for European residential buildings in the temperate or hot regions. To explain these retrofit concepts intuitively, three representative residential buildings in different countries were chosen as the demo buildings to implement different novel energy-saving measures proposed in SUREFIT project. These demo building models were simulated with an intermittent or continuous heating schedule in IDA Indoor Climate and Energy simulation software (IDA ICE), and used as the reference cases for retrofit technologies simulations. The retrofit technologies were divided into different retrofit packages and integrated into the building models to examine their impact on building energy consumption and indoor climate. Finally, several scenarios of retrofit packages combinations were simulated to check the lowest building energy consumption and best indoor climate after renovation.

According to the simulation results, the proposed retrofit technologies all have a certain impact on building energy consumption and indoor climate, while their impact varies significantly in different demo buildings. For retrofit packages combinations simulated based on the intermittent heating schedule, there is at least one combination scenario that can meet the reduction of building energy consumption after renovation by close to or higher than 60 % in each demo building. When these demo buildings are continuously heated, the energy consumption reduction after renovating with retrofit packages combinations is up to 22 % higher than the same combination scenario simulated with the intermittent heating schedule.