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Evaluating the Potential of Hybrid Ventilation for Small to Medium sized Office Buildings with Different Intelligent Controls and Uncertainties in US Climates

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Abstract

Coupling natural ventilation with mechanical ventilation, hybrid ventilated buildings have the potential to minimize the energy bills for owners without compromising the thermal comfort of building occupants. The thermal performance of this type of building is much more robust compared to naturally ventilated buildings due to the supplementary cooling provided by the mechanical system when the outdoor environment is not favorable. With benefits of both energy saving and health improvement, the hybrid ventilation is promising to make buildings more sustainable and occupants healthier. The first step to popularize this type of building is to clearly realize its benefits across different climates. To fully map out the potential of utilizing hybrid ventilation, in our study, we applied general uncertainties and different intelligence levels of building control to an illustrative small to medium commercial building to investigate potential benefits of hybrid ventilation across different climate zones in US with respect to energy saving. The research is composed of two phases – the first phase for a preliminary investigation and the second phase for a thorough investigation. The results show that the hybrid ventilation could help save 10% ~ 50% of energy across different climates. In US, Climate 3B Coast – Los Angeles and Climate 3C – San Francisco are the most suitable climate zones for the hybrid ventilation based on our investigation while the other zones share similar potentials (window opening hour percentage). Lastly, improving the hybrid ventilation operation intelligence turns out to be significant in enhancing the performance of hybrid ventilation buildings. Large discrepancy of energy saving is

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