

Energy Interaction among HVAC and Supermarket Environment

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Abstract : Supermarkets are the most electricity-intensive type of commercial buildings. The unsuitable indoor environment of a supermarket provided by abnormal HVAC operations incurs waste energy consumption in refrigeration systems. This current study briefly describes significantly solid backgrounds and proposes easy-to-use analysis terminology for investigating the impact of HVAC operations on refrigeration power consumption using the field-test data obtained from building automation system (BAS). With solid backgrounds and prior knowledge, expected energy interactions between HVAC and refrigeration systems are proposed through Pearson's correlation analysis (R value) by considering correlations between equipment power consumption and dominantly independent variables (driving force conditions). The R value can be conveniently utilized to evaluate how strong relations between equipment operations and driving force parameters are. The calculated R values obtained from field data are compared to expected ranges of R values computed by energy interaction methodology. The comparisons can separate the operational conditions of equipment into faulty and normal conditions. This analysis can simply investigate the condition of equipment operations or building sensors because equipment could be abnormal conditions due to routine operations or faulty commissioning processes in field tests. With systematically solid and easy-to-use backgrounds of interactions provided in the present article, the procedures can be utilized as a tool to evaluate the proper commissioning and routine operations of HVAC and refrigeration systems to detect simple faults (e.g. sensors and driving force environment of refrigeration systems and equipment set-point) and optimize power consumption in supermarket buildings. Moreover, the analysis will be used to further study FDD research for supermarkets in future.

Keywords : energy interaction, HVAC, R-value, supermarket buildings

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