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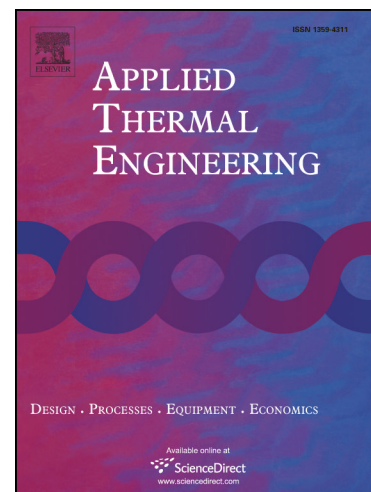
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## Evaluation of renewable energy utilization efficiency in buildings with exergy analysis

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**Abstract:** Renewable energy is increasingly used in the building nowadays, how to scientifically evaluate the renewable energy utilization efficiency is a problem worthy of study. Considering extra conventional energy consumption, based on exergy analysis method, a general formula is proposed to evaluate the utilization efficiency of the building renewable energy. The evaluation indexes of substitution rate are deduced, which is divided into two categories. One is for single kind of renewable energy output, another is for multi-output, which can get two or more cooling, heating or domestic hot water by the same renewable energy system. The building common renewable energy system ground source heat pump (GSHP) for heating and cooling, and solar thermal system for heating are analyzed in this paper with the method. The results show that for single kind of renewable energy output, if the exergy efficiency of conventional energy system is greater than the renewable energy system, the renewable energy substitution rate must be less than zero, which means the renewable energy utilization shouldn't be encouraged. For renewable energy multi-output, if the substitution rate for one kind of output is minus, another kind of output is greater than zero, the total substitution rate may be more than or less than zero, which should be calculated to estimate the renewable energy utilization is reasonable or not. For ground source heat pump(GSHP) system, the higher the efficiency of the conventional

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