

能源和环境工程

## 复合热源太阳能热泵热水系统性能模拟

杨磊, 张小松

东南大学能源与环境学院

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摘要

提出了一种复合热源太阳能热泵热水系统, 通过阀门切换, 可以根据不同的天气状况改变运行模式, 以空气和太阳辐射作为热源制取生活用水。针对设计的150 L热水系统建立了数学模型, 对不同运行模式下的性能进行了计算机模拟分析, 分析了太阳辐射强度及环境温度对系统性能的影响, 并计算了系统的全年运行状况。从模拟结果可以看出, 热泵串联集热器模式 (HP+SC) 比集热器串联热泵模式 (SC+HP) 耗时稍长, 但COP更高, 各月总热效率前者略高于后者。COP及总热效率均随太阳辐射强度及环境温度的升高而升高。在4~10月的晴朗天气下, 应尽量优先采用集热器模式 (SC), 仅在完全没有太阳辐射时才使用热泵模式 (HP)。

关键词

[复合热源](#) [运行模式](#) [性能模拟](#) [全年状况](#)

分类号

## Performance simulation of multiple heat source solar heat pump water heater system

YANG Lei, ZHANG Xiaosong

### Abstract

A multiple heat source solar heat pump water heater system was presented. This system can heat residential water from air heat source and solar radiation by valve switching, based on different weather conditions. A numerical model for 150 L water heating was established. The performance of different operation modes was simulated. The effect of solar radiation and environment temperature (air heat source) on the system performance was analyzed and the all year round operation status was also calculated. The results showed that heat pump with solar collector mode (HP+SC) took a slightly longer heating time than collector with heat pump mode (SC+HP) and had a higher COP. The former had a high monthly total thermal efficiency than the latter. Heat pump COP and total thermal efficiency increased with increasing solar radiation and environment temperature. On sunny days in April to October, solar collector mode (SC) should have top-priority to save electricity. Heat pump mode (HP) should be only utilized in non-solar radiation conditions.

### Key words

[multiple heat source](#) [operation mode](#) [performance simulation](#) [all year round status](#)

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