

熱泵熱水系統能效資料分析-以大學生宿舍為例

王翠蘭*

輔仁大學商學研究所

李天行

輔仁大學商學研究所

謝邦昌

台北醫學大學管理學院院長

摘要

因應全球節能趨勢及減少溫室氣體排放和降低運營成本，熱泵被廣泛安裝在大學學生宿舍中，以提供沒有使用時間限制的沐浴用熱水；為確保始終有熱水，避免客訴，初步建置的熱泵熱水系統中，熱水儲水槽水溫的設定，通常非常保守，並配有額外的回水加熱設備。

通過使用更精確的動態溫度設定可以提高能效，減少支出與不必要的浪費，之前尚無使用大數據分析來提高熱泵能效的實例研究，本研究以實際運行數據來識別潛在節能因素，然後概述如何動態設置溫度的系統化模組，以2016年熱泵熱水系統實際數據，經過檢視與分析，我們確定了兩個可以作為未來自動化動態控制模組的關鍵變因：室外空氣溫度和設定溫度點的日期類別。

本研究結果展現了能效方面的顯著改進：節省了1/3的能源浪費，降低1/5的壓縮機起停次數和30.37%的能源成本，以研究結果建立的動態控制模型，顯著的提高能源效率，可以預期創造創新和可持續的再節能業務模式。

關鍵字：能源技術服務業，熱泵熱水系統，局部散點平滑估計法、回水加熱、加熱能力

* 通訊作者 E-mail: 004330@mail.fju.edu.tw

Performing Data Analysis on Energy Efficiency of Heat Pump Hot Water System -A Case Study of University Student Dormitory

Tsuey-Lan Wang[†]

Graduate Institute of Business Administration, Fu Jen Catholic University

Tian-Shyug Lee

Graduate Institute of Business Administration, Fu Jen Catholic University

Ben-Chang Shia

College of Management, Taipei Medical University

Abstract

In response to the global trend of energy saving and the reduction in greenhouse gas emissions and operating costs, heat pumps are widely installed in university student dormitories to supply hot water without time limits. To ensure hot water is always available, the set point of water temperature is usually very conservative and accompanied by additional backwater heating equipment. However, the energy efficiency could be enhanced by using more accurate temperature set-point. To our best knowledge, there is no prior studies using big data analysis for improving energy efficiency. In this study, we use actual operational data to identify the advanced potential energy-saving factors in the first place, and then outline the system modules of how to set temperature dynamically.

Using a real case of automatic control modules of heat pump hot water system in 2016 we identify two key factors: outside air temperature and the date of setting temperature point. We demonstrate a significant improvement on energy efficiency: a saving of 1/3 energy waste, 1/5 re-start times, and 30.37% energy costs. Our model of showing a significant improvement on energy efficiency indicates that innovative and sustainable energy business models could be expected.

Keywords: backwater heating, energy service companies(ESCO), heating capacity, heat pump, LOESS

[†] Corresponding author E-mail: 004330@mail.fju.edu.tw