SEMARAK ILMU PUBLISHING

Journal of Advanced Research in Fluid Mechanics and Thermal Sciences

Journal homepage:
https://semarakilmu.com.my/journals/index.php/fluid_mechanics_thermal_sciences/inde
ISSN: 2289-7879

A Review of HVAC System Optimization and Its Effects on Saving Total Energy Utilization of a Building

Rajeanderan Revichandran[1,*], J S Mohamed Ali[1], Moumen Idres[1],A.K.M Mohiuddin[2]

[1] Department of Mechanical Engineering, Kulliyyah of Engineering, International Islamic University Malaysia
[2] Director & Chief Scientific Officer, AQ Chowdhury Group, Dhaka, Bangladesh

ARTICLE INFO

Article history:
Received 29 October 2016
Received in revised form 1 December 2017
Accepted 9 December 2017
Available online 10 December 2017

Keywords:

HVAC optimization, Control Parameters, Common Energy Model, Prescient Energy Model, Thermal Comfort, Optimization Models, PMV Index, EnergyPlusTM.

ABSTRACT

The paper illustrates the review on the optimizations studies of HVAC systems based on three main methods – HVAC operational variables optimization, optimization of control parameters in HVAC system and parameter optimization in building models. For the HVAC system's operational variables, the optimization process is based on the common and prescient energy utilization models. Thus by comparing both, the non-common HVAC system models can get better output of energy reduction. Based on most of the studies, the occupancies thermal comfort requirements, are represented by the indoor air quality (IAQ) or the predicted mean vote (PMV) indexes. Comparing both requirements, the PMV index had a better overall energy reduction output of 47 % and estimated annual energy reduction of 2,769 kg/year. Meanwhile, in optimization of HVAC's control parameters, its overall aim is to achieve a better response output of the HVAC system in order to prevent energy wastage. Among this different optimizations controller, the fuzzy logic tuning optimization has a better overall energy reduction. On the other hand, the parameter optimization in building model approach is performed before the construction of the structure itself, where multiple construction parameters are considerations in the design. In overall, when different tools for building parameter and model optimization are compared, the EXRETopt by using PMV comfort index approximately reduces 62% of the energy utilization.

1. Introduction

The HVAC system stands for heating, ventilating and air conditioning where an optimized HVAC system aims to provide efficient output of thermal control and occupancy comfort by using the principles of thermodynamics, fluid mechanics, and heat transfer. HVAC systems are widely used in all types of buildings all over the world and it is one of the highest utilizer of energy [1-4]. For HVAC systems, the coefficient of performance (COP) has been utilized as an index to evaluate, its total energy performance [5-7]. COP is defined as the ratio between the output of cooling/heating energy and input of electrical energy. Generally, lower energy consumption and higher efficiency of system are outcomes of greater COP values, as shown in study by Oropeza-Perez [8]. In order to increase the COP value thus to achieve a lower energy utilization, the indoor set temperature can be increased to

* *Corresponding author.*
E-mail address: jaffar@iium.edu.my (J.S. Mohamed Ali)