Towards Energy Efficient Operational Patterns in Air Handling Units in Highly Sensed Buildings

Gokmen Dedemen, Semiha Ergan
New York University Tandon School of Engineering, USA
gd1097@nyu.edu

Abstract. Building Energy Consumption accounts for more than 40 % of the total energy consumption in the U.S, and Heating Ventilating and Air Conditioning (HVAC) systems have a major share in the building energy consumption. Building Automation Systems (BAS) provide a valuable data source for energy savings in HVAC systems. However, there are a vast number of HVAC operational parameters stored in BAS, and not every operational parameter recorded in BAS is correlated with energy consumption. The facility management industry needs help to make sense of the captured BAS data and identify operational parameters relevant to the energy consumption. Data-driven approaches help facility managers monitor the patterns that occur between such parameters and energy consumption, and reveal energy efficient configurations of the parameters to prevent energy waste. This study provides a methodology that guides facility managers to define subset of operational parameters over a data captured and analyzed from a highly sensed building. Our results demonstrated that the number of AHU operational parameters dictate energy consumption can significantly be reduced to a subset by following the proposed approach. Case study analysis using the approach showed that pressure after cooling coil (PAC), supply air pressure (SAP), and fan speed (FSPD) were within the subset for the building analyzed.

1. Introduction

The energy consumption of residential and commercial buildings accounts for 41% of the total energy consumption in the U.S, and space heating and cooling has a share of 47% in this amount (DOE 2012). It is estimated that $20 billion per year can be saved by achieving energy efficiency in buildings (IPMVP 2001). Thus, energy savings in Heating Ventilating and Air Conditioning (HVAC) systems are a key in accomplishing energy efficient buildings and society. One way of achieving that is to examine how HVAC systems are running with respect to the energy use and identify configurations of HVAC system operational parameters that result in efficiency in the energy use. Although primary functions of Building Automation Systems (BASs) are monitoring and controlling the operation of HVAC systems, BASs are able to provide voluminous data on HVAC operational parameters over time. Utilization of this available data in BASs provides opportunities to gain insights on the efficient operation of HVAC systems and relate them to potential energy savings. However, BASs store the records of more than hundreds of HVAC operational parameters measured by sensors 24/7, some of which are irrelevant to energy consumption. For instance, humidity measurements of the conditioned air are expected to be more relevant to the indoor air quality rather than the energy consumption. In the current practice, the identification of operational parameters relevant to energy consumption is based on the domain knowledge of facility operators, although the vast amount of data stored in BAS is a valuable resource that can be utilized in the identification of these parameters. Therefore, an essential step to benefit from BAS data is to identify a subset of HVAC operational parameters that dictate the energy consumption of the system. Once such a subset is identified, patterns in the subset of HVAC operational parameters and in the energy consumption can be extracted to identify the energy efficient configurations of these parameters corresponding to lower energy consumption levels.