Estimation of Energy Baseline by Simulation for On-going Commissioning and Energy Saving Retrofit

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Abstract: This paper proposes a method of estimating the adjusted energy baseline using simulation models, which can calculate the energy baseline with various conditions, such as conditions of weather, occupancy and equipment operations. Especially, this paper reveals what detailed data the calibration of the model needs and the change of accuracy caused by different calibration data. Using the operational data of a middle-scale office building in Osaka Japan, the simulation accuracies of three models, which are calibrated using monthly energy consumptions of whole building (Level 1), monthly energy consumptions of subsystems (Level 2) and the detailed operational data of equipments (Level 3) respectively, are compared. The result shows that the differences of daily-integrated energy consumptions between measured value and simulated value using the model of Level 1 and 2 are not much different. The model of Level 3 is about 3% more accurate than the model of Level 1 and 2.

1. INTRODUCTION

It is important to propose an objective and rational method to evaluate energy savings caused by the implementation of Commissioning or the retrofit conducted by ESCO (Energy Service Company). Because electric power consumption, gas consumption and water usage (in this paper these are called “energy consumption” in all) of a building changes according to weather conditions and conditions of the building operation, it is necessary to adjust the energy consumption of pre-retrofit using the post-retrofit conditions in order to estimate the energy savings properly. Then, the energy savings can be determined by the difference between the post-retrofit energy consumption and the adjusted pre-retrofit energy consumption (in this paper it is called “adjusted energy baseline”).

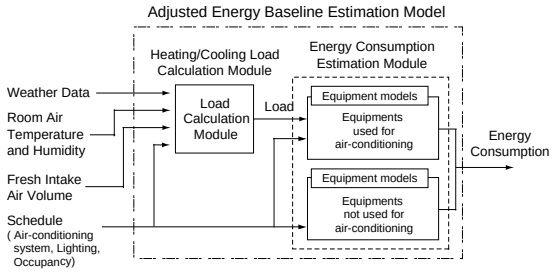

Fig. 1 Adjusted energy baseline estimation model

U.S. Department of Energy proposes four options to estimate the adjusted energy baseline, which are Option A, B, C and D described in International Performance Measurement and Verification Protocol [1]. In Japan, most energy saving companies use Option C, which estimates the energy baseline using simple regression models whose coefficients are determined using pre-retrofit monthly energy consumptions, and few companies use Option D, which estimates the energy baseline using simulation. Although Option D needs more information and manpower than Option C, Option D can estimate the energy baseline with various conditions, such as conditions of weather, occupancy and equipment operations, and can