Monitoring and BEMS(Building Energy Management System) Process Models of Green Building

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ABSTRACT

In order to optimize and maintain the performance of the operational stage of green buildings, development of efficient operation and management technologies is necessary. For this, there must be an integrated standard for the construction of evaluation systems and processes that are objective and reliable from the planning to the construction stages of green buildings. This study suggests a monitoring process model in order to provide information and expertise on monitoring system construction planning, while optimizing performance and investments through its construction for green building performance evaluations to the building owner and user. Also, this study suggests worker-oriented BEMS construction process model for new buildings that apply BEMS, which can optimize energy used in the operation of green buildings, to minimize expenses and labour used in construction and to make smooth cooperative relations with other management systems and systematic role division possible. Furthermore, the developed monitoring and BEMS process models were applied in the POSCO Green Building that is currently under construction to identify improvement effects and provide feedback.

KEYWORDS: Monitoring System, BEMS

1. INTRODUCTION

To manifest green buildings, not only are technologies for designing and construction by integrating the development technologies required, but also integrated technologies that can optimize buildings for operations. However, unified standards through development of performance evaluation systems and construction of processes that are objective and reliable are necessary to procure high quality for green buildings through such technologies. Moreover, the most important factors are the building owner and user's interest and will. A strong guideline that can put it into practice based on this is required. In other words, monitoring and BEMS upon orders by the constructor should not be simply

constructed, but require the participation of the owner and user from the planning to completion stages of the building operation and management system. It is crucial that the owners and users participate so that they can obtain expertise for management and for the green building to procure high quality.

2. Contents of Research

2.1 Setting the Research Objective

Past guidelines on construction of monitoring systems do not have sufficient information on detailed monitoring construction plans and there are no separate guidelines for participants in the construction industry. Likewise for BEMS construction, there is no concrete guideline for working-level employees and advanced nations are merely restricted to determining application levels through BEMS levels. It suggests measurement levels by space or time according to ratings or to determine the application level for heating and cooling, hot water, lighting and ventilation, but does not provide separate guidelines for follow-up work on it.

Therefore, this study was carried out in two forms. First, is to develop a systematic monitoring process model to prevent construction period delays and to reduce expenses focusing on the building owner by taking into account monitoring system construction for the performance evaluation of green buildings. The second is to develop a clear operation definition that takes into consideration the planning, design and construction of the building focusing on the working-level labourer when applying BEMS from the building's energy management aspect.

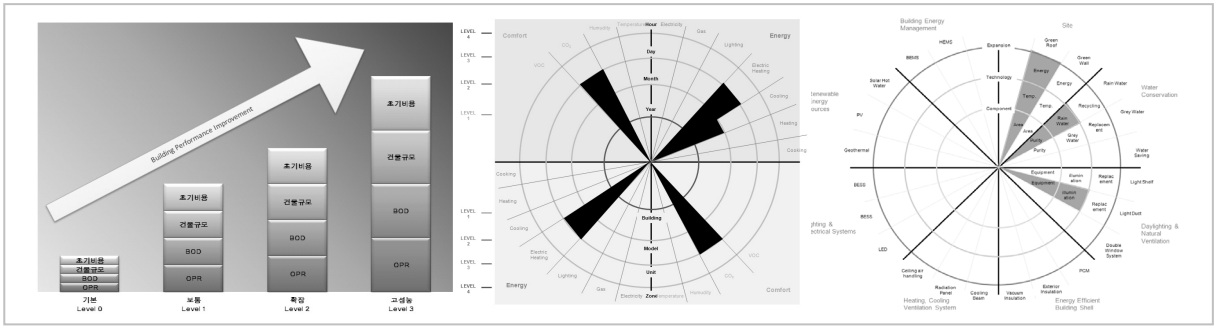
2.2 Process Model Development

2.2.1 Monitoring Process Model

The processes for the monitoring system construction plan for green buildings are made up of a total of four stages. The first is to set the monitoring objective. Taking into account the level of demands by the building owner/operator, investments and scope of the building, a feasible monitoring rating is set. They are categorized from A to D ratings and the burden ratio of invested monitoring system construction expenses, level of building usage, level of detail of measurement, level of interaction with BEMS, etc are presented as guidelines for setting the rating. Once the objective is set, the monitoring basic plan is established. It was made easy to understand and access by the user using the matrix method and here the building information, measurements of external environment, energy per usage, and matters on water and fee information are determined. In the third stage, the detailed plans for monitoring are established. The items on heating and hot water facilities, cooling, water resources, renewable energy, pleasantness, crime prevention and safety are determined. The range of the matters in the basic and detailed plans is to receive guidance according to the level determined in the first rating setting. Lastly, based on the set plans it was configured so that the monitoring system operation plan is established and the monitoring scenario that will be used after construction of the green is deduced.

The process model developed in this research was applied to the POSCO Green Building. The highest rating 'A' that is suitable for research-use buildings was applied. By establishing the basic plan,

monitoring plans on the materials, and single and compound technologies of twenty core technologies applied in the POSCO Green Building were established as detailed plans and monitoring plans per time and space. Based on this, the scenario was drafted by establishing monitoring system operation plans that will be used after the completion of the POSCO Green Building.



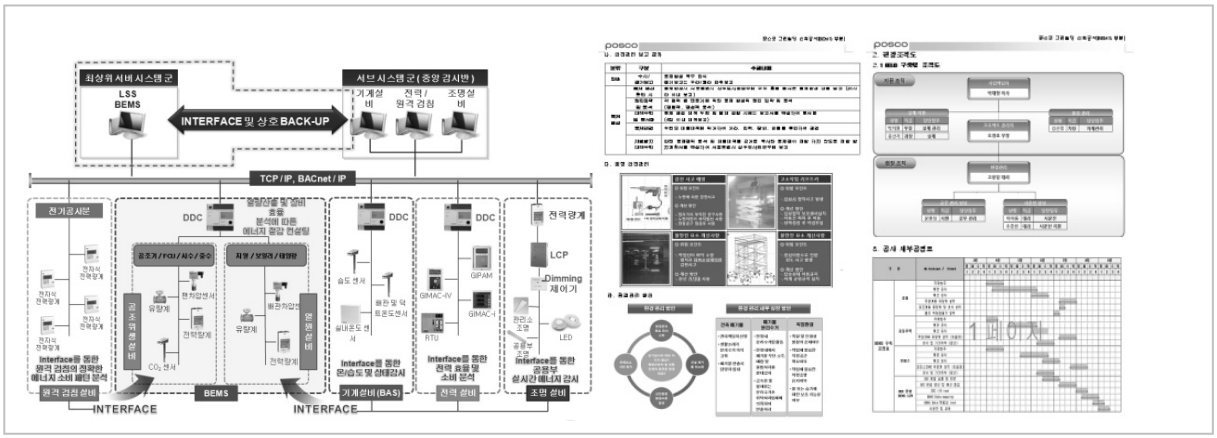
(a) Monitoring Level (b) Establish Basic Plan (c) Establish Detailed Plan

Figure 1. Monitoring Matrix

2.2.2 BEMS Process Model

The BEMS Process Model was developed with the goal of making cooperation among participants of the BEMS construction easier and to reduce investment expenses and construction periods. The process model is made up of a total of three stages – planning, design and construction. In the planning stage, first the building energy design standards are reviewed. Legal reviews on green buildings are then carried out and technology standards and domestic/overseas environment-friendly building certification systems are analyzed to deduce items related to BEMS. Afterwards, the design literature and illustrations of the building are reviewed and procedures for establishing energy usage prediction and conservation objectives are carried out. In the design stage, after the drawing work of BEMS, the operation and analysis methods are designed. Using the data collection function design, the data interlink plan and DB structure plan are computed and the analysis evaluation method is designed. Furthermore, LCC evaluation, investment payback period, etc are computed and the environment-friendliness is analyzed. The construction stage includes the roles of the participants related to preparation for construction, construction stages, and test operations.

The process model developed in this research was applied to the POSCO Green Building. The energy design standard review form was drafted in the design stage and the design literature and drawings of POSCO Green Building were reviewed to complete the establishment of energy-related plans. The max level of BEMS was set and in the design stage, the BEMS block diagrams and illustrations were drafted and the operation analysis methods were designed. The energy conservation objective in the operation stage was set by analyzing environment-friendliness. Currently, the construction plan for BEMS applied in POSCO Green Building is completed and is now under construction.



(a) BEMS Block Diagram (b) BEMS Construction Plan

Figure 2. BEMS of POSCO Green Building

3. CONCLUSIONS

In this research, first, a green building owner-oriented monitoring process model was developed to achieve optimization of invested expenses and performance of monitoring system construction. Through systematic process development from the establishment of monitoring system construction plans to operation plans, the basic performance and concept according to monitoring construction per stage can be conveyed to experts participating in the construction such as the designer, building owner and constructor, thus enhancing efficiency.

Secondly, by developing a standard process for worker-oriented BEMS construction, it is expected to provide guidelines for all processes from planning to design and construction stages appropriate for new buildings. Based on this, it appears that it will be possible to lead to reduced expenses, shortened construction periods, and expanded markets for the BEMS industry.

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