Design of a Web-based Remodeling Management System for Public Building Energy Savings

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ABSTRACT

To prepare the global climate change, various efforts to save the energy are being actively conducted such as the 21st Conference of Parties. Especially the building (Residential, Commercial and Public buildings) energy consumption is over the 20% of the total energy consumption in South Korea. Therefore, the government has implemented various institutions and policies to save building energy. Utilizing state of the art technologies for building energy analysis can find the efficient use measures of energy in the building operation phase. However, in the case of aging buildings, Energy savings through the building remodeling is higher than efficient use in building operation phase. Especially in the case of public buildings, there are difficulties in the selection of the target building to remodeling because it must be promoted by the limited government budget. To help these difficulties, the system for managing the public building remodeling history information and statistical data is required for the national public building remodeling assistance projects. For this purpose, we propose the Design of a Web-based Remodeling Management System for Public Building Energy Savings.

KEYWORDS

BEMS, BAS, ECMs, Public Building Remodeling, Web-based System

INTRODUCTION

The building energy consumption is over 30% of the world energy consumption (IEA 2016). As shown in Figure 1, the Building sector accounts for 20% of total energy consumption and public buildings consume more than 10% in South Korea (Yearbook of energy statistics 2014). Therefore, various researches and developments are being carried out to save the building energy. Recently, big data-based data mining (Mathew at al. 2015) and machine learning (YM Kim et al. 2016) techniques using Building

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Energy Management System (BEMS), Building Automation System (BAS) and a variety of sensors and meters data have been studied for building energy diagnosis and analysis. However, this high-level technologies require a lot of money and professional skills and it can only find energy conservation measures in the building operation phase but not reduce the over-consumption of energy due to aging of the building itself. Building remodeling is the most effective way to conserve the energy for aging buildings. For many aging public buildings are not easy to get the support of the limited government budget for the remodeling because of difficulties in the selection of the target building. In addition, this process takes a lot of time and human resources because it requires collecting numerous reports and on-site inspection. In order to solve these difficulties, we propose the Design of a Web-based Remodeling Management System for Public Building Energy Savings. The proposed system manages the building profile information and energy consumption information and it provides building remodeling history information and its statistical information for managing public buildings in a national level.

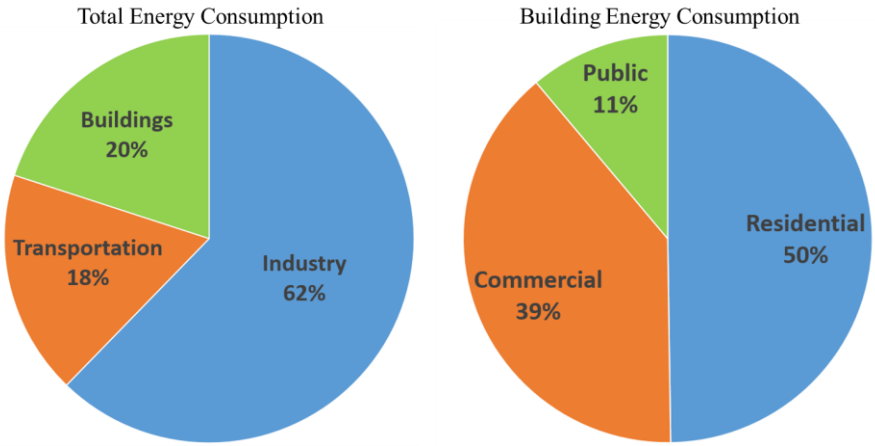

***Figure 1**. Annual Energy Consumption Statistics in South Korea*

WEB-BASED REMODELING MANAGEMENT SYSTEM

As shown in Figure 2, Web-based Remodeling Management System consists of Integrated Database, Monitoring-Based Commissioning (MBCx) based Energy Diagnosis, Economic Analysis of Energy Conservation Measures (ECMs) and Service Framework.

***Table 1.** Public Building Energy Consumption Management Agency in South Korea*

Agency	*Object*	*Contents*
Ministry of Land, Infrastructure and Transport (MOLTI)	Reporting of energy consumption	Basic Information (building spec, heating & cooling system, quarterly energy use etc.)
Ministry of Trade, Industry and Energy (MOTIE)	Energy consumption Report	Basic Information, Detailed Facility Info.
	Energy use plans & Performance	Basic Remodeling Information
Ministry of Environment (ME)	Greenhouse gas reduction goals & plans	Basic Information, monthly energy use, detailed remodeling info.

South Korea has about 8.6 million public buildings (Administration, education, Police, Medical, Fire station, Culture, Research, etc.). As shown in table 1, public building manager should periodically report energy consumption information to each government agencies. Integrated Database receives the public building data from each individual agency systems and manages information of public building energy diagnosis, analysis and statistics as a control center.

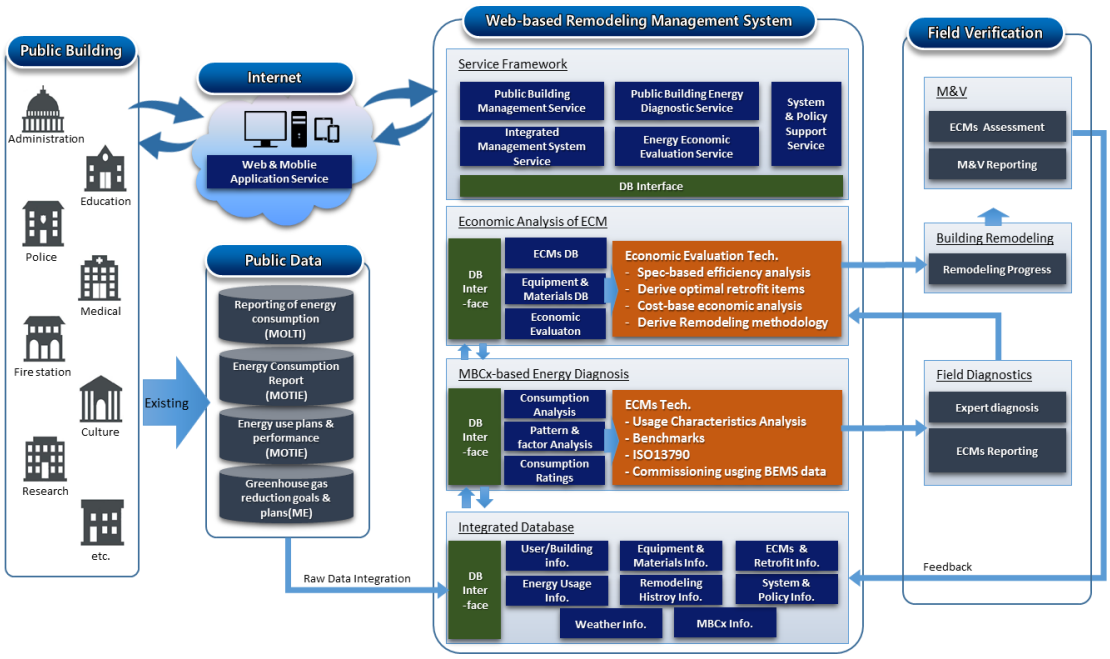

***Figure 2**. A System Achitecture of a Web-based Remodeling Management System*

A Web-based Remodeling Management System provides following services basically. Public Building Management Service (building registration and approval, remodeling history management, building energy consumption management, building facilities and materials management etc.), Public Building Energy Diagnostic Service (building energy consumption analysis, energy consumption pattern and major factors analysis, energy consumption rating etc.), Energy Economic Evaluation Service (specification-based efficiency analysis, derive optimal retrofit items, cost-based economic analysis, recommend remodeling methodology etc.), Integrated Management System Service (user and service permission management, statistical and reporting data management, Integrated DB management, etc.) and System and Policy Support Service (public building remodeling information management, etc.). Web-based Remodeling Management System also provides field verification services associated with on-line services. Field verification services upload field diagnosis reports, Measurement and Verification (M&V) reports and building remodeling reports by field experts to the web-based Remodeling Management System by referring to building energy diagnosis and analysis reports from an on-line services.

As shown in Figure 3, public building managers who registered building information in a Web-based Remodeling Management System can receive on-line services. And also government officials in charge of supporting the public building remodeling projects can easily select the target buildings through the energy diagnosis and economic analysis reports and the statistical information of a Web-based Remodeling Management System. A Web-based Remodeling Management System developed by responsive web technology, in accordance with HTML 5 Standard provides same user

interface to users regardless of the device environment via the internet anywhere and anytime.

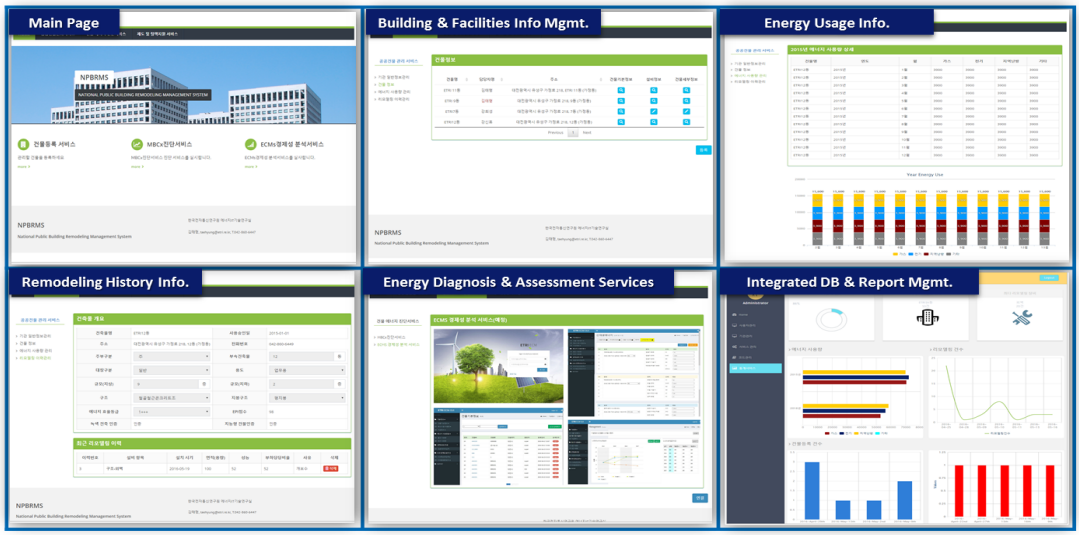

***Figure 3**. A User Interface of a Web-based Remodeling Management System*

RESULTS

In order to efficiently support of the government for public building remodeling, the integrated remodeling management system is needed in a national level. In addition, economic evaluation should be ongoing for remodeled buildings by managing the history of buildings remodeling information. In this paper, we designed a Web-based Remodeling Management System for Public Building Savings. And we will propose to the government institutions and policies needed to develop the system. Finally, the developed service framework will be open to the Energy Savings Companies (ESCO) and building energy diagnostic and analysis companies to provide various energy services.

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