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Applications of the National Building Energy
Integrated Management System for the Public and Private Sector

조상규 Cho, Sang Kyu
이은석 Lee, Eun Seok

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In the new climate era, the systematic dissemination and operation of green architecture need government efforts. The greenhouse gas related to using building is much more than the building construction process. The building greenhouse gas emissions control should focus on the efficient use of the various energy sources consumed by the activities of people in the building. The solution should be ranked first in the ranking.

As part of this effort, the Ministry of Land, Infrastructure and Transport built a national building energy integrated management system in 2015. Specifically, the government prepared a legal basis for the creation of the information system through amendment of the "Green Building Support Act." Based on this, a new system for energy consumption disclosure and building energy consumption certification was established, and conditions for collecting national building and energy information were created. Currently, the name is changed to 'Building energy greenhouse gas information system, ' and the Korea Appraisal Board is in operation.

The technology of energy efficiency of the building is combined with the digitalized energy usage data which is digitally measured beyond the combination of equipment and construction method. The building energy information of the National Building Energy Integrated Database is the world's first data system that combines all the building energy use information of one country. This includes energy consumption data such as electricity, city gas, district heating collected in units of meters, and building information database containing everything from the birth of the building to the present.

In foreign cases, building energy data is constructed and provided for each city. Case building energy data consists of a data system that allows the public to intuitively utilize building energy information. In other words, energy consumption information by building can be obtained as table information, and it is easy to utilize visualization data such as a graph using the information. Furthermore, a building energy map linking energy consumption and building basic information and a platform for downloading the retrieved data have been developed and are in operation. In this way, building energy consumption information should be intuitive information access for public and private use. To do this, a big-data platform must be constructed that is implemented with refined form data, graphs, and building energy maps.

Through this study, we solicited a method of linking the big building data of national building energy and geographic information. First, we examined the theoretical analysis methods related to the data structure and processing techniques. Moreover, we analyzed the data structure of national building energy integrated management system that has been built so far and analyzed the possibility of developing it as a utilization model. The main point of the model development is geographical informatization of building energy data. Therefore, we have identified the process of reconstructing the raw data of building energy data provided by Korea Appraisal Board, which is a building energy greenhouse gas information system management organization, on its server. A geocoding process was performed to create a database of raw materials composed of building information and building energy data in a database, and to apply geographic coordinates to the form data using address information in the data. This led to the building of a web-based building energy map with a geographic information system of building energy information.

We set the development environment in a way that is accessible to the general developer. Therefore, we reset and used the raw data form by the format of the building energy data released by the Government 3.0 measure so that anyone could use it. It was desirable to build a web-based map information system so that it could be utilized smoothly in the public and private sectors. Therefore, it was necessary to reduce the weight of the raw data that contains information on the current buildings and information on energy usage. This research utilized an existing X-ray map engine optimized for map implementation to quickly derive the results

from the web environment. Then, various parameters needed to implement the energy map were selected, applied and deleted repeatedly, and the necessary parameters for energy map implementation were found at the current level. The details are as follows.

- Required building information: Building address, main area, land area, floor area, year of use approval, structure
- Required energy information: The total energy consumption of the buildings is the sum of monthly consumption information such as electricity, gas, district heating, and oil
- Geographic Information Needed: Individual parcel information or location information of buildings with national standard coordinates

This study suggests that building energy data should be focused on the creation of new industries in the private sector and the utilization of public sector policies. Also, considering the foreign cases that utilize building energy as a precedent rather than presenting a broad range of alternatives, we limited the utilization of building energy map.

The application of the policy area is proposed as 1) national policy operation 2) selection of green remodeling objects and target management 3) combination with geographical information for utilization of building energy information.

There are five types of plans for utilizing the building energy database in national policy. First, it provides energy conservation management of national-scale buildings. Secondly, it provides induction of the related energy growth in the related fields, and it is directly applied to national energy policy setting and goal management. The fourth is energy and greenhouse gas emission management. Finally, it can be used to build and operate a standard building energy usage statistics system for each building type.

Green Remodeling Support Object Selection and Management propose a method to be applied to the screening criterion of green remodeling target buildings. Based on the accumulated building energy information, it is possible to simulate the energy consumption pattern of the building before the green remodeling project. Since green energy remodeling and greenhouse gas reduction can be estimated in advance

after green remodeling, it can be used as a performance evaluation criteria and evaluation criteria for the efficiency of building energy consumption.

The combination of building energy and geographical information is a mix of energy usage statistics and location information contained in building information to geographical information. Furthermore, it is possible to propose the utility of the building energy map based on the energy consumption of each building. When geographical information is constructed by combining energy use and building location information, each energy consumption amount can be converted to calories together with consumed amount data of each energy source in use, so that the energy consumption distribution pattern of each building can be confirmed. Furthermore, combined with information on potential new and renewable energies in the area where the building is located, it will be possible to find a suitable type of new and renewable energy and to operate effectively. Each building energy map can be easily used to form evaluation index and review items in establishing local custom building standards.

The utilization of the private sector can be summarized as 1) finding new and renewable energy businesses in the building sector; 2) utilizing building energy information in connection with real estate transactions, and 3) activities to improve energy consumption behavior.

Building energy consumption information can contribute to finding new and renewable energy applications, such as promising solar PV business buildings (high solar power generation capacity and excessive energy consumption). Currently, it is possible to consider the information system that can be applied to the photovoltaic power generation business and the photovoltaic rental business in cooperation with the solar energy business specialist and to improve the existing information system. In the future, passive buildings and various new and renewable energy systems can be used for new and green remodeling projects, which are merged into one building.

Building energy information linked to real estate transactions can be used to identify the energy consumption amount and the factors that improve the behavior of the building owner or the tenant by inducing the energy consumption self-diagnosis. The energy efficiency of the building is linked directly to the management cost and

directly or indirectly related to the real estate price of the building, which can contribute to the confirmation of energy performance of the building and improvement of the usage behavior.

It is possible to consider linking with building energy data and resident registration system. When individual energy consumption behavior is understood within the scope of privacy protection, it is possible to exchange information centered on residents and energy between buildings. By analyzing the energy consumption behavior, it is feasible to categorize the energy-vulnerable classes and utilize the data in low-income energy efficiency improvement projects and vacant house maintenance projects. Also, in conjunction with the smart meter, it is possible to obtain basic data that can flexibly respond to energy supply and demand prices considering the characteristics of consumption behavior of building users.

Building energy data is a kind of big-data. Even now, providing a Web-API using a big-data system is enough to enable information connection through personal devices associated with the Internet of Things (IoT). Furthermore, if the usability of the building energy information system is strengthened, it is expected to be used as a sustainable growth engine for the energy efficient user Internet development market centered on buildings such as smartphone app development.

Keywords: Building Energy Data, Building Information, Big-data, Building Energy Map, Green Building, Green Remodeling