녹색건축 정책수립을 위한 건축물 온실가스 배출량 통계 구축 및 분석

Compiling and Analyzing GHGs Emission Statistics in Building Sector for Green Building Policy

조상규 Cho, Sang Kyu
김영현 Kim, Young Hyun

(auri

Compiling and Analyzing GHGs Emission Statistics in Building Sector for Green Building Policy

Cho, Sang Kyu
Kim, Young Hyun

According to the 2007 IPCC report, building sector related carbon emissions account for approximately a quarter of global carbon emission levels. The building sector is also identified as having the highest potential for reducing carbon emissions while requiring the lowest cost for such reduction efforts. However, data regarding energy use and detailed statistics that form the basis of policy-making are still lacking. Currently, the greenhouse gas emission inventories of the building sector are obtained through the Yearbook of energy statistics, and calculations are based on energy supply data of the comprehensive energy reports where statistics are merely categorised into two parts, 'commercial and public' and 'residential'. This makes it difficult to extract information according to different building use and energy consumption attributes.

In order to achieve the government target of reducing building sector greenhouse gas emission by 26.9% until 2020, much progress is needed including the improvement of existing facilities. Hence, it is necessary to compile a top-down database system according to individual building energy use and attributes of greenhouse gas emissions.

Recently, due to the need of a comprehensive nationwide individual building

energy consumption data management, the Ministry of Land, Infrastructure and Transport has implemented the 'National comprehensive building energy management system project' through which relevant statistics of Seoul, Gyeonggi, and Incheon have been compiled. This study uses the data compiled through the 'National comprehensive building energy management system' in order to empirically analyse greenhouse gas emission levels and emission attributes by building use and type, and suggests directions for green building policy.

In chapter 2, theories relevant to building sector greenhouse gas emissions have been revised and major green building policies of individual ministries have been examined. Regarding the theoretical aspect of calculating greenhouse gas emissions, the greenhouse gas protocol of World Resources Institute and the World Business Council for Sustainable Development(WRI/WBCSD), the IPCC guideline, and Korea Environment Corporation's local government greenhouse gas emission calculation guide were revised. In addition to this, new policies and programmes pursued by the Ministry of Environment, the Ministry of Trade, Industry and Energy(MTIE), and the Ministry of Land, Infrastructure and Transport(MLIT) were examined.

In chapter 3, the current greenhouse gas data collection and management systems were comprehended through the revision of energy and greenhouse gas statistics and reports, and various planning and project reports for the set up of data management systems. The project report of the 'National comprehensive building energy management system' currently implemented by the MLIT was examined, and interviews of relevant personnel were conducted to understand the operation and limitations of the system. Moreover, overseas case studies(the US, England, the Netherlands, Japan, Europe and Canada) of building energy management systems were conducted, and in particular, the American case study

was explored in detail as it showed most relevance for Korea.

In the fourth chapter, energy consumption and greenhouse gas emission analysis were conducted on both a national and local scale based on the Yearbook of energy statistics provided by the MTIE, and local governments' statistics yearbook, respectively. In order to conduct detailed analysis of energy consumption and greenhouse gas emission by sector, the comprehensive energy report(during the years of 2002 until 2011, the 7th and 11th official report respectively) provided by the Korea Energy Economics Institute were adopted. By using information on the 'residential' sector's fuel consumption by local area, by housing type, and the 'commercial and public' sector's fuel consumption, greenhouse gas(CO_2, CH_4, N_2O) emissions were calculated according to the 2006 IPCC guidelines of applying scaling factors. Furthermore, energy consumption data according to individual building were obtained to calculate greenhouse gas emission level per Won by building type (again the data was retrieved from the 'National comprehensive building energy management system' which is currently in process of construction). In addition, Seoul's electric, gas, water supply raw data produced until the end of 2012 were obtained to calculate total greenhouse gas emission by different building use, housing type, building type, building structure, building area, storey, local areas and by area unit, whereby attributes were analysed.

At the same time, an analytical system was developed to aid continuous energy consumption data analysis. Again, Seoul's energy consumption data was used to develop a place-based analysis tool according to the energy consumption and greenhouse gas emission attributes by building type, age, storey, and structure. The researchers searched the energy consumption and greenhouse gas emission level by building type, and the results of the search were mapped and

made available for further GIS analysis through a web—based analysis tool co—developed with another professional organisation.

In conclusion, the fifth chapter discussed improvement measures for the 'National comprehensive building energy management system', and the comprehensive energy report and related data construction. As a final comment, green building policy directions were suggested based on the findings of energy consumption analysis by building unit. The 'National comprehensive building energy management system' currently aggregates building energy consumption level by using electric, local gas, and district heating data. However, the research suggested that renewable energy, and petroleum energy consumption levels should also be included in this dataset. Second, in order to eliminate difficulties in collecting energy consumption data, regular data provision should be made a legal obligation. Third, administrative information and energy consumption data of buildings need to be better connected. Fourth, a wide range of certification should be in place including the green building certification, and building energy efficiency level certification propelled by the current government. Another area of consideration is that the current sampling survey of the comprehensive energy report and data construction method of the 'National comprehensive building energy management system' belong to different classification systems which make comparative analysis unviable. In order to improve this, common building attribute information needs to be provided for all categories of residential, commercial and public sector buildings.

In consideration of the energy consumption analysis by building use etc, based on the comprehensive energy report data and national building energy data, the research suggests three major policy directions. First, commercial sector energy efficiency improvement is more pressing than that of the

residential sector. The commercial sector accounts for almost 40% of the total energy consumption level, and has increased at such a rate in the past 20 years where immediate energy efficiency improvement measures are called for. Second, policy needs to be developed towards lowering the reliance on electric energy. The use of electricity, compared to other energy sources, have increased drastically, and accounted for more than 60% of the total energy consumption level in 2012. Third, in terms of the residential sector, singular housing and lower income family homes need immediate measures to improve energy performance. The energy consumption level, by area unit, of singular housing were found to be approximately 3 times higher than that of multi-unit housing. Also, small-scale buildings with building area less than 100 square metres compared with mid-scale buildings consumed almost twice as much energy. Hence, policies to support energy efficiency improvement for lower income family homes need to be developed urgently.

Keyword : Green Building, Building Energy Statistics, Green House Gas Emission, National Comprehensive Building Energy Magegement System