

Korea Energy Conservation Policies for Extending Sustainable Buildings

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ABSTRACT: The policy on energy plays an important role in Korea's sustainable construction. The purpose of this study is to provide a broad overview of the policies related to building energy efficiency in Korea. Through this work, this paper suggests visions for extending sustainable building in Korea. This study investigates major policy measures related to the improvement of energy efficiency of buildings. Also, this thesis proposes policy measures to reinvigorate building energy efficiency and detailed programs for sustainable building. In conclusion, the findings from this study are discussed in measures to improve energy conservation in buildings for the future.

Keywords: energy policy, building code, energy efficiency, sustainable building

1. INTRODUCTION

Korea imports 98% of its energy source from foreign countries, and 20% of this sum goes to the cost of energy importation. As the sixth largest crude oil importer, Korea spends more than 55 billion Won yearly.

World oil prices continually vault to record highs, stirring fears of 150-dollar-a-barrel oil before the end of this year, as price passed over the 130-dollar-a-barrel mark. This is more than 10 times of the price of 1998, which recorded the first time it went more than 10-dollar-a-barrel.

Furthermore, Korea is finding it hard to avoid taking on its duty to reduce greenhouse gas(GHG) emission as a member of OECD as well as the world's eighth biggest GHG emitting country. Korea is likely to be included among the Post-Kyoto countries by 2013.

Energy consumption in building sector takes about 23% of total energy consumption in Korea. Because of improving energy efficiency in building sector is directly connected to the increase of diffusion ratio of households, the national economy as the infrastructure and the

quality of people's living, an approach is needed linking it up with an overall and comprehensive national goal for energy policy on buildings rather than a simple saving dimensions.

On these backgrounds, the purpose of this study is to provide a broad overview of building energy efficiency policies and to consider measures to improve building energy efficiency in Korea.

2. THE PRESENT CONDITION AND TENDENCY OF ENERGY CONSUMPTION OF BUILDINGS

2.1 The Present Condition of Energy Consumption in the Building Sector

The energy consumption in building sector which consists of residential, commercial, public, etc. has been showing continuous increasing tendency until 1997, and suddenly decreased in 1998 with such reasons as the financial crisis and wrenching climatic change, but has since been rising again.

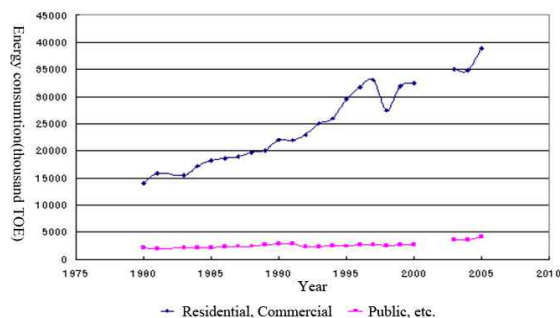


Figure 1: Progress of energy consumption in the building sector in Korea

The energy consumption in the building sector grew to 24,783 thousand TOE in 1990 from 16,121 thousand TOE in 1980, and then recorded 35,044 thousand TOE in 2000 which is 1.4 times as much as that of 1990. The average annual increase rate between 1980 and 2000 was about 3.8%.

The average energy usage per floor area of a building fluctuates as outdoor

temperature(heating degree-day) changes averaging around 250Mcal/m²·year, although electricity use in buildings have increased rapidly due to expansion of appliances and personal computers. This indicates the effect of continuously driven energy policies for buildings such as reinforcing insulating performance and improving the energy efficiency of heating and cooling system. However, as energy usage per floor area tends to increase again in spite of relatively low heating degree-days since 1999 with financial recovery, there is a need to rouse the society's attention to energy saving.

2.2 The Prospect of Future Energy Consumption in the Building Sector

Building area in Korea has increased by 13.6% per year since 1990, and stock area reached 1,380,148 thousand m² as of 2000. While the diffusion ratio of households recorded 100% in 2002, about 5 million more houses would be built by 2012 and about 7 million houses including not only new construction but also reconstruction would be built owing to continuous population growth.

The average area of houses increased from 58.2m² to 81.5m² between 1975 and 2000, but is expected to keep present conditions as the number of people per household gradually decreases.

Judging from the above prospect, energy consumption in building sector from hereon can be calculated as presented in Table I. The reason that an increasing rate of commercial/public/etc. division is higher than others is the increasing rate of construction area of the division, which is higher than residential because of expansion of service industry, and electricity usage recording higher in the energy component ratio of commercial buildings.

3. CURRENT STATUS OF ENERGY POLICIES FOR BUILDINGS

Table I: A long term energy demand prospect for building sector¹

Division (million TOE)		2000	2010	2020	Average annual increase rate (%)		
					'00~'10	'10~'20	'00~'20
End-use energy	Max.	152.9 (100.0)	210.7 (100.0)	261.1 (100.0)	3.6	2.2	2.9
	Min.	152.9 (100.0)	205.1 (100.0)	248.0 (100.0)	3.3	1.9	2.6
Residential demand	Max.	23.6 (15.4)	30.4 (14.4)	36.3 (13.9)	2.8	1.8	2.3
	Min.	23.6 (15.4)	30.4 (14.8)	36.3 (14.6)	2.8	1.8	2.3
Commercial/ public/etc. demand	Max.	12.3 (8.0)	20.4 (9.7)	27.2 (10.4)	5.8	2.9	4.3
	Min.	12.3 (8.0)	21.2 (10.3)	28.4 (11.5)	6.3	3.0	4.5
Building (total)	Max.	35.9 (23.5)	51.6 (24.5)	64.7 (24.8)	-	-	-
Residential + Commercial + Public	Min.	35.9 (23.5)	50.8 (24.8)	63.5 (25.6)	-	-	-

Most measures to reduce GHG are in force related to energy efficiency policies in Korea. The insulation standard in new buildings that took effect in 1979 was the start of energy efficiency policies in Korea, and then measures that require submitting energy-saving plan for energy glutton buildings are enforced.

The building code required installing energy-saving insulation material in 1979 and using high-efficiency energy equipments according to the energy-saving design standard in 1986. The energy management standard was established in order to promote reasonable energy use in existing buildings. Finally in 2001, the building energy efficiency rating system

was introduced to improve synthetic energy efficiency.

The legislative systems for building energy efficiency are regulated according to the building code and Rational Energy Utilization Act. The building code mainly manages energy-saving system in the design stage, while Rational Energy Utilization Act mainly does operation of existing buildings and the use of high-efficiency energy equipments.

The principal policies for building sector in connection with energy-saving in buildings are described below.

3.1 Major Policy for New Building Design

(1) Building energy-saving design standard

Building energy-saving design standard is a code taking charge of building insulation as well as performance of appliances and electric equipments installed in buildings.

¹⁾ National energy master plan, () refers to the component ratio, maximum and minimum prospects are identical in transportation and residential division on the assumption that GDP does not change accompanied with changes of industrial structure.

The ministry of Land, Transport and Maritime Affairs amended the 「rules on building facility standards, etc.」, and reinforced the insulation standards for the outer walls, roofs and floors of buildings permitted construction in June 2001 and afterwards by more than 20%. Also, more buildings have the obligation to use new high-efficiency energy equipments.

(2) Green building certification system

The purpose of the green building certification system is to improve environmental efficiency and reduce energy consumption as well as GHG emission by assessing environment-influencing elements such as nursing resources and reducing pollutants throughout all processes of construction from production of building

materials, design, construction, maintenance and to scrapping materials.

(3) Energy efficiency labelling program for buildings

Energy efficiency labeling program started in August 2001 in order to increase the efficiency of energy use in buildings. This program works with new apartments that have more than 18 households so that more buildings would be built with energy-saving facilities and equipment(grades 1~3) from the design stage. Buildings that satisfy energy performance standard in the building code can get a certification and a loan at low interest rates.

3.2 Major Policies for Energy Consuming Equipments

Table II: Outline of the main energy policies for buildings

Policy	Reduced GHG	Mode	Enforcement status	Supervising government department
Building energy-saving design standard	CO ₂	-Insulation standard: obligatory on all types of buildings -Design standard: obligatory on buildings bigger than standard size	Effective	Ministry of Land, Transport and Maritime Affairs
Green building certification system	CO ₂	Recommended	Effective	Ministry of Environment, Ministry of Land, Transport and Maritime Affairs
Energy efficiency labelling program for buildings	CO ₂	Recommended(Financial incentives)	Effective for apartment houses	Ministry of Knowledge Economy
High-efficiency energy equipment certification system	CO ₂	Recommended	Effective	Korea Energy Management Corporation
Energy efficiency standards and labelling program for products	CO ₂	Obligatory	Effective	Ministry of Knowledge Economy

(1) High-efficiency energy equipment certification

This system evaluates high-efficiency products, and grants quality guaranteed mark to outstanding energy equipments that meet performance standards. High-efficiency induction motor, 26mm32W fluorescent lamps, ballast stabilizers for fluorescent lamps, bulb-type fluorescent lamp fixtures, high-intensity reflector, auto illumination control lighting fixtures, waste heat recovery ventilation systems, highly air-tight insulation windows, monitor energy savers, gas boilers for industrial buildings, gas boilers for homes, high-efficiency pumps, UPS, and power transformers can be the subjects of this certification program.

(2) Energy efficiency standards and labelling program for products

This is a program that marks energy efficiency rank on products according to energy efficiency star rating (grades 1~5) to promote consumers to purchase high-efficiency products. Electric refrigerators, electric air-conditioners, electric washers, dishwashers, electric water dispensers, incandescent lamps, fluorescent lamps, ballast stabilizers for fluorescent lamps, lamps with built-in ballast stabilizers and home gas boilers are the subjects of this program. Automobiles are also managed separately.

4. IMPROVEMENT OF ENERGY EFFICIENCY PROGRAMS IN THE BUILDING SECTOR

4.1 Expanding Object Buildings for Energy Efficiency Program

Small-scale buildings are not the object of current energy efficiency programs. However, buildings covering all over purposes tend to become larger and larger recently, and small neighbourhood facilities or public offices are consisted of large-scale building in some cases. As a consequence, it is demanded that an energy-saving program

for these kinds of buildings be reinforced. Large-scale facilities including passenger terminal, train station, airport are also needed to be considered as they are excluded from submitting energy-saving plans.

Therefore, basically all buildings should be obligated to submit energy-saving plans with the exception of low energy consumption buildings and small-scale buildings.

4.2 Supplementing Building Energy-Saving Design Standard with Contents Relevant to New Renewable Energy

Mandatory use of alternative energies was reflected in the revision of "Code for development, use and diffusion of alternative energies" in March 2002, and has been in force on buildings ordered by public institute since 29th March 2004.

As a substitute with the exhaustion of fossil fuels, increasing international pressure on reducing GHG and a sudden rise in oil prices, development and diffusion of new renewable energy is an urgent national task in Korea. However, voluntary adoption of new renewable energy in the market seems to be hard due to low economic efficiency and public reliability, and introducing those items into related codes is needed as a national principal task.

4.3 Introduction of Performance-Based Energy-Saving Standard for Buildings

If advanced building energy management system is introduced to Korea based on the results of research on performance-based standard, it is expected to contribute to energy-saving efforts of government and non-government entities.

Furthermore, the whole standardization of building energy analysis would be obtained and utilized for improving Korean building energy and facility technology.

More than 10% of additional energy-saving is expected to be achieved by converting the current energy-saving standard system for buildings to an

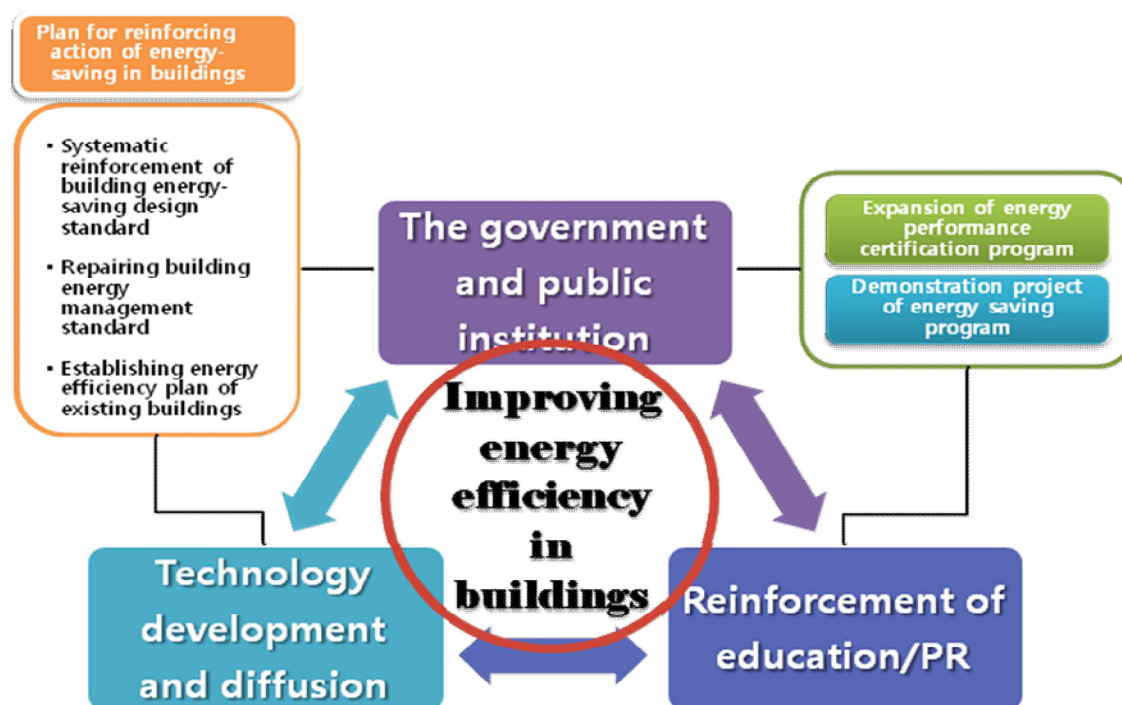


Figure 2: Basic structure and scheme for improving energy efficiency in buildings

advanced one that enables effective national energy management.

4.4 Reinforcement of Synthetic Connection among Related Codes

There are mainly three categories of the current building energy-saving codes being carried out by governments.

- ① Rational Energy Utilization Act enacted by Ministry of Knowledge Economy,
- ② 'Regulations for preventing building heat loss' and 'Building energy-saving design standard' of Building Codes enacted by Ministry of Land, Transport and Maritime Affairs, and
- ③ Codes of the Ministry of Environment that comprehensively control problems about environment and energy

As above, present codes are enacted by several different ministries and are not directly related to each other. So, there is a need to consolidate the relationship between the codes in order to increase the effectiveness of operation. It is also

necessary to establish a discussion system that can control and manage the codes comprehensively and systematically.

5. CONCLUSION

Recently such changes occur in the international energy market as rising oil prices and the pressure of Kyoto protocol, and these changes demand reinforcing energy-saving policies. Not only strengthening energy efficiency policies and regulation but also consumers' voluntary and active participation are now necessary. So, future policies should be established to combine a regulation system with the cooperation of public institution and NGOs, based on indirect support of the government in order to maximize the effect of building energy-saving programs.

Current principal energy policies came into effect in the building sector are as follows; Green building certification system, Energy efficiency labelling program for buildings, Energy efficiency standards and labelling program for products, building

energy-saving design standard and High-efficiency energy equipment certification system.

National energy policies in building sector, firstly, should be diversified from making standards mandatory based on accurate cost-benefit analysis, accelerating dissemination of recommended standards, and supporting pilot projects in order to promote building energy efficiency. Second, as buildings built 20 years ago or more would occupy 50% of the total number of buildings by 2010, not only introducing energy efficiency program for new buildings but also institutional support for existing buildings should be reinforced and considered as soon as possible in order to reduce total energy consumption. Also, effective propelling of building energy efficiency needs consistent and continuous funding as well as continuity of driving energy-saving policies for building from establishing synthetic organization, long-term and macro-saving goal, and constant and systematic constitution/revision. Lastly, there is a need to obtain and organize whole data of platform technology including building specifications, construction guidelines, energy evaluation tools, substandard and basic/reference data. Likewise, preparing performance assessment standards related to building materials, facilities and energy consumption are also necessary.

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