Energy efficiency building standards in Korea

Although government-affiliated research institutes, universities, and utility companies have investigated building energy efficiency since the mid-1980s, Korea did not formally adopt a building energy standard until 2004. Since then, Korea has put in place a comprehensive program to minimize building energy consumption, coupling mandatory standards with voluntary efforts in building energy labeling, a Green Building Certification program, and financial incentive programs.

Status of Building Energy Efficiency Standards

Korea passed its mandatory building energy standard on December 31, 2004 under Notification 2004-459 of the Ministry of Construction and Transportation (MOCT).

Scope. This standard is mandatory for all buildings where high energy consumption is expected, i.e., residential buildings with over 50 households, office buildings greater than 3,000 $m^{2,}$ public baths or swimming pools over 500 m^2, hotels and hospitals over 2,000 m^2, department stores over 3,000 m^2, and exhibit halls or schools over 10,000 m^2. For these buildings, an Energy Conservation Plan must be submitted before construction to show how much of the standard has been incorporated in the building design, and a point total estimated based on the Energy Saving Plan. All buildings required to submit an Energy Saving Plan must get a point total of at least 60 in order to comply.

Contents. The Korean building energy standard was developed after review of codes from several countries, including the US, UK, Germany, Japan, and Canada. Although the developers acknowledged the quality and detail of the more complex codes such as those in the US and Germany, they felt a simple prescriptive code, such as those in the UK and Japan, was most appropriate and easier to implement in Korea.

The standard that was developed contains three parts – architectural, mechanical and electrical – each with mandatory and "encouraged" requirements. The mandatory requirements represent basic responsible design, while the "encouraged" requirements represent more innovative and "best practice" strategies.

- For the architectural portion, the mandatory requirements are to meet the specified thermal requirements for the building envelope in Table 1, install an air barrier inside the insulation to prevent condensation, and add vestibules to building entrances. "Encouraged" requirements include design strategies such as better siting, minimizing the amounts of walls and windows, and utilizing daylight, shade, and natural ventilation.
- For the mechanical portion, the mandatory requirements are to follow existing design conditions and insulation requirements, and minimize the use of electricity during peak hours by use of thermal storage or gas-driven cooling. "Encouraged" mechanical requirements include using high-efficiency appliances and pumps, photovoltaics, heat recovery, ventilative cooling, etc.
- For the electrical portion, the mandatory requirements include the use of efficient transformers, motors, and lighting, and occupant sensors for entry lighting; encouraged" electrical requirements include induction motors, demand controllers for peak load conditions, energy-efficient elevators, and HID lamps for outdoor spaces (see Appendix 1 for complete listing of all mandatory and "encouraged" requirements).

Table 1. Shell Requirements of the Mandatory Building Energy-Saving Standard
No. 2004-459, 31 Dec 2004, of the Ministry of Construction and Transportation

Building Element	Region		Overall Heat Transfer Value ($W/m^2 K$)		
			Zone 1	Zone 2	Zone 3
Wall	Exposed to the outside air		0.47	0.58	0.76
	Semi-exposed to the outside air		0.64	0.81	110
Ground floor	Exposed to the outside air	Floor heating	0.35	0.41	0.47
		etc	0.41	0.47	0.52
	Semi-exposed to the outside air	Floor heating	0.52	0.58	0.64
		etc	0.58	0.64	0.76
Roofs in the top floor	Exposed to the outside air.		0.29	0.35	0.41
	Semi-exposed to the outside air		0.41	0.52	0.58
Side Walls in the Multi-Family Housing			0.35	0.47	058
Middle floor in multi-family units	Floor heating		0.51	0.81	0.81
	etc.		1.16	1.16	1.16
Glazing & door	Exposed to the outside air		3.84	4.19	5.23
	Semi-exposed to the outside air		5.47	6.05	7.56

The use of a point system for compliance effectively turns the Korean standard into a quasi-performance-based standard. To arrive at the required 60 points for compliance takes more than simply meeting all the mandatory requirements. The owner must also adopt at least some of the "encouraged" requirements, although their selection and choice are completely at the discretion of the owner. In the design of the point system, MOCT took into consideration not only the energy-saving potential of the "encouraged" measure, but also its ease of adoption in the actual building market. For example, a new technology that has a good energy-saving potential, but is expensive will be given higher points to encourage its use.

Although this is not exactly a performance-based standard, other information received from the Korean Energy Management Company (KEMCO) indicates that standard requirements equate to a heating energy consumption level of 123 kWh/m^2-year for residential and 116 kWH/m^2-year for commercial buildings.

Jurisdiction. The standard was developed by the Ministry of Construction and Transportation (MOCT), and is administered as part of the building permit process for new buildings. To get a building permit, the building owner must submit an Energy Conservation Plan (signed by a licensed architect, a professional mechanical, and an electrical engineer) to the local government office in charge of building regulations. Some local offices review the plan by themselves, but those lacking expertise can request help from KEMCO. KEMCO provides voluntary help to local authorities, but the final decision and responsibility for approving an Energy Conservation Plan rests with the local authorities. However, KEMCO does have the legal authority to pass Energy Conservation Plans.

The MOCT plans to examine and approve 1,450 Energy Saving Plans in 2005, 2000 in 2006, and 2500 in 2007. However, in actual practice, in the first year (2003-2004), 2,564 Energy Saving Plans had already been examined. To further improve the Korea's building energy code, the government

asked Korea Institute of Construction Technologies (KICT) to investigate the status of the current code and policies, and recommend improvements. This investigation was completed in December 2006, with the expectation that the scope of the code will be expanded to more buildings, and a performance-based energy code limiting the total energy use per square meter of floor area in new buildings will be developed. Simultaneously, the government has also announced that it will make its insulation standard more stringent over time, and will extend it from new construction to existing buildings. Finally, the government is considering requiring that all real estate transactions include an energy efficiency certificate, with the associated document attached on all sales transactions.

Status of Voluntary Non-Regulatory Programs

In addition to the mandatory building standards, the Korean government has also established an impressive number of voluntary programs to stimulate building energy efficiency. These include:

1. Issuance of Certificates of Building Energy Efficiency (Grade 1-3) for buildings above a given energy performance standard. Certified facilities are eligible for long-term and low-interest loans from KEMCO.

2. Issuance of certification for buildings that have the capacity to improve environmental performance and reduce energy consumption and GHG emissions through life cycle assessment. This is also implemented by KEMCO under Notification No. 2002-239 of the Ministry of Commerce, Industry and Energy. These cover co-generation, energy savings, ESCO, demand forecasting, or use of alternative energy (see Table 2).

Related end-use efficiency programs

1. Since December 1996, Korea has been implementing a High-Efficiency Equipment Certification Program that certifies high-efficiency equipment such as boilers, motors, and lamps and provides financial support and tax benefits to equipment manufacturers. By 2001, 22 items were certified. The number increased to 34 in 2007, and the future plan is to increase to more than 40 by 2009.

2. Since 1992, efficiency standards (grades 1-5) and labels have been marked on products including refrigerators and automobiles. By 2001, 5,294 models of 11 items were classified and registered, of which 3,849 models were evaluated as high efficiency products of grades 1 and 2, representing 73% of the total number of products. The government plans to increase 1 to 2 items per year that are subject to efficiency classification. For example, compact fluorescents (CFLs) were added in 2003. The Minimum Energy Performance Standard (MEPS) is continuously implemented and upgraded. Currently, refrigerators, air-conditioners, and gas boilers are subject to the MEPS.]

3. Through the amendment of the Promotion Act for New and Renewable Energy Development, Utilization & Dissemination in February 2002 and the Energy Conservation Guideline for Public Institutions in April 2002, public institutions including government institutions are required to use high-efficiency products and equipment.

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Table 2. KEMCO's financial support for projects in the rational use of energy in the buildings area

(under Notification No. 2002-239 of the Ministry of Commerce. Industry and Energy)

			Incentives (Financial Support)
Project with Energy-Saving Facilities	Energy-Saving Project	- Co-Generation - Energy-Saving Facilities	Facility construction cost on loan (100% of the facility construction cost, at an annual interest of 5.25%) / 8-year grace period and loan payable in 7 years Under 10 billion won for each project owner
		- Voluntary Agreement	Facility construction cost on loan (100% of the facility construction cost, at an annual interest of 4.00%) / Under 10 billion won for each construction site / 8-year grace period and loan payable in 7 years Under 20 billion won for each project owner / Review energy-saving performance in last 5 years and energy-saving plan for upcoming 5 years
	ESCO (Energy Saving Company) Project	-	Facility construction cost on loan (100% of the facility construction cost, at an annual Interest of 4.00%) / 5-year grace period and loan payable In 5 years Under 10 billion won for each investor
	Demand Forecasting Project	- Demand Controlling Facilities - Thermal Storages	Facility construction cost on loan (100% of the facility construction cost, at an annual interest of 4.00%) / 3-year grace period and loan payable in 5 years. Under 20 billion won for each building
	Energy-Saving House Promotion Project	- Project Promoting Energy Efficiency Labeling Certification Program for Building Efficiency	Facility construction cost on loan (100% of the facility construction cost, at an annual interest of 4.00%) / 2-year grace period and loan payable in 2 years Under 15 billion won for each construction site (Under 30 billion won for each project owner) 30-40% energy efficiency, and grade 2 or higher grade required
Project with Alternative Energy Source		- Solar Energy Facilities - Alternative Energy Facilities	Facility construction cost on loan (100% of the facility construction cost, at an annual interest of 4.00%) / 3-year grace period and loan payable in 5 years Under 15 billion won for each project owner

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