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72

Recommendations for Improving Incentive Systems in the Building Sector of South Korea

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ABSTRACT

Purpose: Reducing energy consumption and greenhouse gas emissions is a primary concern throughout the world, and the building sector is a particularly efficient area for making these reductions. In South Korea, the government has recently enacted policies for "Green Growth" that, among other things, enforce regulations in the building certification rating system (BCRS) and reorganize existing incentive systems. Method: In this study, we examined regulations and incentive systems used in the United Kingdom, Germany, and the United States that encourage the use of energy efficient technologies in construction and compared these policies to those used in South Korea. We also disseminated surveys to experts in the fields of architecture, planning and design, and engineering to better understand their knowledge and perception of the BCRS and its incentive systems. Additionally, we sought their recommendations for improving these incentive systems. Result: Based on our comparative case studies of regulations and incentives in other countries, alongside recommendations from experts in South Korea, we concluded that incentive systems in South Korea are limited and require improvement. We make recommendations for strengthening existing regulations and incentives and for implementing new incentive programs.

KEYWORD

Inducement regulation
Building certification rating system
Energy performance certification

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1. Introduction

Greenhouse gas emissions are a primary concern throughout the world. International pressure to reduce energy consumption has accelerated since the United Nations Framework Convention on Climate Change was established in 1992. Systematic policies have been established in many advanced countries to make these reductions.

The European Union (EU) has set a goal of increasing energy savings by 20% by 2020 [1] while the United States (US) legislated the Energy Independence & Security Act in 2007 to promote improved energy performance and reduced energy consumption by the Federal Government. However, even though energy use reductions in the building sector have been realized in many countries, reductions in this sector are often difficult, primarily because of inadequate or inefficient laws, incentives, implementation techniques, and available building materials and products [2].

Buyers of real estate are more inclined to concentrate on the upfront price of a property, which is perfectly visible [3]; however, there is no evidence that a significant relationship exists between environmental and/or energy performance and rental capital values [4]. Because executants will not keep investing in activities if the public benefit cannot be transferred to them [2], it is unlikely that business proprietors and owners will improve the energy efficiency of their buildings. In addition, many construction projects suffer from time delays, cost overruns, and quality defects [5]. Thus, incentives offered at the proper time, in the proper way, and to the proper people are critical for broadly improving energy efficiency in existing and new construction.

In general, energy policies are categorized into economic, administrative, and informative policy instruments [6]. In addition, energy subsidies can act as tools that have both direct impacts (e.g., grants and tax exemptions) and indirect impacts (e.g., regulations) on prices or costs [7]. In this study, we focus on economic energy policies and the direct and indirect impacts of these policies. Our overall objectives in this study are to better understand energy policies and incentive systems in the building sector in South Korea and to make suggestions for improving them. To do this, we investigate incentive systems used in key developed countries throughout the world.

These incentive systems fall into two categories: financial (direct) support and non-financial (indirect) support [8]. Financial support systems are directly connected to monetary value (e.g.,

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initial construction cost, tax demanded before completion, and loans) and are typically related to the beginning of the building process. Non-financial support systems, on the other hand, are related to any non-monetary bonus or reward that encourages participation in a given program. Although non-financial support systems do not lead to a direct cost reduction, these bonuses or rewards often lead to a total cost reduction and determine market prices. Both types of incentive systems can be further categorized by time period within the building's life cycle (i.e., initial cost of business, cost of construction, and running cost) and beneficiary type (i.e., business proprietor, owner, manager, and user). In addition to these case studies, we undertake a survey of experts in architecture-related fields in South Korea to gauge their opinions regarding the building certification rating system (BCRS) and how underlying incentive systems could be improved. Based on the study's two approaches, we conclude with recommendations for how to improve South Korea's policy and incentive systems for increasing the use of energy-efficient technologies.

2. Comparative case studies

2.1. Building a Certification Rating System based on Energy Performance of Building Directives

In all EU member countries, energy policies related to building energy efficiency are based on the European Energy Performance of Building Directive (EPBD) [9], whose implementation is based on individual national-level legislation. Under the EPBD, Energy Performance Certification (EPC) [9] is required by law for all buildings to provide a standardized rating from A (good) to G (poor) that describes the energy performance of a given building and allows ratings of energy efficiency to be comparable among similar structures. Because EPC typically involves energy audits under Energy End-use Efficiency and Energy Services [10], it can offer valuable information to existing building owners or tenants and is required to be made available to prospective buyers/tenants before a building's sale/rental [11]. EPC is expected to influence purchasing and renting decisions by revealing reliable information on the energy efficiency of a building [12]; however, the lack of evidence on the returns of energy efficiency improvement continues to be one of the most significant barriers to energy efficiency investments [13]. Furthermore, the influence of sustainability and energy efficiency on the financial performance of commercial property investments is mostly a topic of speculation, rather than being subject to rigorous empirical evaluation [13]. Thus, incentives under BCRS require rigorous analysis.

Activities under the EPBD are mandatory and utilize non-financial support systems, such as the Sustainable Energy Europe Campaign [14], to raise public awareness and promote sustainable energy production and use. In addition to the EU's model program, we investigate incentive systems used to promote improved energy efficiency in specific countries, including the United Kingdom (UK), Germany, the US, and South Korea. Summaries of the incentive systems for each of these countries are provided in Table 1.

2.2. Examples of Key Developed Countries

2.2.1 The United Kingdom

In the UK, buildings are responsible for almost 50% of the country's energy consumption and carbon emissions [15]. In an effort to decrease energy consumption and reduce greenhouse gas emissions to 12.5% below 1990 levels, the UK has implemented a number of regulations and incentive programs. For example, regulations include the Buildings Act of 1984, which set standards for the design and construction of buildings in England and Wales [14, 16], and the EPBD. Direct financial incentives employed by the UK include the Landlord's Energy Saving Allowance (LESA), which provides tax deductions to private landlords who make investments in certain energy saving measures (e.g., improved insulation) for rental properties [17]. Similarly, Enhanced Capital Allowances provide tax relief for business owners who purchase and install energy saving technologies (e.g., boilers, heat pumps for space heating, ventilation, and air conditioning zone controls) [18]. Finally, the Climate Change Levy is a tax on the use of energy in the industrial, commercial, and public sectors with the objective of encouraging businesses to become more energy efficient and reduce greenhouse gas emissions [19].

In addition, the UK uses EPCs alongside Display Energy Certificates to inform the public of operational ratings for energy use over the previous three accounting periods. Information from these certificates can inform potential property buyers and renters of a building's energy efficiency,

which ultimately affects market prices. Furthermore, the UK offers energy audits to help owners identify areas of improvement for energy efficiency and, accordingly, costs related to energy usage [20].

2.2.2 Germany

In an effort to slow the effects of climate change, Germany has been a frontrunner among EU members in decreasing energy usage and greenhouse gas emissions. Like the UK and other EU countries, Germany utilizes EPCs. Its regulations include the Energy Conservation Act (e.g., Energieeinsparungsgesetz and EnEG) [21] and the Energy Regulation Act (e.g., Energieverordnung and EnEV) [19]. Furthermore, the German government encourages energy

conservation and promotes renewable energy development by offering long-term, low-interest financing to individuals under programs by the Germany Credit Institute for Reconstruction (KfW: Kreditanstalt fur Wiederaufbau), paid for through the Ministry of Finance. Loans can be used to purchase technologies that will improve energy efficiency or reduce carbon dioxide emissions. Loans are determined based on number of family members in a household, household income, cost of living, monthly rent fee, housing deterioration, and facilities. Subsides are typically a direct cash payment by the government to an energy producer or consumer in order to stimulate the production or use of a particular fuel or form of energy [7]. Finally, the Ecological Tax Reform imposes an energy tax in addition to an incremental tax increase on oil in an effort to discourage high energy consumption [22].

2.2.3 United States

Energy policies in the US are determined by federal, state, and local entities and include legislation, accession to international treaties, subsidies and incentives for investment,

investment, guidelines for energy conservation, taxation, and other public policy techniques. Financial incentives have been incorporated in the National Energy Act (NEA), which was implemented in the 1970s to deal with energy security assurance. As a grant policy, the Act offers tax deductions to businesses that purchase facilities related to renewable energy. Furthermore, there are insulation rebates and other incentive-based programs offered by federal and state governments as well as local utilities to building owners and corporations that install energy efficient products and technologies. In addition, commercial building tax deductions provide incentives for building owners who implement energy saving retrofits to their properties.

In the US, the most common non-financial incentive system is energy labeling or energy certification on individual products, which informs potential buyers of energy use characteristics and options for improvement [23]. Labeling services can be comparative (e.g., EnergyGuide) or act as endorsements (e.g., EnergyStar) [24]. For example, EnergyStar is an international standard for energy efficiency in consumer products originally created in 1992 by the US's Environmental Protection Agency.

3. Building a Certification Rating System in South Korea

In South Korea, the BCRS is a building performance measurement system and policy that offers business proprietors, owners, managers, and users objective building information (e.g., how much energy is consumed and the building's monetary value). This system is based on the EU's EPBD. Because the BCRS is strictly voluntary at this point in time, the South Korean government also provides financial incentives to encourage participation, increase interest in the policy, and reduce initial investment costs. Government -sponsored incentive programs can greatly increase the likelihood that an owner will incorporate energy efficient technologies into new and existing structures, and these programs have been regarded as the keystone for improving the energy efficiency of buildings [2].

The predominant energy policy in South Korea focuses on improving energy efficiency in buildings, making the BCRS one of the most important building-related policies. It has been amended four times since its initial implementation on 29 August 2001.

The amendment, in December 2009, expanded certification requirements to include new office buildings in addition to homes, and simultaneously consolidated evaluation standards. Although the BCRS is currently voluntary, some public institutions are obliged to follow its mandates and achieve a second grade BCRS rating.

The most recent amendment of the BCRS, in May 2013, included detailed certification criteria to encourage people to improve energy efficiency for existing structures. The BCRS has two phases: pre-certification and main certification. The main certification phase is used to estimate a building's energy performance through field investigation after the completion of construction. Table 2 show the number of certifications within the three-grade framework of the BCRS in South Korea, which means the second grade accounted for 65.6% of pre-certification levels and 68.8% of main certification levels by December 2013.

This is likely because public institutions typically attempt to acquire a second grade or better in their new construction.

In addition, business proprietors are eligible for tax reductions in acquisition and registration fees when their buildings achieve a second grade or better, which provides strong incentives to reach this level.

Financial incentives for the BCRS program are available to individuals before and after they acquire EPCs. For example, the South Korean government offers programs such as low interest financing and matching grants to reduce initial building costs for individuals who plan to use energy efficient technologies in construction. New home owners are eligible to receive up to KRW200,000 (USD185) per unit area if the home earns a first or second grade within the BCRS program. In addition, the Renewable Portfolio Standard is a regulation that requires increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal. In addition, business proprietors can get initial tax reductions (e.g., Article 286, Local Taxes Act).

As well as direct financial support systems, indirect non-financial incentives are offered in South Korea to encourage individuals to construct energy efficient buildings under the BCRS program (Table 1). For example, density bonuses permit developers to increase the maximum allowable development on a property. Similarly, the government relaxes restrictions on maximum building height and extent of landscape architecture depending on the structure's Energy Performance Index and BCRS grade.

Compared to incentive systems for energy efficiency used in other parts of the world (Table 1), South Korean incentive systems are relatively limited. Most financial support systems are run by the government, while there is limited use of many types of non-financial support systems (e.g., marketing for sale, logo certification, and free technical assistance). In addition, those support systems that are used typically focus on reducing initial costs (e.g., tax exemptions), which are primarily beneficial to business proprietors and owners. However, management and operational costs account for 83.5% of life cycle building costs [25], and additional support systems that reduce these costs are needed urgently.

4. A Survey Design of the Need for Incentive Systems

We designed a survey for the purpose of gathering opinions on how the BCRS could be improved in the future [26]. The survey contains 23 questions in two main parts that require both objective and subjective answers. The parts are: (1) obligations of the BCRS and (2) the legal framework and operating system. The questions focus on the awareness, need, obligations, and legal framework of the BCRS, as well as incentive systems, EPC leasing, and trading.

Ideally, we would have liked to gather all types of beneficiaries (building proprietors, owners, managers, and users). However, BCRS is not yet an obligatory legislation for the public in South Korea and the public does not generally know about the system. Furthermore, in South Korea, legislation is enacted by parliaments, which commonly receive professional advice from experts. Therefore, we decided to disseminate our questionnaire via email [27, 28] to members of the Architectural Institute of South Korea who are major agents in the construction industry, employed by government-related organizations, or are researchers.

Table 1 Incentive systems for promoting improved energy efficiency and reduced energy consumption in the United Kingdom (UK), Germany (G), United States (US), and South Korea.

Incentive	Details	LCC a c			Beneficiaries b c			Case Studies	South Korea
		I	C	R	BP	O	M&U		
Financial Support System (direct)	Grants to Producers or Consumers	▒			■			Direct Grant (G) / REAP (US)	Renewable Portfolio Standard (RPS)
	Low-Interest Financing	▒			■			Preferential Loan (G)	EPC 1stgrade:Lessthan$200perarea EPC 2ndgrade:Lessthan$150perarea
	Tax Exemptions			▒		□		Landlord's Energy Saving Allowance /Enhanced Capital Allowances / Climate Change Levy (UK) Ecological Tax Reform (G), Commercial Building Tax Deductions (US)	1st grade or above EPI 90point : 10–15 % 2nd grade or above EPI 80–89point : 5–10 %
Non-Financial Support System (indirect)	Marketing for Sale		▒	▒	■	□		Energy Performance Certifications (UK, G)	None
	Logo Certification			▒		□	□	Energy Performance Certifications (UK, G) EnergyStar (US)	None
	Free Technical Assistance			▒			□	Energy Auditing (UK) Information and Advisory System (G)	None
	Density Bonus	▒			■			None	EPI point and grade of EPC : 2–6 % EPI point and grade of EPC and GBC : 4–12%

a Specific phases of the building life cycle (LCC; initial cost of business (I), construction cost (C), and running cost (R))
b Specific beneficiaries (business proprietor (BP), owner (O), and manager/user (M&U))
c what phase of the LCC and beneficiary are impacted by a particular existing (black square) or proposed (open square) incentive

Table 2 Number of pre- and main certifications given within the framework of the Building Certification Rating System (BCRS) as of December 2013 in South Korea.

	Pre- Certification				Main Certification			
Grade	First	Second	Third	Total	First	Second	Third	Total
N (%)	213 (26.7)	524 (65.6)	62 (7.8)	799 (100)	90 (25.3)	245 (68.8)	21 (5.9)	356 (100)

Table 3 Employment and educational background of survey respondents (total: 114).

	N (%)	N (%)	N (%)	N (%)	N (%)
Workplace	University	Architecture firm	Other institution	Students	Engineering firm
	50 (43.9)	39 (34.2)	11 (9.7)	6 (5.3)	8 (7)
Educational Major	Planning & Design	Energy	Education & Research	Construction	Other
	61 (53.5)	20 (17.5)	10 (8.8)	10 (8.8)	13 (11.5)
Experience in Field	> 20 years	10-20 years	< 10 years		
	47 (41.2)	36 (31.6)	31 (27.2)		
Highest Degree	Ph.D.	Master's Degree	Bachelor's Degree		
	58 (50.9)	40 (35.1)	16 (14)		

This is because we are of the view that the survey should be oriented toward informed people. Thus, we chose only experts for our sample rather than beneficiaries.

For these reasons, we targeted individuals based on their expert knowledge and motivation to improve existing policies. Two weeks after sending the questionnaires via email, we received responses from 114 individuals (Table 3).

As Table 3 shows, a significant proportion of respondents are employed by universities in architecture-related departments (43.9%) or architecture firms (34.2%) and have worked in their field for more than 20 years (41.2%).

The educational backgrounds of respondents are primarily in planning and design (53.5%) and energy (17.5%), and most have earned a graduate degree (PhD: 50.9%; Master's: 35.1%).

5. Results and Recommendations

5.1. Objective answers

The majority of respondents indicate that the BCRS has led to an improved level of energy savings (76.3%, who choose the upper categories 4 or 5) and an improved economy (71.1% choose categories 4 or 5). They also indicate that the BCRS has improved

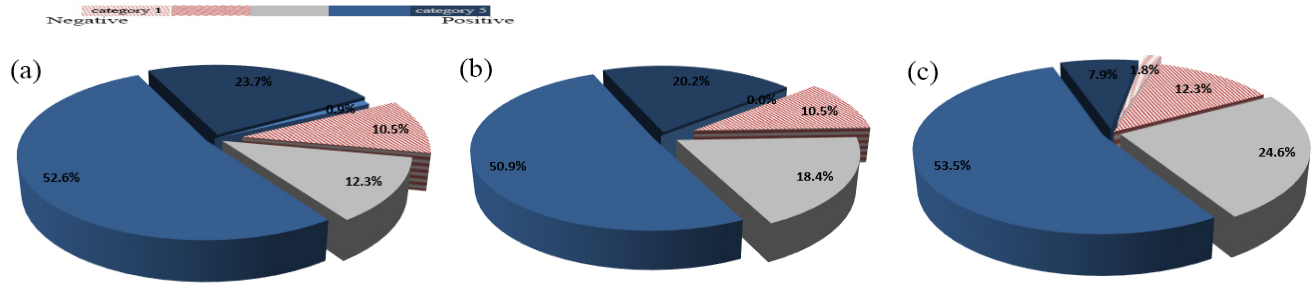

Fig. 1. Proportions of survey responses by impact levels of the Building Certification Rating System (BCRS).
These represent whether the respondent indicates that the BCRS has affected (a) energy savings and the economy and (b) quality of life. Respondents also highlight (c) the BCRS's overall impact

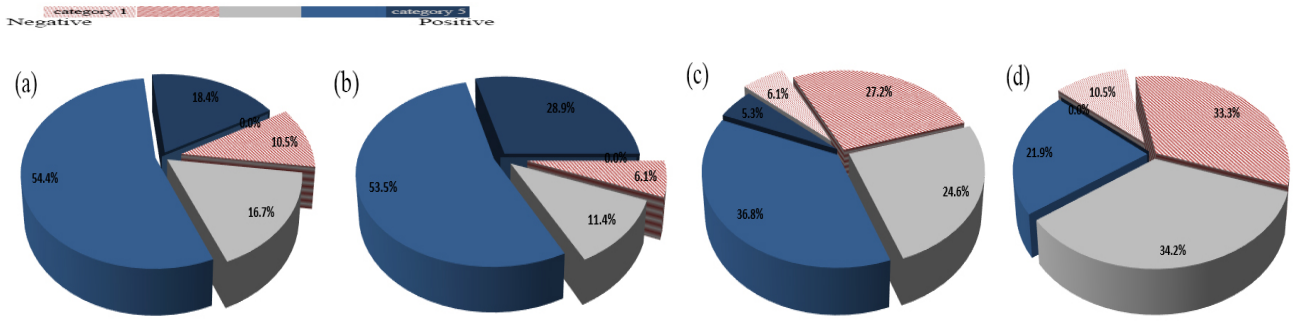

Fig. 2. Proportion of survey responses by knowledge levels of the Building Certification Rating System (BCRS).
These are for (a) level of respondent knowledge of the BCRS program, (b) level of respondent interest in the program, (c) level of respondent knowledge of incentive programs under the BCRS, and (d) whether respondents indicate existing incentive programs are appropriate for the BCRS system.

quality of life (61.4% choose categories 4 or 5) (see Fig. 1).

As Fig. 2 shows, we find that 72.8% of respondents know about and 82.4% of respondents are interested in the BCRS program (these proportions choose categories 4 or 5). In addition, we find that 42.1% of respondents know about incentive programs under the BCRS program (they choose categories 4 or 5). As Table 4 shows, the significance probability is 0.000, which is less than the significance level of 0.05.

In addition, Fig. 2 shows that approximately twice as many respondents indicate that existing incentive systems for the BCRS are inappropriate (43.8%, who choose categories 1 or 2) compared to those that indicate they are appropriate (21.9% choose categories 4 or 5).

5.2. Subjective answers

We invite written answers from respondents and find that financial incentives are proposed by respondents more often than non-financial ones. Respondents particularly recommend expanding the use of tax exemptions. They also recommend that existing incentives (e.g., tax exemptions, grants, and density bonuses) should be reinforced alongside the introduction of new incentives (e.g., costs of repair, utility fees, fast track permitting, marketing for sale, and free technical assistance).

5.3. Recommendations for improving energy efficiency in South Korea

Density bonuses are currently the main incentive type used in South Korea (clause 4, Article 65 and clause 2, Article 66 of The Building Act). They are employed substantially more often than grants and subsidies. Thus, we recommend that financial support systems should be expanded such that incentive programs target tax exemptions at all phases of a building's life cycle, not just the initial cost phase. Such tax exemptions could be used to reduce costs for maintenance, management, and repairs or for remodeling. In addition, low interest financing for remodeling and reconstruction could encourage owners to incorporate energy efficient technologies.

We also recommend the consideration of alternative direct financial incentives for users (e.g., utility fees and diversification of electricity pricing). For example, electricity fees can be considered a de-escalated system that can be applied to customers who achieve EPCs or use energy efficiency equipment.

South Korea currently has a progressive tax scheme. Furthermore, regular education (e.g., free technical assistance)

Table 4 Statistical probability of respondents' knowledge of/ interest in the Building Certification Rating System (BCRS)

	Mean	Variance	F	P-value	Scheffe
(a) level of respondent knowledge of the BCRS	3.807	0.741	35.173	p < .001 (1.32E-14)	b > a > c
(b) level of respondent interest in the BCRS	4.053	0.652			
(c) level of respondent knowledge of incentive system under the BCRS	3.079	1.000			

Table 5 A classification method for incentive systems in South Korea used to encourage use of energy efficient technologies in building construction.

Incentives	Details of Incentive (NF/F(%)) a	LCC b d			Beneficiaries c d			Case Studies
		I	C	R	BP	O	M&U	
Relaxing regulations	. density bonuses (NF/8.8%) . an optional choice among regulations (NF/8.8%)	■ □			■ □			Density Bonuses
Expansion of tax exemptions	. existing tax (acquisition, registration) (F/20.6%) . an optional choice among other tax (F/8.8%) (transfer tax, etc.)		■ □			■ □		LESA/ECAs ETR
Grants to facilities	. installation cost of new renewable energy (F/11.8%) . installation support of high efficiency equipment (F/5.9/%)	■ ■			■ ■			RPS CCL
Cost benefits after completion	. cost for maintenance/ management (F/2.9%) . cost for re-modeling/ repair (F/11.8%) . low-interest financing for remodeling and reconstruction (F/2.9%)			□ □ ■		□	□ ■	From Survey CBTD Preferential Loan
Logo certification	. renewal expenses of certifications (F/2.9%) . for maintenance of certification rating (NF/2.9%)		□ □	□ □		□ □	□ □	From Survey From Survey
Direct benefits for users	. utility fee (electricity/gas)(F/11.8%) . diversification of electricity pricing (F/2.9%) . marketing for sale (NF/2.9%) . free technical assistance (NF/2.9%)		□	□ □ □ □	□	□	□ □ □	From Survey From Survey EPCs Energy Auditing
Others	. expedited and fast track permitting (NF/5.9%)					□		From Survey

a Columns indicate two categories of incentive system (financial (F) and Non-financial (NF))
b Specific phases of the building life cycle (LCC; initial cost of business (I), construction cost (C), and running cost (R))
c Specific beneficiaries (business proprietor (BP), owner (O), and manager/user (M&U))
d what phase of the LCC and beneficiary are impacted by a particular existing (black square) or proposed (open square) incentive.

could be used as an indirect non-financial incentive to provide users with expert knowledge and encourage the use of energy efficient technologies. Table 5 summarizes our recommendations for improvements to incentive systems in South Korea.

6. Conclusions and Discussion

In South Korea, the Presidential Committee on Green Growth set a target of reaching full zero energy for all buildings by 2025, that is, 100% of all buildings' energy should come from renewable sources. In addition, the government has mandated that, from 2017, EPCs must be provided for any building sold or rented (Presidential Committee of South Korea, 2011).

To accomplish these goals and mandates, we conclude that the BCRS must transition from a voluntary to a mandatory program. In addition, stronger alternative incentives are needed to encourage people to build with energy efficient technologies.

In this study, we found that South Korea's current incentivesystems are limited compared to other countries and non-financial incentives are rarely used. Based on the responses of experts in the fields of architecture, planning and design, and engineering, we recommend that existing incentives in South Korea (e.g., tax exemptions and density bonuses) be expanded to include application range, application ratio, and cost. The experts in our survey especially recommend that direct benefits (e.g., marketing for sale and regular technical assistance) should be offered to users. Incentives of this type can be important in a voluntary program to ensure that users become active supporters.

In addition, we expect that reductions in electricity/gas utility fees and fast track permitting would be strong direct financial benefits for users. Finally, we recommend implementing new incentive programs, including cost benefits after completion of buildings (e.g., repair cost, maintenance cost, and low interest financing for reconstruction).

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