



# Case 5: Seoul

## Building Retrofit Program (BRP) Loan Support Scheme

### Abstract

As part of its wider One Less Nuclear Power Plant policy, Seoul Metropolitan Government has formed an ambitious Building Retrofit Program (BRP) to spur retrofitting in government, commercial and residential buildings. This case focuses on the loan support scheme for this programme that targets building owners and tenants, and also, energy service companies and retrofitting contractors. This initiative promotes energy efficiency refurbishments by facilitating access to highly attractive, low interest rate loans with generous repayment and grace periods. In parallel, it lowers financial barriers to key building technologies such as high performance insulated windows and doors.





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## 1. Programme context

### Citywide reduction target(s)

In 2012, Seoul Metropolitan Government (SMG) launched its ambitious vision for 2020 in its One Less Nuclear Power Plant policy. Phase One of this plan aimed to reduce energy demand by the equivalent of 2 million tonnes of oil equivalent (TOE) by 2014. This amount equates to the output of a typical nuclear power plant for the period. Energy reduction strategies were formulated for six key areas: new and renewable energy production, building retrofitting, environmentally friendly and high-efficiency transportation, green job creation, smart urban planning and fostering of energy conservation in the civic sector. The 2 million TOE goal was met within two years, in the first half of 2014, approximately six months ahead of schedule. From July 2014, Phase Two set the goal of achieving a 20% rate of self-sufficiency in electricity production by 2020 from 2012 levels whilst also achieving 4 million TOE of energy savings and production. This would lead to a 10 million tonne savings of GHGs.

In addition to the One Less Nuclear Power Plant policy, SMG has also set the target of reducing CO<sub>2</sub> emissions by 40% by 2030 relative to 2005 levels.

### Built environment context and programme background

In South Korea, energy consumption continues to climb each year. Presently, 83% of national GHG emissions are related to energy production and consumption. Recently, in response to growing energy demand and instability of supply, the Government of South Korea has continued to expand nuclear power generation.

South Korea's share of domestically produced energy accounts for only 4%. The other 96% is dependent on imported energy resources such as oil, natural gas and uranium. Despite this reliance on imports, government subsidies and supportive policies for nuclear energy (especially electricity of which around 30% is generated from nuclear power plants) have resulted in electricity prices significantly cheaper than other industrialised nations.

Energy consumption is particularly high in the Seoul metropolitan area, home to some 10 million residents. In 2011, Seoul was consuming 7.5% of total national energy and 10.9% of national power consumption. Between 2009 and 2013, electricity consumption grew annually at 1.12% and was forecast to reach 50,330 GWh by 2020. In 2013 Seoul's use share of renewable electricity made up 4.2%, with the remainder coming from fossil fuels and nuclear. Furthermore, the building sector in Seoul is responsible for emitting annually 32.96 million t-CO<sub>2</sub>. This makes up 69% of citywide GHG emissions. The building stock is dominated by commercial and residential buildings. Some of this is aged, as a total of 340,000 citywide residential buildings were built over 20 years ago. Having been constructed during an era where energy efficient design was not emphasised, some of these buildings have poor energy efficiency. The energy





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efficiency standard for new building design has been strengthened since 2001, however retrofitting the older stock is an important challenge.

Despite a large potential for raising energy efficiency, retrofitting buildings to reduce energy expenditures has lacked an economic rationale due to cheap consumer prices for electricity. A national loan programme has existed for several years to help with the financing of energy efficiency upgrades for industrial facilities at the national level. However this did not cover the retrofitting of older commercial and residential buildings, including small houses, which account for the majority of energy consumption in Seoul.

SMG's Building Retrofit Program (BRP) therefore sets out to advance energy efficiency in government, commercial and residential buildings to pursue progress towards the One Less Nuclear Power Plant target and the citywide CO<sub>2</sub> reduction goal of 40% by 2030, from 2005 levels.

## 2. Programme overview

### Overall goals and start year

Starting in 2008, BRP aims to spur the retrofitting of government, commercial and residential buildings to reduce energy consumption as part of the wider One Less Nuclear Power Plant policy. In its early stages, BRP began with a focus on retrofitting projects for commercial and public buildings (including social welfare facilities and schools). Specific strategies for this includes developing a model to demonstrate energy efficient upgrades, provision of guidelines for inspection of building energy performance and deploying building energy management systems (BEMS), provision of retrofitting subsidies and installation of LED lighting. For particularly energy intensive commercial buildings, SMG analysed energy consumption patterns, disclosed this data and reduction measures to the public, and additionally, offered various incentives to entice retrofitting. As of 2015, retrofitting has been carried out on 59 social welfare facilities, 116 schools and several hundred commercial buildings. BRP aims to achieve the retrofitting of 90,000 buildings by 2018. This goal also represents 20% of total citywide buildings built over 20 years ago.

In parallel, BPR has been accompanied by other SMG efforts as part of the One Less Nuclear Power Plant policy. One key and connected programme involves diffusing the installation of several million LED lights across the city. This has targeted subway systems, high-rise apartment buildings, restaurants, fitness centres and so on. An Energy Service Company (ESCO) program was introduced to replace the lighting in underground parking lots of apartments and office buildings with LED lights. Lighting is installed free and costs later recuperated from electricity invoices. These various BPR initiatives for public and private buildings are also supported by improving energy policies in the field of urban planning and architecture at the municipal and national government level.

In 2012, the focus and strategy of BRP expanded measures to explicitly drive retrofitting in residential buildings by integrating a loan support scheme with cooperation of private lending institutions.

### Target and scope

This case study focuses specifically on the BRP loan support scheme for private buildings, which as mentioned, forms a key component of the wider BRP project.

Anyone within the Seoul metropolitan area can apply for a BRP loan. Eligibility includes the owners and tenants of both residential (including multi-family buildings and single apartments, townhouses or detached housing) and commercial buildings. ESCO registered businesses and energy saving equipment suppliers and installers may also apply to the loan to expand business operations. Financing may be used, for example, to procure and replace high-

performance insulation and windows, LED lighting and lighting equipment, air-conditioning and heating systems and renewable energy production facilities.

There are two types of BRP loans: “Housing BRP” targeting the residential sector and “Building BRP” (non-residential) targeting commercial buildings. In 2016, Building BRP supports loans in the range of KRW 5 million to 20 billion (\$US 1 = KRW 1,126.24 as of 17.9.2016) whilst the Housing BRP provides between KRW 2 million to 15 million to each applicant. Loans may cover up to 100% of project costs. An attractive low interest rate and long-term payback period has been set for the programme. In 2016, interest rates were set to 1.45% and payback periods up to eight years. As of 2015, total loans provide through the programme amounted to KRW 54.9 billion.

Programme structure and function

Figure 1 explains the process of the BRP loan support scheme and the involvement of three sets of actors: applicants, SMG officials and private financial institutions. The application process is essentially the same for all types of buildings and applicants.

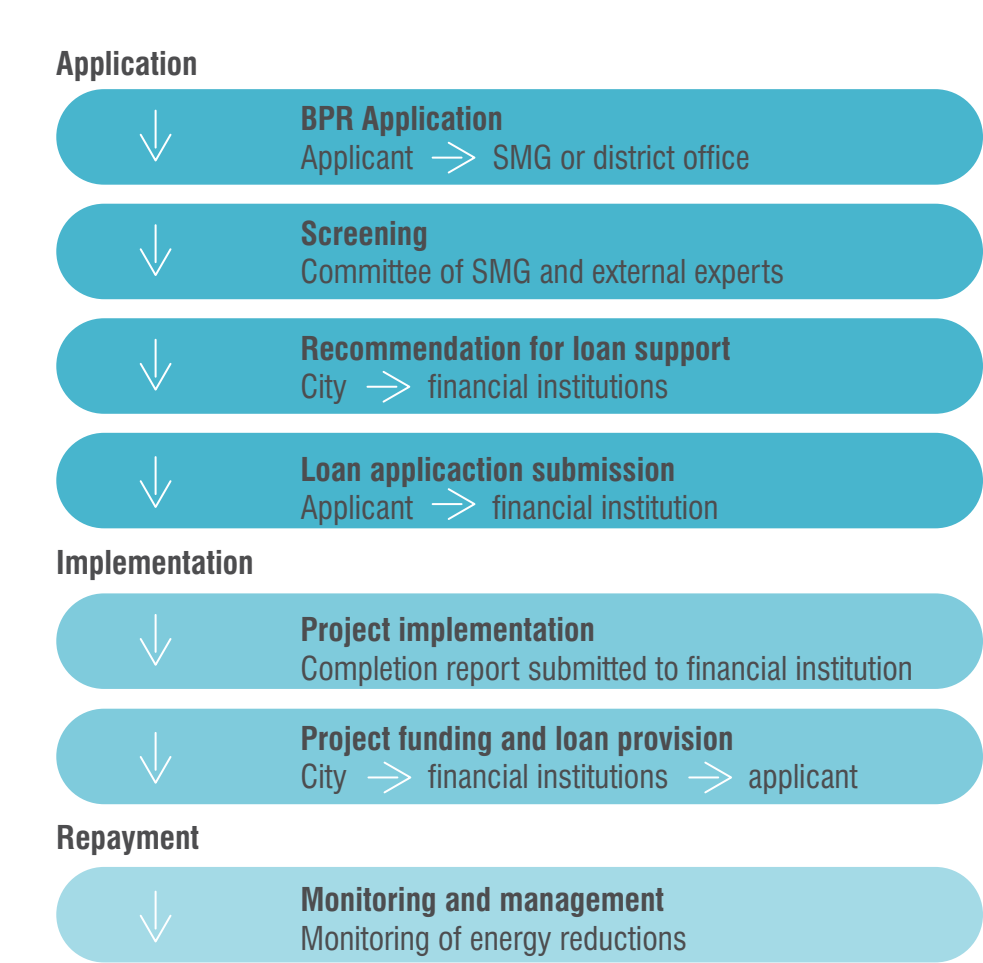
Application

Applicants first submit an application to SMG or a district city office. Applications must include an overview of the planned nature and scope of the energy reduction retrofitting or construction project. This plan must also outline the projected energy savings. Eligible projects for commercial buildings would include, for example, installation of exterior wall insulation and high-performance insulated windows, lighting and equipment, Building Energy Management Systems (BEMS), waste heat recovery systems and high-performance heating, ventilation and air-conditioning systems and renewable energy installations. For residential, projects would typically include upgrades or installation of insulated windows, doors and entrances, wall insulation, high-performance heating systems and LED lighting. Loan support only applies to retrofitting or construction projects under planning or still in the process of implementation. Completed projects are not eligible to apply.

SMG officials evaluate the application to assess the adequacy and economic feasibility of the proposed retrofit and to determine suitability for loan support. Screening is conducted by a committee comprising of two SMG officials, one representative from the Korean Energy Agency and three external experts from the field of building, machinery and electrical engineering. In this manner, SMG serves as a screening committee for banks, helping eliminate technical and financial uncertainty. This committee also act as a mediator between banks and the borrower, who in many cases, would not be able to secure finance if approaching a lender directly.

In the case of a successful screening, SMG then makes a recommendation to financial institutions and the applicant submits a loan application to a bank. The bank confirms the possibility of financing.

Figure 1: Overview of BPR loan support process



Implementation

SMG and the financial institution then review the report and provide loan support upon the approval of SMG. The SMG Climate Change Fund covers the project funds. These are transferred to applicants as a loan from the financial institution. Once funds are received and the retrofitting project implemented, a completion report is then submitted to the financial institution.

Repayment

Applicants repay the loan directly to the financial institution concerned. Applicants have the option of a long-term repayment plan up to eight years. In the case of non-residential buildings, applicants are also eligible for a three-year grace period where repayments are subject only to interest. As detailed below, the performance of retrofit projects is monitored and energy saving amounts recorded by SMG.



**Data collection and utilisation**

To monitor the energy saving impacts achieved by retrofitting, data is collected two different ways. First, the expected energy consumption reduction amounts are provided in the application process, as mentioned. Second, energy consumption amounts are monitored by collecting utility invoices which SMG collects itself. All types of energy consumption are monitored, and the reduction is usually calculated by comparing the fuel consumption amount per hour before and after the retrofit. This hourly rate is then multiplied by the number of hours operated per year.

**Innovative and unique features**

The BRP loan scheme is the first programme in Seoul to cover residential buildings of all types and size. Until now there have been a few national loan schemes that have supported projects for energy efficiency improvement; one being the ESCO programme by the Korean Energy Agency. However, this mostly targets industrial facilities.

Additionally, the loan support scheme is open to all groups of building stakeholders such as owners, tenants, ESCO operators and retrofitting contractors. This approach of opening the scheme to diverse stakeholders has several impacts. Firstly, there have so far been several cases of tenants participating in the scheme. These applications have usually involved the financing of projects which have a shorter period of return on investment and relatively high energy reduction effect such as replacements of indoor lighting to LED. Secondly, by working with ESCOs and contractors, SMG has forged several memorandums of understanding (MOU) with construction material suppliers such as LG Hausys and Eagon Window and Doors. These provide citizens with insulated windows and doors at reduced prices when bought as collective purchasing. Third, by providing low-interest loans to ESCOs, SMG is able to promote uptake of ESCO implemented projects. These are typically self-financing, nullifying the need for building owners to generate repayments on their own accord.

**Incentive and support mechanisms**

The primary incentive for tenants and owners of private buildings to participate in the loan scheme comes from the prospect of receiving finance under highly attractive conditions. As mentioned, interest is currently set to an extremely low rate of 1.45%, loans are repayable over eight years and also include a three-year principal free grace period for non-residential projects. Additional incentives come from the reduced prices for materials such as insulated windows and doors, which are achieved through MOUs between product distributors and SMG. For ESCOs and general contractors, an important incentive is provided where they may use the scheme to apply for loans on behalf of a building owner. This allows them to expand their businesses whilst at the same time playing a key role in marketing the scheme to potential clients.



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**Links to other city policies or programmes**

Since 2012, buildings participating in BPR can receive additional benefits through the SMG eco-mileage system (C40, 2014). This is a reimbursement system, established to incentivise energy conservation in the residential, commercial and public sectors. As of October 2016, 1.87 million memberships have been issued. Based upon the quantity of energy consumption (electricity, natural gas, water and district heating) saved in schools, businesses and individual houses etc., citizens and organisations are able to earn points. These can be redeemed for goods such as LED lamps or services such as ESCOs (in the case of individuals) and financial support for building greening and installation of renewable energy facilities (in the case of institutions). For completed BRP projects, the accumulation of energy reductions can be checked and accumulated through the eco-mileage system and exchanged with these services, goods or monetary benefits.

### 3. Design and implementation

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#### Timeline and inputs

SMG designed the wider BRP initiative by devising a comprehensive plan for rationalization of private building energy performance in 2008. Coinciding with this, SMG reorganised the Climate and Environment Headquarters, where the Energy Efficiency Team under the Environmental Policy Division is in charge of designing and planning BRP. Staff resources included one team leader and four staff members. Implementation of the early BPR initiative took place from 2008. The initial focus was limited to eight pilot retrofitting projects for government buildings and a few private sector, large office buildings which participated voluntarily. These were supported with KRW 500 million per building from the SMG Climate Change Fund, with a total budget allocated of KWR 3.3 billion. From the following year to 2015, a total of KRW 78.9 billion was spent.

BRP entered into a major stage of expansion in 2012 when the SMG launched the One Less Nuclear Power Plant plan. BRP created a new target of including small residential and multi-family buildings to widen retrofitting support from its initial focus on commercial buildings. To this goal, KWR 22.5 billion was set aside for funding the loan scheme in 2012. KRW 15 billion has been set aside for 2016. Also in 2016, a marketing and communication budget accounted for KWR 10 million to produce materials for BRP promotion.

#### Key collaborations

SMG has recruited six banks to serve as official partners and agencies for the loan support scheme. These are Woori Bank, Industrial Bank Capital, Hana Bank, Kookmin Bank, NH Bank and SME bank. Woori Bank is the only one providing a financial service for residential applicants.

In parallel, a large number of MOUs have been forged between the private sector and SMG. These include those created with the Korea Chamber of Commerce and Industry, the Korea Federation of Banks and the Korea Association of ESCOs. As already mentioned, MOUs have also been forged with various suppliers of material such as insulated windows and doors to offer reduced price materials to citizens.

SMG has also collaborated with Korea Green Building Council to offer education and training courses for building interior retrofitting contractors to obtain professional knowledge and skills and also to promote the residential arm of the loan scheme. Participants in these courses include interior design and construction companies, members of Korea Green Building Council and social housing welfare companies. On completion of the course, SMG will select the best performing “Green Interior Shops”. These are given a certification mark and posted on the SMG website for promotion.

#### Compromising or adjustments

Several adjustments have been made to the loan support scheme since initial implementation in 2012. Most notably, SMG has adopted the strategy of constantly reducing interest rates to entice further uptake of the scheme over successive periods. For the first year of BRP, annual interest rates were set to 3%. This was then lowered to 2.75% in 2011, 2.5% in 2012, 2% in 2013, 1.75% in 2015, and most recently, 1.45% in 2016. Also, in reaction to feedback that the application procedure (until recently, conducted in person at SMG or local ward offices) was complicated and inconvenient. A streamlined online procedure was introduced in 2016 with the aim of increasing accessibility to the scheme.

### 4. Outcomes and impacts

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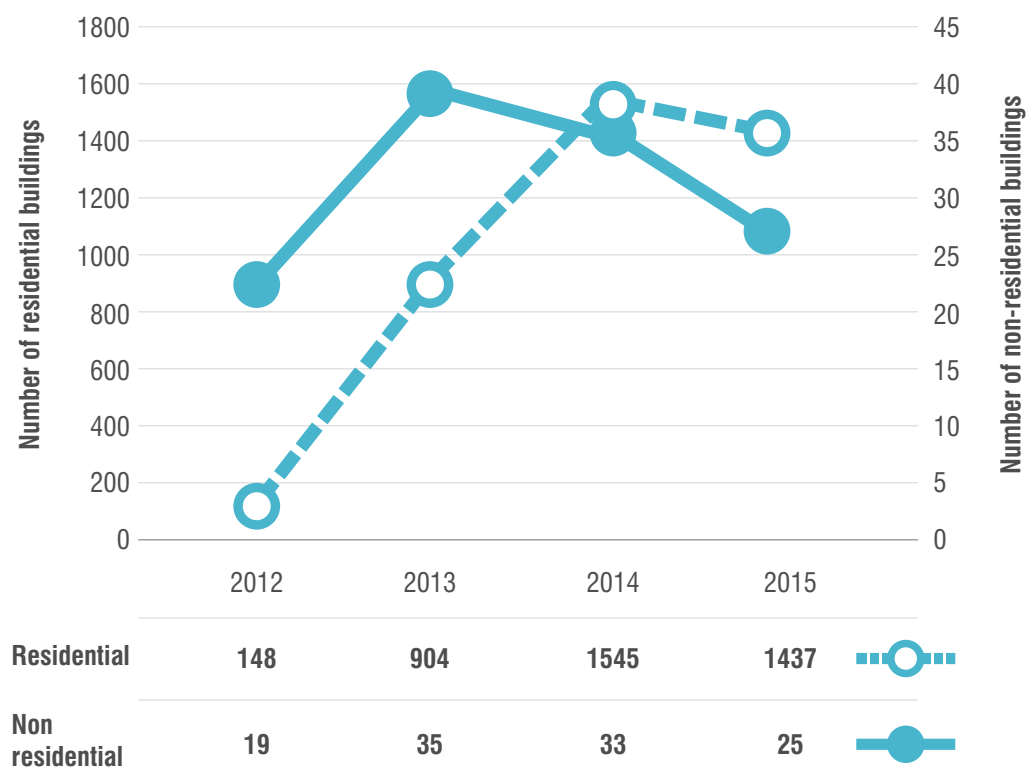
#### Environmental impacts

Some 4,200 projects implemented through the BRP loan support scheme have achieved a savings of 25,841 t-CO<sub>2</sub> for the period 2012 to 2015. Savings are larger for the BRP programme as a whole, owing to the participation of larger commercial and public buildings, and a far larger number of projects. In 2014, SMG collected data from 100 buildings retrofitted over 2012 to 2013. These results show an energy use reduction in TOE of 10% in residential housing and 6.5% in the non-residential building sector.

#### Market impacts

The BRP loan support scheme has clearly brought about an increase of retrofitting across the private existing building sector. Figure 2 shows the total number of buildings that have successfully completed retrofitting projects through the scheme each year. Residential buildings make up the bulk of participants, with a steady growth each year, culminating in a total of 4,034 successfully completed projects in 2015. Non-residential buildings are considerably fewer, with a total of 112 financed as of 2015.

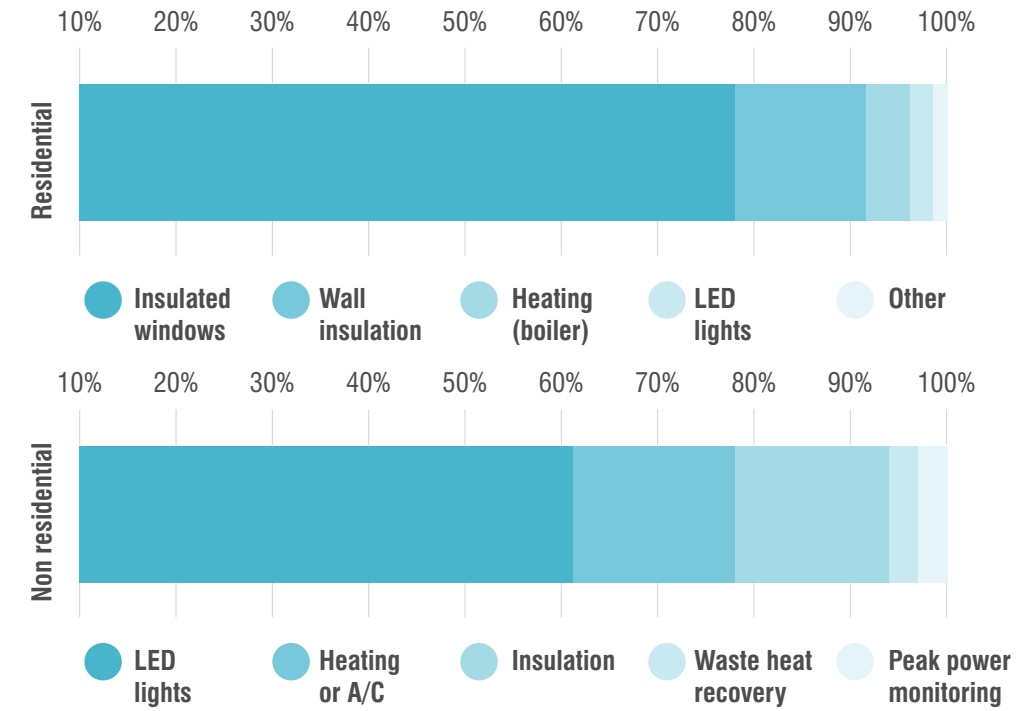
Figure 2: Number of completed retrofits in BRP loan support scheme



(The left axis shows annually completed residential building project numbers. The right axis shows annual non-residential building project numbers)

This retrofitting activity has spurred installation of an array of targeted low-carbon technologies. Figure 3 shows the types of equipment installed through the loan scheme from 2012 to 2015. As can be seen, for residential buildings, the majority of projects involve the installation of insulated windows (77%) and wall insulation (14%). For smaller households, these represent a relatively faster return on investment and an immediate improvement to thermal comfort. Upgrades to heating systems (5%) and LED lights (3%) were far less common. For non-residential buildings, results differ. Replacement of lighting to LED light is the most popular (61%) due to larger lighting areas and higher prospects of achieving a faster return on investment. Next most common are upgrades of heating systems (18%) and insulation (15%). Other technologies such as waste heat recovery (3%) and peak power monitoring (3%) measures were also installed, but to a far lesser extent.

Figure 3: Types of retrofitted equipment through the BRP loan support scheme



Lastly, by providing finance to ESCOs and building contractors, the scheme has also contributed to the expansion of these industries, serving to increase green job opportunities. At the same time, it has also boosted citizen access to affordable insulated windows and doors by lowering cost and finance barriers to these technologies.

Social impacts

The steady increase in the number of loan support scheme participants suggests that the initiative has succeeded in motivating approximately 4,000 residential applicants to invest in reducing home energy use and upgrading properties. It is also notable that several tenants have used the scheme to fund lighting upgrades to LED.

Another important outcome is that the Government of South Korea, through the Ministry of Land Infrastructure and Transportation, has adopted many elements of the BRP loan support scheme in its recently introduced Green Remodelling Interest Support Programme. This national initiative also supports the financing of commercial and residential building retrofitting projects and has made insulation upgrades mandatory for every project.



## 5. Lessons learned for replication

### Strengths and drivers

#### *Multiple and attractive financial incentives*

A core strength of the BRP loan support scheme lies in its multiplicity of approaches to lowering the financial barriers to retrofitting commercial and residential buildings. Firstly, it offers extremely attractive interest rates, which have consistently declined since the scheme was first launched. Secondly, it has expanded the total possible loan amount, from 80% to 100% of eligible retrofitting costs. Thirdly, payback terms are generous. Loans may be paid back over a period of up to eight years, with three-year principal free grace periods also available for non-residential projects. Additionally, the scheme has also taken the approach of lowering the costs for procuring key building technologies offering high energy savings potential such as insulated windows and doors. As mentioned, this is by forming MOUs with several key manufacturers and installation companies to provide reduced prices for group purchasing.

#### *Involvement of ESCOs and installation contractors*

Since ESCOs and retrofitting contractors are able to apply for project funding, these stakeholders serve as powerful marketers and promoters of the scheme. This approach also allows residential and commercial clients to install important, energy efficient building technologies without having to raise collateral or direct cash repayments. This is because ESCO business models are able to generate repayments from the energy savings achieved from retrofitting projects. On the other hand, the BRP loan support scheme also provides the opportunity to ESCO and retrofitting contractors to recruit retrofitting projects in the goal of increasing their business activities.

#### *Sustainable business model*

The BPR loan support scheme does not rely on subsidies for its sustenance. It draws instead on funds from the SMG Climate Change Fund. These are administered to eligible projects through private sector lending institutions with legal power to ensure repayments are honoured. As such, the scheme is able to continue in the long-term, fixing ambitious targets to continuously secure large numbers of new applicants as money is returned to Climate Change Fund. Of note, the scheme has fixed itself the long-term goal of financing projects for approximately 12,500-13,000 new applicants each year from 2015 to 2020.

### Challenges, limitations and countermeasures

#### *Citizen preference for subsidy models*

Increasing the scale of participation in the BRP loan support scheme in line with its lofty targets is proving difficult. Many citizens are reluctant to take on the economic burden of loans and prefer direct government subsidies. The principle approach to dealing with this has been to increase the attractiveness of loans by decreasing interest rates, increasing loan amounts and coverage, and simultaneously, by working with contractors through MOUs to lower costly retrofitting technologies such as insulated windows, doors and entrances.

#### *Success in residential, challenges for commercial buildings*

Whilst there has been much success in recruiting residential applicants (apartments and detached dwellings), progress has been slow for commercial buildings. The reasons for the growth in residential applicants appears to be linked to growing interest in reducing energy expenditures. This also appears to be driven by expectations of being able to improve property value, particularly through exterior surface renovations. Conversely, the low involvement of commercial type buildings appears to be hindered by split-incentive issues, whereby energy saving effects would benefit the tenant whilst the owner would cover the significant costs.

#### *Cheap energy costs*

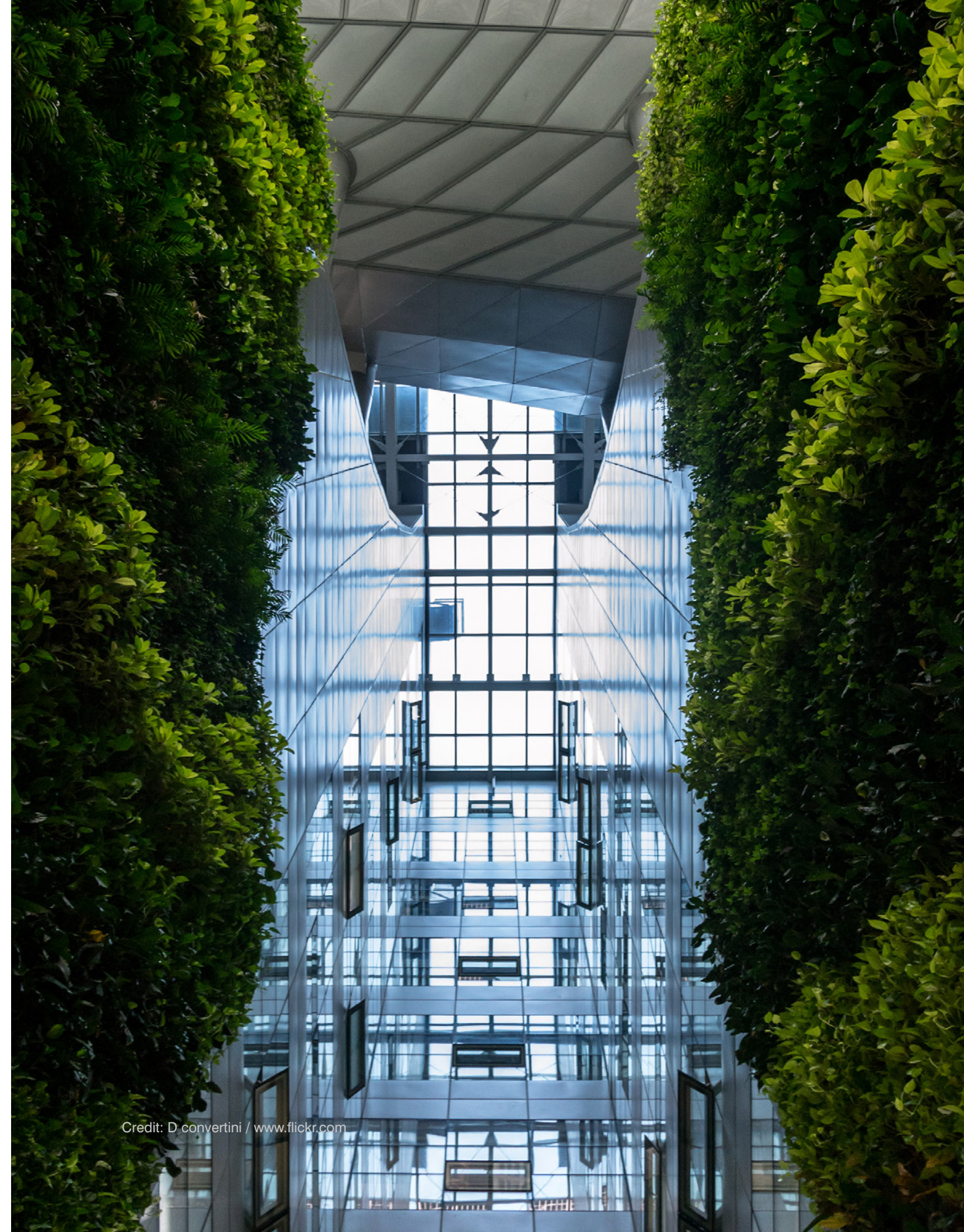
Citizens and businesses in Seoul and the rest of South Korea currently enjoy some of the cheapest electricity prices in OECD nations. As such, it is difficult for policy makers to spur efforts to invest in retrofitting to save energy. This is because cheap power prices reduce the economic rationale for retrofitting by undermining returns on investment. Due to this situation, building energy performance in the real estate market also tends to be undervalued.



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