Global Green Growth Institute

Case Study

Greening Industrial Parks — A Case Study on South Korea's Eco-Industrial Park Program

Acknowledgements

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This case study is intended to serve as an example of policies and practices relevant to pursuing a green growth model of development. It describes activities and programs performed by organizations other than GGGI, and GGGI itself had no direct role in their development, adoption, or implementation.

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Contents

01 Summary

Special economic zones have played a critical part in South Korea's rapid industrial development over the past few decades, and have contributed to significant economic and social benefits to the country. However, this rapid development has also resulted in severe environmental degradation and consequential challenges to public well-being. Industrial Complexes (ICs), once the symbol of the Korean economic miracle, gradually became areas to avoid due to various forms of pollution, and businesses in those special industrial areas faced increasing public scrutiny and disputes over damages caused by their operation. Stimulated by the United Nations Conference on Sustainable Development in 2012 (Rio+20), the Korean government began introducing new environmental management measures harmonized with industrial growth.

The Korean National Cleaner Production Center (KNCPC) launched the National Eco-Industrial Park (EIP) program in 2003, in line with efforts by the Ministry of Trade, Industry, and Economy (MOTIE) to promote innovative industrial development which simultaneously achieves environmental sustainability. A rather top-down implementation approach failed to attract private sector participation during the first two years of the program, resulting in few meaningful outcomes. This changed after the Korea Industrial Complex Corporation (KICOX) took over the role of implementing agency and adopted a new more engaging and business-centric strategy. Business participation started picking up in the third year and eventually resulted in a surge in projects. KICOX also revamped the program with more specific goals and a three-phase implementation strategy, covering the period from 2005 to 2019.

As of 2015, KICOX had received 595 project proposals, out of which 388 projects were funded for further research and development and 197 were constructed. Direct and indirect benefits of the program were significant. As a result of adopting cleaner production and Industrial Symbiosis (IS) facilities, projects yielded 6.48 million tons of carbon dioxide (CO_2) emission reductions and 1.09 million tons in reductions of other toxic gases from 2005 to 2014. New investments in R&D and industrial infrastructure development created 848 jobs, promoted technology development, and produced 56 new patents and 100 pending patents. As of 2015, participating companies also benefited from a windfall of KRW 1,848 billion (approximately USD 1,680 million) collectively, by saving resources or selling waste and by-products through IS systems.

Several factors contributed to the success of the Korean EIP program. First, KICOX effectively utilized local experts and their networks to expand business and civil society engagement in the program. KICOX particularly invested a lot of effort in engaging and attracting resident companies in ICs, since their involvement was critical for the success of the program. Through close working relationships with industries in the ICs, regional EIP centers and designated local coordinators were able to build up communities of stakeholders based on commonalities such as industry or resource types.

In order to stimulate business participation and investment in the program, KICOX focused on delivering quick wins and demonstrating economic profitability of EIP projects, especially during the early years of the program implementation. KICOX strategically utilized regional EIP centers to promote the EIP program and its benefits to strengthen business participation in the program. Success stories were widely promoted through both online and offline communications channels.

The Korean government also employed an effective funding scheme to facilitate private participation and investment without causing fund recipients to become dependent or avoid accountability. The government provided funding to support R&D needs of selected project proposals, and funding levels were determined based on the size of the recipient company, the scale of potential impact, the degree of technological innovation, and other specific criteria.

Also, various government programs supplemented private investments by offering special loans or grants, in most cases to support implementation of proven or innovative technologies or to reduce pollution and conserve resources.

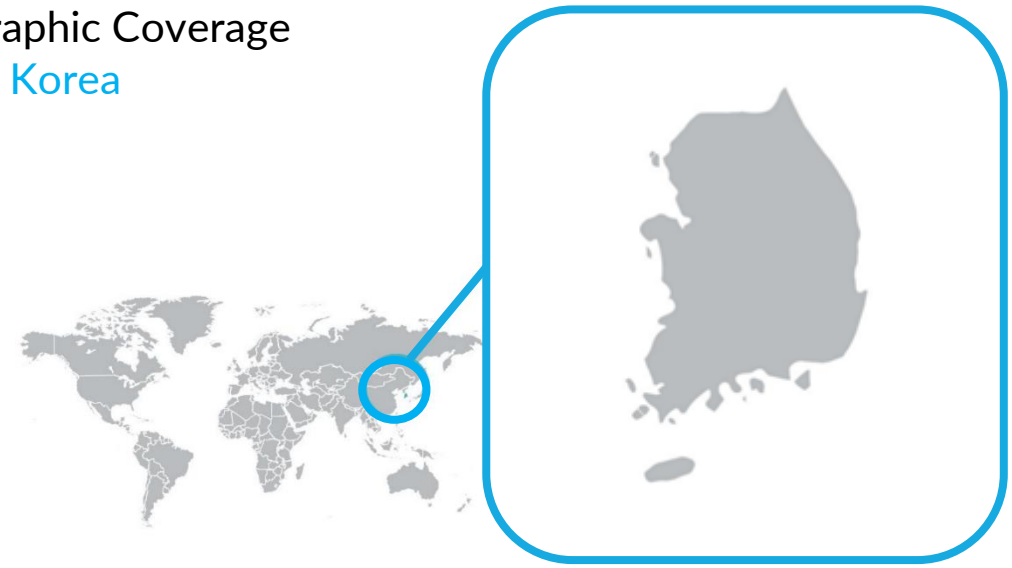
Despite its many achievements, the Korean EIP program has potential opportunities to improve. First of all, the program could focus on further enhancing environmental impacts of EIP construction.

Emissions of CO_2 could be reduced further relative to from the implementation of the program is not so significant when considering the overall emission from the industrial sector or the national greenhouse gas (GHG) reduction goal. In line with this, stronger measures could be adopted to support projects that are less economically viable but still environmentally beneficial. Lastly, cooperation and collaboration between national EIP implementation agencies and local governments needs to be strengthened and systematized to bring about more effective outcomes. National and sub-national policy coordination is essential to make these changes happen.

Sectors in Focus	Industry, Energy, Cities
Key Challenges	Sustainable industrial development, resource efficiency, greenhouse gas emission reductions
Impacts	Environmental: The program reduced a total of 6.48 tons of CO_2 emissions and 1.09 tons of other toxic gases during 2005-2014 Social: A total of 848 new jobs have been created as a direct consequence of the 10 years of operating the program Economic: Private investments totaled USD 623.7 million for R&D and construction of industrial symbiosis facilities and relevant infrastructure. This helped generate total new income of USD 1.1 billion from selling by-products and waste for recycling. Additional energy and material savings amounted to USD 848 million
Keywords	Industrial complexes, eco-industrial parks, industrial symbiosis, resource efficiency maximization, waste recycling, circular economy, zero-emission production

Geographic Coverage

South Korea



02 Context

From a war-torn and poverty-stricken country in the 1950s to the world's 11th largest economy in 2015, the Republic of Korea (South Korea) has achieved economic growth that is often described as a "miracle." South Korea's dramatic economic transition started in the 1960s with a series of government-led five-year economic development plans. Industrial Complexes (ICs), specialized areas for industrial clusters, played a significant role in the process and were the main engines of growth. The government chose ICs as a strategic vehicle for fostering development of priority industries, which shifted from light manufacturing industries in the 1960s to heavy industries in the 1970s and 1980s and to more technology intensive and service-oriented industries in the 1990s and 2000s. The Korea Export Industrial Complexes Corporation, which later became Korea Industrial Complex Corporation (KICOX), was established under the Ministry of Commerce and Industry as the central agency for managing the ICs.

The importance of ICs in the Korean economy remains significant. The number of ICs grew from two in the 1960s to 1,124 in 2015 with total land area of 1,400 square kilometers, with approximately 80,000 companies operating in various types of ICs across the country (KICOX 2016b). Economic outputs of the ICs totaled USD 928.9 billion in 2015, representing 63% of the national GDP. Exports supported by companies operating in ICs accounted for 73% of the national total for the same year.

Table 1. Industrial Complexes in Korea (as of 2015; 1 USD=1,100 KRW)

Type	Number	Land Area (km^2)	Number of Companies in Operation	Employment	Production (million USD)	Export (million USD)
National	41	789.8	46,993	1,223.766	539,891	209,406
Regional	597	530.5	26,178	781,876	302,884	130,161
Urban High-tech	19	6.2	151	5,508	854	256
Rural	467	75.6	6,041	149,601	46,310	11,341
Total	1,124	1,402.1	79,363	2,160,761	889,938	351,164

Source: KICOX statistics (www.e-cluster.net)

The ICs have also been highly important for local economies. Besides the direct employment of 1.2 million in the ICs, they have also created more than 2 million jobs in total across the country. In many regions, development of ICs promoted urban development and economic growth in surrounding local areas.

For example, development of Ulsan-Mipo IC, one of the first and the largest industrial zones in South Korea, transformed the host city Ulsan from a small agricultural town in the 1960s to the nation's number one industrial city with a population of 1.2 million.

The city ranked at the top for per capita Gross Regional Domestic Production (GRDP) and income among South Korean regions and metropolitan cities in 2014, surpassing even the nation's capital, Seoul (Statistics Korea 2015).

Despite the wealth generated through this industrialization process, inattention to environmental concerns had caused considerable harm not only to natural ecosystems but also to the general well-being of local communities. In the case of Ulsan, pollutants from industrial zones severely contaminated air and water, making Ulsan one of the most unlivable cities in South Korea. Air became so toxic that several Ulsan schools in close proximity to industrial facilities had to move or close down due to the impacts on students' health (Han 2015). Odor from polluted rivers caused headaches and waste treatment became a big challenge to the city government. This same situation was repeated in many industrial cities from the 1970s to the 1990s, and companies and industrial zones faced increasingly fierce public scrutiny and criticism on impacts on the environment and public health.

Many companies had to bear considerable financial burdens as a result of the environmental harm they generated. Air pollutant emitters in Ulsan, for example, had to pay significant compensation to nearby farmers every year for losses caused by sulfur dioxide (SO2) and fluorine gas emissions. This was recorded at about USD 1 million in 1991 (Lee 1991). Securing quality workers also became a serious challenge for companies in ICs, as people started avoiding living and working in polluted area.[1]

Table 2. Energy consumption, waste generation, and GHG emission from industrial complexes in Korea (2005)

Classification	Energy consumption (1000 toe/yr)					Waste (Kt/yr)	GHG Emission (Mt CO_2-eq/yr)
	Coal	Petroleum	Natural gas	Electricity	Other		
National level (A)	22,311	96,781	17,811	28,588	3,896	103,768	569.5
Industrial sector (B)	21,237	50,905	4,656	14,346	3,222	44,126	547.4
% industrial	95%	53%	26%	50%	83%	43%	96%

Source: (Park, Park and Park 2016)

During the 1980s, the Korean Government started to introduce tougher regulations on emissions and environmental safety. Further motivated by the Rio+20 Summit, the Government introduced legislation in the 1990s which reset the fundamentals of national industrial environmental policy. One of these laws was the Act to Promote Environmental Friendly Industrial Structure (APEFIS), introduced by the Ministry of Trade, Industry and Energy (MOTIE) in 1995. Aiming at reforming industries to be more resource efficient and environmentally sustainable, APEFIS placed an emphasis on promoting cleaner production (CP) and a certificate program for environmental management system (EMS) based on ISO 14001. In addition, the Government's Low Carbon Green Growth declaration in 2008 added extra momentum to the green transition of the economy. This new national strategy stressed green economy as the new growth model and a means to achieve the greenhouse gas (GHG) reduction goal of 30% below the business-as-usual (BAU) level (776.1million tons) by 2020.[2]

[1] According to a recent survey, 2/3 of university graduates do not want to work in an industrial complex and 80% of them pointed out non-finacial factors such pollution, negative image and lack of convenient infrastructure as the main reason (Haud Co. LtD 2014).

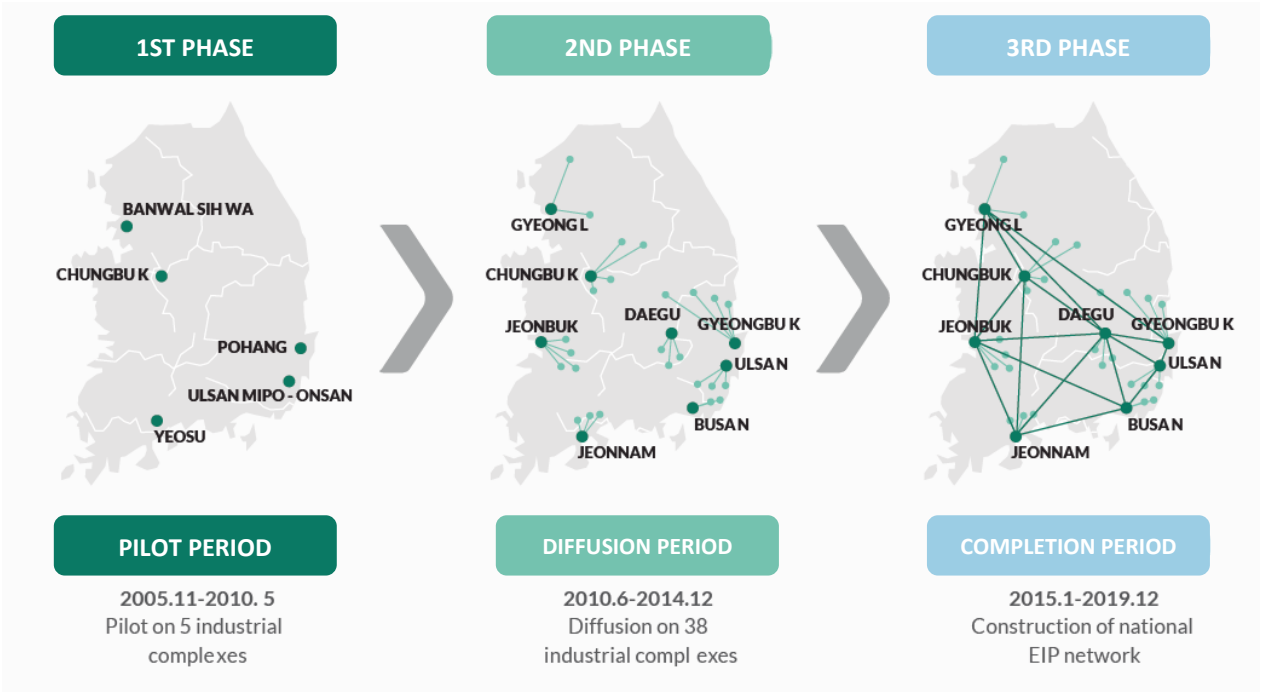
[2] The South Korean government revised this target in June 2015 to be 37% of the 2030 BAU level (850.6 million tons).

03 Approach

In line with MOTIE's effort to promote innovative and sustainable industrial development, in 2003 the Korean National Cleaner Production Center (KNCPC), a government-funded institute established to support SMEs, started the National Eco-Industrial Park (EIP) program. After an extensive situation analysis and consultation with international as well as national experts, KNCPC unfolded a 15-year master plan for EIP development with three expansion phases (see Figure 1). Upon the announcement of the program, KNCPC also ran a number of information-sharing sessions across the country and received applications from ICs to serve as pilot project sites. KNCPC selected five locations for Phase I of the program.

Figure 1. Three levels of Eco Industrial transformation

Vision	Smart eco society where industrial complexes and local communities coexist
Goal	Establishment of 300 EIP networks by 2019
Sub-goals	1. Total value of KRW 500 billion resource savings and additional income 2. Annual reduction of 2 million tons of GHGs 3. Creation of 800 jobs per each 5-year phase 4. 1,500 companies benefit from resource sharing in each implementation phase
Implementation phases	



Source: KICOX EIP website (http://www.eip.or.kr/)

From late 2006, the government changed the implementation agency to KICOX to more effectively leverage its experience and capacity in managing ICs and also to better integrate the EIP program with other IC development policies. Regional EIP centers were also established in each of the five pilot locations to provide on-site management for KICOX (Table 3).

Table 3. **Profile of 5 pilot EIP sites**

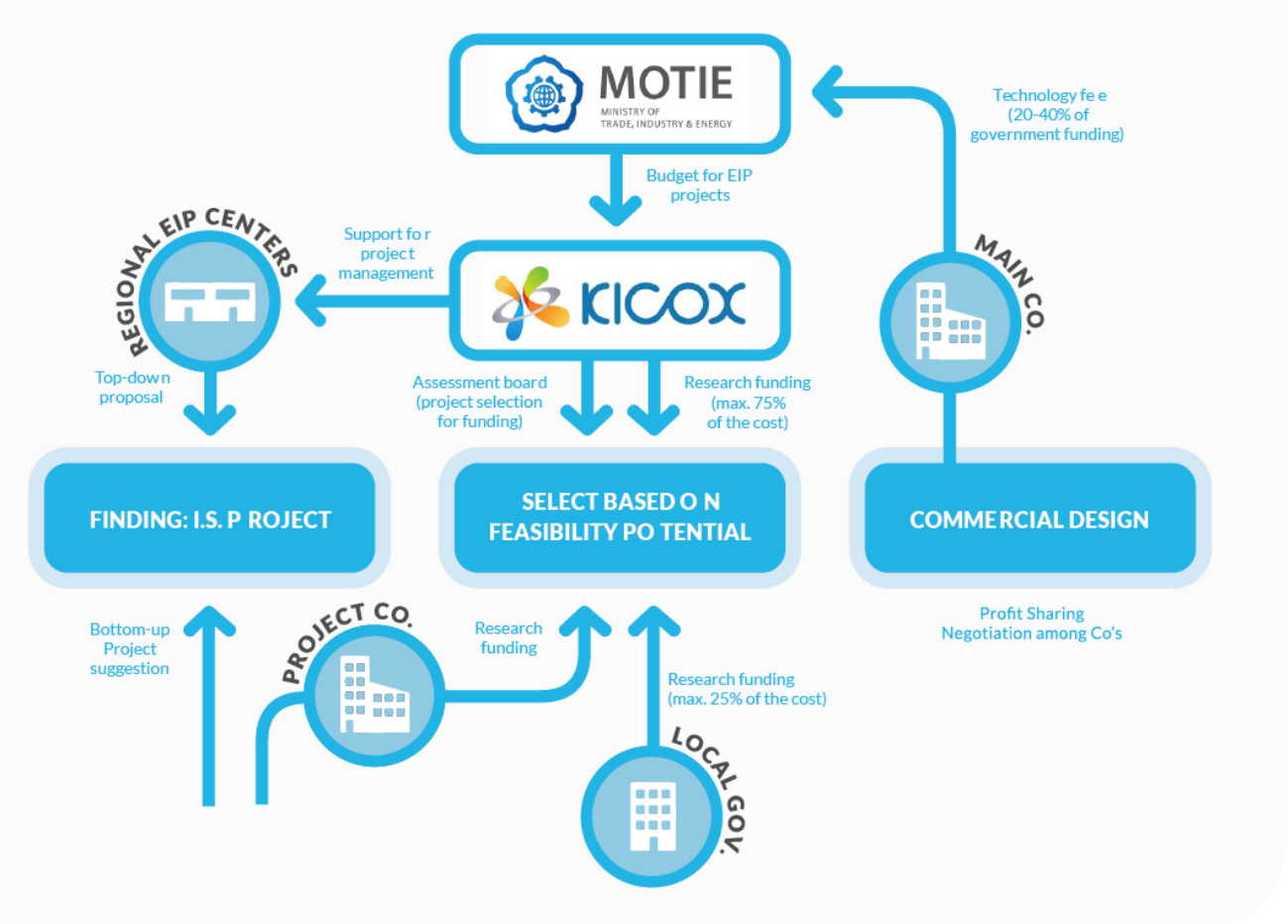
Industrial Complex / Location	Land area (km^2)	No. of companies in operation	Main characteristics
Banwol-Siwha	31,942	6,990	SMEs / Manufacturing (textile dying, garments, electronics components, small machineries, petrochemicals, etc.)
Cheongju	4,099	351	Medium and large companies / Manufacturing (electronics, machineries, petrochemicals, etc.)
Pohang	17,624	89	Large companies (POSCO and affiliates) / Heavy industries (world top 5 steel producer)
Ulsan-Mipo/ Onsan	65,418	1,052	Large companies / Heavy industries (oil refining, petrochemicals, automobiles, ship building, etc.)
Yeosu	31,628	329	Large companies / Heavy industries (national petrochemical production center)

Source: (KICOX 2015)

In order to attain maximization of resource efficiency and reduce waste and pollutants, development of industrial symbiosis (IS) systems was proposed as a key strategy in EIP implementation. There were some cases of IS prior to the EIP program, although the application was very limited in most cases to a bilateral exchange between two companies within the same value chain. Thus, the goal of the Korean EIP program was to develop a comprehensive and nationwide network of IS through the application of a systematic approach. Developing proper infrastructure as well as promoting the use of shared services and facilities became the primary focus in the implementation phase.

In the Korean EIP program, potential IS projects were identified in two ways: first, through top-down project proposals from regional EIP centers, and second, through bottom-up proposals from businesses or local research institutes. Ideas developed into project proposals were submitted to KICOX through regional EIP centers, and then evaluated by the assessment committee. KICOX also set up tentative targets for economic, environment, and social benefits for each project based on information presented in the proposal. Selected proposals received funding from KICOX for R&D to realize the ideas. The amount of funding for each project, which ranged from 33 to 75% of the R&D cost, was based on the size of benefitting companies as well as technological importance and impact potential. Participating companies were required to contribute a minimum of 10% of the total R&D budget. Local governments also provided funding on an ad-hoc basis, particularly when the impact was expected to be at a regional level. During the second phase of the EIP program, local government participation became a project proposal evaluation criterion to help systematize their involvement (Park, Park, & Park, 2016).

Figure 2. Project development and funding process



Source: KICOX EIP website (http://www.eip.or.kr/)

Once R&D was completed, projects which had secured investment were carried forward to implementation. The most critical part in materializing an investment plan was drawing up an agreement among investors on cost and income-sharing details, project ownership and management responsibilities, and other related considerations. Regional EIP centers usually supported the negotiation process and local coordinators also played an important role as mediators. Companies generally divided the cost according to their portion in the profit expected from the new IS investment (Behera, Kim, Lee, Suh, & Park, 2012).

Various government programs have contributed to the investments. Water or energy-related projects, for example, could be financed through Water Saving Company (WASCO) or Energy Service Company (ESCO) program.

For projects that involved public infrastructure building, Korea Infrastructure Credit Guarantee

Water Saving Company (WASCO) and Energy Service Company (ESCO) programs are both government initiatives to promote private investment in each respective field. Through the ESCO program, energy users with insufficient financial capacity can upgrade their energy facilities through ESCO certified companies. Savings made from a new energy-saving facility are share with the ESCO companies to redeem their investment. ESCO companies can also utilize government loans to finance their investment. WASCO was launched in 2014 with the same basic concept. As of January 2016, 56 companies are registered as WASCOs (KETI 2016).

Fund (KICGF) and various other Public-Private Partnership (PPP) project financing mechanisms were available. The Ministry of Knowledge Economy operates the Quality Working life (QWL) fund to facilitate private investment in improving decrepit facilities and infrastructure in ICs. The Korean government provides several other financing programs especially for SMEs, to support their investment in energy saving or GHG reduction facilities.

When the new IS system construction was completed, KICOX conducted the final evaluation and determined the amount that companies had to pay back in fees to the government to obtain full ownership over project facilities and technologies. The fees are usually calculated at 10-40% of the total government funding for R&D, and the payment can be made in installments over 5 years.

Table 1. Government loan programs for energy projects by SMEs and non-profit and public organizations (1 USD = 1,100 KRW)

Program		Total Budget	Funding ceiling per company per year	Loan period	Interest rate (as of Q4, 2014)
ESCO		KRW 22.5 billion (USD 20.5 million)	KRW 30 billion (USD 27.3 million); KRW 15 billion per project	Repayable in 7 years (3-year interest free period)	1.5%
Investment support for Controlled Entities under the GHG target management scheme		KRW 50 billion (USD 45.5 billion)	KRW 15 billion (USD 13.6 million)	Repayable in 5 years (3-year interest free period)	1.75 % (1.5% for SMEs)
Support for energy saving facilities	Energy saving facility installation	KRW 22.5 billion (USD 20.5 million)	KRW 15 billion (USD 13.6 million)		
	Production facility upgrade for higher energy efficiency (SMEs only)		KRW 1 billion (USD 0.9 million)		
	Energy storage and generation facilities (Heating/cooling systems)		KRW 5 billion (USD 4.5 million)		

Source: Korea Energy Agency website (http://www.energy.or.kr/winwin/support/support03_01.aspx)

04 Outcomes

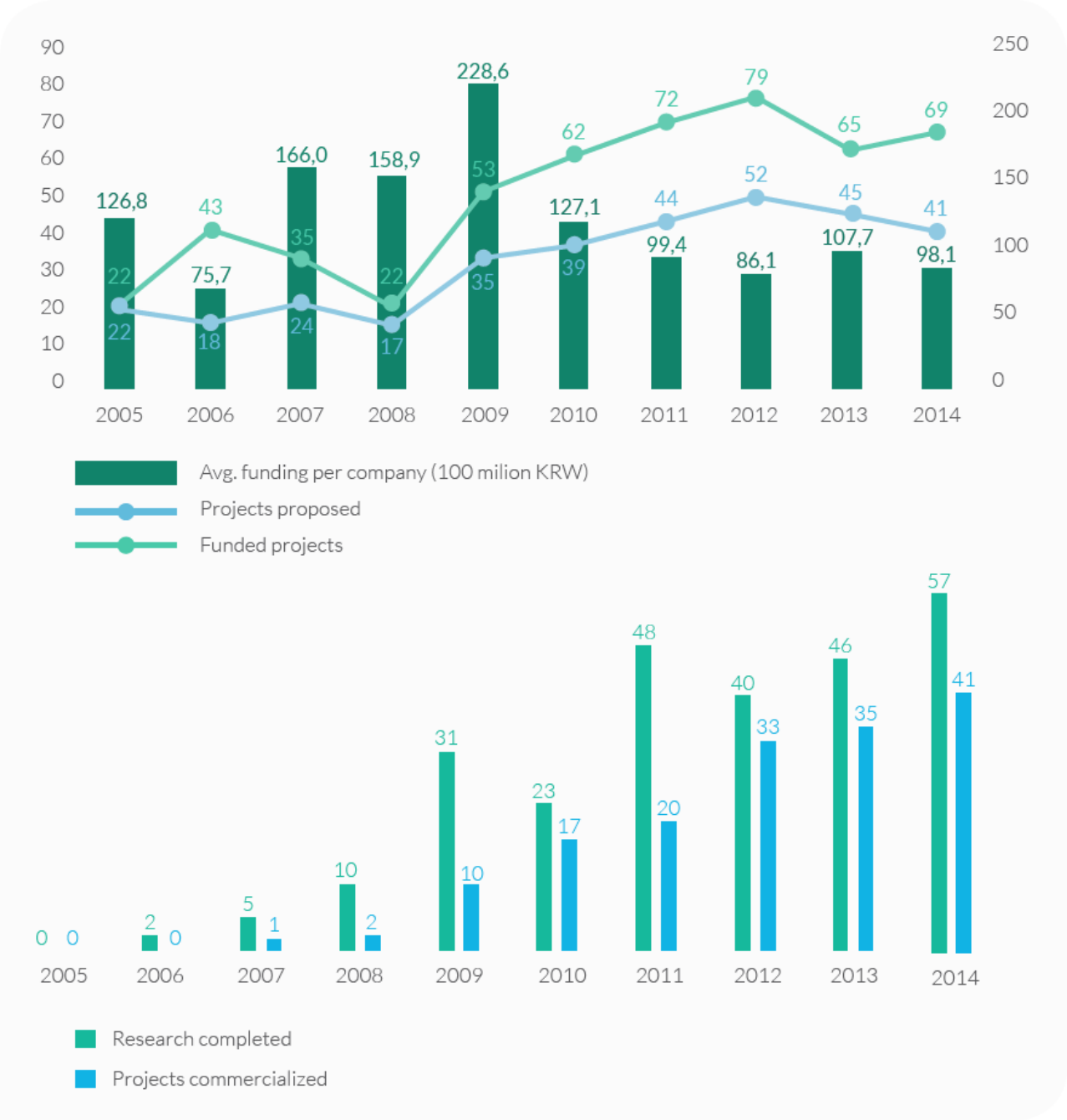
The EIP program did not achieve much success during the first couple of years. The initial implementation plan overlooked the needs and interests of the private companies which were the main investors and beneficiaries of the program, and instead involved mostly researchers and academics. This resulted in low participation by businesses and no IS development. With the change of the implementation agency from KNCPC to KICOX in 2006, the EIP implementation strategy was also adjusted to be more participatory and business-centered. This strategic realignment consequently stimulated more substantial and proactive participation by business actors in the EIP program, which brought about a noticeable increase in the number of projects proposed and realized. In the end, a total of 116 projects were funded for R&D among 175 proposed projects during Phase I (2005-2009), 30 of which were operationalized for the same period (KICOX 2016).

Phase II (2010-2014) delivered better results with more active participation of business actors. This was facilitated by standardized processes and diversified program entry points. Compared to 57.8% during the first phase, the number of projects initiated by private companies increased to 93.7% of the total. Various promotion efforts and some compelling results from the first phase catalyzed new business participation. KICOX also formulated a specific EIP development model for each participating IC according to their individual capacity as well as comparative advantages, and started providing customized support to each IC based on their own EIP development strategies. For example, an SME-focused EIP was a model chosen for the Banwol-Siwha complex, whereas larger-scale energy infrastructure development became the priority for the Ulsan-Mipo complex where most of resident companies are large conglomerates. Thanks to these refined strategies, the overall outcome of the second phase improved significantly, with 146 out of 221 R&D projects operationalized, selected among a total of 346 proposals. As of 2015, KICOX received a total of 595 project proposals in total, of which 388 were selected for R&D funding, and a subsequent 197 of which were constructed.

IS development research projects promoted various innovations and technological development in resource recycling and use of by-products. New technologies and business ideas emerged for capturing previously discharged or discarded resources such as stream, heat, gases, and other waste materials and reusing them in production as sources of energy or as raw materials. By the end of 2015, EIP R&D projects had generated 56 new patents and 100 pending patents. In addition, 38 academic papers were published on research outcomes.

Economic benefits generated by the EIP program were also significant. Companies enjoyed a high return on their investment for IS facility development, either from saving on raw material and waste treatment costs or by earning additional income from selling by-products or waste materials. As of 2015, these economic benefits were estimated to be KRW 1,848 billion in total, including KRW 1,102 billion in new revenues and KRW 746 billion in cost savings (Jeong, 2016). For projects implemented during Phase I, return on investment ranged from 24% to more than 3,000% (Park, Park, & Park, 2016)

Figure 1. IS facilities and infrastructure proposed, funded, and constructed during Phase I & II

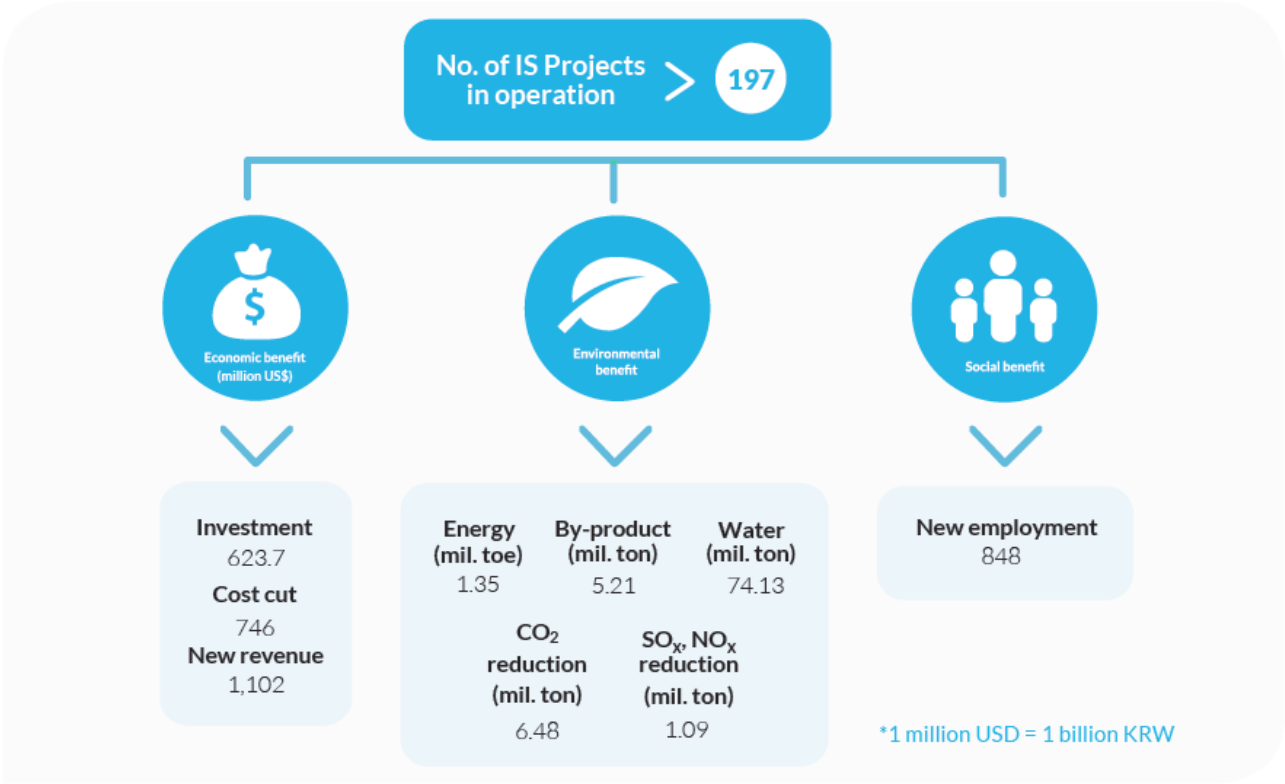


Source: (KICOX 2016a)

Social as well as environmental benefits were also considerable. Total private investment for the construction of IS facilities amounted to KRW 623.7 billion as of 2015, which created 848 new jobs. On the environmental side, the program saved 1.35 million toe in energy use, which resulted in reduction of 6.48 million tons of CO_2 emissions and 1.09 million tons of toxic gases such as SOX and NOX. In addition, 74.13 million tons of water was saved in total, and 5.21 million tons of by-products and wastes were reused (Jeong, 2016). This consequently improved the negative image of the ICs as pollution emitters and also enhanced relations with neighboring local communities. The Korean government also estimated that the overall benefit of EIPs well exceeded the government investments (MOTIE 2014).

The overall government budget spent for Phase I was KRW 29.3 billion, and is estimated to be around KRW 38 billion for Phase II. Until the end of 2013, local governments also provided a total of KRW 11.4 billion for the program additionally. The program is currently in Phase III (2015-2019) for which KRW 63 billion is allocated from the national R&D budget. During this phase, national government support for research has been reduced to a maximum of 70% of the research budget and local governments are required to provide funding to cover up to 20% of costs. There were 105 EIPs in operation as of 2015, with 12 regional EIP centers supporting them under the supervision of five regional head offices.

Figure 4. Economic, environmental, and social achievements of the Korean EIP program (2005-2015)



05 Lessons

Much of the success of the Korean EIP program is attributed to the government's effective stakeholder engagement measures which succeeded particularly in bringing the private sector into the program. Building on the failure of the first year, the government quickly changed the strategy as well as the implementing agency to KICOX and started focusing on developing relationships with key stakeholders including private businesses in the five selected ICs. One of the first actions of KICOX was to establish regional EIP centers which played a critical role not only in building up the stakeholder relationships but also in diffusing information to promote the program. KICOX also ran various programs to establish regular communications channels with different groups of stakeholders as well as among themselves. This included organization of focus group meetings, seminars, and conferences for training and information-sharing. Regional EIP centers organized forums in every IC by type of resources (e.g., water and wastewater, energy, sludge, byproducts, etc.) and type of industry (e.g., petrochemicals, textiles, steel, etc.) to create networks among resident companies and local experts, and also to encourage exchange of potential IS project ideas. During Phase I, for instance, KICOX conducted 27 thematic forums involving 969 participants, which resulted in testing 113 new project ideas (Park, Park and Park 2016).

The role of 'coordinators' were also significant in stakeholder relationship building and facilitating IS implementation. Coordinators typically were highly experienced business retirees or well-known academics from the region, who regional EIP centers would hire to identify potential IS projects, match needs and capacities among companies, and mediate interests between various project participants through their extensive local knowledge and networks. Coordinators also liaised private sector participants with the national and local governments as well as various government funding sources. As the program progressed, these networks and communication channels acted as project development and implementation pipelines, while facilitating both vertical and horizontal information-sharing.

KICOX also invested heavily in developing databases with information about companies and research institutes participating in each IC, available facilities and technologies they own, expert profiles, on-going projects, relevant supporting organizations, and so on. KICOX shared this information on an online platform (www.eip.or.kr).

By the end of the first phase, there were 16,616 data points available about recycling materials, 6,443 on companies involved in the program, and 7,100 on organizational, human, and infrastructure resources (KICOX 2016a). These information sources were critical to map out the needs and capacity of each IC and to identify 'low-hanging fruits' to kick-start program implementation.

On top of this, making the implementation strategy more business-centric was key to achieving the program's current success. During Phase I, KICOS focused on delivering quick wins which could showcase economic as well as environmental benefits of IS investment. Priority was given to projects which were either led by a business participant or showing a good profit potential, so that the project could easily

get private investments for the implementation. Success stories were immediately shared through the EIP website and the on-site communication channels, which enhanced interests of other companies and eventually induced their voluntary participation in the program. The more businesses got involved, the more innovations resulted from their initiatives.

Another success factor of the Korean EIP program was the appropriate utilization of government finance to encourage the private sector's participation. Government funding for R&D of selected projects mitigated financial risks in failed research and thus facilitated entry of private businesses into the program. However, the government also provided research funding at a level that did not undermine motivation and the sense of accountability among funding recipients. Funding levels were determined according to a clearly defined set of criteria, such as the technological importance of project's outcomes, the scale of impact, and the size of the implementing company. And the funding level was doubled for SMEs in order to encourage their participation.

The success that the Korean EIP program achieved within a relatively short time attracted interests from other countries working to promote similar initiatives. The EIP program model has been replicated in Bangladesh's Chittagong Industrial Zone, and recently the World Bank applied the model for a project to improve efficiency of Hoakhan Industrial Zone in Da Nang, Vietnam.

Despite a number of strengths and notable achievements, the program also experienced various weaknesses and limitations. Firstly, more efforts are necessary to scale up the impact of the program on GHG emission reduction. The program achieved meaningful outcomes in terms of environmental performance with a total reduction of 6.5 million tons of CO_2 emissions during the 10-year program. However, more aggressive measures are required to bring the impact to a fuller scale, considering that the industrial sector accounts for more than 95% of national GHG emissions and their annual CO_2 emissions are about 547 million tons on average. In line with this, the EIP program will also need to be more systematically integrated with other national support programs for CP technology development, EMS certification, and use of renewables.

The government's strategy of emphasizing economic viability of IS projects helped successfully leverage private investment. However, at the same time this made the program less advantageous for projects that were less profitable but still environmentally beneficial. The Korean government already has diverse financing programs for these areas, but they are currently under different ministries and managing agencies. Regional EIP centers provide support to companies with investment financing. However, an integrated information channel and a streamlined access to all government programs would further facilitate the development of EIPs.

Coordination with regional governments and their policies has been another weakness of the Korean EIP program, particularly during the first phase. Local government participation in the program happened only on an ad hoc basis, and mostly through lengthy coordination by regional EIP centers. KICOX started making efforts to systemize local government participation from Phase II, but it became integrated in the budget process only from Phase III with the requirement of matching funds from local governments. Moreover, the program has been limited to ICs managed by KICOX without much integration with regional city or industrial development policies. In the case of Ulsan, for example, the city government provided massive support for the EIP program as part of their eco-city development plan. This created significant synergies and made the Ulsan EIP one of the best performing cases among the first five pilot sites. However, it was a voluntary action of the

city government and the level of support for the EIP program from local governments varies greatly depending on their priorities and interests. Stronger central coordination as well as tighter national-subnational policy integration will be needed to achieve greater impact and long-term sustainability of the program.

Success Factors

- Extensive effort to build up stakeholder relationships and communication channels
- The role of regional EIP centers and local coordinators which greatly contributed to formal and informal information collection and engagement of stakeholders
- Effective use of public financing that facilitated private investments
- Business-centric approach which focused on economic profitability of IS systems, and which attracted private investments
- Emphasis on the promotion of the program especially through concrete success examples

Impact

- Reduction of CO_2 and other toxic gases through considerable savings in energy and material use
- Creation of new business opportunities from byproducts and waste recycling that generated additional incomes for participating companies
- Sizable new investment in industrial facilities and infrastructure and the creation of new jobs
- Improvement of air and water quality, and thus improved relationships with local communities Improvement in the negative image of industrial complexes

Limitations and Challenges

- Insufficient GHG reductions in comparison to the amount of GHG emissions from the industry sector and national GHG reduction goals.
- Less emphasis on the environmental significance of a project due to the priority placed on commercial viability.
- The limited boundary of the program within each industrial complex.
- Absence of central coordination with local city development policies.

Further Information

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