

Performance Evaluation of Seoul's Eco-Mileage Program Using the Logic Model

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Reducing greenhouse gas (GHG) emissions has become an important global issue, and as a result, Korea's central and local governments have taken various measures to reduce GHG emissions. Here some representative examples include the promotion of electric vehicles and research on new sources of renewable energy. That is, the main objective of this paper is to assess the outcome of the Korean government's policy on energy savings.

For this, the representative projects are selected to evaluate the policy, and then the achievement, efficiency, and effectiveness of the program goals(40,000) are thoroughly examined in terms of policy sustainability, budgets, and success. Finally, the paper contributes by highlighting some effective measures for improving energy savings through a performance evaluation based on an in-depth analysis of current limitations.

Key words _ Energy Saving Policy, Greenhouse Gas, Logic Model, Policy Evaluation

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로직모델을 이용한 서울시 에코마일리지 프로그램의 성과 평가

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에너지 수급 및 에너지 절감 정책은 석유파동과 블랙아웃 현상 등을 겪으면서 국가적 관심이 시작되었고 이후 기후변화 대응 차원에서 지속적으로 추진돼 왔다. 반면, 정책의 효과나 효율성에 대한 연구는 부족하여 그 동안 정부의 에너지 절감 정책의 성과를 평가하고 문제를 분석하여 실효성 있는 대안을 마련하는 것이 필요하다. 이 연구는 에너지절감 정책의 성과를 평가하는 것이 가장 큰 목적이고, 대표 사업의 목표 달성도 및 효율성, 효과성까지 평가하여 그 동안의 문제를 분석하고 개선방안을 제시하여 실효적인 에너지 절감을 이루는데 조력하는 것이 궁극적인 목적이다.

서울시 에코 마일리지 사업을 에너지절감정책의 대표사업으로 선정하여 분석한 결과 당초 설정한 목표를 초과달성한 것으로 나타났다. 특히 회원가입, 에너지절감 모두에서 공통적으로 에너지 절감, 탄소저감 등 세계적인 요구 속에서 에코마일리지 제도는 효과적이고 효율적인 사업이라 할 수 있다. 무엇보다 신재생에너지 시설투자와 비교하면 에너지생산 방식이 아니라 에너지절감방식이라는 점과 비용이 적게 든다는 점 등에서 장점이 있다고 판단된다. 연구의 한계로는 본 사업의 회원 중 에너지절감이 있는 가구와 없는 가구의 차이가 어디서 발생하는지 원인 규명을 하지 못했다는 점이다.

주제어 _ 에너지절감정책, 온실가스, 로직모델, 정책평가

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I . Introduction

1. Background and purpose

With the unprecedented occurrence of the so-called “black out” in Korea, which has caused widespread power outages and sharp increases in the electricity rate, the topic of energy savings has received considerable attention in the country in recent years. In accordance with policies concerning energy supply and saving, considerable national attention has been paid to the question of energy savings in the face of the oil crisis. Reducing greenhouse gas (GHG) emissions has become an important global issue, and as a result, Korea's central and local governments have taken various measures to reduce GHG emissions. Here some representative examples include the promotion of electric vehicles and research on new sources of renewable energy. Won-soon Park, the mayor of Seoul, has promoted “a project to reduce one nuclear power plant” as a campaign targeting the public. However, such approaches are limited in that they require enormous amounts of time and money.

Most Koreans are willing to save energy because they understand that the country produces little energy. The government has tried to provide people with incentives to reduce GHG emissions. However, it has been difficult to attract voluntary participation because such efforts entail long-term inconveniences. In addition, the Carbon Point Program (Ministry of Environment) and the Eco-Mileage Program (EMP) have introduced a comprehensive plan to close one nuclear power plant through energy savings and new energy production methods.

On the other hand, energy use has been increasing, and the public has now shown active participation in energy savings (e.g., reducing excessive automobile and gas use). According to a press release by Seoul City, large buildings provide better performance than small ones in terms of cost savings. In addition, individuals or households are likely to show insufficient energy savings. More specifically, 46% of the people participating in programs promoting energy savings are able to reduce energy use, whereas the rest tend to use more energy. This suggests a need for a more effective alternative based on a careful performance evaluation of Korea's policy on energy savings as well as for an in-depth analysis of its limitations. That is, the main objective of this paper is to assess the outcome of the Korean government's policy on energy savings.

For this, the representative projects are selected to evaluate the policy, and then the achievement, efficiency, and effectiveness of the program goals are thoroughly examined in terms of policy sustainability, budgets, and success.

Finally, the paper contributes by highlighting some effective measures for improving energy savings through a performance evaluation based on an in-depth analysis of current limitations.

2. Scope and Methodology

1) Scope

Seoul's EMP is selected as a representative project to draw clearer insights. Given that the energy policy is closely related to people's lifestyles, the role of local governments is more important than that of the central government. In this context, Seoul City is a representative local government in Korea. The EMP can motivate citizens to voluntarily participate and has a positive effect on GHG reductions. The program has been in effect since 2009, and therefore there is a need for the interim monitoring of policy outcomes. Therefore, this paper will analyze from the following point of view.

The first is performance evaluation of the Seoul EMP. Specifically an evaluation of the success and effectiveness of the EMP, a logic-based analysis of the cause-and-effect relationship between various components of the program, an easy evaluation of program effectiveness based on comparing outcomes, an analysis of EMP performance factors, and an analysis of factors influencing EMP success and limitations(e.g., a lack of promotional campaigns and incentives). Second, evaluation of program effectiveness based on comparing outcomes. Third, suggestions for measures that can maximize policy performance and improve the EMP.

2) Methodology

(1) A literature review

The methodology of this study is as follows. First, an analysis of trends in the energy policy and means through a literature review.

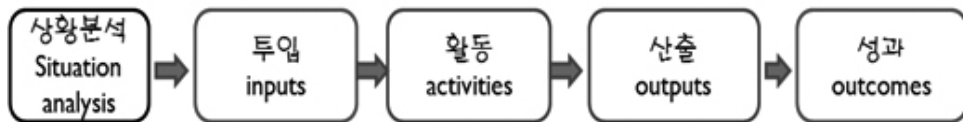
〈Table 1〉 Variables of the literature review

Variables	Contents
Policy source	• The Seoul plan
Data assessment	• previous research • Seoul City's policy evaluation reports
Survey data	• Results of opinion polls by Seoul City, among others

(2) A policy evaluation by applying the logic model from program theory

The application of the logic model to major EMP elements. The logic model is applied for the following reasons. First, The EMP clearly reflects various issues and objectives associated with energy savings and GHG reductions and focuses on achieving goals through various activities and human and material resources. Second, The logic model is a visual representation method for describing how a program functions and producing intended results. Finally The logic model can help achieve the initially intended result and reduce trial-and-error project efforts toward energy savings by systematically analyzing the whole program process according to the model.

〈Figure 1〉 Conceptual diagram of the logic model



〈Table 2〉 Variables of the logic model

Variables	Elements
Inputs	• project budgets • personnel • program measures,
Activities	• planning • implementing projects • adjusting plans • achieving agreement
Outputs	• effects of energy savings • economic effects • carbon reductions
Outcomes	• subscribers

(3) In-depth interviews

The third is the in-depth interviews. Opinions of the policy background, performance assessment, efficiency, and effectiveness through in-depth interviews are specifically the case. The interviews were Seoul City officials, EMP participants and non-participants.

II . Literature review

1. Program theory and the logic model

Program theory explains why a program is expected to work, and the logic model illustrates program theory. Program theory explains how and why a program is supposed to work. Spelling out this theory can be one of the most important steps in achieving program success. This provides a logical and reasonable description of why people engage in program activities and can facilitate intended results or benefits.

Simply put, the logic model provides a picture of a given theory that shows how one thing leads to another, as in the case of a flow chart. The logic model uses short phrases to represent things that are explained in greater detail in program theory. Another key difference is that a logic model uses only an arrow to show that one thing leads to another, whereas program theory needs to provide evidence to demonstrate why one thing is believe to lead to another. The logic model is a widely used tool for illustrating the underlying program theory and is most often presented in the form of a flow chart illustrating relationships between program components and outcomes.

The logic model displays the sequence of actions describing what the program is, what it is designed to do, and how any investment is related to outcomes. IN this paper, five core components are included in this depiction of this action sequence:

The logic model (also known as the framework, the theory of change, or the program matrix) is a tool used most often by program managers and evaluators to evaluate the effectiveness of a given program. This model usually provides a visual depiction of logic-based relationships between program resources, activities, outputs, and outcomes.

Since the development of logic models in the 1970s by Carol Weiss and Joseph Wholey, among others,

many refinements and variations have been added. Many versions of logic models set out series of outcomes/impacts to better explain the logic how an intervention contributes to intended or observed results. This often includes distinguishing between short-, medium-, and long-term outcomes and between direct and indirect outcomes.

〈Table 3〉 Variables of the logic model

Variables	Elements
Inputs	• Resources, contributions, investments, staff members, volunteers, facilities, equipment, and supplies required by the program.
Activities	• Any services or treatment provided by the program.
Outcomes	• Results or changes realized by individuals, groups, communities, organizations, communities, or systems.
Outputs	• Activities, services, events, and products that reach program participants or targets.
Outcomes/ impacts	• Short-term results (learning: awareness, knowledge, skills, and motivations); medium-term results (action: behaviors, practices, decisions, and policies); long-term results (consequences: social, economic, and environmental, among others).

The logic model is often used by governments or nonprofit organizations when the mission or vision is not focused on achieving financial benefits. In such cases, because profitability is not the intended result, it may be difficult to monitor progress toward outcomes. The program logic model can provide various indicators of performance outputs and outcomes. Therefore, it is important for such entities to carefully specify desired results and consider how programs can be monitored over time. In the case of education or social programs, outcomes are often related to their long-term success. In such cases, medium- or short-term outcomes may be identified to indicate progress toward the ultimate long-term outcome.

2. Previous research

This paper discusses the use of logic models in planning and evaluating substance abuse treatment services. The best part is the "sample data maps," which specify evaluation questions, measures, and variables. The paper is part of the Integrated Evaluation Methods Package for substance abuse treatment programs developed under the auspices of the Center for Substance Abuse Treatment, Department of Health and Human Services. The full discussion on this evaluation framework, including its concepts and tools, is presented in Devine, Patricia(1999).

Many researchers in Korea have addressed logic models: Lee(2010) pointed out that the existing

evaluation of government policies remains outside an objective-based assessment and that there is a need for improvements based on project characteristics. In addition, he applies the logic model to a customized healthcare center providing home visits. Lee(2010) suggests a model and methods that are suitable for domestic affairs through simulations based on the logic model. As an example, he considers the “zero-level secondhand smoke” project by developing evaluation criteria and suggesting developmental directions focused on performance-oriented indicators, evaluation models, and indicator configurations. Cho et al. (2011) provide a performance evaluation of complaints processed by Seoul’s 120 Dasan Call Center for various city services. Kim et al.(2003) examine the possibility of social welfare programs, and Lim(2011) consider a survey of resident satisfaction and an objective-based model.

The present paper extends previous research by considering an applied project (EMP) and being the first to assess its performance as part of Korea’s energy policy. Given that the EMP reflects a new system involving large numbers of private and public organizations in partnership, it provides a new opportunity for evaluating program performance.

III . Research design of the EMP

Energy suppliers' provision of information on citizens' energy consumption. Energy providers such as Korea Electric Power Corporation and city gas firms and the waterworks authority send information on EMP participants' electricity consumption to the EMP system. This information contains the level of electricity use in the last two years. Based on the data, the city administration can implement incentive systems based on total electricity use.

1. Input

1) Budget

〈Table 4〉 Budget for the EMP

	Budget Total	Individual	Group	District	PR
2010	2,532	1,290		600	500
2011	3,078	1,215	830	625	33
2012	3,209	1,260	974 (fund)	625	80
2013	3,656	2,841	840 (fund)	625	30
2014		3,466	886		
2015		2,925	1,498		
2016	5,849	4,121	583		

Source : SMG

(1) Incentive

The amount of energy consumption for two or more types of energy, including electricity, water, city gas, and district heating, is compared over a six-month period. If households reduce energy use by more than 10% and groups, by more than 5%, then they can be funded at amounts equivalent to the SMG. Even if this amount is less than the standard, there are additional incentives (Amendment 12. 3. 9)

The Seoul government's budget has been kept to a minimum because of private firms' sponsorship. The government has spent KRW 2.5 billion on constructing a web-based system and KRW 1.2 billion on incentives, indirect incentive costs, and assistance for district projects and managed the EMP system through donations from private firms after the development of the Eco-Mileage Card system. The system

can now be sustained with no additional budget input.

2) Organization and personnel

(1) Human resources

Seven officials of the city administration has been assigned to the task force team.. In addition, 25 districts have sent representatives to be part of the planning process. Further, the BC Card has been fully engaged in the implementation of the Eco-Mileage Card system.

(2) Technical resources

The card system has been developed to accurately measure participants’ energy consumption and guarantee the security of personal information. The new system, approved by the National Information Agency, is connected to energy providers’ computer systems, which allows for the real-time availability of information on participants’ energy use.

<Table 5> Organization and personnel for the EMP

	2009	2010	2011	2012	2013	2018
Team name	Policy team for climate change	Policy team for climate change	Policy team for the air	Project team for climate change	Team for the EMP	Team for the EMP
No. of teams	7	7	7	6	6	7
No. of staff members	1	3	4	4	6	6

Source : SMG

The Seoul government and 25 autonomous districts have closely cooperated with one another. The former (Climate and Environment Headquarters) is responsible for preparing the EMP guidelines and adjusting systematic arrangements, whereas the latter, for direct contact with the public in areas such as publicity and education. To maintain effective collaborative relationships with the district offices, the city administration has held regular workshops, collecting ideas and implementing them by modifying the EMP.

A number of civic groups have called on Seoul City to devise an effective energy conservation system. In April 2008, the Seoul government established procedures for the implementation of the EMP in conjunction with a system for managing the amount of energy consumption under the city’s director of the Climate and

Environment Headquarters. The purpose of the EMP, implemented in January 2009, is to reduce the city's GHG emissions.

(3) Sponsorship by socially responsible firms

The reward is not cash. It includes mileage and environment-friendly products and facilities. The city administration has signed a memorandum of understanding (MOU) with 24 firms (both large and small), including Samsung Electronics, Hyundai Motor, and LG Hausys, which produce highly efficient electronic products or environment-friendly products. These firms offer their products to the city administration free of charge, and the city government delivers them to those showing substantial energy savings.

2. Activity

From April 2008 to January 2009, there were 12 advisory council meetings attended by scholars, researchers, activists, and officials of energy-related institutions. In addition, there were 8 workshops for officials from autonomous districts to collect diverse opinions on various issues and improve the EMP system.

1) Establishment of the plan

The main cause of global warming is GHG emissions, for which Korea ranks ninth, releasing 564 million tons of CO₂ in 2009. Seoul accounts for about 8.7% of CO₂ emissions in Korea, and residential, office, and commercial buildings and vehicles account for about 94%. The EMP is an energy policy driven by Seoul based on the provision of incentives for individuals to voluntarily save energy.

The guidelines for smart energy use by households include using a thermometer, considering energy efficiency, unplugging unused appliances, verifying the amount of water use, using public transportation, consuming food products produced nearby, and promoting the vegetarian diet.

In terms of offices, the guidelines include using an energy service company (ESCO), maintaining the proper temperature for air conditioning and heating, turning off air conditioning and heating at one hour before lunch and at the end of the day, turning off lights near windows, using reflectors, switching to highly efficient lights and equipment, operating elevators on every other floor above the fourth floor, cleaning boilers, installing double-glazed windows or thermopanes, reinforcing insulation, and expanding sources of renewable energy, among others.

(1) Establishment of the Seoul EMP at the request of civic society

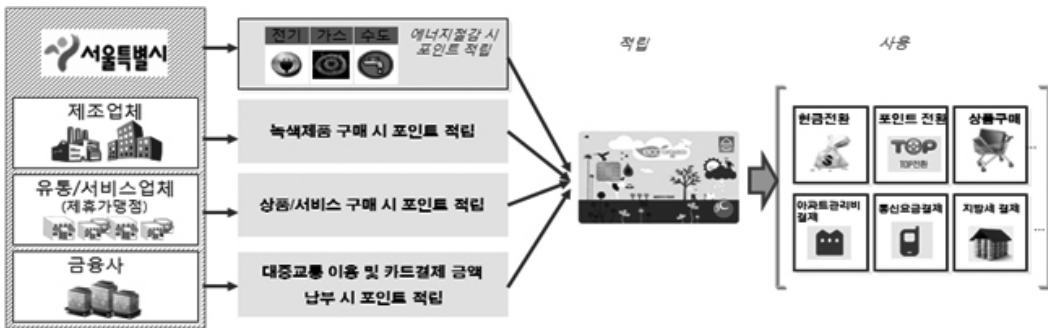
The EMP team at the Climate and Environment Headquarters has attempted to find ways to encourage the public to engage in sustained efforts to save energy through contact with the public, civic groups, scholars, research institutions, and government agencies and concluded that there are limits to the public’s efforts to save energy and that the Seoul government should play a more important role as a partner in targeting energy conservation endeavors.

The Climate and Environment Headquarters of the city administration have formed a task force team, and through numerous meetings with officials of Korea Electric Power Corporation, five city gas firms (including Seoul City Gas Co., Ltd.) and the Waterworks Authority have established a system and developed a software program to receive information on consumers’ energy consumption through these organizations’ assistance. For this, the city administration has implemented a new incentive system and launched a two-way communication channel to ensure sustainable reductions in GHG emissions.

2) Launching of the system

In October 2008, the Seoul government executed an MOU with the same organizations, laying the groundwork for the implementation of the EMP system. In December, the city received approval from the National Intelligence Service regarding the security of the EMP system, ensuring that the system would not encroach upon the privacy of individuals.

< Figure 2 > Conceptual diagram of the EMP



Source : <http://ecomileage.seoul.go.kr/>

3) MOU for the program

In February 2009, a pilot EMP system was implemented in 25 districts. Cash rewards were provided according to decreases in carbon emissions. To gather feedback, 12 advisory council meetings were held with experts, and 8 meetings were arranged with district officials.

To encourage public participation and address issues identified in the implementation stage of the EMP system, the Seoul government has established a new governance system based on the participation of civic groups, firms, the Seoul Metropolitan Office of Education, and municipal governments. The purpose of this governance system is to foster closer collaboration between the public and private sectors. In addition, open forums and seminars have been held to reach a consensus on various issues.

(1) MOU with BC Card and Six Banks

The EMP Card system offers mileage for conserving energy, purchasing environment-friendly products, and using public transportation. Mileage benefits are possible through the city administration's MOU with BC Card, the largest credit card firm in Korea, and six commercial banks, including Woori Bank, SC (Standard Chartered) Bank, and NH Bank. The system has continued to evolve. New card benefits are expected to include low-carbon benefits accrued from purchasing low-carbon products through collaboration with manufacturers and retailers of environment-friendly products.

(2) MOU with KT Corporation

KT Corporation, an integrated wired-wireless telecommunications firm, provides mileage to users who contribute to the EMP website. When users post tips on energy conservation or report cases of energy waste, KT provides them mileage. With this mileage, users can purchase various offerings through KT's online shop and claim them offline in various retail outlets such as convenience stores or bakeries. As mileage turns into products and services, more users are expected to participate in online communication through the website.

(3) Cooperation of the Seoul Metropolitan Office of Education

The city administration has signed an MOU with the Seoul Metropolitan Office of Education for schools in Seoul to actively implement energy conservation programs in the context of environmental education because students are expected to play a leading role in the creation and development of sustainable

environments. As of November 2012, a total of 1,407 elementary, middle, and high schools in Seoul participated in the EMP system, and many students have been educated on saving energy through lectures and case studies.

4) Expansion and modification of tools

Mileage use can be extended to the maintenance cost of an apartment, mobile charges, and local taxes. BC Card has donated 50% of its EMP proceeds in Seoul, which has helped to ease Seoul City's budget. In September 2009, cash rewards were replaced with environment-friendly goods and facilities. There has been a shift in incentive recipients from EMP participants to those making substantial contributions to reductions in GHG emissions. The EMP system was officially launched in the same month.

In October 2009, the city administration introduced a two-way website so that residents could express their opinions while obtaining a wide range of information on energy conservation from experts. In January 2010, the city administration expanded the EMP system to embrace green consumption and transportation in conjunction with BC Card and implemented the Eco-Mileage Card system. Through an MOU with BC Card, which has about 6.5 million subscribers, the Eco-Mileage Card has been issued since December 2010.

In March 2010, the city administration signed an MOU with 24 manufacturers of highly efficient environment-friendly products, including Samsung Electronics, to supply their products as EMP incentives. Since October 2010, the MOU with KT has allowed participants to receive online mileage benefits from the telecommunications firm.

5) Payment agreement on the maintenance cost of an apartment

About 90% of the all apartment units, representing about 139 million households, signed the MOU. In January 2012, the city administration held three advisory council meetings with experts from environment groups, universities, and research institutions to explore the possibility of connecting the EMP system to its new campaign to reduce energy use to close one nuclear power plant or eliminate the need to build a new plant.

The results of the meetings indicate a need for the diversified use of EMP benefits and a wide range of events designed to boost the self-esteem of energy conservationists. The expanded use of the EMP includes the payment of maintenance fees for apartments or other types of multi-unit residential units by using accumulated mileage, which has received considerable support from residents.

6) Promotion and education

EMP promotion and education efforts have included metro-wide Seoul City, posters at bus stops, outdoor billboards, video campaigns, leaflets distributed in apartment complexes, and training programs for managers and members of apartment community associations.

The EMP system began in April 2008 at the request of civic groups to promote a “program designed to address climate change through citizens’ energy conservation efforts to reduce greenhouse gas emissions.”

Pamphlets have been sent to people’s homes to highlight the need for reducing GHG emissions, and various education programs on the environment have been offered during extracurricular hours. Such programs have emphasized the necessity and effectiveness of the EMP system and called for the public’s active participation.

3. Output: The number of beneficiaries

The number of individual participants increased from 500,457 in 2011 to 692,199 in 2012. The Eco-Mileage Card program has about 800,000 members, and the city has promoted its benefits on a nationwide basis, issuing more than 3.2 million cards nationally. The card mileage system has provided the public with substantial benefits and enhanced participants’ commitment to environmental protection. Such benefits have been the outcome of collaboration between the city administration, a card company, financial institutions, manufacturers, and retailers, and the cost of the system has been negligible for the city administration.

〈Table 6〉 Number of participants (unit: 10,000)

	2010	2011	2012	2013	2014	2015	2016
Individuals	24	47.1	65.7	82	187	168	183
Groups (buildings)	2.5	2.9	3.5	3.6	2.7	3.0	4.0
Ratio of savings	38.4%	49.4% 46.0% (room)	58.7% 74.3%(building)				

Source : SMG

Participants can be divided into two major sections: 657,082 households and 35,117 organizations(SMG, 2013). In terms of types of residential units, apartments account for about 52.4% of all households; detached houses, 19.0%; multiunit houses, 16.3%; and row houses, 10.3%. In terms of household size, four-member households account for about 43% of all households; three-member households, 23.2%; and two-member

households, 11.1%. In terms of organizations, private actors account for about 79.1% of all organizational members; public institutions, 10%; and schools, 5.0%.

However, the proportion of environment-friendly buildings has increased steadily because of PR campaigns and the incentive system, including from 38.4% in 2010 to 50% in 2011 and 56.5% in 2012. In addition, the level of energy conservation has increased from 1.0% in 2010 to 2.1% in 2011 and 2.9% in 2012.

IV. Analysis of policy outcomes

1. Effectiveness

For the evaluation of the effectiveness of the EMP, policy enforcement and performance outcomes are compared to the original objectives. That is, this analysis determines the extent to which the original objectives of the proposed policy have been achieved. This evaluation is based on the number of participants and the level of energy savings.

1) Participants

〈Table 7〉 Number of participants (unit: 10,000)

	total	2010	2011	2012	2013
Targets			50	65	120
Individuals		24	47.1	65.6	82
Groups (buildings)		2.5	2.9	3.5	3.6

The number of participants as of 2012 was 692,199, exceeding the original target of 650,000.

2) Energy savings

The total energy savings in 2012 were 101,501 TOE and 308,192 tons of GHG emissions, reflecting 60,000 TOE and 12 million tons of GHG emissions in reductions over 2011. That is, the outcomes exceeded the targets by about 30%.

〈Table 8〉 Comparison of outcomes to targets in energy savings (unit: TOE)

	2011	2012
Targets	7,000	40,000
Outcomes	49,000(10)	100,000

Source : SMG

(1) Analysis of consumption by participants

Because energy shortages are serious and can lead to sharp increases in energy prices, the need to save energy has received increasing attention in recent decades.

〈Table 9〉 Comparison of energy consumption between participants and the whole population for net effects

	Electricity(KWh)	Gas(m ³)	Waterworks(m ³)	
Member	3,539	649	237	Sample 19,267
Resident average	3,089	680	173	parameter 4,192,752
Ratio	114.5%	95.4%	137.0%	

Source : SMG

2. Efficiency

The efficiency of the EMP is assessed by comparing policy outcomes to input resources. Here efficiency is measured as the percentage of outcome among input.

Although the cost of program incentives increased from KRW 903 million in 2010 to 1.9 billion in 2011 and 3.21 billion in 2012, these increases can be viewed as a positive indicator of increased energy savings. Table 7 compares the outcomes relative to the level of investment.

〈Table 10〉 Comparison of investment outcomes

	Input	Outcome		Cost	
	Input	TOE	CO2	TOE	CO2
2012	3,209	101,501	308,192	31.6	3.03
2011	1,924	42,263	85,880	22.0	2.03
2010	903	22,083	39,164	24.5	1.77

Source : SMG

As of 2012, the level of GHG emissions was 308,192 tons, and the cost of reducing a ton of GHG emissions was about KRW 3 million.

〈Table 11〉 Cost per ton of GHG reductions

	Savings (ton CO2)	Incentive budget (in million KRW)	Budget/ton (KRW)
total	145,622	2,014	13,830
House	50,137	1,514	30,197
School	7,748	200	25,813
Building	87,737	300	3,419

Source : SMG

In terms of GHG reductions per unit cost, the EMP is about two times more effective than other programs such as the solar program and the project for retrofitting buildings, demonstrating the maximum benefits at the lowest cost. The cost of the EMP is KRW 13,830/t CO₂, which is about 0.1 ~ 0.3% of the cost of other programs such as the BRP, renewable energy, and LED projects.

〈Table 12〉 Comparison with other GHG reduction projects and the level of investment

Program	Savings(ton CO2)	Budget(in million KRW)	ROI*(million/ton CO2)
EMP	145,622	2,014	0,01
BRP	6,438	22,298	3,46
Geothermal	504	1,935	3,84
Solar heat	169	974	5,76
LED	392	2,448	6,24
Sunlight	1,078	8,835	8,19

* ROI (return of investment): The amount of investment per ton of GHG emissions.

V. Conclusions

1. Major findings

The results for EMP effectiveness indicate that the outcomes have generally exceeded the original targets and that the number of participants and the level of energy saving amounts. By contrast, the central government's carbon point program has been effective. According to the results, energy savings of 1 TOE require about KRW 1 million, indicating that the EMP is more efficient than other programs. This suggests that the EMP may be an effective and efficient program for addressing global issues such as energy savings and carbon reductions. In particular, the EMP is attractive in that it can facilitate greater energy savings and is less costly than other programs such as those entailing renewable energy without being an energy production system.

2. Implications and limitations

This paper quantitatively measures the performance or effectiveness of the EMP, a policy promoting energy savings. The paper contributes to the literature by being the first to assess the EMP by comparing investment outcomes to targets and thus facilitating efficient project design and policy implementation. The results have important implications for improving the policy and devising a systematic plan for such efforts.

The success of the EMP may be explained by the following three factors. First, the Seoul mayor has shown strong commitment and devotion to the EMP. To achieve the city's GHG reduction goal (a 40% reduction from the 1990 level by 2030), it may not be enough to rely only on traditional municipal policies, including the use of new and renewable energy sources and the rationalization of energy consumption by buildings. Residents have to participate in a wide range of measures in areas such as conserving energy, purchasing environment-friendly products, and using green transportation. The Seoul mayor has regularly reviewed EMP progress while actively adopting opinions of both city administration divisions and resident through numerous meetings. In addition, the director of the Environmental Protection Headquarters has made substantial contributions by taking charge of the task force team, identifying problems and presenting solutions.

Second, district offices have shown active cooperation. Each of the 25 district offices established a task force team to encourage the public's active participation in the EMP by meeting maintenance managers of apartment complexes, managers of commercial buildings, and officials of women's associations in small communities. Here residents have been provided with training programs to recognize their correct choice as "green" consumers. Resident centers serving as administrative units have enabled citizens who are not comfortable using computers to apply for their membership online.

Finally, schools have participated actively in the EMP. The necessity of the EMP for reducing GHG emissions and fostering a sustainable environment has been emphasized to students, who would inherit the environment and the climate in the future. Convinced of this necessity, students have shown willingness to participate in the EMP to improve the environment by reducing GHG emissions.

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서울시립대학교 대학원 도시행정학과를 졸업하고 행정학 박사학위를 받았다. 국회 사무처에서 정책보좌관으로 일하며 예산결산 심의와 총리실 등에 대한 정책감사를 하였고, 서울특별시 정책기획보좌관 등을 지내며 정책입안과 집행과정 등을 모니터링 하였다. 이를 토대로 ‘서울 행정학(2011, 신라미디어)’과 서울시 정책변동, 주택정책, 기후변화 대응체계에 관한 논문이 다수 있다. 이외에 ‘장기전세주택(2012, 한국학술정보)’, ‘국민이 원하는 정책, 헌법 속에 다 있다(2016, 흥가비전)’ 등의 저서가 있다. 관심분야는 정책평가와 행정혁신 등이며 서울시립대학교 연구교수를 거쳐 현재 서경대학교에 재직중이다.

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서울시립대학교 도시행정학과에서 행정학 박사학위를 취득하고, 서울연구원, 경기연구원 등을 거쳐 현재 경기대학교 창의공과대학 건축공학과에 재직중이다. 주요 관심 분야는 도시재생, 도시행정, 건축(공학), 정책평가 및 인구정책 등이다. 주요 저서로는 “도시미래와 재생”(형설출판사, 2017), “세계도시의 이해”(한국학술정보, 2014), “신도시학개론”(형설출판사, 2013), 등이 있으며, 주요 논문으로는 “정치적 요인에 따른 지방자치단체 정책 변동유형 연구: 박원순 서울시장의 취임 전후 정책비교를 중심으로”(2017), “도시재생사업의 도시리질리언스적 진단과 정책적 함의”(2017), “경기도의 생활인프라 격차 분석 연구”(2017) 등이 있다.