

New Renewable Energy: One Less Nuclear Power Plant

Date 2015-06-18 Category Environment Updater scaadmin

Energy Consumption & Production in Seoul

Energy Consumption Pattern

As of 2012, 94.6% of Seoul's energy came from the following three energy sources: oil (37.7%), LNG (30.8%), and electricity (26.1%). Seoul's reliance on LNG has remained around 30% since the 2000s while its electricity consumption increased from 21% in 2003 to 26% in 2012. During the same years, the proportion of renewable energy in the city's energy mix jumped about three-fold.

By sector, industry makes up the largest portion of energy use in the nation while in Seoul the largest share (86.2%) is used by households and the commercial, and transport sectors together. The nationwide energy consumption by industry has been on the rise for the past 10 years while decreasing in Seoul.

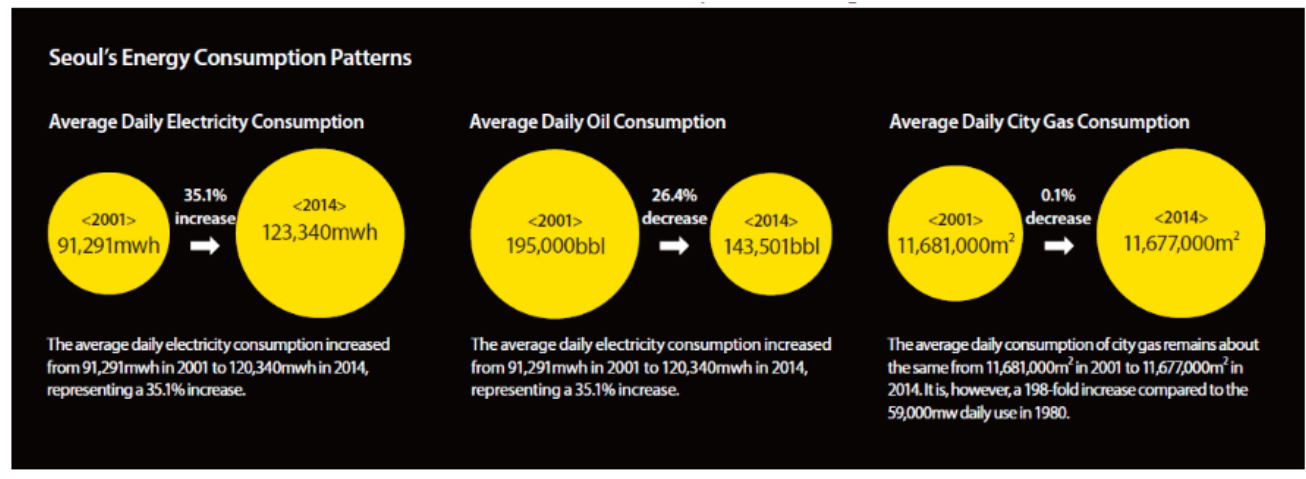
Energy Production Pattern

In 2012, oil accounted for the largest portion of Seoul's primary energy consumption, followed by LNG and renewable energy. The total consumption of primary energy peaked in 2007 and has since been declining slightly. Coal, in particular, has been showing a downward trend since its peak in 2006, while oil, too, is following. As of 2013, Seoul generated 1,946 GWh of electricity per year from its power production facilities located within the city, which are mainly thermal and renewable energy production plants. The production level, however, accounts for only 4.2% of its annual electricity consumption, which stands at 46,555 GWh.

Use of Renewable Energy

Since 2000, many more renewable energy facilities have been installed in Seoul. Facilities for photovoltaics, fuel cells and geothermal energy saw a particularly great expansion as well as those for heat generation from waste. Although facility expansion led to a 3-fold increase in production of renewable energy, as of 2012 green energy still accounted for only 26% of the nation's total energy consumption and a mere 1.5% of the city's. These figures suggest a clear need to expand the share of renewable energy.

Meanwhile, the share of photovoltaic (PV) generation dramatically soared from a mere 0.1% in 2003 to 2.5% in 2012. Yet, as of 2012, 92% of total renewable energy production came from bio-energy and energy from waste combined, making up the largest share of the mix. However, with Seoul's One Less Nuclear Power Plant initiative, PV's role is expected to be greater in the future.



Seoul's Energy Consumption Patterns

Average Daily Electricity Consumption

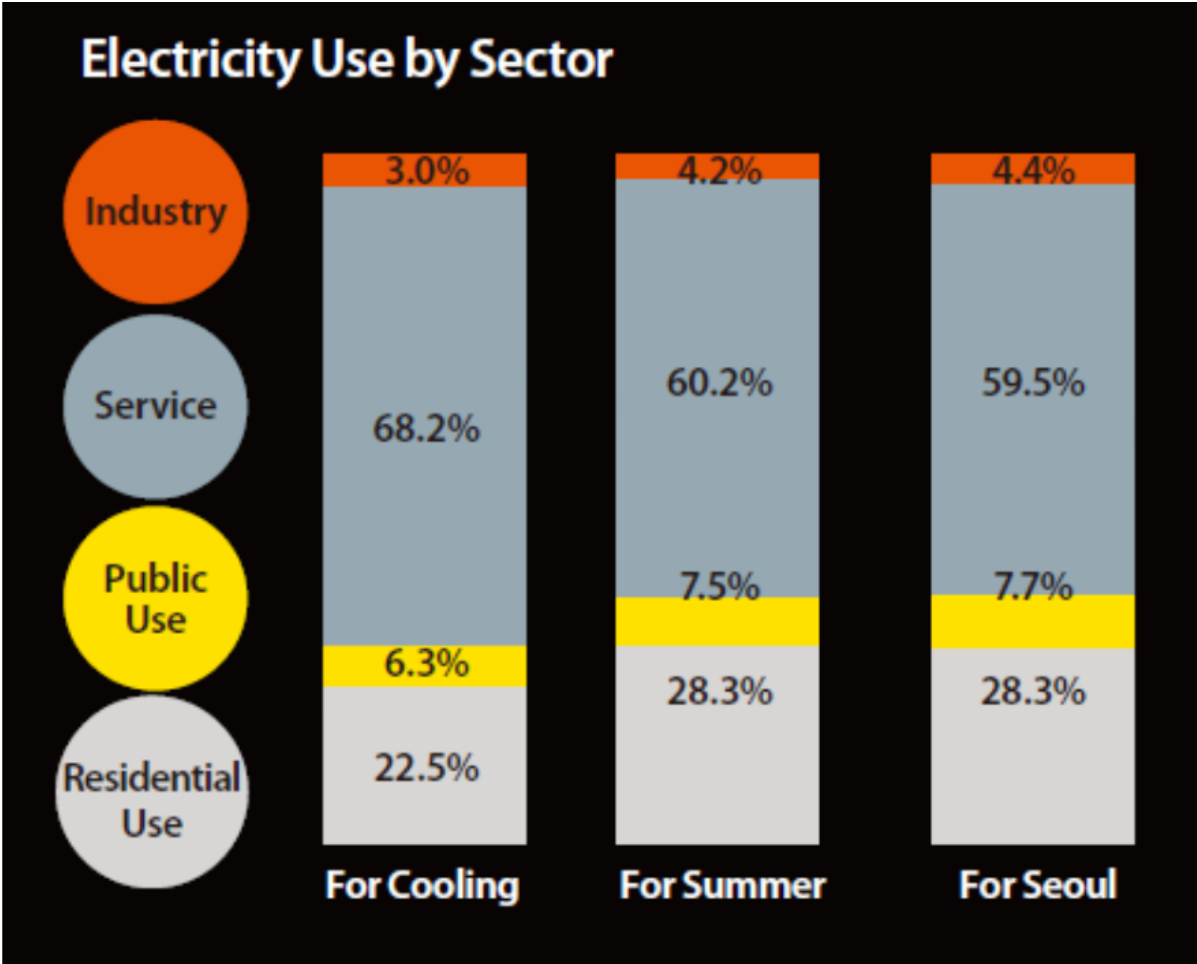
The average daily electricity consumption increased from 91,291 MWh in 2001 to 120,340 MWh in 2014, representing a 35.1% increase.

Average Daily Oil Consumption

The average daily oil consumption decreased from 195,000 bbl in 2001 to 143,501 bbl in 2014, representing a 26.4% decrease.

Average Daily City Gas Consumption

The average daily electricity consumption of city gas remains about the same from 11,681,000m³ in 2001 to 11,677,000m³ in 2014. It is however, a 198-fold increase compared to the 59,000 m³ used daily in 1980.



Electricity Use by Sector

Industry / Service / Public / Residential

For Cooling / During the summer season / For Seoul



Energy Efficiency Improvement

(Unit: case)

Sector	Performance
Energy Consumption	352,098
BRP	192,304
LED	201,252
Transport	123,370
Total	869,024

Energy Reduction

(Unit: 1,000 TOE)

Category	Target	Reduction Achieved			
		2012	2013	2014	Total
Energy Production	410	35	78	147	260
Energy Efficiency	1,110	145	328	396	869
Energy Saving	480	151	515	245	911
Total	2,000	331	921	788	2,040

Energy Production

(Unit: case)

Category	Production
Power Generation (PV, Fuel Cell, etc.)	410
Waste Heat (wastewater, incineration), geothermal	119,218
Environmental Impact Assessment	82,912
Total	259,533

Energy Saving

(Unit: case)

Category	Details	Savings
Waste	Eco-Mileage System, Building Indoor Temperature Regulation	777,376
Public Sector	Public sector energy conservation	55,302
Public Participation	Waste recycling	77,607
Total		910,285

Improvement of Energy Efficiency / Reduction of Energy Use / Energy Production / Energy Savings

Sector / Performance / Power Generation (PV, Fuel Cells, etc.) / Waste Heat (wastewater, incineration), Geothermal / Environmental Impact Assessment / Waste / Eco-Mileage System, Indoor Temperature Regulation / Public Sector / Public Sector Energy Conservation / Public Participation / Waste Recycling

Introduction of the One Less Nuclear Power Plant Initiative

Beginning

As of 2011, nuclear energy accounted for 31% (154,732 GWh) of the country's annual power generation (496,893 GWh). Although nuclear energy is safe and efficient, it incurs enormous human, environmental and economic costs if something goes wrong, as was seen in the Fukushima nuclear disaster. Therefore, there has been an increasing demand for a safer, sustainable energy source.

Meanwhile, Seoul's power consumption accounts for 10% of the national total, yet its power self-sufficiency rate is a meager 3.0%. In addition, Seoul's power demand has been continually rising so that the increase is equivalent to the amount of energy generated by one nuclear power plant for an entire year. To proactively respond to energy crises and climate change, the Seoul Metropolitan Government (SMG) worked closely with city residents to set up a comprehensive energy plan, one that would be the basis of the city's attempt to reduce energy use and generate more energy from renewable sources. As part of this plan, the SMG introduced the One Less Nuclear Power Plant initiative, whose objectives included reducing the city's energy demand by an amount equal to the capacity of one nuclear power plant (1 GW) by 2014. The longer-term objective is to reach 20% energy self-sufficiency by 2020.

Listening to Citizens & Experts

The SMG announced its One Less Nuclear Power Plant initiative on April 26, 2012 and laid out its ambitious goal of reducing energy consumption by 2 million TOE, equivalent to the production capacity of one nuclear power plant, by 2014. To materialize this initiative, the city government created a dedicated team and amended relevant ordinances.

Private sector investment was first attracted to establish the production bases for PV generation in Seoul. The SMG also amended institutions to encourage citizens to participate through small-scale generators. This was complemented by efforts to provide small-scale PV technology that can be utilized by multiple-unit dwellings. At the same time, efforts were made to diversify the energy mix, adding fuel cells and small-scale hydro power plants as well as PV.

The SMG also launched the Building Retrofit Project, or BRP, to improve building energy efficiency. To engage more of the population, long-term low-interest loans are provided. In fact, the interest rate was lowered from 2.5% to 2.0% in January 2013, and was further cut to 1.75% in December of that year.

Another important part of the One Less Nuclear Power Plant initiative is replacement of lights to LED. With private sector investment, the city government replaced 430,000 traditional lighting units in 243 subway stations in Seoul with eco-friendly LED lights. Lighting fixtures at other high energy-consuming places such as gyms and restaurants were also replaced with 4.97 million LED lamps.

Of all the programs and policies, the Eco Mileage program has proven the most effective. This voluntary, citizen participatory energy-saving program enjoyed the participation of 1.68 million people by June 2014,

saving 190,000 TOE. In addition, Seoul runs a car sharing service known as Nanum Car. With two electric vehicle companies taking part now, the service could provide as many as 1,070 cars ready for sharing by 150,000 members who would give up driving their own vehicles by 2014. Other participatory programs include Energy Clinic, which has given eco-friendly driving instruction to 10,000 people, and the Energy Guardian Angel Corps.

History of One Less Nuclear Power Plant

(Jan 2012) Public opinion from advisory group and civil society is heard



(Apr 2012) Official presentation to the public
Executive committee is formed



(Jan 2013) Public engagement project with 43 groups began



(May 2013) Rent charge for PV changed

(Jun 2013) 1 million members to Eco Mileage Program

(Jul 2013) PV power plant in Arisa Arisu Purification Center (5MW) set up



(Dec 2013) BRP interest rate cut from 2.5% to 1.75%

(Dec 2013) Operation of PV facilities in Gwangam Purification Center & Seonam Water Reuse Center (3.8MW)



(Mar 2014) Decision to sell city gas from Jungnang Water Reuse Center

(Jun 2014) 1,200 cars and 200,000 members to Nanumcar Service

(Jun 2014) Energy inspection service for 15,000 households through Energy Clinic program



(Jun 2014) 20,000 homes & buildings under BRP, 6.79 million LED lamps replaced

(Jun 2014) 16 Energy-related cooperatives formed
(Jun 2014) 1.7 million members to Eco Mileage program

2012

(Feb 2012) Policy workshop for One Less Nuclear Power Plant



(Jul 2012) Seoul's energy ordinance amended

(Dec 2012) Development of project evaluation for the project

2013

(Feb 2013) Goduk fuel cell plant set up (20MW)

(Feb 2013) Agreement with 5 companies (LG) to cut BRP price



(Oct 2013) Construction for district energy with Tanchon Water Reuse Center began

(Nov 2013) Seoul Global Energy Conference



2014

(May 2014) lightings at 243 subway stations replaced with LED



(Aug 2014) Presentation of the 2nd phase One Less Nuclear Power Plant project



History of the One Less Nuclear Power Plant Initiative

(Jan 2012) Opinions are heard from advisory group and the general public

(Feb 2012) Policy workshop for One Less Nuclear Power Plant

(Apr 2012) Official presentation to the public

Executive committee formed

(Jul 2012) Seoul's energy ordinance amended

(Jan 2013) Public engagement project with 43 groups begun

(Feb 2013) Goduk Fuel Cell Plant set up (20 MW)

(Feb 2013) Agreement with 5 companies (including LG) to cut BRP price

(May 2013) Rental charge for PV changed

(Jun 2013) 1 million members in Eco Mileage program

(Jul 2013) PV power plant in Amsa Arisu Purification Center (5 MW) set up

(Oct 2013) Construction for district energy with Tanchon Water Reuse Center begun

(Nov 2013) Seoul Global Energy Conference

(Dec 2013) BRP interest rate cut from 2.5% to 1.75%

(Mar 2014) Decision to sell city gas from Jungnang Water Reuse Center

(May 2014) Lighting units at 243 subway stations replaced with LED

(Jun 2014) 1,200 cars and 200,000 members in Nanum Car Service

(Jun 2014) Energy inspection service for 15,000 households through Energy Clinic program

20,000 homes & buildings under BRP

6.79 million LED lamps replaced

16 Energy-related cooperatives formed

1.7 million members in Eco Mileage program

(Aug 2014) Presentation of the 2nd phase of the One Less Nuclear Power Plant initiative

Policy Outcomes & Evaluation

Thanks to its multifaceted and multilayered approach, the city government successfully reached its target of reducing energy consumption by 2 million TOE during the 2 years between April 2012 and June 2014. As of 2013, Seoul's energy consumption had dropped by 1.4% while the nation's energy demand had increased by 1.7%. The One Less Nuclear Power Plant initiative is also meaningful in that it placed significant focus on renewable energy and energy efficiency as evidenced by its BRP project.

Furthermore, the initiative merits recognition as it engages citizens, seeks to change the perception of the public, creates jobs in the energy sector and helps the city strengthen its image on the world stage as a truly green city. In fact, in October 2012, Seoul became the headquarters of ICLEI and is slated to hold the ICLEI World Congress in 2015.

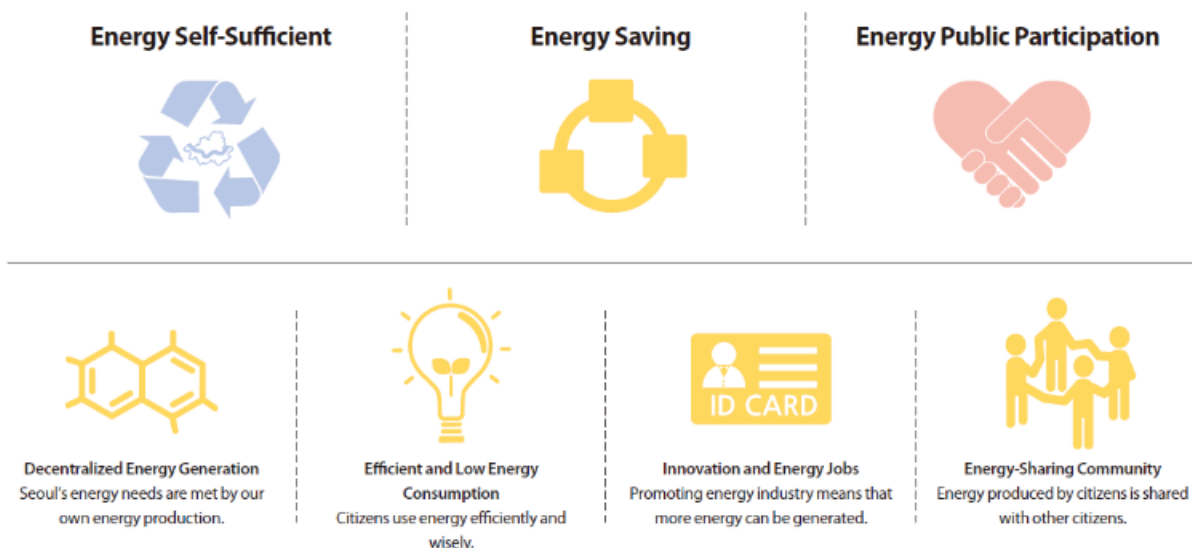
Phase 2 of the Project: An Energy Housekeeping City

The SMG is launching Phase 2 of the initiative to bring greater value and vision to the capital city of Korea. For this, the more ambitious and far-reaching part of the project, the SMG has made every effort to listen to public opinion from the very beginning of policy design. It organized several discussion sessions to listen to the One Less Nuclear Power Plant Committee comprised of 48 people from academia, industry and the general public. It also listened through a variety of other channels such as the Seoul International Energy Advisory Council (SIEAC), social fiction, policy hearings and even online surveys.

The slogan of the second phase, "An Energy Housekeeping City" suggests that Seoul needs to clearly identify its role and present situation and use that information to create a city that is energy self-sufficient. The three core values include energy self-reliance, energy sharing and public participation.

'Energy Housekeeping City, Seoul'

Seoul, Energy Self-Sufficient City where Citizens Produce Energy and Consume Them Efficiently



'Seoul – An Energy Housekeeping City'

Seoul - An Energy Self-Sufficient City where Citizens Produce Energy & Use It Efficiently

Energy Self-Sufficient / Energy Saving / Public Participation in Energy

Decentralized Energy Generation: Seoul's energy needs are met by our own energy production.

Efficient & Low Energy Consumption: Citizens use energy efficiently and wisely.

Innovation & Energy Jobs: Promoting the energy industry makes for more energy generation.

Energy-Sharing Community: Energy produced by citizens is shared with other citizens.

20% Energy Self-Sufficiency by 2020

The main objective of the second phase is 20% energy self-reliance. To materialize this ambitious goal, the SMG will create a sustainable energy ecosystem, a virtuous cycle in which citizens produce energy themselves and consume it efficiently. To complement this, 88 unit projects under 4 policy categories will be implemented. With greater citizen participation in many of its projects and in the comprehensive 10 Key Actions Plan, the city believes that together, the city's energy consumption can be cut and more energy produced from renewable, distributed sources. These changes, in turn, will boost Seoul's energy self-sufficiency rate while reducing 10 million tons in GHG emissions and cutting energy consumption by 4 million TOE.

Decentralized Energy Generation

The SMG is committed to creating a city based on distributed energy, or decentralized energy in which everyone is involved in generating it cleanly and safely. In order to materialize its plans to have every citizen

produce as well as use energy, the SMG intends to supply a variety of small, grid-connected devices such as PV systems (250W) that are easily installable on apartment balconies. These mini power generators will be provided to 8,000 households in Seoul this year, while a total of 40,000 households will be offered similar systems, resulting in each household saving about KRW 10,000 per month in electricity bills.

The SMG also plans to create a Civic Fund for PV Power Generation, which will allow citizens to directly invest and earn income from private power generation. The annual fund will provide a 4% return on investment and is expected to be KRW 10 billion in size by 2018. In addition, Seoul now requires new buildings to generate energy and heat, up to 20% of their energy consumption, from renewable sources and decentralized systems.

Efficiency & Low Energy Consumption

Towards energy efficiency and low consumption becoming norms in Seoul, the SMG will specifically target buildings, which account for 56% of the city's total energy consumption. To this end, the city government offers consulting on individual building energy performance and loans (at 1.75% interest) for the cost of insulating or enhancing building energy efficiency.

For large new buildings, the current standard for environmental impact assessments will be strengthened. In addition, the use of energy-saving technology and facilities for all buildings will be enforced towards achieving "zero energy" by 2023. Seoul also plans to make information on building energy efficiency publicly available during sale/lease processes, so that the value of energy efficiency can be reflected in the building price.

As for lighting, all 2.2 million lighting fixtures in public buildings, street lights, and security lights in small alleys will be replaced with LED lamps while 65% of all privately-owned buildings, or 290 million lighting units, will also be replaced with LED.

Believing that saving energy is just as important as pursuing efficient energy use, Seoul is making every effort to engage the public. The best example of programs that seek participation is known as Eco Mileage, whose membership is expected to reach 2.8 million by 2018 through a variety of incentives.

Innovation & Jobs in Energy

The SMG plans to create quality, sustainable employment by promoting the energy industry and facilitating innovation. To this end, it will support the public sector first by fostering ICT electricity technologies, including smart grid and Building Energy Management Systems (BEMS) suitable for large cities. In addition, the city government will support the local energy service industry while facilitating start-ups, developing talent, and finding new market openings for those in the industry. The SMG plans to run pilot green cluster projects in 2015 in Gasan and G-Valley in Guri, two of the best-known clusters for renewable energy. The number of pilot clusters will expand to 6 by 2018 and include Mapo and Nowon.

Seoul will also foster social enterprises and cooperatives in green energy. An energy hub center will be built in each neighborhood to provide support with installation and monitoring, as well as post management, which in turn will provide more jobs.

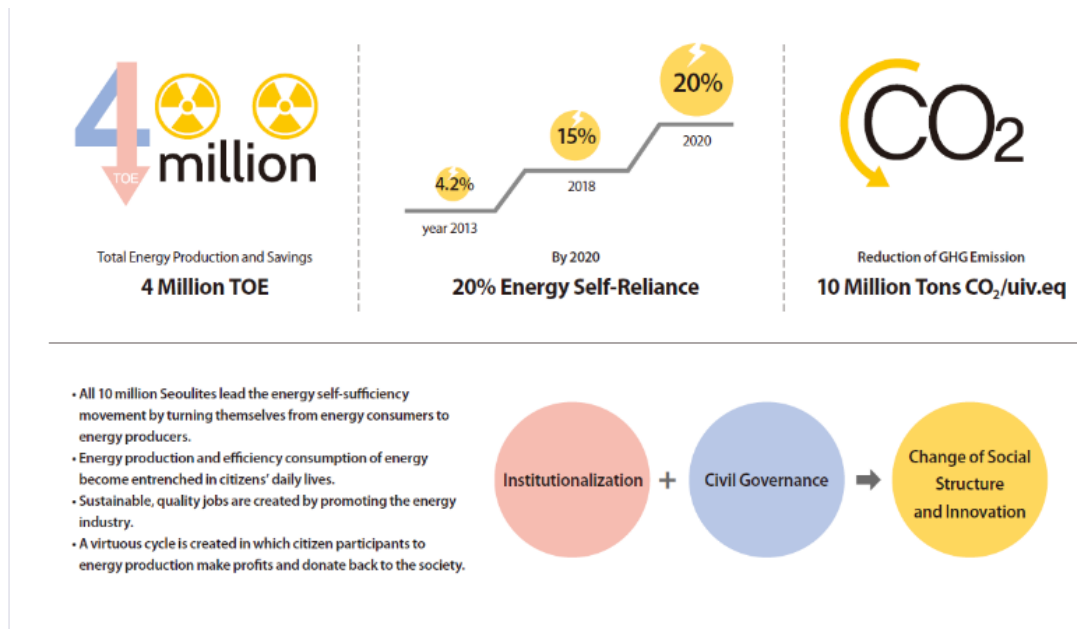
Energy-Sharing Communities

Publicly-funded support will be extended to the energy poor, or those who suffer disproportionately from winter cold and summer heat. These people spend 4.7 times more on energy since they only have access to energy sources that are relatively expensive (LPG, kerosene) but low in efficiency. Unfortunately, there has been very limited support in this area. To change this, the SMG will take an inclusive approach to create better energy security for all.

Seoul will push institutional reform to ensure the protection of basic rights to energy. For instance, a welfare charter and relevant ordinances will be adopted and a welfare fund created to be run and distributed by citizens themselves. Currently, Seoul is targeting 100,000 participants for the fund, which will be funded by net profit from energy savings and generation (from PV, LED replacement, BRP), which will then be shared

with the energy poor population.

Furthermore, to encourage continued and voluntary civic participation in energy generation, efficiency and reduction, Seoul will focus on expanding local energy communities such as the Energy Independent Community. The overall goal of the SMG's energy policy is to create a virtuous cycle in which reducing energy use will become an entrenched part of everyday life and part of the culture.



Total Energy Production & Savings/ 20% Energy Self-Reliance / Reduction of GHG Emissions /

- Seoul's 10 million residents will lead the energy self-sufficiency movement by changing from energy consumers to energy producers.
- Energy production and efficiency will become entrenched in daily life.
- Sustainable, quality jobs are created through promotion of the energy industry.
- A virtuous cycle is created in which citizen energy producers earn money and give it back to society.

Institutionalization + Civil Governance + Change of Social Structure & Innovation

New Renewable Energy System & Policy

Through the Tokyo Protocol taking effect in 2005, the obligation to reduce greenhouse gases needed to be fulfilled between 2008 to 2012, and Seoul, as the largest consumer of energy in Korea, was required to support the Korean government's new renewable and renewable energy policies as well as make a concerted effort to promote the reduction of atmospheric contamination and mitigate global warming.

Through the Seoul Energy Declaration in 2007, the goal of the nation's first low carbon society vision and the obligation to reduce greenhouse gases were established. Furthermore, the 5 Year Green Growth Plan (2009-2013) was proposed, involving the application of low carbon technologies and the development of "green" cities. Along with this plan, demonstrative cities in the low carbon urban restoration project and low carbon, energy saving new city developments were selected and supported. Out of this, a specialized new renewable energy supply project was initiated for residential housing, buildings, and regions.

The SMG reflected regional properties and the flow of international society in establishing its Energy Master Plan in 2008. This Plan included a vision of ‘The realization of sustainable energy’ and, in the following year, the city strengthened its connection to the Energy Master Plan by announcing the 2030 Seoul Energy Master Plan, which included a vision of ‘Low carbon, green growth’. To realize this Plan, three initiation strategies were proposed: creation of a low energy consumption city, an energy recycling city, and an energy welfare city. To initiate these three strategies, specific plans were established to guarantee basic energy rights, encourage long and short-term energy saving, increase efficiency, and plan the supply of low carbon energy into homes, commercial buildings, transportation, and the public sector. In 2011, a goal was set to reduce GHG emissions and energy consumption, and increase the use of new renewable energy as part of the Seoul Energy Declaration. In addition, the 2030 Seoul Green Design Masterplan, which includes integrated and long term plans, was established to bring about compliance with the central government’s policy vision of low carbon green growth, and to propose an initiative to emphasize the properties of metropolitan Seoul.

The SMG came up with an integrated means of the One Less Nuclear Power Plant initiative through reduced energy consumption and increased generation of new renewable energy. The goal was established in 2012 to reduce energy use by 2 million TOE by producing 410,000 TOE through new renewable sources (including solar power and hydrogen cells), increasing energy efficiency in buildings and transportation, and reducing consumption by 1.59 million TOE.

In 2014, the initiative’s Phase 1 goal was achieved, and the Phase 1 project was effectively reinforced. The Phase 2 project was implemented, whose goals were to reduce energy consumption by 40 million TOE, achieve the energy self-reliance rate of 20% by 2020, and reduce greenhouse gas emissions by 10 million tons.

Table 1. Comparison of Phase 1 & 2 of Seoul’s One Less Nuclear Power Plant Initiative

	Phase 1	Phase 2
Vision	▪ Energy self-reliant construction	▪ Seoul – An energy self-reliant city - Three energy values: independence, sharing, participation
Goal	▪ Reduce energy consumption by 20 million TOE	▪ 20% energy self-reliant (2020) - Reduce energy consumption by 40 million TOE, reduce GHGs by 10 million tons
Strategy	▪ Production, efficient use of new renewable energy, and reducing overall energy consumption	▪ Change social structure through institutionalization - Become a distributed energy generating city

		- Energy-efficient, low consumption social structure - Innovative jobs in energy - Create energy-sharing communities
Task	▪ 71 projects in three fields	▪ 88 projects with 23 tasks in 4 fields

Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul

One Less Nuclear Power Plant Initiative

The SMG anticipated that the Phase 1 objective of reducing 2 million TOE would be completed in the first half of 2014, six months earlier than planned. It began discussing the establishment of a successive plan in January 2014.

Phase 2 included various professional meetings, citizen discussions, and analyses of overseas cases to realize the values of energy self-reliance, sharing, and participation. These were based on improved policies and innovation of the energy consumption structure achieved in Phase 1.

Discussions on how to implement Phase 2 were held by the One Less Nuclear Power Plant Plan Executive Committee, a private and governmental governance organization. The agenda was the values and visions of this phase. In order to establish an efficient executive plan, the existing four divisional committees were reformed into five divisions of General Affairs, Energy Generation, Energy Efficiency & Reduction, Energy Industry & Employment, and Energy Welfare & Community. After numerous meetings, they defined the tasks required to achieve the visions and values. Furthermore, a forum held to discuss policy for the energy industry and collect the broad opinions of experts and the general public.

Table 2. Phase 2 Executive Plan for the One Less Nuclear Power Plant Initiative

General Affairs Division	Energy Generation Division	Energy Efficiency & Reduction Division	Industry & Employment Division	Welfare & Community Division
Organization of plans Reformation of policies and regulations	Renewable energy Dispersive energy, etc.	Building and transportation sectors Eco Mileage program, etc.	Industry and employment support Social enterprise support	Support of low-income households Donations and sharing projects

Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul

To better devise projects in Phase 2 of the One Less Nuclear Power Plant initiative, the opinions of citizens were actively collected through discussions and online forums. The name was selected as 'Phase 2 of the One Less Nuclear Power Plant Initiative' through a public naming competition in February 2014. In March, a survey of 2,000 citizens was done on awareness and willingness to participate in the One Less Nuclear Power Plant initiative. Furthermore, a Social Fiction Festival for Phase 2 of the initiative was held at Seoul City Hall with "10 Million Citizen's Sunlight Imagination Fair for an Energy Self-reliant City of Seoul" as its theme. As many as 400 citizens attended to share their wisdom.

Phase 2 of the One Less Nuclear Power Plant initiative was planned to effectively reinforce the projects of Phase 1 and manifest the value of energy through a progressive change in production and consumption of energy and eco-friendly policy. Furthermore, efforts were made to supplement the associated problems, including lack of governance and lack of an integrated executive, which were identified in Phase 1. The One Less Nuclear Power Plant Executive Committee focused on application of new technologies, introduction of previously-implemented policies and exploration of new tasks.

Policy Goals

The management of quantitative goals in Phase 1 of the One Less Nuclear Power Plant initiative evolved to energy value goals in Phase 2, deducing the three values of energy self-reliance, energy sharing, and energy participation.

Figure 1. Three Values of Phase 2 of the One Less Nuclear Power Plant Initiative

Energy Self-Reliance	Decreased dependency on external energy to facilitate conversion into a responsible city in terms of energy consumption Generation of safe, sustainable energy in preparation for an energy crisis Expansion of energy industry and employment through the process of energy self-reliance
Energy Sharing	Citizens with sufficient energy services share their resources with those who are energy poor and save them for the future generation Coexistence through energy welfare in minority classes and fair distribution of energy generation and consumption
Energy Participation	Construction of energy governance for the establishment and execution of energy policies Publication of energy information and policies, and provision of education and training opportunities

Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul

The SMG has set expanding energy self-reliance as its goal, from 4.2% in 2013 to 20% by 2020. Development of new renewable energy and thermal convergence will be responsible for 46% of this self-reliance, while 54% is to be achieved through improved energy efficiency and reducing energy consumption.

As a core index, energy self-reliance seeks to change Seoul from an energy consumption city to one that generates energy, and reflects regional energy policies that supplement the central government's policies on mass production and mass transmission. Furthermore, it is also an index for ascertaining the initial achievements of policy to increase efficiency and generate distributed energy. The targeted energy self-reliance rate represents the generation of new renewable and distributed energy, efficient use and reduction. There are difficulties, however, in reflecting the effort and achievement of reducing the use of other energy sources, such as fossil fuels, and thus, the reduction of greenhouse gases and the amount of total energy generated and reduction of overall TOE are managed concurrently.

The amount of energy consumed by 2020 in Seoul is expected to be 50,330 GWh, after applying the 1.2% annual average rate of increase in energy usage in the city between 2009 and 2013. Energy consumption is planned to be only 40,777 GWh by 2020, by reducing 9,553 GWh through Phase 2 of the One Less Nuclear Power Plant initiative: 5,639 GWh through increased energy efficiency by introducing BRP and LEDs, and 3,914 GWh through energy-saving methods such as the Eco Mileage program.

In addition, to reach the 20% energy self-reliance goal, 8,155 GWh of energy is to be generated through the expansion of new renewable energy and thermal power generation, as well as heat convergence generation. Through the generation of new renewable energy, including 256 GWh of solar power and 2,365 GWh of fuel cell, a total of 2,711 GWh of energy will be generated, and 1,195 GWh of group energy, 803 GWh of self-heat convergence energy and 3,446 GWh of thermal energy will be generated. A total of 5,444GWh will be produced.

Figure 2. Core Index: Prospects of Achieving 20% Energy Self-Reliance



Prospects of Energy Generation	Prospects of Energy Consumption & Reduction Rate
New Renewable Energy Thermal Heat Convergence	Consumption Eco mileage

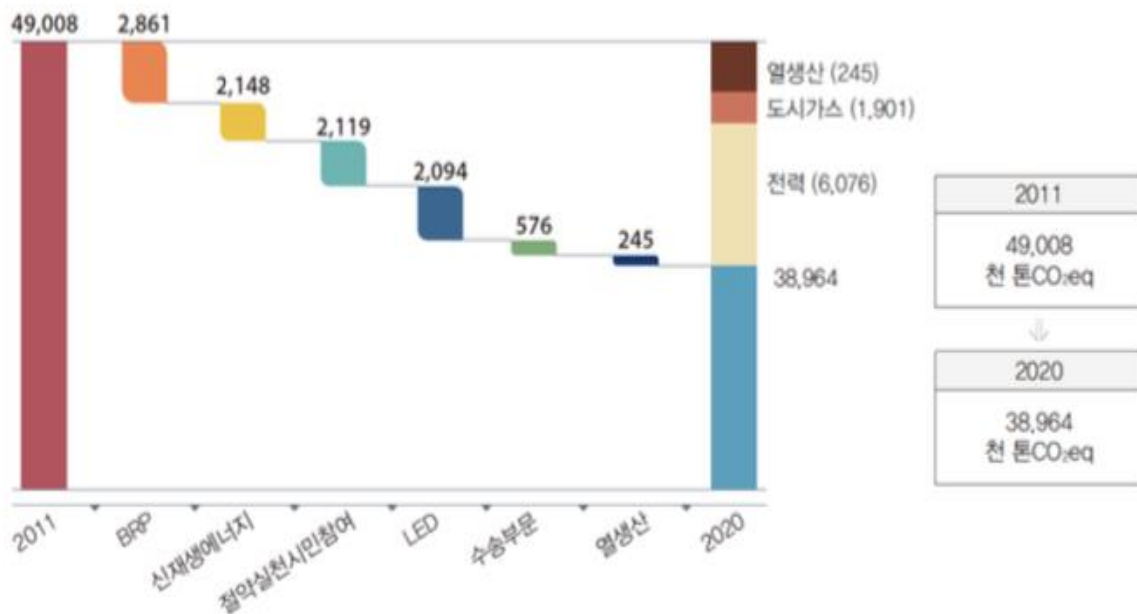
Prospects of Energy Generation / Prospects of Energy Consumption & Reduction Rate

New Renewable Energy / Thermal Heat Convergence / Consumption / Eco Mileage

Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul City

The SMG has proposed reducing 10 million tons of greenhouse gases by 2020, a 20.5% reduction of the 49,008,000 tons CO₂eq emitted in 2011. To achieve this, 2,861,000 tons CO₂eq will be reduced through greater energy efficiency, 2,148,000 tons CO₂eq through the use of new renewable energy, 2,119,000 tons CO₂eq through lower consumption, 2,094,000 tons CO₂eq through the expanded use of LEDs, 576,000 tons CO₂eq in the transport area, and 245,000 tons CO₂eq through generation of thermal energy. The final goal is to reduce by 10 million tons CO₂eq.

Figure 3. Reduction of 1 Million Tons of Greenhouse Gases



Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul

Necessity of New Energy Policy

Seoul's energy self-reliance rate is remarkably lower than its energy consumption, and the generation of new renewable energy represents a mere 1.5%. There is a need for a new energy policy paradigm.

Although nuclear power is a cheap and efficient source of energy, it comes with significant human and financial costs should a problem occur, as demonstrated by the Fukushima nuclear accident in Japan. Seoul is reducing its need for nuclear power plants through the generation of environmentally-friendly energy. As much as 90% of greenhouse gases, which increase the earth's temperature, are caused by the generation and consumption of energy; thus, the SMG has endeavored to do its part to decrease these rising temperatures and make the city healthy and safe for future generations.

Due to climate change and the possible depletion of fossil fuels, new renewable energy is seen as the future's sustainable energy resources. However, the new renewable energy sources that have been developed so far are not sufficient or come at a high cost. There is a need, therefore, for more research and development and better policies for new renewable energy, and the SMG is working hard in this area.

Figure 4. The Need for the One Less Nuclear Power Plant Initiative



Low energy supply rate (3.0%) Rapid increase in power consumption	Need for energy self-reliance in preparation for energy crises	Reduction of energy consumption by 2 million TOE through the reduction of energy use and expanded generation
Increased public anxiety after the Fukushima nuclear accident	Need for safe, sustainable energy sources	
Intensified global warming and signs of climate change	Need to reduce greenhouse gases	

Source: One Less Nuclear Power Plant Initiative Guidelines, Seoul

Main Policy Content

Phase 2 of the One Less Nuclear Power Plant initiative primarily introduces 10 core projects divided into 88 units and 23 tasks. The four basic energy policy guidelines are: expand distributed energy generation, become an energy-efficient city, have good energy worksites through innovation, and create energy sharing communities.

Figure 5. 4 Guidelines in the One Less Nuclear Power Plant Initiative, Phase 2

4 Energy Policy Guidelines

Expansion of Distributed Generation 5 Tasks, 19 Projects	Energy Efficient City 9 Tasks, 34 Projects	Good Energy Worksites 4 Tasks, 17 Projects	Realization of Welfare through Sharing 5 Tasks, 18 Projects
1. Seoul – A City of Sunlight! Project 2. Opening of the distributed energy generation era in buildings 3. Expansion of group energy to 60,000 units by reducing heating costs by 20% 4. Finding unused energy within the city 5. Active support for energy self-reliance through innovative policies	1. Proclamation of the “Zero Energy” initiative for new buildings 2. Healthy and comfortable architectural city through diagnosis of energy situation and increased energy efficiency 3. Strengthened responsibility for increasing energy efficiency in the public sector 4. Seoul – A city of LED lights! 5. Transformation of urban structure to low energy consumption 6. Expand supply of “green” vehicles 7. Creation of an energy conserving traffic environment 8. Creation of an energy-efficient daily culture 9. Creation of the world’s top recycling city	1. Creating green energy work places with the public 2. Customized support for each phase of green energy corporation lifecycles 3. Construction of the green energy industry and green technology infrastructure 4. Fostering IT-based green energy innovation and technology	1. Construction of an energy welfare fund (platform) with public participation 2. Guarantee basic energy rights 3. Conversion and increased efficiency of reducing energy costs 4. Special means for the energy minority class 5. Energy community projects

Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul

A distributed energy generating city

Next is a focus on the 4 projects of public participation, distributed power, generation of new renewable energy, and regionally-specialized energy. The initial goal is to increase dispersed power sources of small sizes through new renewable energy and thermal convergence generation.

Figure 6. Initial Goals of Energy Dispersed Generation City

Public Participation	Dispersed Power	Generation of New Renewable Energy	Regionally-Specialized Energy
40,000 mini solar power units	61 MW self-thermal convergence	300 MW from solar and fuel cell power	1.65 million Gcal cooling and heating energy

Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul

More support is offered to expand the supply of new renewable energy led by the public sector to include small-scale generation of private buildings as well as the initiation of policies in which the public participates, including mini solar power units, sunlight generation citizen funds, and mini power plants.

Along with the mandatory implementation of distributed power, policies are also in place to increase power generation within the city. As it works to achieve this, the SMG will introduce stricter criteria for environmental impact assessments, and lower the cost of city gas for fuel cells and thermal convergence generation.

1) Production of 'healthy, clean electricity' with Citizen Sunlight Generation

- To change people from energy consumers to energy generators, interest in environmentally-friendly energy is induced by supplying 40,000 250W mini solar power units, which are easy to install on apartment balconies and house verandas.
- 10MW solar power units will be installed on urban streets by 2018 to directly fund a Sunlight Generation Citizen Fund, from which the public will enjoy any profits.
- The installation of solar light is continually expanded using unused spaces (such as school roofs and the outside of corporate buildings), and the locations for the installation of solar power generation facilities using public sites are then diversified.
- The improvement of policies for expanded installation of solar power generation units is continually carried out while the reintroduction of feed-in tariffs is proposed to the central government to protect the profits of small-scale generators.

Figure 7. Solar power generating building



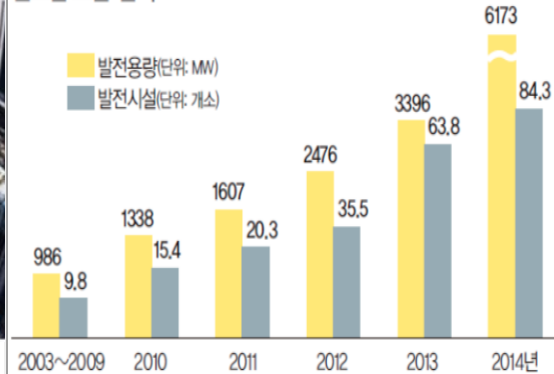
(Source: Seoul's Remarkable Environment Policy (Energy City Seoul) One Less Nuclear Power Plant Initiative, Seoul)

Figure 8. Current status of solar power generation

구분	합계(MW)	공공시설	민간시설	학교시설
2012~2014	63.9	33.3	26	4.6
2003~2011	20.4	6.3	12.2	1.9
계	84.3(100%)	39.6(47%)	38.2(45.3%)	6.5(7.7%)

*2014년 말 기준

연도별 보급 실적



(Source: Seoul's Remarkable Environment Policy (Energy City Seoul) One Less Nuclear Power Plant Initiative, Seoul)

2) A safe city with distributed electricity generation

- As of 2013, there were forty-six 89 MW self-thermal convergence generating apartment and other buildings in Seoul. These units generate electricity and heat in large buildings and are to be expanded from 90 MW in 2014 to 150 MW by the end of 2018.

Figure 9. Rooftop Solar Panel on Top of Gangseo Agricultural Market



Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul

- To increase the power independence rate of housing, old boilers are replaced with extra small heat convergence boilers. These generate electricity and 10,000 sterling engine boilers are scheduled to be supplied to individual large and small apartment buildings by 2020.
- The operational stability of city-based facilities is maintained through an emergency power supply given by 174 MW fuel cell plants. These have attracted significant private investment and strengthened power independence by 2018, and have led to the installation of 20 MW-fuel cells in city based facilities, such as rail stations (Shinnae, Suseo, Jichuk) and the Seonam Water Regeneration Center.
- Group energy supply facilities are to be constructed to create stable heat supply to the Magok region. The expected heat demand will be met in connection with the Mokdong thermal convergence plant and GS Power's Bucheon power plant. A 280 MW combined gas power plant is to begin construction in 2017 for use as a stable heat source after 2020.
- Policies on expansion of distributed power are also underway. To increase the installation of new renewable energy facilities over new large buildings with surface areas greater than 100,000 m², the SMG will give greater weighting to the mandatory installation of new renewable energy facilities in the EIA criteria.

Figure 10. Solar Panels Installed on a School Roof



(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

3) The maximum use of energy in adjacent cities and wasted energy

- Wasted thermal energy is collected for regional floor heating. Energy will also be extracted from Jamsil Reservoir, water regeneration centers, and purification centers from water sources, and projects are planned to install a 3,160 kW hydro power plant by 2018.
- Waste heat from adjacent local governments and private corporations is collected to supply heat for 10,000 units, and 35,000 Gcal are to be supplied per year in 2018 in connection with the metropolitan heating pipe networks.
- With participation from the public, the creation of energy resources is promoted by enhancing recycling of plastic and fabric. By 2018, bins for plastic will be used in all areas of Seoul to recycle 243,000 tons a year, and separate disposal of fabric will be enforced to recycle 168,000 tons a year.

Energy-efficient social structure

Buildings consume 56% of the energy used in Seoul and 87% of the electricity, while vehicles release 20% of the GHG emissions, which cause atmospheric pollution. There is an urgent need for greater action to reduce these numbers - including the efficient use of buildings, LED changeovers, making vehicles more environmentally-friendly, and more appropriate urban planning.

Figure 11. Goals in Creating an Energy-Efficient, Low Consumption Social Structure

Efficient Use of Buildings	Changeover to LED	Environmentally-friendly Vehicles	Urban Planning
Energy diagnosis systematization (2015) Publication of energy efficiency (2015)	Public sector 100% (2018), Private sector 25% > 65% (2018)	Increased charge for greenhouse gas emission	Production of an energy map, stronger inspection of environmental efficiency

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

Support for energy efficiency continues to expand, such as through loans for facility improvement, while the mandatory efficient use policy is supplemented in consideration of the fact that it is still in a nascent stage. Policies related to standards have been strengthened for environmental impact assessments, green architecture planning, and public architecture planning. Moreover, the concurrent application of institutional regulations and the efficient use of energy are reflected in the market value of buildings to create the basis for the energy-efficient buildings project to be initiated by market principles. Furthermore, the obligation of diagnosis, substantive application of architecture energy consumption verification policy, and the publication of energy grades will be initiated.

1) Introduction of improved energy efficiency and market principles for buildings through policy

- Seoul will have stricter criteria for environmental impact assessments (EIA), require the installation of building energy management systems (BEMS), and replace all lighting in buildings to LED by 2018 to improve the efficient use of energy in large buildings and large-scale development projects. This will reinforce the construction of buildings with level 1 energy efficiency.

- Policies are to be stricter in terms of energy audits of large buildings that consume 2,000 TOE of energy, and research to be done towards development of an energy reduction model for each application (hospitals, schools, professional facilities, and hotels)

- Financial support is to be increased, such as through loans for the efficient use of energy in buildings and housing; the size of these loans and the scope of covered facilities are to be increased, and an energy audit required upon applying for any BRP projects.

- Loans are to be expanded to include energy audits, eco-friendly boilers, and air conditioning devices, in addition to windows and insulation, as well as installation and replacement, operating systems, and monitoring costs. Furthermore, up to a 15% deduction from asset tax will be given for obtaining a new

Green Architecture certificate or a new architecture energy efficiency level, and the same benefits are to apply to existing building efficiency projects.

- The verification system of the energy efficiency level evaluation report is to be enforced so that energy efficiency is reflected in real estate prices.

2) LED lighting in all public facilities

- 100% of public building, subway station, and security lighting is to be replaced with LED lights by 2018, along with 65% (or 30 million units) of lighting in the private sector.

Figure 12. Solar panels installed at Yangcheon River



(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

Figure 13. LEDs installed at Dongdaemun History and Culture Park



(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

3) Human-oriented, energy-saving traffic environment city

Nanum Car, Seoul's car-sharing program which reduces energy consumption by reducing traffic, has an impact equivalent to taking 3.4 vehicles off the road per year for each vehicle in the program, or 10,000 personal vehicles a year for each 3,000 shared vehicles. Furthermore, the system is to be reformed to focus

on apartment dwellers, members of public organizations, and corporate employees, to expand from 1,500 vehicles in 2014 and 1.68 million users, to 3,000 vehicles in 2018 and 2.5 million users.

- Electric vehicles are estimated to produce 25% less greenhouse gases when the energy generation phase is included, than fossil fuel vehicles. They also contribute to reducing the emission of fine dust.

4) Creation of an energy-efficient daily culture

- Eco Mileage, the most successful energy-saving program for the general public, is to be continued. The 1.68 million Eco Mileage members in 2014 is to be expanded to 2.8 million members by 2018, and 850,000 TOE of energy, such as electricity and city gas, is to be reduced. The additional members will be attracted through connection of the program with various new renewable energy sources, BRP, LEDs, and consulting projects, while energy reduction will be optimized through monitoring, effect analysis and participant feedback.

- Recyclable waste will be converted to energy, while a variety of projects are initiated to connect this process to developing the industry and increasing employment. Recycling stations will be set up in the neighborhoods of detached single houses to increase the recycling rate and provide jobs. The 1,128 stations in 73 quarters that existed in 2014 will be expanded to 3,500 stations by 2016, and their efficient management will lead to increasing employment as an estimated total of 10,000 station personnel will be hired, with 15 to 30 personnel per station.

5) Reflecting energy concerns in city policy, including a climate energy map and urban planning

- An energy map is to be produced for use as basic data upon establishing main urban plans and environmental plans regarding climate change - including city and site usage plans. The energy map is to reflect the researched properties of each region and building with respect to the distribution of use, the climate, and the current usage of energy.

- The 2030 Urban Master Plan includes plans to create living zones towards minimizing the loss of energy during commutes and rush hours. The specifics include composition of pedestrian-friendly living zones adjacent to work and housing, transformation of spatial structures within metropolitan areas in connection with public transit to discourage the use of personal vehicles, and prevention of the expansion of energy-inefficient urban regions.

6) Reduction of GHGs through Phase 2 of the One Less Nuclear Power Plant initiative

- The Emissions Trading Scheme delegates a permissible amount of annual emissions to businesses that release a lot of greenhouse gases. It also allows the trading of leftover "credits" between businesses. The scheme is for corporations that have released between 25,000 and 125,000 tons CO₂eq on average over the past three years. Twenty-five facilities in Seoul are included within this scope, such as waste processing facilities, including the Nowon Resource Recovery Facility, and water regeneration centers that process

water.

- The SMG is preparing GHG inventories by apprehending their emission and identifying the current situation in each sector. It then uses these inventories as basic data for the GHG reduction plans and institutional direction. A GHG inventory organization is selected to establish and verify the plans. They will be implemented in line with the GHG emissions trading scheme.

Good energy worksites through innovation

The foundation for Seoul's green energy industry is very weak. Of the approximately 10,000 businesses involved, 99% are small and medium-sized enterprises (SMEs), including 59.1% micro enterprises with 5 or fewer employees. Although investment in new renewable energy increased with Phase 1 of the One Less Nuclear Power Plant initiative, the main products, such as solar power modules, are mostly produced outside the city. Thus, the effect of direct contribution to job creation has been relatively small.

Figure 14. Initial Goals of Good Energy Worksites through Innovation

Structuralization of the green industry	Citizens' energy project	Regional energy service	Support for green corporations
6 green clusters	70 social corporations and cooperatives	25 energy hub centers	234 enterprise-supporting corporations

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

With continual investment in new renewable energy and LED, new facilities are to be installed, and service industries for post-management will be developed. This support will also extend to introduction of pioneering technologies suitable for Seoul, such as BEMS and the smart grid. Support that suits each stage of enterprise lifecycle will be strengthened after considering the many SMEs with undeveloped management skills and that the formation of an industrial market is in its initial stage.

Employment in the service industry is based on region, and thus, this project is to allow the participation of regional residents and in connection with the energy welfare of the community.

1) Green Metropolitan Seoul - Developing a green energy industry

- G-Valley, located in Guro-gu, Seoul, is the largest cluster in Korea of new renewable energy corporations (including 60 in new renewable energy, 117 in green IT, and 44 involved in LEDs). There is great potential for connection of these corporations with ICT corporations in the same area. Furthermore, green industries, such as those involved in IT integration, urban resource circulation, and green architectural services, are to be expanded to six regions within Seoul, with each region's focus to be based on the experience of G-Valley, with a variety of services to receive support.

Figure 15. Initial Direction of the Seoul Green Industry Cluster Development Project

Pilot Operation	Expansion	Creation of Achievement
Creation of Pilot Cluster	Creation of Regional Clusters	Combination of Regional Clusters
* Demonstrative new renewable energy cluster project in G-Valley	* Beginning as a contest targeting areas where green industries are concentrated * Consortium of local governments, universities, research institutes and regional entities	* Joint research and production of fused products that include solar power and LED * Nurturing of independent and global clusters

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

- The SMG is initiating a smart grid (intellectual power network) pilot project towards establishment of a demand management market and to improve energy efficiency by fusing IT to the existing power network. A variety of projects are to be initiated according to the regional situation and characteristics of the city. Specifically, a project will be initiated in Sadang-dong in connection with the community energy supply system (CES). The Urban Industrial Complex Efficient Energy Project is to be initiated in Guro Digital Industrial Complex, while a project to increase energy efficiency of the city's subway system will be initiated by Seoul Metro, and an intellectual wiring power network is to be initiated in unit-divided apartments. Together with these projects, electric gauges, which allow individual management of automatic power consumption and demand, will be supplied by half in 2016 and fully installed by 2020. Furthermore, an electricity usage information alarm system, which notifies users of electricity usage and gradual increases in real time, is to be developed and used in apartment buildings in Seodaemun-gu.

2) One-stop customized lifecycle support for green corporations

- To support the foundation of green corporations, Seoul has set up a Green Corporation Enterprise Fund. –Three funds worth KRW 46 billion were created in Phase 1 and five funds worth KRW 80 billion in Phase 2, for a total of eight funds worth KRW 126 billion. The Green Corporation Enterprise Fund will be used to support corporations that have green technologies but not sufficient financial strength, for 4 to 5 years. Prospective venture corporations are prioritized to receive annual support from the KRW 25-30 billion SME Development Fund.
- To create jobs in the green industry, the development of green technologies (GT) has been actively supported. Financial support will be granted by 2018 for R&D in 7 major areas including vehicles, IT, new renewable energy, architecture, and LED lighting. GT research and development tasks that suit corporate demand are to be selected to support new technologies in connection with corporate-affiliated and university research institutes.

3) Creation of jobs in the green energy industry

- By 2018, Seoul will select 70 social enterprises and cooperatives in their initial stages in the energy field for intensive support to develop them into grade corporations with remarkable self-sufficiency. First, up to KRW 300 million is to be provided as a pilot project, and a consulting education program operated through the Socioeconomic Support Center and the Cooperative Consultation Center.
- Seoul will establish as many as 25 regional energy hub centers by 2017, which will provide energy-related services to the public, such as installation of energy equipment, monitoring, and post-management, installation of LED lighting, installation of solar lighting, provision of price information, facilitation of group purchases, and product exhibitions. The centers will use the offices of resident groups, and lease space from public organizations when needed. There are also plans to expand into a service sales network and energy cooperatives.

Realization of welfare through sharing

An estimated 10.3% of households spend 10% of their income on energy, making them energy poor. Low income households consume relatively high-priced energy (LPG, kerosene), and use low-efficiency home appliances, meaning that they spend 4.7 times more on energy than the average household. The government has thus far failed to introduce sufficient policies in this regard.

Figure 16. Goals for Initiating Energy Sharing Communities

Responsibility for	Public	Conversion, increased	Community
--------------------	--------	-----------------------	-----------

energy welfare	participation	efficiency	
Enacting Korea's only energy welfare ordinance	100,000 welfare fund participants	Low Income Insulation project to include 1100 units	200 energy self-reliant neighborhoods

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

A regional energy welfare policy suitable for local government is to be realized. To this end, institutional consideration is supplemented in regions that are not benefitting from central government welfare policies by reflecting each region's characteristics. These include rented homes and lower class accommodation in the regions through enactment of an energy welfare ordinance and provision of basic energy rights.

Fundamentally, energy conversion projects are to be initiated that include increasing energy efficiency in homes and the reinforcement of solar light. Direct support of vouchers and energy costs are concurrently given in preparation for energy crises. Moreover, energy welfare officers will be trained to carry out specialized policies regarding energy welfare, and the energy functions in residential welfare support centers will be strengthened.

1) Guarantee of energy welfare rights through policy

- Seoul is coming up with an institutional basis that guarantees the availability of energy as a universal and basic right. Public opinion was collected to make preparations for an energy welfare ordinance, and the preparation of the ordinance plan is to be announced in order to declare energy welfare. The main thrust of the ordinance relates to the preparation of specific standards, such as on the selection of eligible applicants, as well as specifying the SMG's responsibility toward the energy poor. This will be part of the preparations for introduction of an energy welfare platform (fund).

- Seoul will raise an energy welfare fund for the public that is created, operated, and distributed by the people themselves. Funding is to include donations of profits earned from the production of energy and energy savings (including the use of solar power and LED lighting, increased insulation, and participation in the Eco Mileage program), and is to be used to provide assistance to the energy poor.

Figure 17. Public Participation in Policy

Public participation	Resident management	Sustainable fund
> Participants in solar	> Members of the 100 Citizens	> Preparation of a legal basis for the

power, LED, and Eco Mileage projects	Committee (funding, management, delegation)	fundraising, through the energy welfare ordinance > Connection with professional fund groups
--------------------------------------	---	---

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

2) Building the foundation for regional energy communities

- Energy self-reliant neighborhood plans seek to convert neighborhoods from consumers to efficient generators and users of energy and to realize revenue from this conversion, revenue which will be shared in connection with energy welfare. The participation of fifteen neighborhoods in 2014 will increase to 200 neighborhoods by 2018, and specialized projects suitable for each neighborhood will be branded.

- A virtuous energy ecology is to be created in communities by expanding the citizen's energy saving project. After analyzing the effect of two demonstrative power saving stations in 2014, ten more will be installed in 2015, and consecutively expanded from 2016. A citizen power saving station is initiated with the direction of promoting value by reinvesting and sharing the incentive given to eco mileage members. A main fundamental group of the region will be selected, and a director trained for each power saving station will serve as a coordinator. An "Energy Station" for energy recharging services will be run in each neighborhood, and investment for energy projects will come by reforming the Eco Mileage system and an energy saving point system.

Figure 18. Energy Projects through the Public Participation System

Eco Mileage reduction point system	Power saving stations in each neighborhood	Energy project investment and consumption	Neighborhood corporations
> Citizen power saving station	> Coordinator groups, power saving station director > Networking, promotion, etc.	> Energy station > Energy supermarket, BRP, solar light, etc.	Citizen fund

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

Effect of Policy

1) Proposal of vision and successful model of regional energy policy

The One Less Nuclear Power Plant initiative is an energy policy that expands the former focus on energy saving to the generation of new renewable energy and BRP, which has reduced the total consumption of energy such as electricity, gas, and fuel. Furthermore, regardless of the restriction of a local government group, it is evaluated that a successful model of a regional energy policy is proposed through creative policy improvements and projects. Seoul's good policies, such as feed-in tariffs (FIT), improved rental of solar power generation sites, and the supply of mini solar power in particular, have been expanded to other district groups.

2) Improvement of public awareness of energy policies and revitalized public participation

The One Less Nuclear Power Plant initiative can be considered a citizen-led energy policy. As many as 1.68 million Seoul citizens have participated in the Eco Mileage program, and around 20,000 students in the Energy Guardian Angel group to partake in energy saving at home and school.

This public participation is estimated to be based on the active support people have given the One Less Nuclear Power Plant initiative. According to a survey conducted on this initiative in March 2014, as many as 71% of the respondents said they knew about it. Furthermore, since 59% of the respondents stated that the initiative was 'good', it appears to be something that is highly regarded and necessary in Seoul at the current stage.

3) Formation of initial basis for energy-related industry and employment

The One Less Nuclear Power Plant initiative has revitalized the Korean LED market through the supply of LEDs to large public facilities, including the replacement of all lighting in subway stations and the installation of LEDs in new public offices, and has attracted KRW 600 billion in private capital to contribute to the preparation of employment in production and installation of new renewable energy sources, such as solar power and fuel cells. Furthermore, energy planners have obtained new employment in the establishment of three cooperatives based on energy diagnosis in commercial buildings.

Policy Outcomes

Outcome of Phase 2 of the One Less Nuclear Power Plant Initiative

1) Initiation of the core index of Phase 2, including increasing energy self-reliance

The foundations of most projects were constructed during Phase 1, which accumulated experience to

exceed the goals of the first year.

Figure 19. Achievements in Energy Self-Reliance

Index	Goal (Jul 2014 – Dec 2015)	Outcome (Jul 2014 – Sep 2015)
Energy self-reliance rate	7.0% (2014 Goal: 5.0%)	4.7% (based on facility capacity at the end of 2014)
Increased efficiency in generating energy and reducing consumption	902,000 TOE	910,000 TOE

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)*as of 2014

Figure 20. Reduction and generation of energy in main projects

(Unit: 1,000 TOE)

Generation (64,000 TOE)	Increased efficiency (495,000 TOE)	Saved (351,000 TOE)
* Solar power 8.3 * Fuel cells, etc.: 55.6	* Green architecture planning: 225 * Energy efficiency of buildings: 86.4 * Use of LEDs: 176.2 * Traffic: 7.3	* Eco Mileage program: 351

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)*as of 2014

2) Main achievements

Initiation of ‘Seoul - City of Sunlight’ as a core project in Phase 2 of the One Less Nuclear Power Plant initiative led to the installation of 30 MW solar power plants by September 2015. Seoul now has a total of 101 MW solar power generation facilities, to allow 34,000 homes in Seoul to use power generated only by sunlight.

In order to expand the supply of mini solar power plants, which was actively pursued from Phase 2, the support that was provided only to housing units installing the mini plants was then expanded to all areas (including the public sector) by increased contact with citizens and sales at large supermarkets and other locations. Furthermore, a pilot project installed enough solar panels on sale booths to generate 2,528 kW in 3,469 areas by September 2015.

Seoul has established a special-purpose company (SPC) to be exclusively in charge of replacing lighting with low-energy, high-efficiency LED units and has used private capital to replace 93,000 lighting fixtures in 48 business sites in Seoul and 13 other district areas as part of the public lighting replacement project. The project to replace approximately 210,000 lighting fixtures in subway station offices and control rooms (Seoul Metro, Urban Railway Cooperation) was enforced by this SPC and to be completed in October 2015. With the addition of 430,000 lighting fixtures in Phase 1, a total of 640,000 fixtures, excluding interior subway train lighting, were exchanged.

A fund worth KRW 1.6 million in cash and gifts (LEDs, etc.) was raised and in January 2015, the Seoul Social Welfare Association was selected to administer the fund, and an agreement was then concluded. In July 2015, the Seoul Citizens' Energy Welfare Fund Council was established, and a volunteer university group created. Since a warm social atmosphere is important for the success of energy welfare, in addition to physical support, an energy welfare fund website was constructed to invite people to create a cordial living environment. Funding has also been raised by the public through donations and promotion.

Figure 21. Annual Goals for the Energy Welfare Fund

2015	2016	2017	2020
KRW 200 million	KRW 600 million	KRW 1.7 billion	KRW 3 billion

(Source: One Less Nuclear Power Plant 2, Seoul Sustainable Energy Action Plan, Seoul)

Main Challenges & Solutions

After 2015 and the official beginning of Phase 2 of the One Less Nuclear Power Plant initiative, there were some obstacles caused by changes in external conditions and deterioration of the social environment, including the outbreak in Korea of Middle East Respiratory Syndrome (MERS). Accordingly, there was a need to modify the strategies and goals of the project. There was also a need to adjust the excessively high goals of certain projects that had to be done in cooperation with other organizations.

The Home Energy Clinic Service project involved energy planners visiting homes or businesses to check energy usage patterns and provide information on how to save energy. However, it was difficult to continue in the first half of 2015 due to the spread of MERS and people's fear of meeting others due to the potential contagion. In the Wooden Pallet Usage Boiler project, it was difficult to secure the necessary space, which resulted in a reduction of demand and necessitated modification of the project target to public facilities.

Although these setbacks were eventually overcome and the goal reached, new strategies will likely be needed to achieve the Phase 2 goals of the One Less Nuclear Power Plant initiative.

Accordingly, the cooperative system between the One Less Nuclear Power Plant Executive Committee and related organizations has been reinforced and the opinions of experts in the Seoul International Energy Advisory Group will be collected to devise an efficient system of strategies towards achieving the core goals by 2020.

Of the core projects in the One Less Nuclear Power Plant initiative, the solar power project is the only one to focus strictly on power generation. However, as it was initiated to attract private investment, public attention is essential. For instance, instead of installing solar panels only on school roofs, installation on streetlamps near schools will allow people to personally experience and benefit from the results.

Although fuel cells, one of the major renewable energy sources, are used in large buildings or for power generation, the policy has not been properly pushed. Fuel cells create electricity using hydrogen or natural gas, and are not, in themselves, a form of pure renewable energy. They have limitations as they consume more gas to generate energy. There is a need to consider a subsidiary support system for the fuel cell as for the solar panel project. Overcoming these problems is expected to contribute to the reduction of greenhouse gases and the generation of new renewable energy in Seoul. If the city can overcome these and other challenges, great advances will be made towards reducing GHG emissions and developing new renewable energy.

Related Film