TITLE: ENERGY SELF-SUFFICIENCY VILLAGE - CLEAN ENERGY TRANSITION WITH PUBLIC ENGAGEMENT

ISSUE AREAS

☒ **ICT and SMART technology** ☐ Sustainable mobility ☐ Land use and nature-based solutions
☒ **Clean energy** ☐ Sustainable solid waste management ☒ **Building energy efficiency**
☐ Innovative urban governance ☒ **Behavioral change**

OVERVIEW

Seoul metropolitan is home to about 10 million residents. In 2018, energy consumption of the city accounted for 6.3% of the total energy consumption of the country. Residential and industrial sectors are the largest energy users, accounting for 57% of the total energy consumption of the city (Climate and Environment Headquarters, 2020). Furthermore, energy security and safety are also topics of high prominence and interests from the local communities and citizens as nuclear safety is a continuous debate due to the Fukushima incident in the neighbouring country, Japan (Seoul Institute, 2016).

Against this background, the Seoul Metropolitan Government (SMG) engaged its communities to fight against climate change and energy crisis by launching the Energy Self-Sufficiency Village project in 2012 under the slogan “citizens are energy”. This concept heavily involves community participation beyond their role as energy consumers. Local stakeholders and communities are able to directly contribute to the energy crisis through energy saving, energy efficiency, and further energy generation by using solar panels (Climate and Environment Headquarters, 2019). When looking at the GHG inventory of the city in 2018, energy consumption (90.7%) has a surprisingly large share (92.2%) in the energy sector, while energy supply has a very little share (-1.5%) (Climate and Environment Headquarters, 2021). Therefore, the entire concept of the Energy Self-Sufficiency Village is to increase energy independence through decentralized solar power generation and consumption at each village, which in turn will support Seoul’s overall energy independence. However, this does not mean that the energy generated is fully sufficient to power the entire village yet.

The project has been developed with two phases. Between 2012 and 2018, the Energy Self-Sufficiency Village 1.0 project was designed and implemented to stabilize the concept of

the villages, i.e., minimizing villages’ demand for external energy sources and enhancing the

capacity to be self-sufficient in energy generation and consumption. The number of villages increased from seven in 2012 to 100 in 2018 with various features. In 2019, the Energy Self-Sufficiency Village 2.0 project consequently followed to develop a profitable, standard, urban model and expanded the scope from village to district with the creation of an urban ecosystem for economic benefits from energy self-sufficiency. The second phase continues to set up 300 villages, 10 energy living LABs, and four energy self-sufficient and innovative districts using Information and Communication Technology (ICT) by 2022 (Climate and Environment Headquarters, 2019).

Photo 1: Mini solar panels installed in Sibjaseong Energy Self-Sufficiency Village
(Source: Seoul Metropolitan Government. https://mediahub.seoul.go.kr/archives/1062198)

THE CHALLENGE - WHY HAS THE CITY TAKEN ACTION

Energy transition goal set by Seoul Metropolitan Government

The urban village model of energy self-sufficiency has been developed and promoted under the One Less Nuclear Power Plant policy, a classic example of energy transition policy of Seoul city (Climate and Environment Headquarters, 2019). The Fukushima nuclear accident stirred governmental and public attention to the risks of nuclear power plants and facilitated increasing public consensus about a transition into safe and clean energy (Seoul Institute, 2016).

Large share of residential sector in energy consumption and GHG emissions

In 2018, energy consumption of Seoul city accounted for 6.3% of the total energy consumption of the country. Residential and industry sectors were the largest energy consumers, amounting 57% of the total energy consumption of the city (Citizen's Environmental Cooperation Division, 2019). Moreover, when looking into the GHG emissions inventory by sectors in 2018, energy demand accounted for 92.2% of GHG emission of the city; residential buildings from energy demand emitted 27.9% of GHG emission from the energy sector (Climate and Environment Headquarters, 2021). In this regard, energy demand control and energy efficiency with public engagement were suggested as a solution to Seoul city, because of the large volume of energy demand of about 10 million residents with a high level of dependence on external energy sources.

GOALS AND OBJECTIVES

- To enhance energy independence of the city to be less reliant on imported energy outside of the city
- To contribute to the transition into safe and clean energy

HOW DID STI PROVIDE A LOW CARBON AND CLIMATE RESILIENT SOLUTION?

(STI as a means of implementation)

☒ **Improved decision making** ☐ Offering a low-cost solution ☒ **Inclusive decision making**
☐ Improved governance ☒ **Behavioural change**

(STI as a direct technical solution)
☒ **Cleaner/more eco-friendly infrastructure** ☒ **Cleaner/more eco-friendly equipment**
☐ Faster/better/larger data availability/processing

- How was it innovative? (What enabling policies were employed? What were the local/national government's policy targets, goals and strategies? Were new S&T approaches developed or existing S&T approaches enhanced? Was the city's geography/culture capitalised upon?)

The local/national government's policy targets, goals and strategies
The Korean Government aims to transition to sustainable and clean energy by announcing the Green New Deal and 2050 Carbon Neutral Strategy in July 2020. Korea is highly dependent on energy imports, accounting for 94% of the total energy supply in 2017. Furthermore, its Total Primary Energy Supply (TPES) is also highly dependent on fossil fuels and nuclear energy sources (94.2%) compared to the TPES at the international level, with the following breakdown: Oil (39.5%), Coal (28.5%), Natural Gas (15.7%), and Nuclear Energy (10.5%) (Climate and Environment Headquarters, 2020; Seoul Institute, 2020). Thus, the central government set a goal of increasing renewable energy sources to 30~35% by 2040 (Ministry of Trade, Industry and Energy, 2019).

Aligning with the national approach to energy transition, the SMG implemented an energy management and transition initiative. SMG launched the first phase of the One Less Nuclear Power Plant in 2012 and its second phase in 2014, with a stronger narrative for public engagement(Seoul Metropolitan Government., n.d.a). Moreover, SMG initiated the 'Solar City, Seoul' project with a focus on deploying solar panels generating 1 gigawatt (GW) energy by 2022 (Seoul Metropolitan Government., n.d.b).

- What science and technologies were used? (What does it do? How does it work? How does it address the challenge?)

Technology used in the first phase of the project focuses on energy generation and energy efficiency.

Firstly, in terms of energy generation, 3 kilowatt per hour (kWh) and 250 Watt (W) solar power generators are installed in the villages depending on the housing types, such as detached housing, housing complex, and community building. In general, solar panels are equipped on roofs of detached housing to generate 3 kWh energy (Lee, J., 2017). For example, Seongdaegol Energy Self-Sufficiency Village joined a village-living-LAB project with the Korea Institute of Energy Technology Evaluation and Planning to develop a DIY kit for small-sized solar power generators that can be easily installed compared to those on the market (Climate and Environment Headquarters, 2019). The solar panels are also equipped in balconies of housing complexes, such as apartments with limited space, to generate 250 W energy (Lee, J., 2017).

Secondly, in terms of energy efficiency, low energy efficient light bulbs are replaced with LED lights for both detached houses and housing complexes. Building Retrofit Project (BRP) was also implemented but limited to community facilities in some villages due to high cost (Lee, J., 2017). For instance, Seongdaegol Energy Self-Sufficiency Village carried out BRP to minimize energy loss at the senior citizen community centre through building insulation, deployment of LED, installation of energy efficient equipment for windows, and deployment of micro heat combined boilers (Energy and Climate Policy Research Institute & Seoul National University, 2017).

More advanced technologies including Intelligent Communication Technology (ICT) for collecting and analysing energy data will be applied to the second phase of the project to be completed by 2022.

KEY AREAS OF CONSTRAINT/SUPPORT

- INFRASTRUCTURE REQUIREMENT

Unused space on roofs and balconies of residential and community buildings for solar generator and energy efficient electronics (e.g., light bulbs)

- POLICIES AND REGULATIONS

At the local level, SMG adopted the Ordinance on Energy and the Ordinance on Support to Development of Village Community.

- THE SCALE OF THE PROGRAMME/PROJECT

100 Energy Self-Sufficiency Villages in Seoul Metropolitan Area (Climate and Environment Headquarters, 2019)

- TECHNOLOGY CAPACITY

Technology for minimizing energy loss and generating solar power energy are adopted.

- COST AND FINANCING /BUSINESS MODEL

About 0.3 Million USD was spent in the Energy Self-Sufficiency Village project between 2012 and 2019. Subsidy varied according to the sub-project tailored to the local villages and the project plan's assessment results. Villages received around 10,000 USD a year on average. Villages take responsibility for the project and, in this regard, bear 10% of the project cost.

- HUMAN RESOURCE CAPACITY

Multi-stakeholders consisting of governments at city and district levels, private sectors, and local residents are engaged in developing and implementing the project.

- The Citizens' Energy Cooperation Division of SMG managed the project by providing financial support and supervising the project implementation. Today, the Energy Transition Cooperation Team under the Citizens' Environmental Cooperation Division monitors and promotes the village model.
- The district office connect the project with other existing projects in the respective local areas, including setting up a consultation group for knowledge sharing between the environment agencies and the villages.

- Community service centres, which are set up by the local governments, directly communicate with the villages and contribute to the promotion of the project and public cooperation.
- Consultation agencies communicate with the villages and design programs and a vision for the community.
- The local residents play a major role in carrying out the project with enhancing the sustainability.
- Steering committees support the project implementation at the municipal level, including the project screening and selection, problem consultation, vision casting and strategy setting processes. Inputs received from the local communities are incorporated and reflected in the policies and action plans

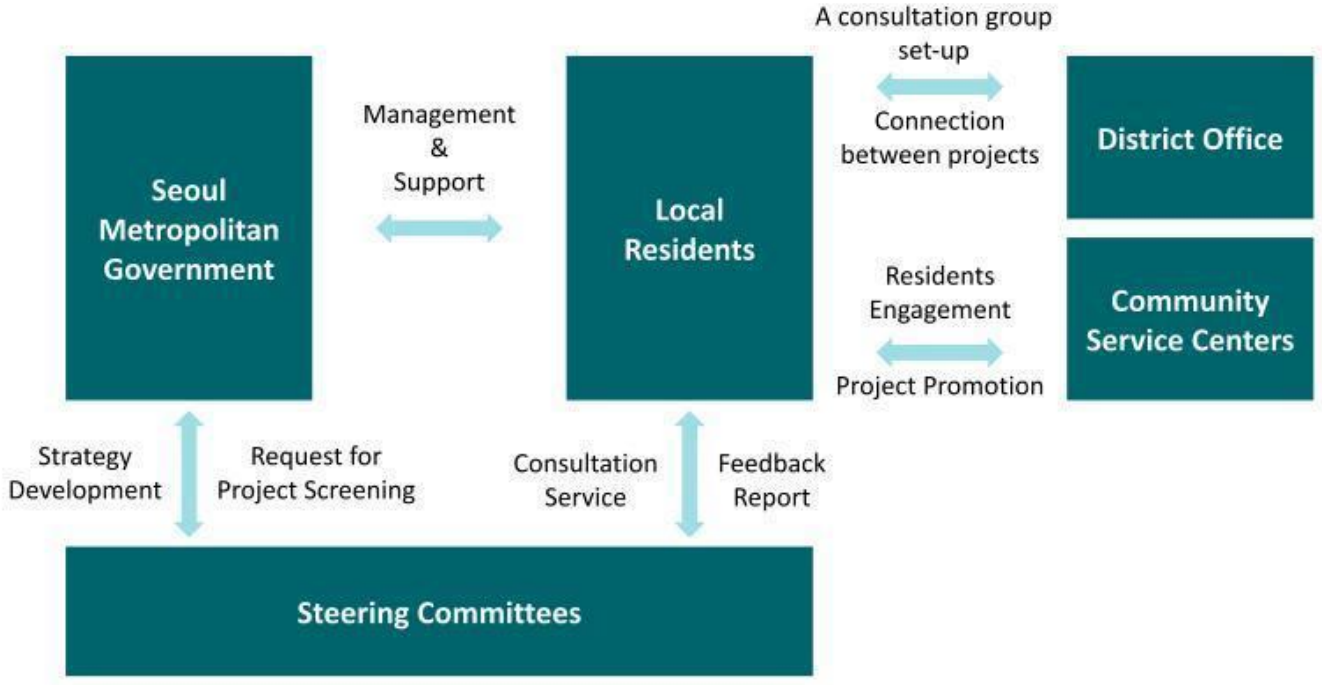

Figure 1: Energy Governance of Energy Self-Sufficiency Villages (Source: Seoul Energy Self-Sufficiency Village White Paper)

- POLITICAL COMMITMENT

- INSTITUTIONAL SET-UP

SMG set up a Division to support the project. Today, the Citizen's Environmental Cooperation Division under the Climate and Environment Headquarters monitors and scales up the project.

- KEY BENEFICIARIES

Residents of Seoul city

TIMELINE

2012 - Present

IMPACTS

- CARBON REDUCTIONS

The number of GHG emission reductions achieved from only the Energy Self-Sufficiency Village project is not available. However, it is assumed to contribute to the achievement of One Less Nuclear Plant – that is, 14.50 million tonnes of carbon emissions reduction of the city between May 2012 and December 2018 – together with 5.18 Millions of tonnes of oil equivalent (Mtoe) of energy generation and strengthened electricity self-independence capacity of the city up to 20% (Climate and Environment Headquarters, 2019).

- RESILIENCE

- CO-BENEFITS (e.g. JOB CREATION, AIR POLLUTION REDUCTION ETC.)

Energy saving

Thirty villages participated in the project between 2012 and 2015, saving about three times more energy than ordinary villages in the city within the same period. In 2015, thirty villages consumed 649 kWh less external energy sources and reduced 12.2% total energy use compared to 2012. Moreover, the average ratio of energy reduction to governmental financing of the 30 villages between 2014 and 2016 was 2.9 kWh per 1,000 KRW (2.9 kWh/0.85 USD). The highest ratio was 33.6 kWh per 1,000 KRW (33.6 kWh/ 0.85 USD). On the other hand, ordinary villages consumed 108 kWh less external energy in 2014 compared to the 2012 level; and reduced 3.4% of energy use compared to the level of 2012 (Lee, J., 2017).

Energy Welfare

Profits from energy saving of the villages are used to support those who have less energy access. For example, the Energy Self-Sufficiency Village housing complex in Seongbuk-district is a classic example of energy welfare. Profits from the “3+1 Energy Saving Campaign” were used to guarantee employment of 30 security guards of the housing complex with increased salary by 19% and to install a small-sized solar energy generator in their office. Later, SMG deployed solar energy generators for more security guards (Climate and Environment Headquarters, 2019).

Job creation

Village model contributes to job creation in the energy sector. For instance, Seongdaegol Energy Self-Sufficiency Village launched a market for selling eco-friendly heat insulating materials, high-efficiency LED light bulbs, chargers using solar energy. The village also launched an online pop-up store selling eco-friendly products and providing consultation services for energy training, home renovation, and solar panels (Climate and Environment Headquarters, 2019).

Photo 2: Energy Supermarket in Seongdaegol Energy Self-Sufficiency Village (Source: Seongdaegol people http://sdgpeople.or.kr/)

FACTORS FOR SUCCESS

Engagement of the local government

Compared to the previous initiatives for enhancing energy self-sufficiency of villages, *the Energy Self-Sufficiency Village project* in Seoul city purposefully engages governments at the city and district levels in launching the project. Multilateral collaboration has a significance of laying the administrative, regulatory, and financial framework necessary to facilitate project management. While SMG provides administrative support in setting up the villages through the Citizens and Environment Cooperation Division, the district provides more practical support tailored to conditions of the villages by keeping continuous and close communication with local residents (Climate and Environment Headquarters, 2019).

Energy Governance at the district level

Aligning with the context of energy policies adopted by SMG, *the Energy Self-Sufficiency Village project* promotes energy governance as a means of enhancing its sustainability. Energy governance adopts a public and private partnership to find solutions to challenges faced by the villages. In particular, public engagement plays a crucial role in making the project sustainable and effective. Local residents contribute to project design, considering the local context, capacity, and challenges, in cooperation with experts and local governments. To do this, governments at the city and district levels help communities to enhance knowledge through education, awareness raising, training provided through energy campaign promotion centres and by the internal and external experts, and on-the-ground energy consultation services (Lee, Y., 2017; Climate and Environment Headquarters, 2019).

LESSONS LEARNED

- OPPORTUNITIES, CHALLENGES, AND SCALING UP

(LOW HANGING FRUITS:)
QUICK THINGS THE CITY CAN BE WORKING ON
SHORT-MEDIUM-LONG TERM STEPS

Challenge 1: The project, from a practical perspective, is to present the political will of SMG to improve the energy supply capacity of the local community. Although the project technically promotes the urban village model of self-sufficiency in energy with three key focus areas - energy saving, energy efficiency, and energy generation using solar panels, it is challenging that the scope of the project limits to electricity independence capacity. Firstly, the Seoul metropolitan has a limited capacity to generate clean energy, which is essential to achieve self-sufficiency in energy, due to the climate, geography, and economic conditions. Secondly, the city cannot be self-sufficient in utilising diverse sources and usages of energy, such as urban gas and heat for heating and cooling, water energy, and petroleum for transportation. Lastly, considering project implementation under the scheme of One Less Nuclear Power Plant, it is clear that its inclination to be self-sufficient in electricity rather than energy.

Challenge 2: The project lacks reliable indicators to evaluate how self-sufficient the local community is in terms of energy. First, project evaluation leans toward reports submitted by participating residents without a system of verifying the data. Furthermore, there is a perspective gap between common understanding of energy independence ratio – the ratio of demand to production – and indicators of reduction ratio of external energy demand compared to a previous year set by SMG. Precise and sound indicators from both quantitative and qualitative perspectives are required to improve objectivity and reliability of project evaluation.

- SUSTAINABILITY

Placing citizen engagement at the core of the project contributes to making the project more sustainable. Local residents join in the overall process from project design to project implementation. They also bear 10% of the project budget. Accordingly, they have an ownership mindset beyond a simple beneficiary and increase effectiveness and efficiency of the project under the local context.

- TRANSFERABILITY

This village model can be applied to any village where a local community platform is available. Some participating villages already had a local community platform developed from a network between residents before joining the project. They utilized the existing platform to implement the project and it went smoothly.

- EFFICIENCY/EFFECTIVENESS

This village model with active engagement of local residents under the local context contributes to tackling other socio-economic challenges faced by the villages. It strengthens the community spirit, generates profits used for community welfare, creates jobs, and provides educational opportunities for youth. Although it begins from an energy issue, it works as an inclusive measure to the villages.

- INSTITUTIONAL CONSTRAINTS/SUPPORTS

FURTHER INFORMATION / CONTACT

Yeajee Kim, Program Officer, ICLEI East Asia
yeajee.kim@iclei.org

Citizen's Environmental Cooperation Division. (December 2019). Seoul Energy Self-Sufficiency Village White Paper. Seoul Metropolitan Government. http://www.edutopia.or.kr/node/2651

REFERENCES

Climate and Environment Headquarters. (2019). *Seoul Energy Self-Sufficiency Village White Paper*. http://www.edutopia.or.kr/node/2651

Climate and Environment Headquarters. (2020). *2019 Energy White Paper*.

Climate and Environment Headquarters. (2021, April 13). *GHG inventory of Seoul city between 2017 and 2019*. Seoul Metropolitan Government. https://news.seoul.go.kr/env/environment/green-house-inventory

Energy and Climate Policy Research Institute & Seoul National University. (2017). *Seongdaegol Energy Self-Sufficiency Village Acitivity White Paper*.

Lee, J. (2017). *An Analysis Energy Saving Performance of Seoul Energy Self-Sufficiency Villages*. Korea University.

Lee, Y. (2017). *A case of public engagement and its impacts in metropolitan cities*. https://www.cni.re.kr/main/search/down.do?gcd=AC0000064167&seq=3

Ministry of Trade, Industry and Energy. (2019). *The 3rd Energy Basic Plan*. https://www.motie.go.kr/common/download.do?fid=bbs&bbs_cd_n=81&bbs_seq_n=161753&file_seq_n=1

Seoul Institute. (2016). *Seoul Energy Self-Sufficiency Village: Sustainable Energy Policy Recommendation with a Case of Voluntary Public Enagement*.

Seoul Institute. (2020). *The 5th Regional Energy Master Plan of Seoul: 2020-2040*. Seoul Metropolitan Government.

Seoul Metropolitan Government. (n.d.a). *One Less Nuclear Power Plant*. Seoul Metropolitan Government. https://news.seoul.go.kr/env/environment/climate-energy/one-less-nuclear-power-plant

Seoul Metropolitan Government. (n.d.b). *Solar City, Seoul*. Seoul Metropolitan Government. https://news.seoul.go.kr/env/environment/climate-energy/seoul-the-city-of-the-sun