

Current Green New Deal Studies in Korea

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Minho Seo

1. Background and significance

■ From a global perspective, carbon neutrality and the Green New Deal present an obligation and opportunity for a leap forward in this era

Mitigating carbon emissions to tackle climate change is an obligation in this era, and the Korean government recently adopted the Green New Deal as one of the key pillars of the Korean New Deal. Furthermore, it is accelerating its transition to a green economy, which is characterized by eco-friendliness and low-carbon policies. The Green New Deal is a policy which aims to generate growth engines, in terms of creating jobs and new industrial markets and addressing inequalities, by providing financial support and expanding the investment in green and environmental industries.

The Green New Deal was started to overcome the 2008 Global Financial Crisis along with various efforts to tackle climate change. The EU launched the European Green Deal in 2019, and the Biden Administration, in the US, launched net zero strategies in 2021. In response, Korea also adopted the Green New Deal as a key strategy for the Korean New Deal in 2020 and set forth its plan to invest 73.4 trillion won and create 659,000 jobs in making a green transition in urban, spatial, and lifestyle infrastructure, disseminating low-carbon decentralized energy, and building an innovative ecosystem in the green industry⁰¹.

■ Necessity to seek the Green New Deal as a *package*, considering the *place* and *ecosystem* of the city

From an urban perspective, however, the Green New Deal

has limitations: fragmented implementation in policies and projects by different ministries, a lack of organic connection across projects, and the division of roles between planning, implementation, and operation agencies. More specifically, although the Carbon Neutral City by the Ministry of Land, Infrastructure and Transport and the Smart Green City by the Ministry of Environment, which are some of the most notable policy projects for the Green New Deal, have a similar objective of reducing carbon emissions in urban buildings and infrastructure and promoting resilience in the ecosystem, there is a lack of a *comprehensive* response and a *solution* for the city as a *place* as detailed projects are restricted to the areas responsible for each ministry. Most importantly, green remodeling, on which the government currently focuses, is restricted to public-sector buildings, resulting in no specific plan for an eco-friendly transition and support for private-sector buildings, which account for approximately 97% of the total buildings in the country. The use of the third sector⁰², including non-governmental organizations (NGOs), which play an important role in public-private partnerships and post-project operations, has not been fully considered.

Therefore, it is necessary to develop Urban Green New Deal policies and projects in a package that comprehensively considers the connection and impact between physical spaces and facilities, urban activities, and economic and social ecosystems in the Green New Deal based on the *city as a place*, and the roles of the public, private, and third sectors need to be divided systematically. Figure 1

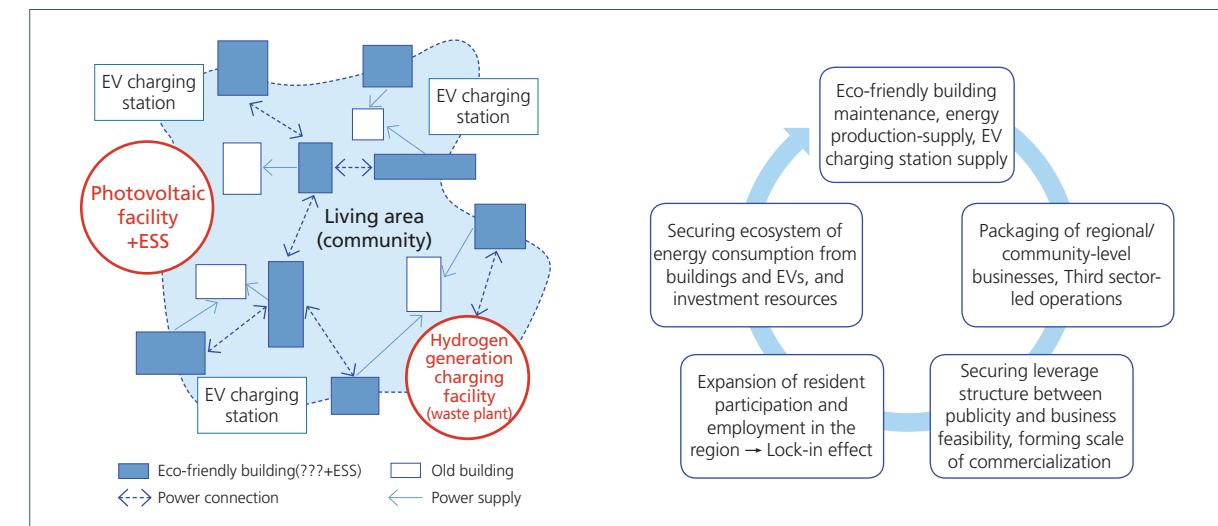
2. Implementation of the Urban Green New Deal and how to use the third sector

■ Concept and implementation strategy for the Urban Green New Deal

The Urban Green New Deal refers to the development of policies and projects as a package related to the Green New Deal, which comprehensively considers the connection and impact between physical spaces and facilities, urban activities,

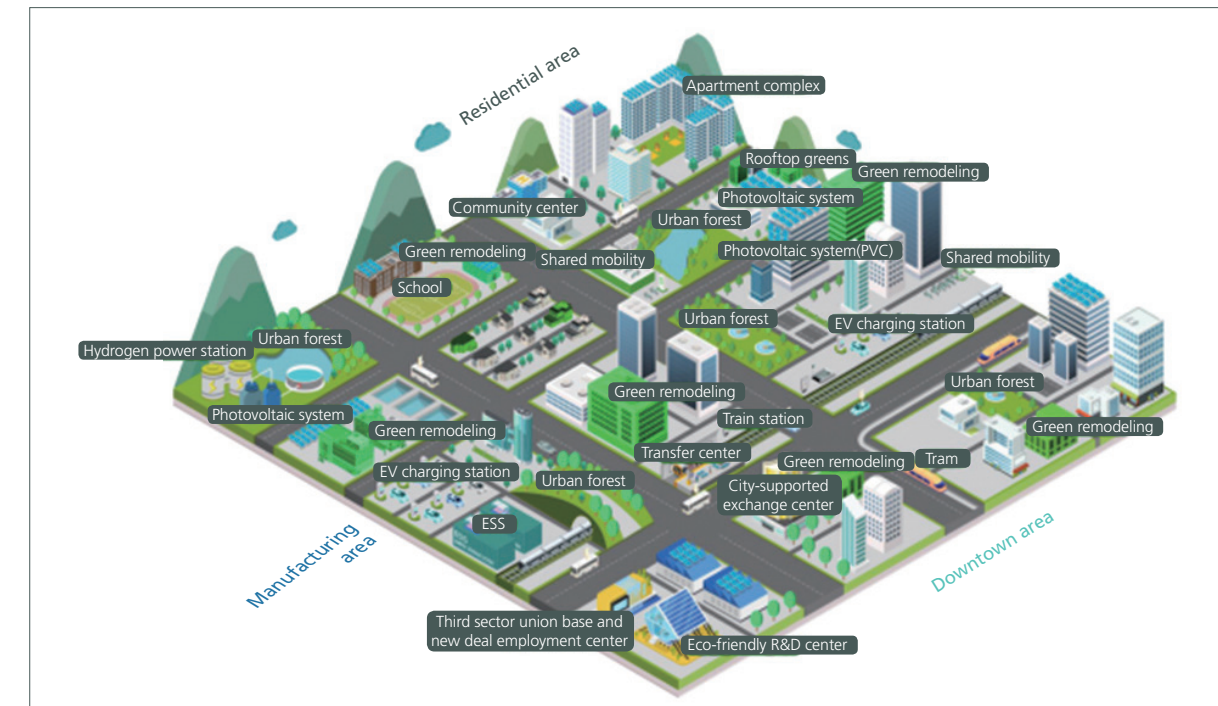
and economic and social ecosystems. First, upgrading the old city center and expanding green infrastructure can be developed as a project package. More specifically, it would be possible to implement strategies to comprehensively improve urban spaces and ecosystems locally, such as remodeling old urban buildings (Ministry of Land, Infrastructure and Transport + private sector), building wind corridors in urban planning (local government), tackling urban heat islands through cooling fog/road projects (Ministry of Environment), and operating

Figure 1. Policy package (left) and ecosystem strategy (right) in the Urban Green New Deal



Source
Seo et al. (2021, p.59)

Figure 2. Policy package in the Urban Green New Deal



Source
Seo et al. (2021, p.162)

01. Relevant ministries. 2020. Comprehensive Korean New Deal Plan – Great Transition of Korea into a Leading Country

02. In general, the third sector refers to groups, organizations, and entities on the border of two sectors in a market, namely public (first sector) and private (second sector) and includes non-profit organizations and non-governmental organizations. As a concept similar to civil society or the social economy, it has been recently understood as the subject or domain that realizes the public interest, builds social capital, and provides social services (Kim, 2014; Suh et al., 2021, 39)

environment-friendly vehicle support facilities (Ministry of Environment) and urban forests (Korea Forest Service) on a community basis (third sector) to expand the number of carbon sinks. Second, for industrial areas within the city, it would be possible to pursue a package of projects designed to reinforce eco-friendly production in manufacturing clusters and establish a resources circulation system. More specifically, establishing solar power and hydrogen production and charging facilities and supply chains (Ministry of Land, Infrastructure and Transport + Ministry of Trade, Industry and Energy) in idle sites in the city center and old industrial infrastructure (private sector) would help supply and manage eco-friendly energy for individual buildings and vehicles (third sector) and implement a job transition, skill training, and campaign (third sector) to support the establishment of a local resources circulation system (local government). **Figure 2**

■ **Role and use of the third sector in the Urban Green New Deal**

Except for the public and private sectors, which are the key sectors in implementing the Urban Green New Deal, the third

sector is effective in organizing and operating the identification, planning, and governance of local projects, which consider the public and private sectors, operating and managing some community infrastructure, and delivering education and public relations projects. It is because the third sector has advantages in planning and operating local projects, identifying issues on the ground and collaborating with different entities, and being experienced in publicly funded projects in the areas which must ensure the public interest. More specifically, it would be most suitable to use the third sector in governance, such as organizing and operating a council which combines implementation entities, project operators, and communities at the local level in the Green New Deal and operating community-based eco-friendly living labs and education and public relations centers. Furthermore, the third sector must be used to establish the ecosystem in the Green New Deal as it has advantages in implementing for-profit projects to operate and manage carbon sinks such as urban forests and eco-friendly product cooperatives and operating urban resources circulation centers and local solar power generation and electric vehicle charging social enterprises. **Figure 3 Table 1**

Figure 3. Strategy to establish the ecosystem with the use of the third sector in the Urban Green New Deal



Source
Seo et al. (2021, p.163)

Table 1. Major planning and project components in the Urban Green New Deal and roles in different sectors

	Public sector	Private sector	Third sector
Buildings	<ul style="list-style-type: none">● Upgrading and reinforcing mandatory green building certification targets and standards step by step● Mandating green building certification for the maintenance, renovation, and repair of buildings in government funded/subsidized projects in urban areas● Expanding the eco-friendly use of national and public properties● Expanding loans with low interest rates for green remodeling (expanding subsidies for private-sector buildings (for establishing building-integrated photovoltaics (BIPV) and remodeling old shopping malls))	<ul style="list-style-type: none">● Advancing technologies to reduce carbon emissions in buildings● Modularizing and diversifying prototypes for interior and exterior materials related to solar power and insulation (building-integrated photovoltaics (BIPV))◆ Transferring know-how about appropriate skills to construct eco-friendly buildings to the local area/ community◆ Developing and operating environmental, social, and governance (ESG)-related real estate investment trusts (REIT) in eco-friendly building and real estate development	<ul style="list-style-type: none">● Conducting monitoring for carbon emissions from buildings (local)● Discovering buildings eligible for green remodeling projects and establishing and operating a council● Implementing site development in combination with green remodeling + house repair projects (social enterprises)◆ Training individuals for house repair and green remodeling and operating local hiring channels◆ Operating crowdfunding to develop and utilize shared properties in an eco-friendly way
Transportation	<ul style="list-style-type: none">● Expanding subsidies for electric vehicles and a transition from old diesel vehicles and discovering additional tax revenue sources● Supporting transitioning into or combining with electric vehicle charging stations at the existing stations (scheme)● Expanding the establishment of pedestrian- and public transportation-centered streets and transfer hubs in the city● Pursuing schemes and supporting projects to promote shared mobility (e.g., personal mobility (PM))	<ul style="list-style-type: none">● Developing, advancing, and disseminating electric vehicle and battery technologies● Transitioning the existing gas stations into electric vehicle charging stations and diversifying revenue models (restaurants + lounge/convenience)● Expanding shared mobility (PM and on-demand bus) projects in living areas	<ul style="list-style-type: none">● Discovering and purchasing potential electric vehicle charging station sites (using community land trusts (CLT) or under-used/ idle national/public land)● Combining the operation of electric vehicle charging stations in living areas and microgrid projects (Ensuring the status and authority of public project operators)◆ Locally outsourcing shared mobility management and mediating local employment for private project operators
Manufacturing	<ul style="list-style-type: none">● Identifying a scheme to support stepwise maintenance for old manufacturing clusters in the city center (combined land use, and incentives)● Providing loans with low interest rates for the eco-friendly transition and maintenance of old factories and facilities◎ Prioritizing the installation of public solar/ hydrogen power plants in carbon sink expansion project clusters◆ Providing operating funds for private-community councils and local transition programs	<ul style="list-style-type: none">● Expanding an eco-friendly transition in the manufacturing process◎ Encouraging the participation of land owners to transition idle facilities and land into eco-friendly facilities (projects to rent rooftops for solar power generation or directly construct facilities)◆ Establishing a direct power purchase agreement (PPA) business council for solar and hydrogen power consumption in the local area◆ Expanding 100% renewable energy (RE100) or ESG management	<ul style="list-style-type: none">● Conducting agency and collaboration to monitor carbon emissions from manufacturing clusters and industrial processes◎ Establishing and operating a public-private council for a carbon neutrality transition in clusters◎ Combining and developing solar and hydrogen power generation and resource circulation projects (social enterprises)◎ Planning and consulting about discovering and using idle land (carbon sinks (urban forests), and small-scale power generation)◆ Supporting eco-friendly skill training and employment transition for appropriately skilled workers
Resources circulation	<ul style="list-style-type: none">◆ Establishing and implementing resource circulation action plans on a local government (or living area) basis◆ Establishing public resource circulation facilities◆ Obtaining and providing public funding and subsidies for resource circulation products (environment-specified local currencies and vouchers)	<ul style="list-style-type: none">◆ Developing technologies to treat waste and resource circulation and advance the process◆ Discovering projects utilizing resource circulation materials and expanding the use of the materials within the local area (waste plastic fibers and 3D printing)	<ul style="list-style-type: none">◆ Operating a public-private resource circulation council and monitoring processes and their elements◆ Operating environmental supporters and encouraging the consumption of resource circulation products within the local area◆ Operating a living lab for a transition in life and policy◆ Mediating vocational training and employment related to waste treatment and resource circulation
Energy and network	<ul style="list-style-type: none">● Installing a microgrid on a living area basis, and improving the scheme to operate the third sector (expanding direct PPA) and providing financial subsidies◎ Expanding carbon absorption and heat island mitigation facilities based on infrastructure within the city (urban forests, cooling roads and fogs)	<ul style="list-style-type: none">● Developing and investing in microgrid technologies (with the percentage of companies less than 50%, conditional on maintaining the public interest)◎ Expanding the greening (planting) of land and facilities owned by individuals and companies	<ul style="list-style-type: none">● Operating the direct PPA by combining energy storage systems (ESS) and electric vehicle charging stations after building a microgrid in the living area or renting it publicly (residents' association or crowdfunding).◎ Operating green infrastructure (e.g., urban forests and parks) with the business improvement district (BID) method and profit modeling

Note ● Making an energy transition and reducing carbon emissions, ◎ Expanding carbon absorption capacity, ◆ Ensuring the circular economy system
Source Seo et al. (2021, p.160)

3. Governance using the third sector and future challenges

■ Governance using the third sector across different stages of the Urban Green New Deal

To ensure that the third sector plays its role properly in promoting the Urban Green New Deal, it is important to share its role with the central government, local government, and private sector, and systematize the structure along with each stage of “preparing and planning projects - establishing the project structure - obtaining and combining individual projects (package) - operating and managing projects - expanding and circulating projects.” First, in the stage of *preparing and planning projects*, it would be appropriate for the third sector to analyze and monitor vulnerabilities and the current status related to the Green New Deal in the city as a whole and on a living area basis (city centers, neighborhoods, and manufacturing clusters), plan improvement directions in connection with the current status and place (living area)

vulnerabilities of Green New Deal projects promoted by the central and local governments, ensure its status as a preferred project partner, and focus on shaping public opinions for the implementation and expansion of Green New Deal projects. Second, in the stage of *establishing the project structure*, the third sector needs to prepare a commercialization plan and serve as a preferred project operator by considering government and private subsidies and for-profit projects, calculate the allocation of participants and the number of jobs based on local residents and communities and implement training, capacity building, and recruitment, and focus on incorporating social enterprises in anchor projects which provide key financial resources for operation and management. Third, in the stage of *obtaining and combining individual projects (package)*, in which individual projects are obtained and combined, it is important to proceed with the projects that can generate profits based on the third sector network, including social enterprises, combine this with government-funded and government-subsidized projects to expand the ecosystem in the Urban Green New

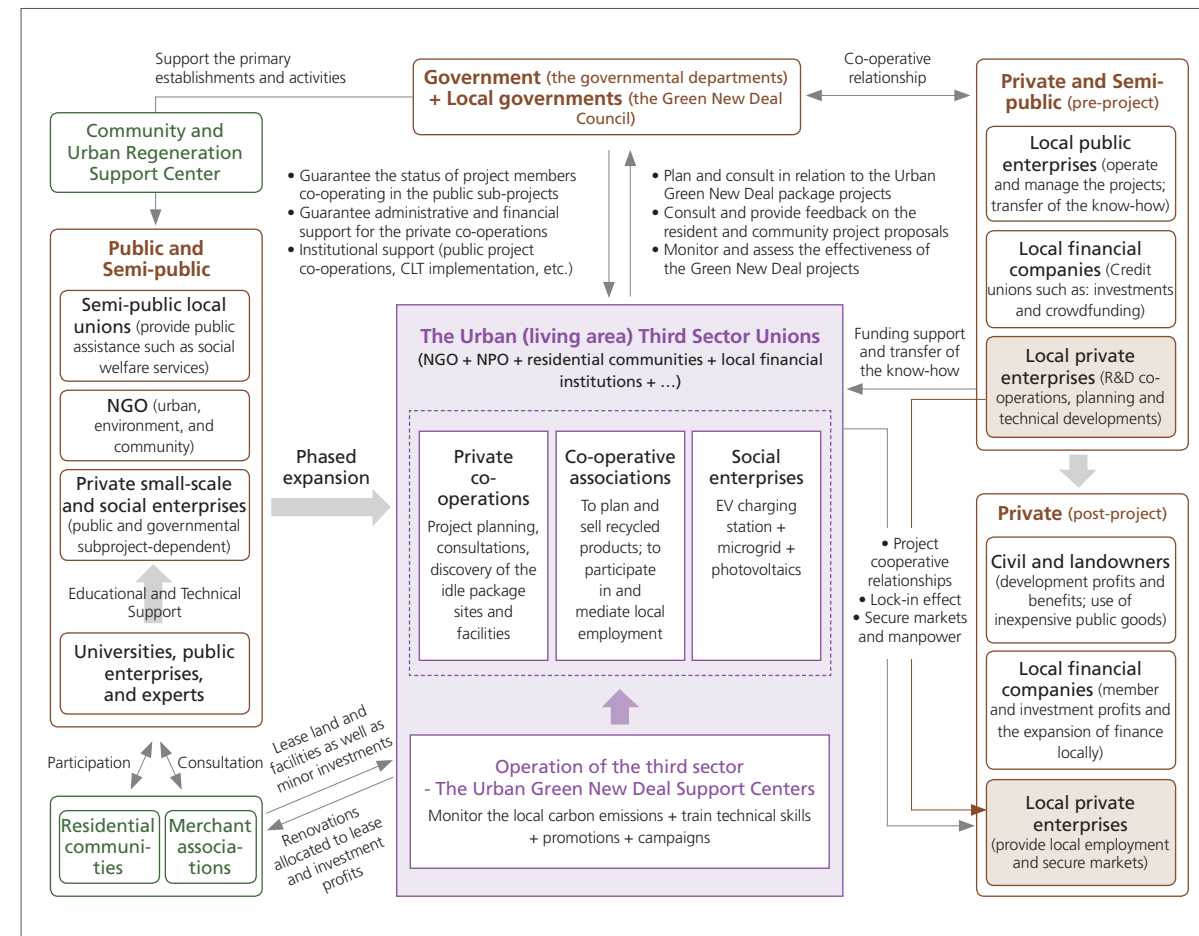
Deal, and diversify investment and participation programs, such as crowdfunding and corporate social responsibility (CSR), to encourage the participation and support of the private sector and residents. Fourth, in the stage of *operating and managing projects*, it is necessary for the third sector to monitor the overall projects, establish and operate public relations spaces (community facilities, education centers, and support for start-up and collaboration) and systems (websites, and monitoring and evaluation modules), serve as an anchor in operating and managing some projects where it is important to ensure the public interest, and form and operate a collaboration and communication council between the public and private sectors (companies, residents, and the media). Finally, in the stage of *expanding and circulating projects*, it would be effective for the third sector to analyze and promote the performance and benefits of anchor, pilot, and individual projects to encourage the continuous participation of residents and companies, continue consultations with the central and local governments to make improvements on the ground for the laws and systems that act as constraints, strengthen the projects in which the third sector functions as a platform for civil society, and ensure its own revenue sources (e.g., marketing, brand products, and local consulting). **Figure 4**

and guidelines for local governments. Second, the local government needs to overhaul the decision-making system and organization for the integrated implementation of the Green New Deal and strive to build public-private collaborative governance. Finally, it is necessary to ensure the legal and institutional status to allow the third sector to act as the agent in the Urban Green New Deal and make efforts to support employment and jobs, while considering the third sector. More specifically, to allow local NGOs, social cooperatives, and social enterprises to participate with their status guaranteed, it is worth considering operating the Green New Deal Local Partner scheme through laws or ordinances and expanding the right to operate and settle publicly subsidized projects and the scope and period of outsourcing.

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Figure 4. Governance structure for implementing Urban Green New Deal projects using the third sector



Source
Seo et al. (2021, p.190)

■ Institutional prerequisite to implement the Urban Green New Deal by using the third sector

To ensure that the Urban Green New Deal using the third sector can work on the ground as discussed above, it is an urgent prerequisite to prepare an institutional system that supports projects and finances on a city and local basis, implement a collaborative governance system based on the local government, and ensure the legal and institutional status of the third sector. First, the central government should comprehensively overhaul applicable laws such as the National Land Planning and Utilization Act, the Building Act, the Special Act on Promotion of and Support for Urban Regeneration, and the Electric Utility Act to cluster projects on a local basis, rather than on a project basis, for the place-centered implementation of the Urban Green New Deal, and present specific strategies

References

- This report summarizes the key research results of the 2021 Basic Project (21-15) “A Study on Urban Green New Deal Implementation Using the Third Sector” of the Korea Research Institute for Human Settlements, and it is equivalent to Seo et al. 2021.

Policy Measures for Low-carbon Road Freight Transportation

Jong-il Park

1. Necessity to reduce greenhouse gas emissions in road freight transportation

■ Serious greenhouse gas emissions from freight vehicles

As freight vehicles handle most road freight and produce significant greenhouse gas emissions compared to passenger cars, it is necessary to prepare measures to reduce their emissions. As of 2018, road transportation accounts for 96.5% of greenhouse gas emissions in the transportation sector, and road freight transportation handles 1,895,686,000 tons, or 92.6%, of the total freight. Since 2011, the distance in freight transportation has increased by 4.6% annually on average, and the proportion of road freight transportation has been dominant. Most freight vehicles in road freight transportation are diesel vehicles (93.5%), the percentage of freight vehicles over 10 years (38.5%) is high, and the driving distance of medium-sized and large freight vehicles (around 400 km on average) is long, producing heavy greenhouse gas emissions (Big Data Research Center of the Korea Transport Institute, 2020).

■ Pollutant emissions concentrated on certain highways

Emissions of pollutants, including greenhouse gases, are concentrated along the Gyeongbu Expressway and other major highways in the Seoul metropolitan area. The Gyeongbu Expressway accounts for 17.2% of total emissions, followed by the Jungbunaeryuk Expressway with 8.8%, the Yeongdong Expressway with 6.7%, and the Seohae Expressway with 6.1% of them. The top six highways account for approximately 50% of the total pollutant emissions, while the top 12 highways account for around 70% of them.⁰¹

■ Road freight transportation eliminated from policy attention

Since 2017, the government has announced low-carbon policies and plans, which cover 27 road freight transportation measures in total. As they are mainly suggested for passenger cars, however, it is necessary to prepare low-carbon policies, considering the characteristics of freight vehicles and road transportation. Some freight vehicle plans are limited to the dissemination of the means of transportation, especially hydrogen freight vehicles. While it is necessary to promote the hydrogen industry and justifiable to provide policy support as part of this effort to establish hydrogen mobility, it is concerning as focusing only on hydrogen freight vehicles may constitute a policy risk.

A review of the 2021 budgets for the Ministry of Land, Infrastructure and Transport, the Ministry of Trade, Industry and Energy, and the Ministry of Environment showed that there were 38 low-carbon projects in road freight transportation worth 3.2 trillion won in total. The Ministry of Environment provides subsidies related to the dissemination of a low-carbon means of transportation, the Ministry of Land, Infrastructure and Transport seeks to alleviate road traffic congestion and improve efficiency for the freight system, and the Ministry of Trade, Industry and Energy focuses on developing a carbon-free means of transportation. Even though different ministries implement the projects in accordance with their roles and functions, they are conducted in accordance with the logic of different ministries, which makes it necessary to evaluate the effectiveness of the projects and whether the budgets are allocated appropriately.

2. Policy measures for low-carbon road freight

(1) Setting directions

First, it is necessary to assess policymaking and project implementation across different ministries. It is needed to establish an implementation framework that can evaluate whether budgets and resources are allocated efficiently to policies segmented from different ministries and whether they are consistent with the overall picture of long-term policy goals. Second, it is necessary to mitigate policy risks focused on the means of transportation (hydrogen freight vehicles in particular). As it is expected to take a significant amount of time to commercialize hydrogen freight vehicle technology, it is required to provide support for various low-carbon and carbon-free freight vehicles. Finally, low-carbon policies need to be set from the perspective of routes for freight vehicles operating for long distances. It would be possible to reduce greenhouse gas emissions by narrowing the speed deviation in medium-sized and large freight vehicles and controlling the routes that can drive constantly at the speed of 60 to 80 km/h.

(2) Implementation framework

■ Designating the control tower

In the UK, the Climate Change Committee serves as a control tower for carbon emissions reduction policies. While the Climate Change Committee is an advisory body without policy-making and legislative authority, it wields a strong influence over the British government and parliament. While the 2050 Carbon Neutrality and Green Growth Commission currently have the legal authority to deliberate and make resolutions on government proposals in Korea, such authority should be reinforced. It is needed to either allow the 2050 Carbon Neutrality and Green Growth Commission to establish national strategies or national plans or strengthen their authority to investigate implementation measures by the government for matters deliberated and resolved by the 2050 Carbon Neutrality and Green Growth Commission.

■ Operating a professional research group, which supports the control tower

The Centre for Sustainable Road Freight in the UK supports decarbonization-related research and policymaking on road freight by the Climate Change Committee. As a research center established in cooperation with three universities, including the University of Cambridge, it conducts research on the electrification of long-distance medium-sized and large freight

vehicles and the development of decarbonization technologies for the road freight transportation system. A similar professional research group is needed in Korea. To produce independent research results and support continuous policymaking and evaluation, it is necessary to prepare provisions, which serve as the basis for the operation and function of a professional research group.

■ Establishing an integrated road freight transportation system plan, which can address a segmented implementation framework

California, US, has established the California Sustainable Freight Action Plan at the state-wide level. An integrated low-carbon plan in the freight sector was established jointly by relevant agencies such as the California Department of Transportation and the California Environmental Protection Agency. Likewise, it is required to set forth plans and projects with an integrated perspective and specify policy measures and the agencies in charge of implementing them. While a carbon neutrality roadmap is published by different ministries, it is prepared for the role of the relevant ministry. Upon reviewing relevant content about the road freight transportation system, it needs to be re-prepared from an integrated standpoint.

(3) Means of transportation

■ Developing Electric Road System (ERS) technologies and promoting demonstration experiments

Carbon-free freight vehicles include electric freight vehicles, hydrogen freight vehicles, and the ERS, and many countries focus on promoting hydrogen freight vehicles. Nonetheless, it is expected to take a considerable time to commercialize hydrogen freight vehicles, and it is risky to concentrate policy resources only on a certain option as it is currently difficult to determine a technological edge among different carbon-free freight vehicles.

The ERS receives electricity through a pantograph and operates an overhead line installed above freight vehicles. As electricity is directly charged based on the established electric power infrastructure, it is highly efficient and free from driving distance limitations due to battery size and weight. The size of batteries can be also minimized, and freight load loss is minimal. The ERS is considered an alternative with a high level of technological readiness and cost-effectiveness, and Germany, the UK, and Sweden are conducting demonstration experiments at the national level. **Figure 1**

01. Based on the 2020 traffic volume from the Traffic Monitoring System, this article analyzed small freight vehicles (three types), medium-sized freight vehicles (four-seven types), and large freight vehicles (nine-12 types), except for passenger cars and buses, among 12 vehicle types. Data from the Ministry of Land, Transport and Maritime Affairs (2013) were used for the average speed by section according to volume/capacity (v/c) and level of service (LOS), and this article used the air pollutant emissions coefficient by type of vehicle and speed from the Public Investment Management Center, the Korea Development Institute (2017). Due to the limitations of assumptions set for the purpose of analysis, it is meaningful to compare relative emissions in different highways, instead of estimated emissions.

Apart from the development of hydrogen freight vehicles, it is, therefore, necessary to develop ERS technologies and promote demonstration experiments. It can mitigate policy risks by focusing on hydrogen freight vehicles and respond effectively until a structural transition to hydrogen freight vehicles is achieved. It would be reasonable to promote the ERS through research and development (R&D) conducted by the Ministry of Land, Infrastructure and Transport. **Figure 2**

(4) Routes

■ Reinforcing carbon-free freight vehicle incentive policies

It is necessary to amend applicable laws related to subsidies for purchasing low-carbon and carbon-free medium-sized and large freight vehicles and establish the Subsidy Handling Guidelines. While a pilot project is in place to provide subsidies for purchasing hydrogen freight vehicles, it is necessary to expand subsidies for purchasing different types of low-carbon and carbon-free means of transportation. Moreover, as Korea has a fuel subsidy support system only for hydrogen commercial

vehicles, it is necessary to create fuel subsidies for various types of low-carbon and carbon-free freight vehicles.

■ Reinforcing internal combustion engine freight vehicle regulation policies

The government needs to make an official announcement regarding the timing of a ban on the sale of internal combustion engine freight vehicles. The UK banned the sale of large internal combustion engine freight vehicles by 2040, while California banned the sale of internal combustion engine freight vehicles by 2045. By officially announcing the timing of a ban on the sale of internal combustion engine freight vehicles, the government must ensure some time for automobile, freight, and transportation companies to prepare for a transition, and the government can also prepare diverse support measures (e.g., subsidies), coinciding with the timing of the ban.

Furthermore, it is necessary to review measures to restrict the operation of internal combustion engine vehicles on specific routes. There is a scheme in place in Korea and abroad,

which restricts the operation of old diesel vehicles (including freight vehicles) to specific regions. Restricting the operation of internal combustion engine freight vehicles on specific routes is expected to alleviate traffic congestion by distributing routes between internal combustion engines and low-carbon (carbon-free) freight vehicles, efficiently locate charging infrastructure for low-carbon (carbon-free) freight vehicles and encourage a transition to low-carbon (carbon-free) freight vehicles.

■ Designating a carbon neutrality freight road network (tentative name) and controlling traffic congestion through applicable road law amendments

Other countries designate a key road network and strongly control it at the central government level. The UK designates the Strategy Road Network and Japan designates an important freight road network to minimize traffic congestion on the road network, which functions as an arterial road. California, US, implements strategic control, such as designating bottlenecks, identifying priorities, and implementing tailored measures, to take better care of traffic congestion in major freight routes. It is necessary to designate the main routes for medium-sized and large freight vehicles as a carbon neutrality freight road network and mitigate greenhouse gas emissions arising from traffic congestion through systematic traffic congestion control. To do so, it is needed to establish a methodology to identify a carbon neutrality freight road network and amend applicable laws and systems.

■ Building exclusive freight vehicle lanes

It is important to review the establishment of exclusive freight vehicle lanes to increase the speed section (60-80 km/h) where freight vehicles produce the smallest amount of greenhouse gas emissions. As exclusive freight vehicle lanes are suitable as the operation section of the ERS and platooning, it is necessary to consider the introduction of the lanes by noting

their value as a space to implement the latest low-carbon technologies without being limited to quantitative installation standards.

■ Building exclusive freight vehicle interchanges (IC)

With a rapidly growing number of large-scale distribution centers and warehouses in the Seoul metropolitan area, there is an increasing number of traffic jams due to the increased traffic volume of freight vehicles in the existing highway ICs. It would be feasible to mitigate greenhouse gas emissions by shortening the bypass distance for freight vehicles and alleviating traffic congestion through the establishment of exclusive freight vehicle ICs. This is also expected to produce additional effects, such as mitigating traffic congestion, preventing large-scale traffic accidents, and increasing resident satisfaction by restricting the entry of large freight vehicles into urban areas.

3. Conclusions

In Korea, most freight transportation is conducted on roads. Compared to passenger cars, medium-sized and large freight vehicles produce a considerable amount of greenhouse gas emissions. It is urgently needed to establish low-carbon policies in road freight transportation, which has been relatively alienated from low-carbon road policies so far. This article suggests policies for the implementation framework, means of transportation, and routes for low-carbon road freight. There is no easy way to achieve carbon neutrality in road freight transportation, and diverse low-carbon policies must be implemented comprehensively for road freight transportation.

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Figure 1. Example of the ERS

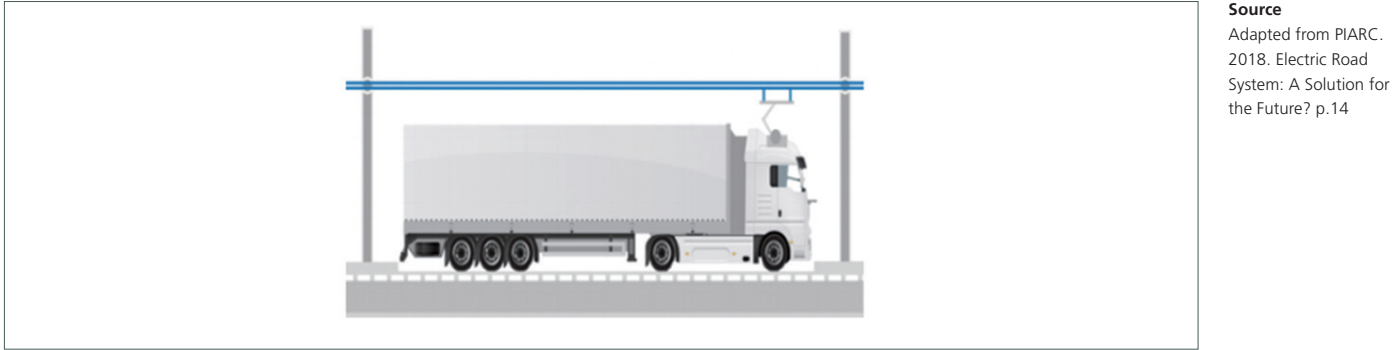


Figure 2. Example of an ERS demonstration experiment (Germany)



References

- Big Data Research Center of the Korea Transport Institute. 2020. *National Transportation Statistics Korea*. Sejong: Korea Transport Institute.
- Ministry of Land, Transport and Maritime Affairs. 2013. *Highway Capacity Manual*. Seoul: Ministry of Land, Transport and Maritime Affairs.
- Park Jong-il, Kim Joon-ki, Ko Yong-seok, Yeon Chi-hyung, Kim Kyung-seok, Kim Chang-mo and Cho Nam-gun. 2021. *Strategic Framework and Policy Measures for Low-Carbon Road Freight Transportation*. Sejong: Korea Research Institute for Human Settlements.
- Public Investment Management Center of the Korea Development Institute. 2017. *Revision/Supplementary Research for Standard Guidelines for Preliminary Feasibility Study in Road and Railroad Projects (6th Edition)*. Sejong: Korea Development Institute.
- PIARC. 2018. Electric Road System: A Solution for the Future?
- Traffic Monitoring System. <http://www.road.re.kr/main/main.asp> (accessed October 25, 2022).
- NEW ATLAS. https://newatlas.com/siemens-ehighway-of-the-future-concept/22648/?itm_source=newatlas&itm_medium=article-body (accessed October 25, 2022).

A Study on Measures for Renewable Energy Management in Mountainous Districts

Manseok Jo

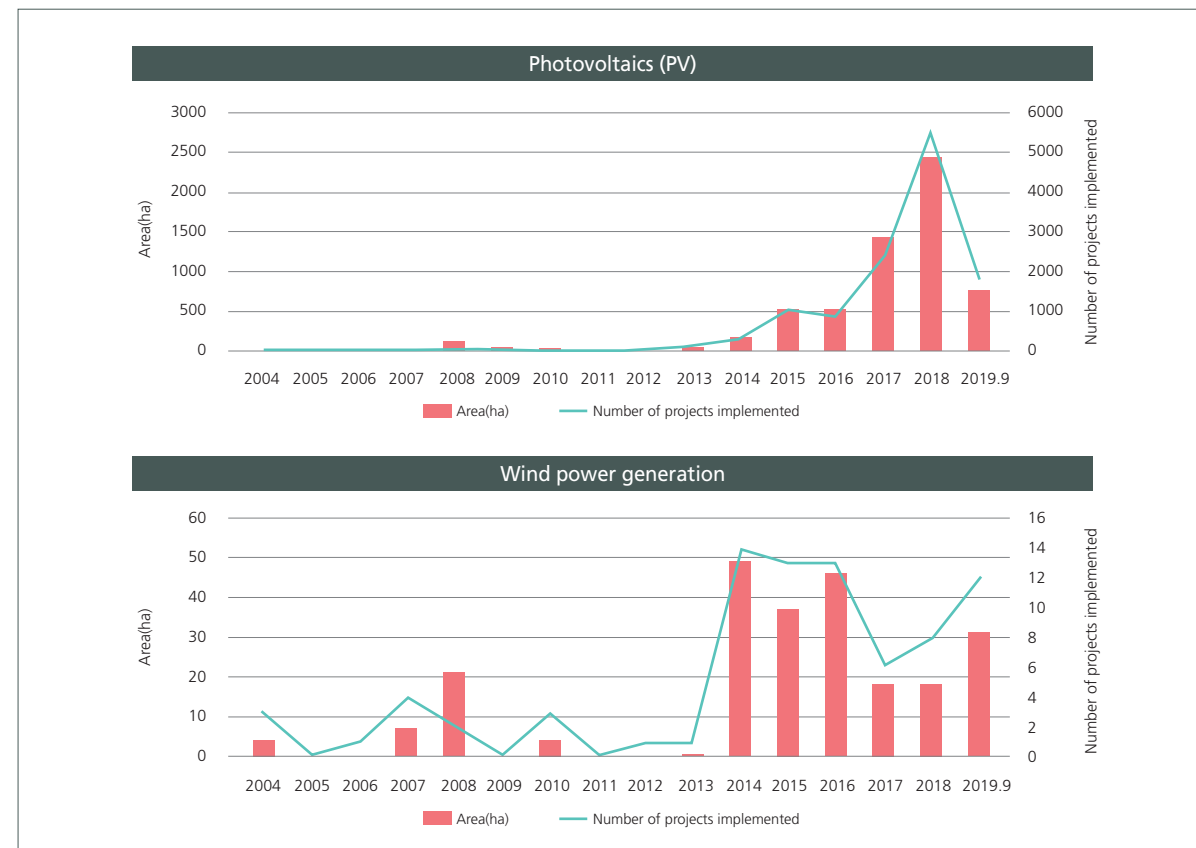
1. Background for renewable energy-related problems in mountainous districts

Increased renewable energy generation in mountainous districts has provoked a social backlash. Sprawl development as a consequence of the installation and operation of renewable energy generators has aggravated damage to mountainous districts and led to civil complaints. The Korean government allowed renewable energy suppliers to establish renewable energy facilities in mountainous districts after obtaining

permission for the exclusive use of these areas until 2018. As a result, the number of renewable energy facilities built in mountainous districts increased rapidly until 2018. In specific, it was found that 60.9% of the facilities built for photovoltaic (PV) power generation projects were located in forests, which accounted for the highest proportion of the entire development area allocated to these projects. Further, facilities built for 54 (approximately 77%) of the 70 onshore wind power generation projects were located in mountainous districts. **Figure 1**

Major problems caused by the establishment of renewable

Figure 1. A trend of the number and area of PV and wind power generation facilities installed after obtaining permission for the exclusive use of mountainous districts (as of September 2019)



Source Park and Kim (2020, p.15)

energy generation facilities in mountainous districts are classified into safety problems, environmental problems, and other problems affecting the surrounding areas. As for safety problems, construction and installation of renewable energy facilities cause reduction of forest trees and instability of slopes, which may result in incidents like landslides, destruction of slopes, and soil loss. The main environmental problems include damage to the ecosystem affecting animals and plants caused by logging and soil pollution and waste generation that occur due to construction and operation of renewable energy generation facilities. With regard to other problems affecting the surrounding areas, large-scale construction and facility placement harm the landscape of mountainous districts and provoke conflicts over land use, noise, and reflection issues between renewable energy suppliers and the residents of adjacent areas.

Furthermore, it is neither inevitable nor advantageous to use mountainous districts for the establishment of such facilities for achieving carbon neutrality. This study compared an analysis of new and renewable energy potential (Korea Energy Agency, 2021) and the active scenario on the required amount of new and renewable energy proposed by the 2050 Carbon Neutrality Committee. The comparison result showed that 927 TWh of new and renewable energy can be annually generated, and 891 TWh of new and renewable energy will be annually required. Based on this result, Korea is unlikely to suffer from the lack of new and renewable energy potential even if mountainous districts are not used for establishing new and renewable energy generation facilities anymore.

Moreover, Kim et al. (2019) examined the environmental benefits, such as reduction of greenhouse gases (GHGs) and fine dust, based on the use of mountainous districts for the establishment of PV power generators and conservation of these areas. They reported that such PV power generators built in the mountainous district of 1 ha led to benefits equivalent to approximately 241 million won (KRW) for about 20 years, and conservation of the mountainous district of 1 ha led to benefits equivalent to approximately 646 million won.

2. Analyzing current policies on renewable energy in mountainous districts in Korea

Current Korean policies and regulations on the establishment and operation of renewable energy generators in mountainous districts are mainly related to the Mountainous

Districts Management Act. The Korean government significantly revised the Enforcement Decree and Rule of this Act in response to several problems and complaints till 2020. The revised regulations require renewable energy suppliers to obtain permission for the temporary use of mountainous districts instead of their exclusive use. Specifically, the Korean government replaced the previous system with the newly-designed system that provides permission for temporary use of mountainous districts for a person who intends to obtain it only when he or she agrees on mountainous district restoration after using the corresponding districts for 10 years. Moreover, he or she should consider various environmental and ecological conservation areas according to guidelines on environmental assessment. Other than the Mountainous Districts Management Act, guidelines proposed by the Ministry of Trade, Industry and Energy (MOTIE) and ordinances announced by local governments specified separation distance between renewable energy generators and roads. The revised Enforcement Decree and Rule of the Mountainous Districts Management Act also includes changes other than restrictions on the location of renewable energy generators in mountainous districts. According to these regulations, the person who intends to obtain permission for the temporary use of a mountainous district should undergo surveys, examinations, inspections conducted by specialized mountainous district institutions as well as regular tests, which apply different conditions, such as periods, according to the scale of the mountainous district used.

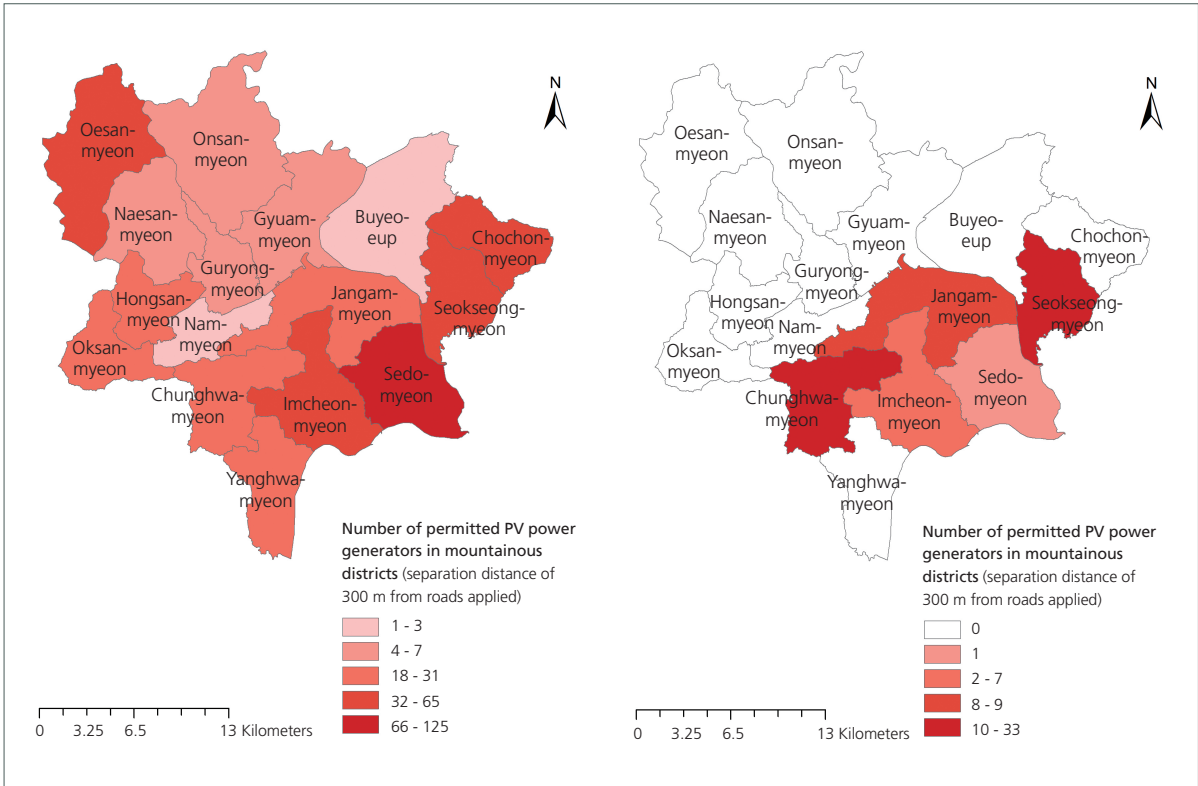
The revised regulations should be analyzed to verify the effectiveness of these policy changes. Thus, this study independently analyzed the effectiveness of the latest policies on the installment and operation of renewable energy generators in mountainous districts. It examined the status of PV power generators currently established (mainly based on permission for the exclusive use of mountainous districts) in mountainous districts by focusing on whether these facilities can still be maintained in the corresponding districts under the reinforced policy conditions. The results showed that only approximately 36% of the existing PV power generators in mountainous districts were permitted to be maintained by the reinforced Enforcement Decree of the Mountainous Districts Management Act. As the number of permitted PV power generators in mountainous districts decreased by approximately 64% under the strengthened policy conditions, the effect of the revised regulation was verified. Moreover, the number of permitted PV power generators in mountainous districts decreased by approximately 86% when both the revised

Enforcement Decree and criteria regarding the separation distance between PV power generators and roads developed by the local governments were applied. In other words, implementation of both regulations significantly controlled the location of these renewable energy generators. **Figure 2**

Furthermore, this study intensively reviewed current policies by conducting surveys involving 80 survey participants, including experts specializing in renewable energy generation in mountainous districts and those responsible for tasks in this field. The participants were requested to select policies that should be urgently revised and evaluate specific alternative policies according to the entire stages of a lifecycle. The survey results showed that respondents emphasized urgency of policy enhancement associated with disaster prevention. They also considered follow-up management more important than obtaining permission. Accordingly, they selected disaster vulnerability as the priority condition to be considered for permission for the establishment of renewable energy generators in mountainous districts. Specifically, 48.8% of the entire respondents prioritized this condition

for permission for establishment of PV power generators in mountainous districts, while 37.5% of the entire respondents prioritized it for permission for establishment of wind power generators in mountainous districts. The majority (25.4%) of the entire respondents stated that policies on the follow-up management stage, including post restoration, extension, and discontinuation, among all the management stages, should be revised urgently. As for specific alternative measures to be prepared by priority in the permission stage for the establishment of PV power generators, the respondents prioritized exclusion of catchment zones (24.4%), enhancement of slopes (19.6%), and restricted concentration of facilities (19.0%), in that order. As for specific alternative measures to be prepared by priority in the management stage of PV and wind power generators, the respondents prioritized guidelines on survey and inspection. Specifically, 33.1% of the entire respondents emphasized the necessity of preparing these guidelines for the management of PV power generators, while 30.6% of all the respondents stressed on it for the management of wind power generators.

Figure 2. The number of PV power generators currently permitted in mountainous districts vs. the number of permissible PV power generators in mountainous districts under the condition of the latest policies applied to the maximum extent (Buyeo, Chungcheongnam-do, Korea)



3. Suggestions for measures for improving policies on renewable energy in mountainous districts

As for the duties of authorities that manage renewable energy generation in mountainous districts, the Korea Forest Service is responsible for land management of mountainous districts. The MOTIE is responsible for managing new and renewable energy generation facilities. The Electric Utility Act enacted by the MOTIE is prioritized for permission for use of mountainous districts, and the Mountainous Districts

Management Act enacted by the Korea Forest Service is prioritized for the restoration of mountainous districts. The MOTIE is responsible for inspecting electric utility businesses, and the Korea Forest Service is responsible for managing mountainous districts. However, as explained above, the responsibility of the Korea Forest Service has increased by policy enhancement including the recently-reinforced conditions for obtaining permission for the temporary use of mountainous districts. However, the Korean government has made less progress in improving policies on approval and management of renewable energy facilities of electric utility businesses based on

Table 1. An analysis of the tasks that the Korea Forest Service is responsible for and the MOTIE is responsible for related to renewable energy generation in mountainous districts

Items	The MOTIE	The Korea Forest Service
Main goals	It aims to enhance the conditions of the new and renewable energy market for promoting increase of new and renewable energy generation and voluntary supply of new and renewable energy by the public and private sectors in accordance with the Framework Act on Energy and the Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy.	It aims to conserve the nature, ecology, and landscape of mountainous districts; strengthen functions of mountainous districts for increasing public benefits, such as disaster prevention and recreation; and encourage environment-friendly use of mountainous districts in accordance with the Framework Act on Forestry, the Mountainous Districts Management Act, the Act on the Management and Improvement of Carbon Sink, and other plans of relevant ministries.
Intervention procedures	It approves and registers electric utility businesses and concludes contracts in accordance with relevant laws, including Article 7 (Electric Utility Licenses) of the Electric Utility Act. It also performs inspection and management in accordance with Chapter 3 (Safety Management of Electric Installations) of the Electrical Safety Management Act.	It provides permission for temporary use of mountainous districts (permission for exclusive use of mountainous districts in the past) and conducts interim restoration and restoration works in accordance with relevant regulations of the Mountainous Districts Management Act.
Tasks regarding permission	It controls standards for the permission for electric utility businesses, determines the style of a business plan to be submitted, and designs procedures for collecting opinions of residents in accordance with relevant laws including Article 7 (Electric Utility Licenses) of the Electric Utility Act.	It designates target facilities, which should obtain permission for temporary use of mountainous districts, a range of actions of these facilities, location of installation of these facilities, and conditions and standards for installation in accordance with relevant laws, including Article 15-2 (Permission for and Reporting on Temporary Use of Mountainous Districts) of the Mountainous Districts Management Act.
Tasks regarding restoration	It discontinues or delays the operation of a business by determining if this business complied with to conduct interim restoration in accordance with Article 31-2 (Transaction of Renewable Energy Exclusively Established in Mountainous Districts) of the Electric Utility Act.	It designates styles for restoration procedures, design plans for restoration, and supervision of mountainous district restoration words in accordance with Chapter 4 (Prevention of Disasters, Recovery Therefrom, Etc.) of the Mountainous Districts Management Act.
Tasks regarding inspection	It establishes procedures for inspection before use of facilities and regular inspection, designates technical standards to be satisfied for maintenance of electric installations, and appoints and manages persons and institutions responsible for safety management in accordance with Chapter 7 (Safety Management of Electric Installations) of the Electric Utility Act and Chapter 3 (Safety Management of Electric Installations) of the Electrical Safety Management Act.	It conducts regular surveys, examinations, and inspections on new and renewable energy generation facilities in accordance with Article 37 (Prevention, etc. of Disasters) of the Mountainous Districts Management Act.

Source
Jo et al. (2021, p.120)

the effect of these facilities on the surrounding environment. Similar problems regarding the issue of renewable energy generation in mountainous districts have constantly occurred all over the country. In this regard, further research should be conducted to improve policies on the management of

renewable energy facilities performed by the MOTIE. **Table 1**

This study presents the following alternative policies by considering unique characteristics of mountainous districts, responsible tasks of relevant ministries, different properties of each new and renewable energy source, and weaknesses

Table 2. Main alternative policies on renewable energy generation in mountainous districts and Green New Deal proposals

Items	Alternative policies	Details
The approval stage	Improvement of standards for permission and completion of works	Strengthening of standards for basic site construction works, application of standards for exclusion of catchment zones, replacement of the existing standard for exclusion of permission based on a steep slope instead of the average slope, implementation of additional standards related to landscape, etc.
	Consideration regarding concentration of facilities	Integration of procedures for approval of similar types of licenses to prevent granting of duplicated permission for the same facility and additionally consider concentration of facilities, inspection on the effect of the target facility on adjacent facilities, etc.
	A period of permission	Policy improvement on relaxing the current standard for extension of a period of permission for temporary use, which is established as 10 years + 10 years, for a facility that has solved a majority of its previous safety and environmental problems and shown considerable business value to facilitate constant use of this facility
	Collection of opinions of residents	Integration and enhancement of existing procedures for collecting opinions of residents, which are limited to announcement of permission for electric utility businesses or development actions, to facilitate more efficient collection of their opinions and benefit exchange
The management stage	Systematization of inspection and management	Improvement of technical standards for inspection and management of new and renewable energy generators, including PV power generators, installed in mountainous districts stated in the Electric Utility Act and the Electrical Safety Management Act, fortification of inspection and management of sites, structures, and facility performance, etc.
	Improvement of the period and number of inspections	Replacement of the current regular inspection systems (i.e., regular inspection conducted every four years according to the Electrical Safety Management Act and regular inspection conducted every three years according to the Mountainous Districts Management Act) with a new regular inspection system that determines a cycle of regular inspection based on the persisting period and deterioration of renewable energy generation facilities, relaxation of requirements for the number of regular inspections to be performed, etc.
	Clarification of inspection details	Clarification of accurate examination procedures, methods, and items, preparation of detailed guidelines on treatment of neglected or stored goods, etc.
	Reinforcement of supervision of mountainous district restoration works	Development of specific guidelines on solving the problem that a responsible public official should determine a status of restoration with the naked eye when a supervisor does not faithfully perform procedures on supervision of mountainous district restoration works and approval of a design plan for restoration
Green New Deal strategies	Job creation	Promotion of job creation related to inspection, survey, and management (e.g., facility inspection and management, environmental impact assessment, and disaster hazard analysis)
	Recovery and restoration projects	Development of Green New Deal projects related to interim restoration required after installation of renewable energy facilities, restoration after suspension or discontinuation of operation of these facilities, planting of trees and herbs, ecological restoration, removal of soil pollution, and waste management
	Development of a symbiotic relationship with agricultural and livestock industries	Legislation of policies on encouraging agriculture based on forage crops, mushrooms, etc., pasturing of animals, and insect breeding, which can be performed on sites of PV and wind power generators installed in mountainous districts, to maximize the utility value of these sites and minimize the effect of these sites on the surrounding areas

Source
Jo et al. (2021, p.122)

of current systems and standards. Among the suggested alternatives, this study particularly emphasizes the significance of reinforcement of requirements for permission, extension of a period of permission, systematization and strengthening of inspection and management, and intensification of supervision of mountainous district restoration works. **Table 2**

This study suggests directions for legal and systemic improvement with regard to electric utility businesses, mountainous district management, and policies on management of planned estates as follows. As for electric utility businesses, the Korean government should prepare a revised policy that transfers contents of site-related requirements, which are stated in the Mountainous Districts Management to the Enforcement Rule of the Electric Utility Act [Appendix 1] (Methods of Completing a Business Plan) and Article 21-2 of Technical Standards for Electric Installations (Requirements for facilities, such as power generators, installed on sites), and requires review of these requirements in the stage of permitting electric utility businesses. As for mountainous district

management, the Korean government should revise Article 18-4 (a period of temporary use of mountainous districts) of the Enforcement Decree of the Mountainous Districts Management Act to extend a period of use of mountainous districts, eliminate current conditions on the cycle of inspections and examinations, and perform regular inspection based on newly established cycles. As for planned site management, this study proposes measures for preparing additional planned site management systems for renewable energy generation in mountainous districts, such as designation of a zone for temporary use of a special mountainous district and verification of validity performed by a specialized institution, by referring to existing systems like designation of a zone subject to ecologically sustainable diversion of a mountainous district, which is stated in Article 9 of the Special Act on Management of Mountainous Districts North of the Civilian Control Line.

Among the proposed alternative policies in this study, the following policies should be particularly examined in future research to scientifically verify the effect of these policies and

Table 3. Future tasks associated with main alternative policies

Policy item	Main contents	Future tasks
Improvement of standards for permission and completion of works	<ul style="list-style-type: none">Standards according to slope, area, and concentration of facilitiesDetails related to exclusion of catchment zonesDetails related to the influence of facilities on the surrounding areas and landscapeCriteria for determining extension or discontinuation of operation of facilitiesCriteria for determining appropriacy of a facility as an electric installment and that of a site for this facility	<ul style="list-style-type: none">Research on improving standards related to the Enforcement Decree of the Mountainous Districts Management ActResearch on standards for exclusion of catchment zones in mountainous districts for disaster preventionResearch on the effect of PV and wind power generators on landscapeResearch on standards for extension or discontinuation of permission for temporary use of mountainous districtsResearch on technical standards for electric installations for PV power generation
Policies on the approval stage	<ul style="list-style-type: none">Strengthening of procedures for collecting opinions of residentsPreparation of a special planned site management system for mountainous districts	<ul style="list-style-type: none">Research on increasing acceptability of residents of renewable energy generation projectsResearch on development of planned site management systems for renewable energy generation in mountainous districts
Policies on inspection and management	<ul style="list-style-type: none">Establishment of operation of surveys, examinations, and inspections in more systematic and concrete waysTask management based on computerizationReinforcement of supervision of mountainous district restoration works	<ul style="list-style-type: none">Research on development of guidelines and manuals on inspection according to the Mountainous Districts Management ActDevelopment of a system for managing renewable energy power generators in mountainous districtsResearch on improving a system for supervision of restoration of mountainous districts
Green New Deal proposals	<ul style="list-style-type: none">Effects of Green New Deal proposalsGreen New Deal strategies	<ul style="list-style-type: none">An analysis of the effect of management of renewable energy generation facilities in mountainous districts on job creationPreparation of Green New Deal projects and strategies related to mountainous districts

Source
Jo et al. (2021, p.142)

provide specific policy details. First, works for improving policies on permission and completion should be constantly analyzed and systematically established based on scientific and objective methodologies. Furthermore, research and system development should be conducted to investigate policies on improving planned site management and collection of opinions of residents and systematize inspection and management of renewable energy generation facilities in mountainous districts. **Table 3**

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Among the suggested alternatives, this study particularly emphasizes the significance of reinforcement of requirements for permission, extension of a period of permission, systematization and strengthening of inspection and management, and intensification of supervision of mountainous district restoration works.
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References

- Jo Manseok, Lee Daye, Park Jonghwa, Hong Naeun, Park Jongsoon, Kim Sukwoo, Kim Younghwan and Sung Sunyong. 2021. *How to Manage Renewable Energy in Mountainous Districts Regarding the Green New Deal Policy*. Sejong: Korea Research Institute for Human Settlements.
- Kim Young-hwan, Yoo Dong-hoon, Han Hee and Bae Jae-soo. 2019. Study on Environmental Benefits and Losses of a Solar Photovoltaic Power Generation Project on Forestland. *Journal of Climate Change Research* 10, no. 4: 317-324.
- Park Ji-hye and Kim Ju-jin. 2020. *The Current Status and Problems of Renewable Energy in South Korea in 2020: Development of Measures for Improving Systems, Site Regulations, and Markets to Encourage the Energy Transition*. Seoul: Solutions for Our Climate.



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