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Korea Sustainability Investing Forum

Ensuring Sufficient Renewable Energy for Korea's Climate Goals: Analysis of 2035 NDC, energy targets, and policy implications

Policy Report

Energy

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Table of Contents

Executive Summary

Korea's current power sector trajectory is not aligned with its 2035 climate targets. While a recent Government announcement of 100GW of installed RE capacity by 2030 significantly raises ambition, it's essential to accelerate renewable energy deployment to achieve its strengthened Nationally Determined Contributions (NDC target of a 53-61% reduction in greenhouse gas emissions) and positioning the country as a credible leader in the global shift away from carbon-intensive power generation.

The transition to renewable energy also presents a strategic opportunity to reduce Korea's dependence on imported fossil fuels. Global fuel crises, such as the current Middle East conflict, leave Korea exposed to volatile fossil fuel prices that can seriously damage its economy. Korea has limited domestic fossil fuel resources and as a result imports 98% of its oil and gas.[1] Moving towards renewables would strengthen energy security, improve the balance of payments, and reduce exposure to global price volatility.

A critical policy gap has emerged between the emissions pathway set out in the 11th Basic Plan for Electricity (BPLE) finalized in early 2025, and the more ambitious 2035 NDC submitted in November 2025. This misalignment presents an urgent challenge that must be addressed in the forthcoming 12th BPLE through higher renewable energy targets and

1 US Energy Information Administration, Country Analysis Brief: South Korea, April 2023

revised planning assumptions. In absolute terms, Korea's renewable energy generation share and installed capacity remain below those of most major economies and the OECD average. While the pace of Korea's structural energy transformation is broadly in line with global trends, the country must accelerate the speed of its power mix transition to meet its near-term climate commitments.

The power and heat sector carries the heaviest decarbonization effort under the 2035 NDC, making clear, step-by-step milestones and tight alignment between the sector's medium- to long-term strategy and national reduction goals, an essential prerequisite for effective emissions reductions. The trajectory of future renewable expansion will ultimately be a core determinant of whether Korea achieves its NDC targets.

On the corporate side, Power Purchase Agreements (PPAs) are set to become a critical tool for companies seeking to procure renewable energy at competitive prices. However, even under conservative assumptions about RE100 participation, PPA supply is expected to meet only around half of corporate renewable energy demand by 2038.[2] As more companies commit to clean energy targets, this supply-demand gap is likely to widen further.

Addressing this gap will require immediate policy action to expand market-based renewable capacity. Key priorities include streamlining permitting for solar and wind projects, strengthening policy support in project evaluation processes, and enabling developers to scale and diversify their business models. Without these interventions, the overall renewable energy supply risks falling significantly short of both corporate demand and national climate ambitions.

Two emerging policy frameworks offer promising pathways to bridge this gap. The RE100 Industrial Complex initiative aims to co-locate large-scale renewable generation with industrial demand, while the Distributed Energy Act (effective December 2024) provides a regulatory foundation for shifting away from a centralized power system. Together, these frameworks can accelerate deployment by aligning generation more closely with demand.

2 RE100 is the is the global corporate renewable energy initiative bringing together businesses committed to 100% renewable electricity.

Recommendations

1. Align the 12th BPLE with the 2035 NDC trajectory through binding targets and revised assumptions

- Ensure the 12th BPLE's demand forecasts, generation mix, and emissions trajectory are consistent with the 2035 NDC.
- Establish binding interim milestones for 2030–2035 to accelerate annual emissions reductions and renewable energy deployment.
- Increase renewable energy deployment targets beyond the 11th BPLE and formally embed the 100GW renewable capacity target, to reflect the RE tripling goal and global expansion trajectories.

2. Strengthen governance through local empowerment and stakeholder participation in energy planning

- Establish transparent, inclusive stakeholder participation processes that actively engage industry and local community actors in energy planning.
- Ensure close collaboration mechanisms between central and local governments to support flexible, coordinated energy transition planning.

3. Build a functional renewable energy market by expanding corporate procurement

- Prioritise policy support for accessible supply via direct procurement mechanisms, including Power Purchase Agreements (PPAs), to meet increasing corporate renewable demand.
- Facilitate Virtual Power Purchase Agreements (VPPAs) to expand renewable procurement options for RE100 companies and support the development of new renewable energy projects.
- Streamline grid interconnection and permitting procedures for renewable energy projects to reduce delays in project commissioning, ensuring that renewable capacity can be deployed in time to meet corporate demand.

4. Transition to a distributed energy system

- Shift policy focus from centralised, transmission-intensive models toward distributed energy systems that integrate local generation with nearby demand.
- Institutionalize the co-location of generation, grid infrastructure, and consumption to address grid capacity constraints.
- Support diversified developer business models and utilise distributed energy sandboxes to enable and scale innovative distributed energy solutions.

Methodology

This study begins with a comprehensive literature review of Korea's energy policy framework, including the 11th Basic Plan for Long-term Electricity (BPLE), Nationally Determined Contributions (NDCs), and relevant international benchmarks. This was complemented by a review of reports and datasets from international organizations, including the IEA, IRENA, and UNEP, to provide a global comparative perspective.

A data-driven analysis was then conducted to estimate renewable electricity demand from RE100 companies in Korea. Firm-level electricity consumption data were collected from sustainability reports of major companies, supplemented by RE100 annual disclosure reports. Where direct data was unavailable or inconsistent, estimates were derived using aggregate statistics and cross-checked against external datasets, including BNEF.

Future electricity demand and renewable energy requirements were projected using a scenario-based approach. Near-term trends were estimated using growth rates from BNEF projections, while long-term demand was aligned with projections in the 11th BPLE. In addition, company-specific RE100 targets and interim goals were incorporated to derive renewable energy demand trajectories.

Renewable energy supply under the national electricity plan was then compared with projected demand to assess overall sufficiency. This analysis incorporated key procurement mechanisms such as green premiums, renewable energy certificates (REC), and power purchase agreements (PPA), allowing for a more realistic evaluation of market feasibility.

1. Comparative Study on NDC 3.0 Target and Renewable Energy Target

1.1 11th Basic Plan for Long-term Electricity Supply and Demand

This section reviews the background and objectives of the 11th Basic Plan for Long-term Electricity (BPLE), as well as its key power mix and overall energy transition direction.

1.1.1 Key Features of the 11th Basic Plan for Long-term Electricity Supply and Demand

The Basic Plan for Long-term Electricity Supply and Demand (BPLE) is Korea's biennial mid- to long-term electricity planning framework, established under Article 25 of the Electric Utility Act. The Plan comprehensively reflects various factors - including the Nationally Determined Contribution (NDC), energy security, industrial structural changes, and technological innovation - with the aim of simultaneously ensuring stable electricity supply and demand and advancing the energy transition over a 15-year planning horizon.

The 11th BPLE covers the period from 2024 to 2038. Following the release of the working draft in May 2024, the plan underwent environmental assessment, stakeholder consultation, and inter-ministerial review before being finalized in February 2025. [3] The framework includes an assessment of the 10th BPLE, identifies areas for improvement, and sets out the overall direction for electricity supply and demand, including projections, demand-side targets, generation policy, and infrastructure planning for 2024–2038.

In formulating the basic direction of the 11th BPLE, the Korean government sought to incorporate changes in domestic electricity demand conditions, the strengthened NDC mitigation targets for the power and heat sector[4], and the accelerating global trend toward decarbonization. Domestically, it projects a sharp increase in electricity demand driven by advanced industries, AI-driven data centre growth, and accelerating electrification, including EV adoption and hydrogen-based steel production.

3 The 11th Plan was finally approved and initially promulgated on February 21, 2025; however, following partial revisions to the detailed contents of the accompanying materials, a revised notice was issued on March 13, 2025 [Ministry of Trade, Industry and Energy Notice No. 2024-238]

4 The use of power and heat sector throughout this document has been translated from the original 전환부문, of which the official translation is 'energy conversion sector'. However the final NDC submitted to UNFCC describes the relevant mitigation measures under 'power generation'.

The framework was also in line with global commitments, including tripling renewable energy capacity and doubling energy efficiency improvements by 2030, and tripling nuclear power capacity by 2050.[5] It also reflected the G7 Joint Communiqué issued in June 2024 calling for the "phase-out of unabated coal-fired power generation".[6]

Taking these domestic and international developments into account, the 11th BPLE was formulated not merely as a supply–demand outlook but as a comprehensive plan encompassing a structural transformation of the overall power system. This includes a shift toward a carbon-free power mix, expansion of transmission and distribution networks and related facilities, strengthened demand-side management, increased utilization of distributed energy resources, and reforms to the electricity market structure.

During the planning process, the feasibility of proposed policies was reviewed through meetings of the Steering Committee, Subcommittees, and working groups. Following the release of the working draft in May 2024, further inter-ministerial consultations and additional stakeholder feedback led to an upward revision of the deployment outlook for solar and wind power.[7]

These changes reflect a stronger commitment to expanding renewable energy and present a medium- to long-term strategy for effectively responding to rapidly evolving power demand conditions, the implementation of carbon neutrality, and global policy and technological shifts (KEEI, 2025)[8]. However, differing perspectives persist regarding the appropriateness and feasibility of the targets (NARS, 2025)[9]. Some critics argue that the plan remains overly supply-oriented, placing insufficient emphasis on demand-side management, while also raising concerns over the increased reliance on LNG and the feasibility of targets for emerging technologies such as hydrogen and ammonia power generation.

The 11th BPLE presents three core directions for its formulation: 1) scientifically estimating and reflecting future electricity demand, 2) establishing an optimal power generation mix in consideration of supply stability, efficiency, and carbon neutrality, and 3) preemptively advancing the power grid and market framework to support the expansion of carbon-free power sources. The key strategies and detailed components corresponding to these directions can be summarized - based on the five core elements of demand forecasting, demand-side management, power generation mix and facility planning, power system development, and the electricity market - as illustrated in **Table 1-1** below.

5 The global commitment to these was made during the COP28 climate commitment and was supported by 117 countries.

6 The G7 June 2024 Communique referenced this their commitment to Energy, Climate and Environment

7 Reflecting proposals from the Ministry of Environment and the Presidential Commission on Carbon Neutrality and Green Growth to further expand renewable energy, the deployment outlook for solar and wind power in 2030 and 2038 was revised upward by 2GW and 2.4GW, respectively.

8 KEEI (Korea Energy Economics Institute), (2025), Energy Brief, April 2025 Issue

9 NARS (National Assembly Research Service) (Jan 2, 2025) Evaluation and Policy Recommendations on the Draft of the 11th Basic Plan for Long-term Electricity Supply and Demand.

Table 1-1: Key Directions and Main Elements of the 11th Basic Plan for Long-term Electricity Supply and Demand

Key Elements		Details
(1) Demand Forecasting	Economy and population trends	• Average annual GDP growth +1.63% through 2038, average annual population change –0.14%
	Industrial structure changes	• Share of service industry: 62.7% (2024) → 65.6% (2038) • Share of manufacturing industry: 28.3% → 26.5% (shift toward high-tech industries)
	Reflection of additional demand	• Separate accounting of electricity demand from high-tech industries, electrification, and data centers
	Electricity consumption outlook	• 557.1 TWh in 2024 → 735.1 TWh in 2038 (avg. annual growth +2.0%)
	Peak demand outlook	• 104.2 GW in 2024 → 145.6 GW in 2038 (avg. annual growth +2.4%) • Widening gap between summer and winter peaks
	Contribution of additional demand	• Additional demand accounts for more than 40% of total electricity demand increase • Electrification 63.0 TWh, data centers 15.5 TWh, high-tech industries 1.1 TWh
	Changes from the 10th BPLE (based on 2036)	• 2036 electricity consumption: 10th BPLE 703.2 TWh → 11th BPLE 707.9 TWh • 2036 peak demand: 10th BPLE 135.6 GW → 11th BPLE 138.2 GW (reflecting expanded additional demand)
(2) Demand side management	Direction of demand-side management	• Shift from past approaches centered on policy intention and conservation awareness → toward verifiable measures
	Targets by institution (2038)	• KEPCO: 7.5 GW (legalization of EERS and higher reduction requirement) • Korea Energy Agency: 2.6 GW (industry, buildings, appliances) • Korea Power Exchange: 4.7 GW (load curtailment through DR) • Others (EVs, V2G, etc.): 1.5 GW
	Reduction plan (2038)	• Reduction of 110.6 TWh in electricity consumption; 16.3 GW reduction in peak demand
	Target demand (2038)	• Electricity consumption: 624.5 TWh; peak demand: 129.3 GW
	Changes from the 10th BPLE (based on 2036)	• 2036 electricity consumption: 591.1 TWh (10th) → 619.0 TWh (11th) • 2036 peak demand: 118.0 GW (10th) → 125.0 GW (11th)

Key Elements		Details
(3) Power generation mix and facility planning	Power generation facilities in 2023	• Total capacity 144.4 GW: gas 29.9%, coal 27.1%, new and renewable energy[10] 21.7%, nuclear 17.1% • Power generation share: coal 31.4%, nuclear 30.7%, gas 26.8%, new and renewable energy 9.6%
	Policy direction	• Restructuring toward a carbon-free power mix - Cease replacing coal with gas; classify gas as thermal power - Timely completion of new nuclear units and promotion of SMR development - Systematic expansion of renewable energy while ensuring NDC attainment - Expansion of clean hydrogen[11] and ammonia power generation, management of integrated energy (CHP) expansion, and reinforcement of pumped-storage hydropower and BESS capacity
	Power generation mix (2038)	• Planned installed capacity 268.1 GW (nameplate): new and renewable energy 125.9 GW (46.0%), gas 69.2 GW (25.8%), nuclear 35.2 GW (13.1%), coal 22.2 GW (8.3%), pumped-storage hydropower 10.4 GW (3.9%) • Total power generation 704.5 TWh: nuclear 248.3 TWh (35.2%), new and renewable energy 232.1 TWh (32.9%), gas 74.3 TWh (10.6%), coal 70.9 TWh (10.1%), hydrogen/ammonia 43.9 TWh (6.2%)
	Changes from the 10th BPLE (based on 2036)	• Total installed capacity: 239.0 GW → 254.6 GW (increase) - Capacity share by source: slight decrease for nuclear, coal, and gas; increase for new and renewable energy and pumped-storage hydropower • Power generation: 667.3 TWh → 693.3 TWh (increase) - Generation share: slight increase for gas, renewables, and others; decrease for other sources
(4) Power system development	Policy direction	• Reflect power grid expansion in line with new facilities and increased renewable energy - Ensure proactive grid reinforcement and establish a stable power system operation framework
	Challenges	• Increased intermittent generation (solar, wind) expected to challenge the existing centralized dispatch-oriented system • Need for system stabilization measures, including frequency stability, reactive power compensation, and voltage control
	System response	• Estimate required capacity of system stabilization resources - Expansion of synchronous condensers, BESS, and pumped-storage hydropower facilities - Proactive grid reinforcement and improvements to system operation

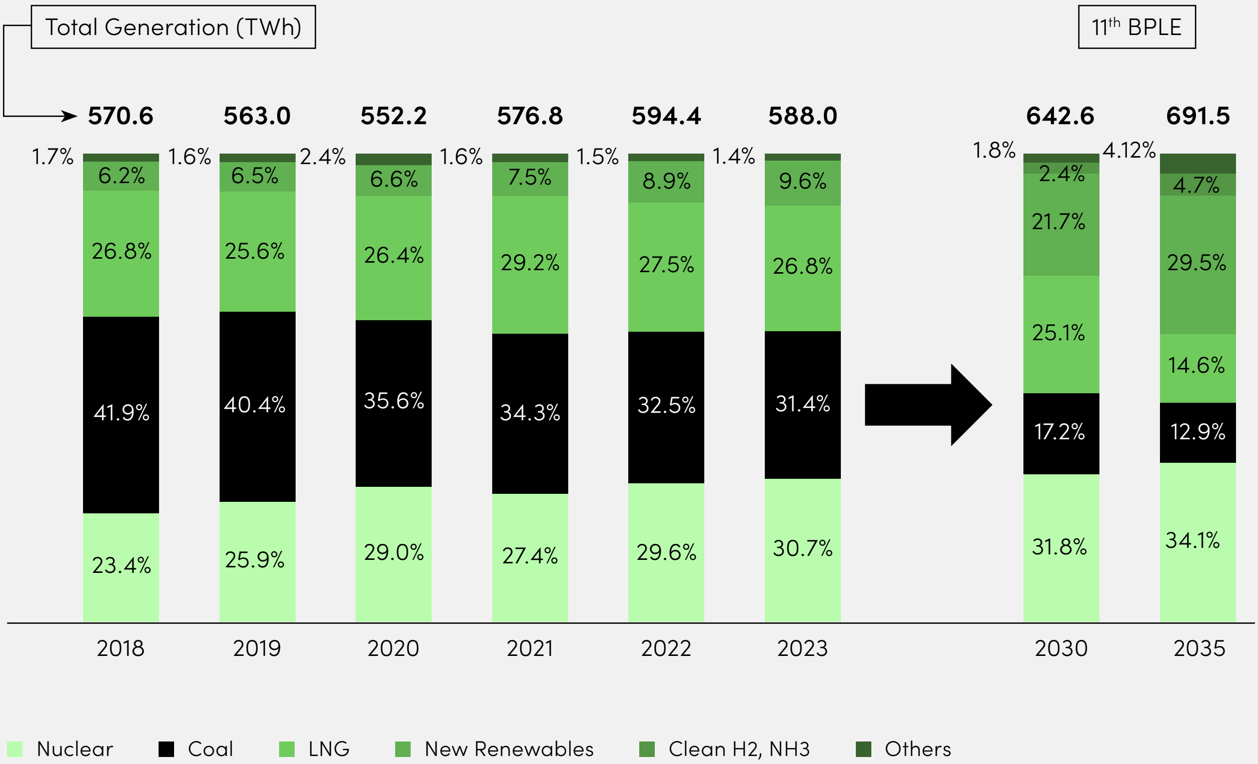
10 "New and renewable energy" under Korea's Renewable Energy Act includes sources that are not strictly renewable, such as fuel cells and Integrated Gasification Combined Cycle (IGCC).

11 'Clean hydrogen' refers to hydrogen produced using zero or nominal fossil fuel or greenhouse gas emissions.

Key Elements		Details
(5) Electricity market	Policy direction	• Expand the role of the electricity market in securing supply stability and promoting distributed generation – Apply market competition from entry (contracts, capacity market) to dispatch (real-time market) – Promote activation of distributed energy through stronger locational signals
	Market advancement direction	• Introduction of a spot market + contract market + capacity market: mitigate new investment risks through long-term contracts; stabilize the investment environment by compensating capacity costs via the capacity market • Locational pricing + distributed energy and direct power transactions: differentiated pricing reflecting grid congestion and system constraints; promote renewable energy dispersion and siting near demand centers; improve tariff consistency • Advancement of the real-time market: incorporate real-time pricing and strengthen price signals for demand-side resources and distributed generation
	Expected effects	• Enhanced medium- to long-term supply stability • Efficient regional dispersion and more rational tariff structures • Strengthened price competition based on system flexibility

Source: Ministry of Trade, Industry and Energy (2024)

Figure 1-1. Power Generation by Energy Source (2018–2023) and Future Outlook under the 11th BPLE



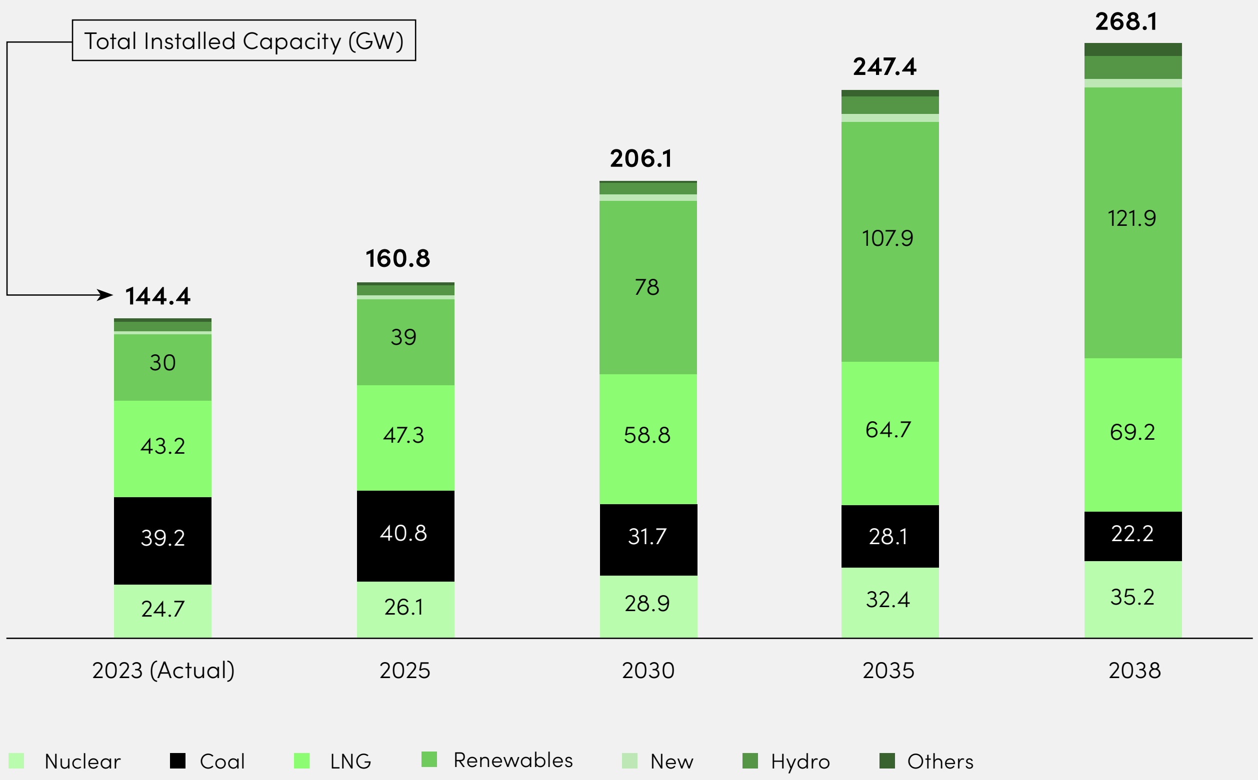
1.1.2 Power Generation Mix and Capacity Planning under the 11th BPLE

The 11th BPLE outlines a fundamental restructuring of the power generation mix to achieve the energy transition and national greenhouse gas reduction targets. Figure 1-1 illustrates the annual total power generation (TWh) and the share of each energy source for the years 2018–2023, along with projections for 2030 under the 11th BPLE. According to the figure, as of 2023, coal and LNG still accounted for approximately 58 percent of total power generation, while new and renewable energy remain below 10 percent. The share of new and renewable energy increased from 6.2% in 2018 to 9.6% in 2023 - an increase of only 3.4 percentage points over five years.

Although Korea's expansion of renewable energy has not made sufficient progress, the government intends, through the 11th BPLE, to accelerate the shift toward carbon-free power sources such as renewable energy, clean hydrogen and ammonia, and nuclear power. The government has set targets to increase the share of carbon-free generation to over 50 percent by 2030, around 65 percent by 2035, and more than 70 percent by 2038.

The Plan projects that total power generation will reach 642.6 TWh in 2030 and 691.5 TWh in 2035 (see Figure 1-1). In terms of the generation mix, new and renewable energy are expected to account for 21.7 percent of total generation by 2030 (120.9 TWh from renewables and 18.7 TWh from new energy sources), while the share of nuclear power is projected to increase to 31.8 percent by maintaining and expanding current levels.

Figure 1-2. Total Installed Capacity by Energy Source under the 11th BPLE



Meanwhile, the combined share of coal and LNG is expected to decline significantly from 58 percent in 2023 to 42.3 percent in 2030. By 2035, this trend is set to accelerate even further, with the share of new and renewable energy generation increasing to about 30 percent. Overall, the planned power generation mix reflects the Korean government's policy orientation of maintaining supply stability in the near term while gradually expanding carbon-free energy over the long term to achieve both carbon neutrality and energy security.

The 11th BPLE capacity outlook is based on a standard reserve margin of 21–22% applied to projected electricity demand, alongside a policy emphasis on replacing aging infrastructure with carbon-free generation. This reflects a dual objective of maintaining supply reliability while accelerating the transition to a lower-carbon power mix.

Figure 1-2 illustrates the projected evolution of installed capacity under the 11th BPLE. Total capacity is expected to increase substantially, driven by a rapid expansion of renewable energy. Renewable capacity is projected to more than quadruple between 2023 and 2038 - rising from 30 GW to over 120 GW - and increasing its share of total installed capacity from around 21% to over 40%[12]. Renewable targets were revised upward during the planning process, reflecting growing pressure to align with NDC targets.

12 Ministry of Trade, Industry and Energy (MOTIE) (Feb 21, 2025), "Key Contents of the 11th Basic Plan for Long-term Electricity Supply and Demand."

Figure 1-3. Total Effective Capacity by Energy Source under the 11th BPLE

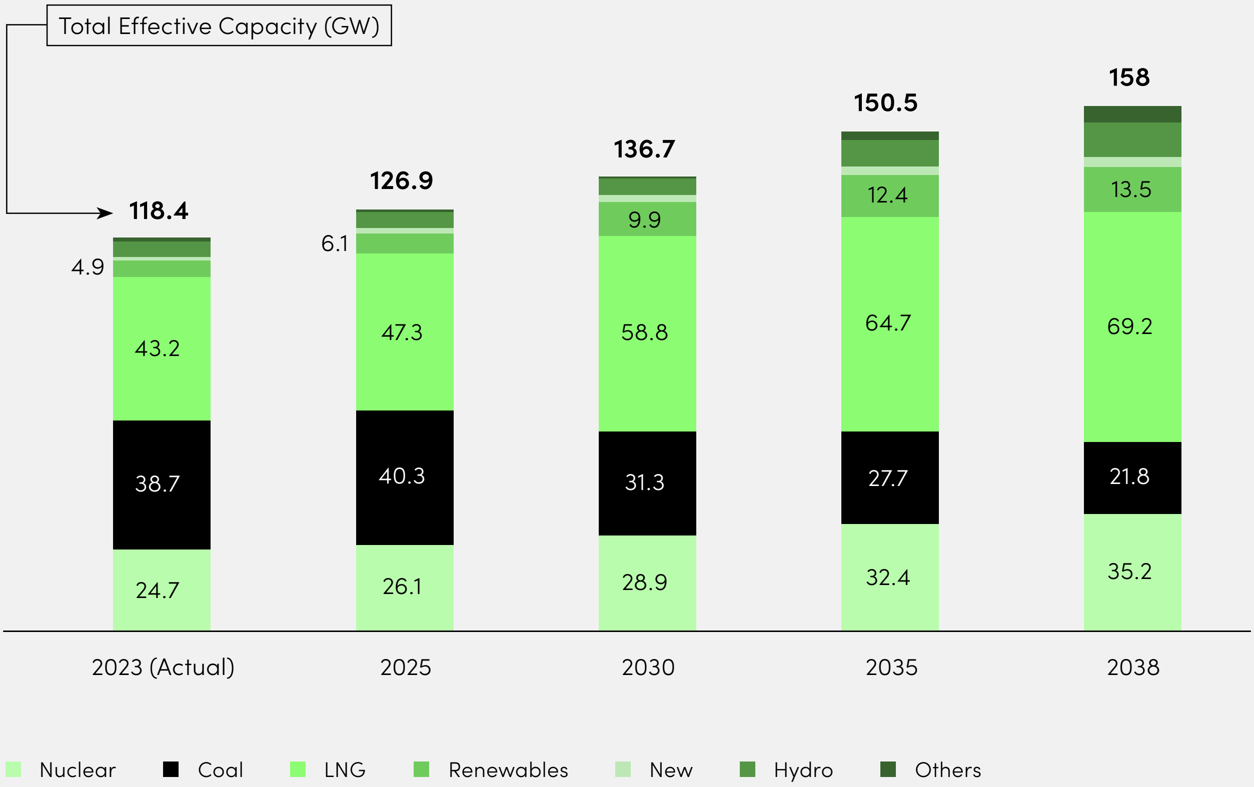


Figure 1-3 shows that growth in effective capacity is significantly more limited than installed capacity. While renewable installed capacity expands rapidly, its contribution to effective capacity remains comparatively low, reaching only around 8.5% by 2038. This highlights a key system constraint: increases in installed renewable capacity do not translate proportionally into reliable supply during peak demand.

A critical structural constraint emerges when comparing installed renewable capacity with effective capacity during peak demand. Installed capacity refers to maximum potential output under ideal conditions, while effective capacity reflects the amount that can reliably support the grid during peak hours (KEEI, 2018[13]). As renewable generation varies by weather and time of day, its effective capacity is much lower than its installed capacity (Paik et al., 2021[14]). Although renewables are projected to reach 121.9 GW by 2038, or 45.5% of total installed capacity, only 13.5 GW is expected to be available during peak demand, equivalent to 8.5% of total effective capacity.

Solar PV and wind account for most planned renewable capacity in 2038, at 77.2 GW and 40.7 GW respectively (Table 1-2), but their effective capacity is projected at only 11.0 GW and 1.0 GW (Table 1-3). Closing this gap will require grid reinforcement, expanded storage, greater system flexibility, and reduced curtailment.

13 Korea Energy Economics Institute, Energy Supply Brief, Vol. 5-1, January 2018.

14 Paik C, Chung Y, Kim YJ. "ELCC-based capacity credit estimation accounting for uncertainties in capacity factors and its application to solar power in Korea." Renewable Energy, 2021.

Table 1-2. Installed Capacity of Renewable Energy by Source (2025–2038)

Installed Capacity (MW)	2025	2030	2035	2038
Solar PV	31,964	55,675	70,811	77,203
Wind	3,017	18,281	32,972	40,671
Hydro	1,909	1,909	1,909	1,909
Marine	256	256	256	256
Biomass	1,852	1,852	1,852	1,852
Total Renewables	38,997	77,972	107,799	121,890
Share of RE (%)	24.3%	37.8%	43.6%	45.5%

Table 1-3. Effective Capacity of Renewable Energy by Source (2025–2038)

Effective Capacity (MW)	2025	2030	2035	2038
Solar PV	4,571	7,962	10,126	11,040
Wind	72	439	791	976
Hydro	405	405	405	405
Marine	0	0	0	0
Biomass	1,083	1,083	1,083	1,083
Total Renewables	6,131	9,887	12,404	13,503
Share of RE (%)	4.8%	7.2%	8.2%	8.5%

1.2 2030 and 2035 NDCs and Emissions Reduction Progress

In this section, we examine the sectoral and annual reduction targets under the 2030 NDC, the progress made to date, and the background, key elements, and mitigation strategies of the recently released 2035 NDC, with a focus on the power and heat sector.

1.2.1 2030 NDC Reduction Target and Progress in the Power Sector

In October 2021, the Korean government strengthened its 2030 Nationally Determined Contribution (NDC 2.0), setting a target to reduce national greenhouse gas emissions to 436.6 million tons CO_2e by 2030 – a 40% reduction from 2018 levels (Joint Ministries, 2021). This target was subsequently incorporated into the 2023 National Framework Plan for Carbon Neutrality and Green Growth.

While the overall emissions target remained unchanged in the updated 2023 NDC, mitigation requirements were reallocated across sectors, with a portion shifted from industry to the power and heat sector to reflect differences in technological feasibility.

As a result, the power and heat sector is assigned a central role in achieving the 2030 target. Its emissions must fall from 269.6 million tons in 2018 to 145.9 million tons by 2030, a reduction of approximately 45.9%. This represents around 42.5% of total national emissions reductions, despite the sector accounting for only 37% of emissions in 2018, underscoring its importance as a primary driver of decarbonisation.

Table 1-4. 2030 NDC – Sectoral GHG Reduction Targets and Reduction Rates (※1996 IPCC Guideline)

Sector		2018 (Base Year)	2030 NDC 2.0 (Oct. 2021)	Updated 2030 NDC 2.0 (Apr. 2023)	
Total Emissions ($MtCO_2e$)		**727.6**	**(net) 436.6**	**(net) 436.6**	**40.0%**
Emissions	Power and Heat	269.6	149.9	145.9	45.9%
	Industry	260.5	222.6	230.7	11.4%
	Building	52.1	35.0	35.0	32.8%
	Transport	98.1	61.0	61.0	37.8%
	Agriculture, Livestock, and Fisheries	24.7	18.0	18.0	27.1%
	Waste	17.1	9.1	9.1	46.8%
	Hydrogen	–	7.6	8.4	–
	Fugitive emissions, etc.	5.6	3.9	3.9	–
Absorption and Removal	Carbon Sinks	-41.3	-26.7	-26.7	–
	CCUS	–	-10.3	-11.2	–
	International Reduction	–	-33.5	-37.5	–

Source: Joint Ministries (2023)

The emissions pathway to 2030 indicates a relatively gradual reduction in the early years, followed by a sharp acceleration after 2026. Emissions are projected to fall below 200 million tons by 2028, with a further rapid decline required to meet the 2030 target.[15] Achieving this trajectory will require concentrated mitigation efforts, including accelerated coal phase-out and a substantial expansion of renewable energy.

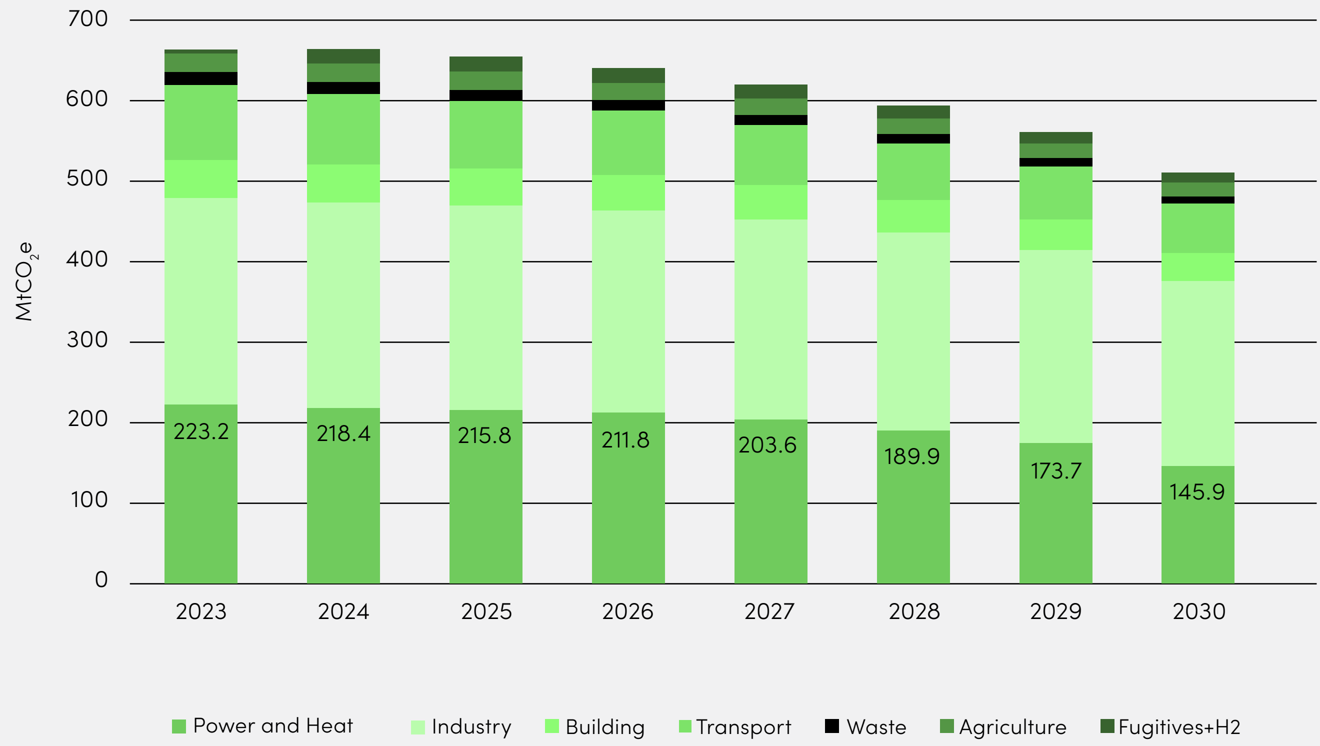
While the industrial sector is expected to deliver more modest reductions, reflecting structural and technological constraints, the power and heat sector is considered more capable of achieving rapid emissions cuts through fuel switching and increased deployment of carbon-free generation.

Recent performance suggests that the sector is broadly on track in the short term. Emissions have declined steadily since 2018, with provisional reductions of approximately 23% by 2024.[16] Current emissions levels are below planned targets, indicating that near-term progress is slightly ahead of schedule.

15 Joint Ministries (Nov 10, 2025), reduction of greenhouse gases by 53-61 percent by 2035 compared to 2018

16 The Greenhouse Gas Inventory and Research Center of Korea (GIR) has been estimating and publicly releasing preliminary national greenhouse gas emissions approximately one year ahead of the final official figures on an annual basis since 2020. While the final emissions figures for 2024 are scheduled to be confirmed and announced in the second half of 2026, the preliminary emissions for 2024 were released on August 20, 2025 (Ministry of Environment press release, August 20, 2025, "Preliminary National Greenhouse Gas Emissions for 2024: 691.58 million tons").

Figure 1-4. Sectoral Emission Targets of Updated NDC 2.0 (※1996 IPCC Guideline)



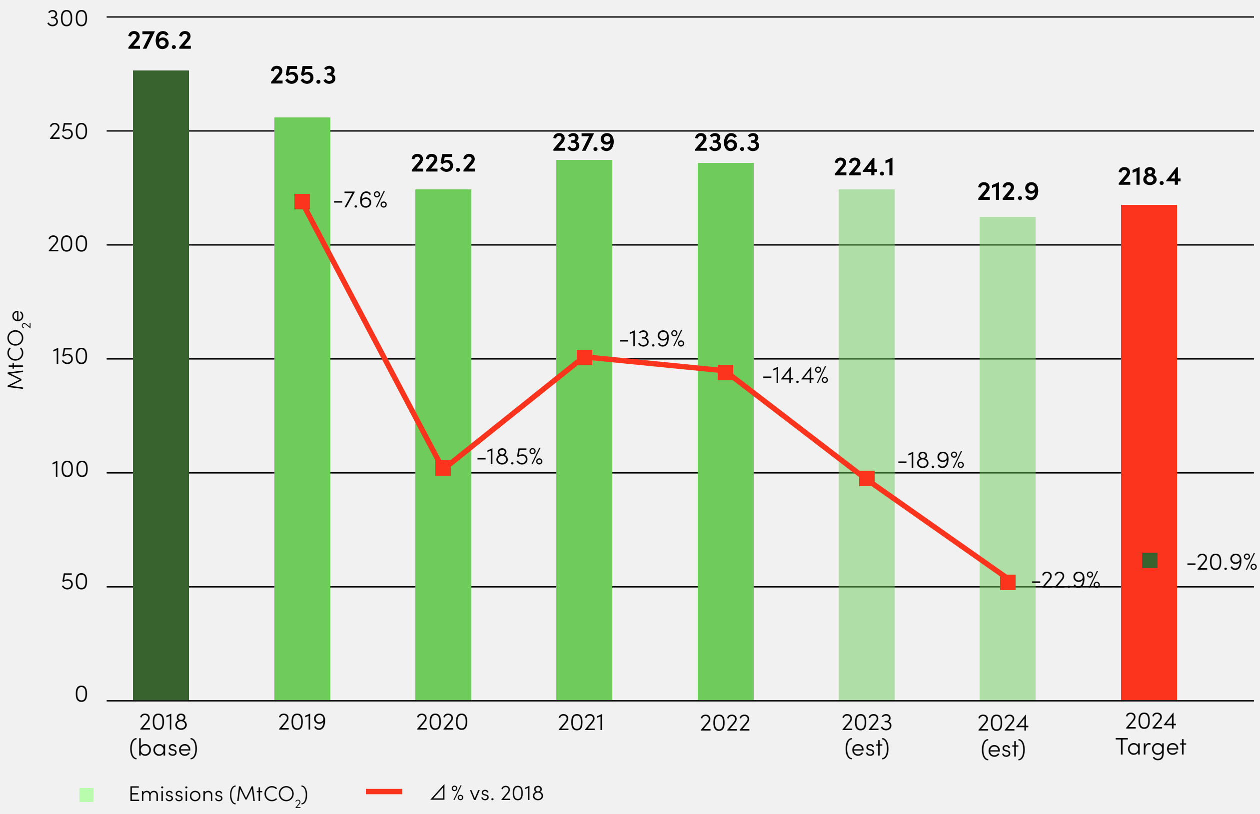
However, these assessments depend on the emissions accounting framework used. Estimates based on the 2006 IPCC Guidelines differ from those under the earlier 1996 Guidelines, resulting in higher reported emissions levels for the power and heat sector. While the overall trend of emissions reduction remains consistent, this highlights the importance of methodological assumptions in interpreting progress.

Despite strong recent performance, significant challenges remain. Renewable energy accounted for only 9% of generation in 2024 - well below the OECD average of 34.4% - and progress in other sectors, such as transport, remains uneven. As mitigation requirements increase sharply toward 2030, sustained acceleration in renewable deployment, coal phase-out, and demand-side measures will be essential to maintain progress toward the NDC target.

1.2.2 Current Status and Key Features of the 2035 NDC

The Korean government finalized its 2035 greenhouse gas reduction target (hereinafter the "2035 NDC target") through deliberation and approval at the Cabinet Meeting on Nov 11, 2025. The government announced the target at COP30 in Belém, Brazil in the same month, and formally submitted it to the UN at the end of 2025 (Ministry of Climate, Energy

Figure 1-5. GHG Emission Trends in the Power and Heat Sector (※1996 IPCC Guidelines)



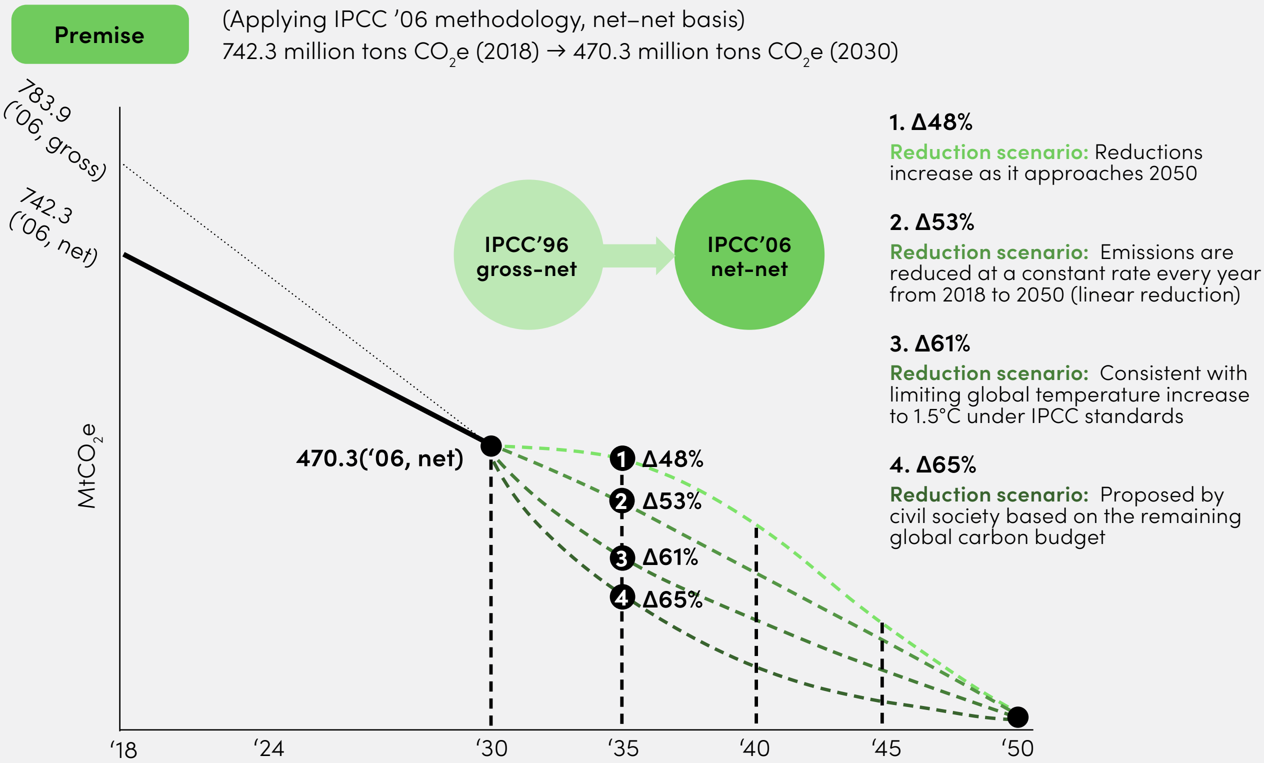
and Environment, Nov 11, 2025).[17] The finalized 2035 NDC target sets a range-based goal to reduce national net greenhouse gas emissions by 53 to 61 percent from 2018 levels (approximately 742.3 million tons) by 2035. Unlike the previous 2030 NDC, which established a single target of a 40 percent reduction from 2018, the 2035 NDC adopts an upper–lower range to reflect policy flexibility and uncertainties in future conditions.

The preparation of the 2035 NDC target involved an extensive stakeholder engagement process, including public discussions by sector and a comprehensive national forum with experts, industry, and civil society (**Figure 1-6**). The government reviewed multiple reduction-rate scenarios—48 percent, 53 percent, 61 percent, and 65 percent - and selected the final proposal through this consultative process. According to the government, the range-based target reflects a balance between the 65 percent reduction advocated by civil society and the 48 percent scenario derived from sectoral mitigation potential, while also considering the Constitutional Court's decision and international recommendations (Ministry of Climate, Energy and Environment, Nov 11, 2025).

Based on materials from the national public discussion forum for the 2035 NDC, the upper bound of 61 percent corresponds to the IPCC-recommended pathway consistent with limiting global warming to 1.5°C, while the lower bound of 53 percent represents

17 Ministry of Climate, Energy and Environment Press Release (Nov 11, 2025), "2035 National Greenhouse Gas Reduction Target and the Fourth Phase Emissions Trading Scheme Allocation Plan Approved at the State Council Meeting"

Figure 1-6. Four Proposed GHG Reduction Pathways for South Korea's 2035 NDC



Source: Joint Ministries (2025.09.23)[18]

the linear reduction rate from the 2018 baseline toward carbon neutrality in 2050 (**Figure 1-6**). Specifically, the 53 percent reduction target (lower bound) implies a national net emissions level of approximately 348.9 million tons in 2035, while the 61 percent reduction target (upper bound) corresponds to a net emissions level of 289.5 million tons (**Table 1-5**).

By setting a 53–61% reduction range rather than a single target, the Korean government commits to at least a 53% reduction while retaining flexibility to pursue deeper cuts, depending on technological progress and policy implementation. This approach reflects the Paris Agreement's "Principle of Progression,"[19] which requires countries to submit increasingly ambitious NDCs every five years. Domestically, a 2024 Constitutional Court ruling[20] requiring the inclusion of intermediate targets has further strengthened the need for a clear long-term mitigation pathway toward carbon neutrality by 2050.

18 Joint Ministries (Sep 23, 2025) Presentation materials for the "Public Consultation Forum on the 2035 NDC Power Sector"

19 The "Principle of Progression" is stipulated in in Article 4, Paragraph 3 of the Paris Agreement, which states: "Each Party's successive nationally determined contribution will represent a progression beyond the Party's then current nationally determined contribution and reflect its highest possible ambition, …"

20 Constitutional Court of Korea (Decision rendered on August 29, 2024, Case Nos. 2020Hun-Ma389 et al.), Constitutional complaint challenging the constitutionality of Article 42(1)1 of the Framework Act on Low Carbon, Green Growth; Case concerning the State Greenhouse Gas Reduction Target for Responding to the Climate Crisis

Table 1-5. 2035 NDC - Sectoral GHG Reduction Targets and Reduction Rates (※ 2006 IPCC Guideline)

Sector		2018 (Base Year)	2035 NDC 3.0			
			Lower bound: Δ53%		Upper bound: Δ61%	
Net Emissions (Δ% vs. 2018) ($MtCO_2e$)		**742.3**	**348.9**	**(-53.0%)**	**289.5**	**(-61.0%)**
Emissions	Power and Heat	283.0	88.3	(-68.8%)	70.0	(-75.3%)
	Industry	260.5	209.1	(-24.3%)	190.6	(-31.0%)
	Building	52.1	24.2	(-53.6%)	22.8	(-56.2%)
	Transport	98.8	39.3	(-60.2%)	36.8	(-62.8%)
	Refrigerant	23.1	27.4	(+18.6%)	25.5	(+10.4%)
	Agriculture, Livestock, and Fisheries	27.6	20.0	(-27.5%)	19.5	(-29.3%)
	Waste	19.4	9.2	(-52.6%)	9.0	(-53.6%)
	Fugitive emissions, etc.	3.7	2.6	(-29.7%)	2.4	(-35.1%)
	Hydrogen	0	8.1	-	6.5	-
Absorption and Removal	Carbon Sinks	-41.6	-38.3	-	-39.3	-
	CCUS	-	-11.2	-	-20.3	-
	International Reduction	-	-29.8	-	-34.0	-

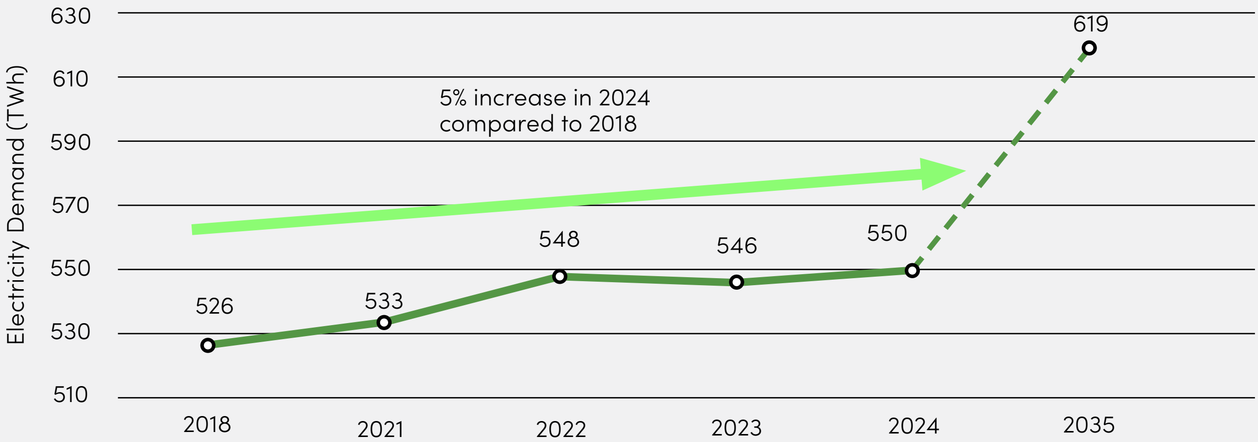
Source: Ministry of Climate, Energy and Environment (MCEE, 2025.11.11)[16]

Against this domestic and international backdrop, Korea's 2035 NDC was finalized as a range-based mitigation target, setting 53 percent - the reduction rate derived from the linear pathway - as the lower bound and presenting an upper bound alongside it. The 2035 NDC officially submitted to the United Nations presents only a single-year target for 2035 and does not specify annual mitigation trajectories corresponding to the upper and lower bounds that were discussed during the NDC formulation process. In light of the Constitutional Court's ruling and the growing call for strengthening the medium- to long-term mitigation framework, it will be increasingly important for future NDCs, which are to be established on a five-year cycle, as well as related national plans such as the BPLE to maintain consistency with the 2050 carbon neutrality goal and a coherent long-term mitigation pathway. Accordingly, a key policy task for the Korean government will be to systematically design sectoral and annual medium- to long-term reduction targets while strengthening the institutional and financial foundations necessary to ensure the effective achievement of these planned goals.

1.2.3 Mitigation Targets and Strategies for the Energy Transition Sector under the 2035 NDC

The sectoral reduction targets required to achieve the lower- and upper-bound goals of the finalized 2035 NDC, released on Nov 11, 2025, are presented in Table 1-5 (Ministry of

Figure 1-7. 2035 NDC Scenario: Power Demand and Generation Mix



Despite demand-side management efforts such as improvements in energy efficiency, electricity demand is projected to increase due to electrification (e.g., high-tech industries such as AI, semiconductors and electric vehicles).

			2035		
Electricity Generation (TWh)	**2018**	**2024**	**48% reduction scenario**	**53% reduction scenario**	**61-65% reduction scenario**
Total	571	596	693	705~711	~739
Renewables	21 (4%)	54 (9%)	202 (29%)	222~233 (32~33%)	270~ (37%~)
Coal	239 (42%)	167 (28%)	55 (8%)	50~44 (7~6%)	~35 (~5%)
LNG	153 (27%)	167 (28%)	126 (18%)	113~105 (16~15%)	~83 (~11%)
Nuclear	134 (23%)	189 (32%)	236 (34%)	222~324 (32~33%)	231~ (31%~)

Source: Joint Ministries (2025.09.23)

Climate, Energy and Environment, Nov 11, 2025)[21]. Examination of the sectoral reduction rates shows that relatively high levels of mitigation are required in the power and heat sector and in energy-consuming sectors such as buildings and transport. In particular, the power and heat sector - which accounts for the largest share of domestic emissions - is expected to achieve a reduction rate approximately 15 percentage points higher than the national average. Specifically, the sector must reduce emissions from 283 million tons in 2018 by 68.8 percent (lower bound) to 75.3 percent (upper bound), resulting in a 2035 emissions level of approximately 70.0 to 88.3 million tons.

Although the finalized 2035 NDC announced recently does not include detailed implementation measures such as the projected power generation mix, the public consultation process conducted during its development discussed the tentative 2035 target for the power sector, the expected power mix, and major mitigation strategies (Joint Ministries, Sep 23, 2025). As shown in the left-side graph of Figure 1-7, electricity demand in 2035 is projected to rise to 619 TWh due to rapid growth in advanced industries - including AI and semiconductors - and the electrification of the transport sector driven by expanded adoption of electric vehicles. This surge in electricity demand

21 The final 2035 NDC document submitted to the United Nations in December 2025 outlines the overall national mitigation target (a 53–61% reduction from 2018 levels) and general sectoral mitigation directions but does not include detailed quantitative sectoral pathways. The sectoral reduction figures presented in Table 1-5 are derived from publicly available presentation materials from the "Public Consultation on the 2035 NDC: Power Sector."

centered on electrification significantly increases the mitigation burden on the power sector and necessitates a much faster transition of the generation mix than previously anticipated. In response, the government presented two main strategies for reducing emissions in the power sector. First, it outlined a pathway to structurally reduce fossil fuel–based generation and substantially increase the share of carbon-free energy such as renewable energy and nuclear power through improvements in the power generation mix. Second, it proposed reducing non-energy emissions by replacing SF_6 gas used in distribution and substation equipment with environmentally friendly alternatives.

As part of the core strategy to improve the power generation mix, coal-fired power generation will be phased down as outlined in the 11th BPLE, with 40 of the existing 61 units scheduled for retirement by 2038, leaving only 21 units in operation. In addition, as part of the Lee Jae-myung administration's national policy agenda for a "renewable energy–centered energy transition," the government announced plans to establish an "Early Coal Phase-out Roadmap for 2040." The government also intends to maintain the share of nuclear power at around the 30-percent level to secure a stable supply of carbon-free electricity. Meanwhile, natural gas (LNG) generation will be gradually replaced - along with coal - by renewable energy over the longer term, in line with the government's strategy to transition to zero-carbon power sources. Accordingly, the share of LNG generation is projected to decline from 28 percent in 2024 to below 16 percent by 2035.

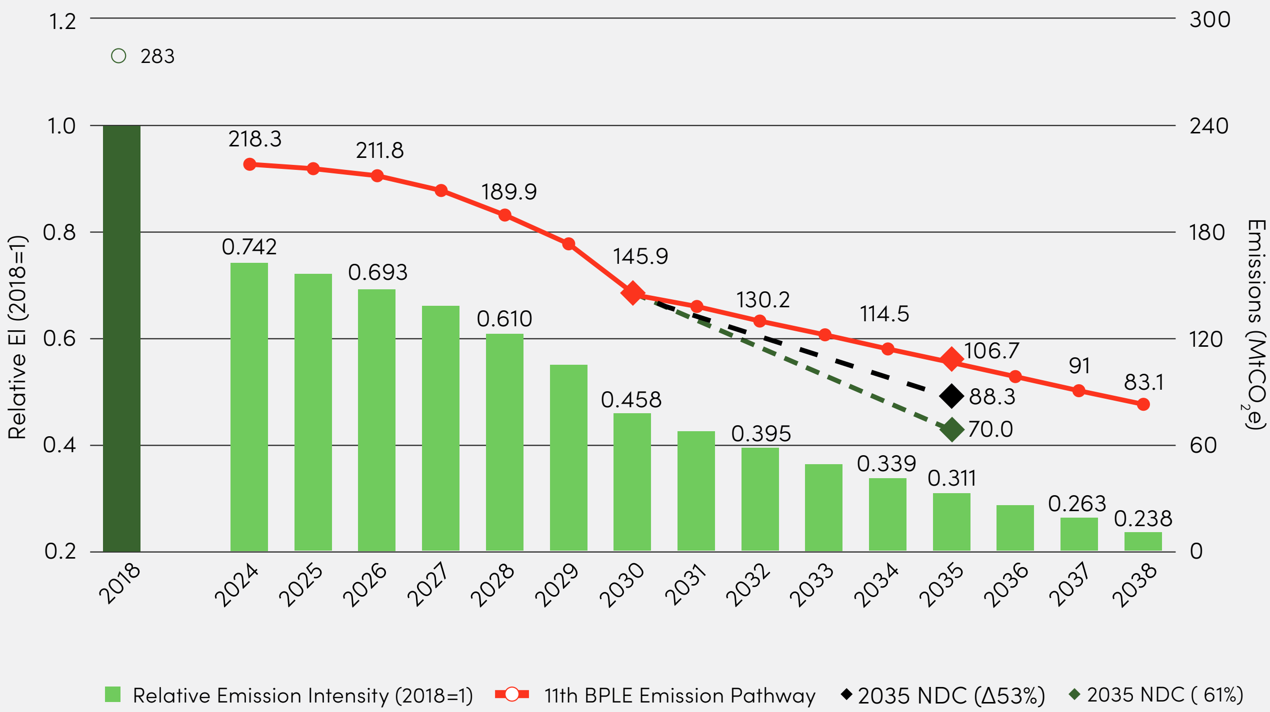
In contrast, the renewable energy targets have been significantly revised upward relative to the 2035 target presented in the 11th BPLE - namely, a 26 percent share (179.9 TWh of generation and 107.8 GW of capacity). According to the power-sector presentation from the public consultation process for the 2035 NDC[22], achieving the lower-bound 53 percent reduction target requires increasing the renewable share in the 2035 power generation mix to 32–33 percent (222–233 TWh). For the upper-bound 61 percent reduction target, the renewable share must rise further to approximately 37 percent (270 TWh) (see **Figure 1-7**).

To meet these targets, the government proposes a rapid scale-up of renewable deployment, with annual additions of around 11 GW through 2030 and 10–12 GW between 2030 and 2035, raising total capacity to 150–160 GW. This represents a significant increase on the 11th BPLE and far exceeds historical installation rates of around 3.8 GW per year, raising concerns about feasibility given ongoing constraints in permitting, grid capacity, siting, and community acceptance.

In summary, Korea's 2035 NDC presents a strengthened national greenhouse gas reduction pathway beyond 2030 by centering deep mitigation efforts in the power sector while pursuing complementary reductions across other sectors. The target is closely linked with the country's renewable energy deployment goals, and the achievement of future renewable expansion policies is expected to become a core determinant of NDC attainment.

22 It should be noted that there are some discrepancies between the detailed mitigation targets presented under the 53% and 61% scenarios in the public consultation presentation materials—including absolute emission reductions and reduction rates relative to 2018 levels—and the mitigation targets for the Power sector as set out in the finalized 2035 NDC.

Figure 1-8. Power and Heat Sector Emission Pathway under the 11th BPLE and NDCs



1.3 Policy Coherence Between 2035 NDC, 11th BPLE, and Global RE standards

As examined above, Korea's 2035 NDC requires the most rapid decarbonization in the power and heat sector. Establishing clear, step-by-step milestones for power-sector decarbonization and closely aligning the sector's medium- to long-term transition strategy with the 2035 NDC are essential conditions for achieving effective greenhouse gas reductions. In this section, we assess the alignment between the 2035 NDC mitigation measures for the power sector and the 11th BPLE and compare Korea's trajectory with global benchmarks for renewable energy.

1.3.1 Alignment between Electricity Sector Targets in the 11th BPLE and the 2035 NDC

In the 11th Basic Plan for Long-term Electricity Supply and Demand (2024–2038), the emissions pathway for the power and heat sector sets targets of 145.9 million tons for 2030 and 83.1 million tons for 2038.

For 2024–2030, the pathway aligns with the 10th BPLE and the Framework Plan for Carbon Neutrality and Green Growth, ensuring consistency with existing climate and energy policies, including the 2030 NDC. For 2031–2038, the trajectory is based on linear interpolation between the 2030 and 2036 targets in the 10th BPLE.

Following the adoption of the 2035 NDC, the government selected a more ambitious emissions reduction scenario for 2038 (83.1 million tons rather than 95.8 million tons), which was incorporated into the final 11th BPLE (Ministry of Trade, Industry and Energy, 2024). Under this pathway, emissions in 2035 are projected to reach approximately 106.7 million tons (Figure 1-8).

Table 1-6. Required Emission Reductions: 11th BPLE vs. 2035 NDC

	2030 and 2035 Emission Targets ($MtCO_2e$)		2030 → 2035 Reduction ($MtCO_2e$)		2030 → 2035 Reduction Rates (%)	
Year	**2030**	**2035**	**Total**	**Yearly**	**Total**	**Yearly**
11th BPLE	145.9	106.7	39.2	7.84	26.9%	6.0%
2035 NDC (53%)	145.9	88.3	57.6	11.52	39.5%	9.5%
2035 NDC (61%)	145.9	70.0	75.9	15.18	52.0%	13.6%

However, this trajectory falls short of the reductions required under the 2035 NDC. Achieving the lower-bound 53% target requires emissions to decline from 145.9 million tons in 2030 to 88.3 million tons in 2035—an approximately 40% reduction over five years. The upper-bound 61% target requires an even steeper reduction to 70.0 million tons, equivalent to a 52% decline over the same period.

A direct comparison (Table 1-6) shows that the 2035 NDC targets are significantly more ambitious than the 11th BPLE pathway. The lower-bound target is 18.4 million tons below the BPLE projection, while the upper-bound target is 36.7 million tons lower. This indicates that the current BPLE pathway is not aligned with the 2035 NDC and that substantially faster emissions reductions will be required, particularly after 2030.

Between 2030 and 2035, the 11th BPLE assumes annual reductions of approximately 7.8 million tons, whereas the NDC requires reductions of 11.5–15.2 million tons per year. Similarly, the average annual reduction rate under the BPLE is around 6%, compared with up to 13.6% under the upper-bound NDC scenario - more than double.

Against a backdrop of rising electricity demand, achieving absolute emissions reductions will require a sustained decline in emission intensity. This will depend on expanding low-carbon generation and reducing reliance on fossil fuels.

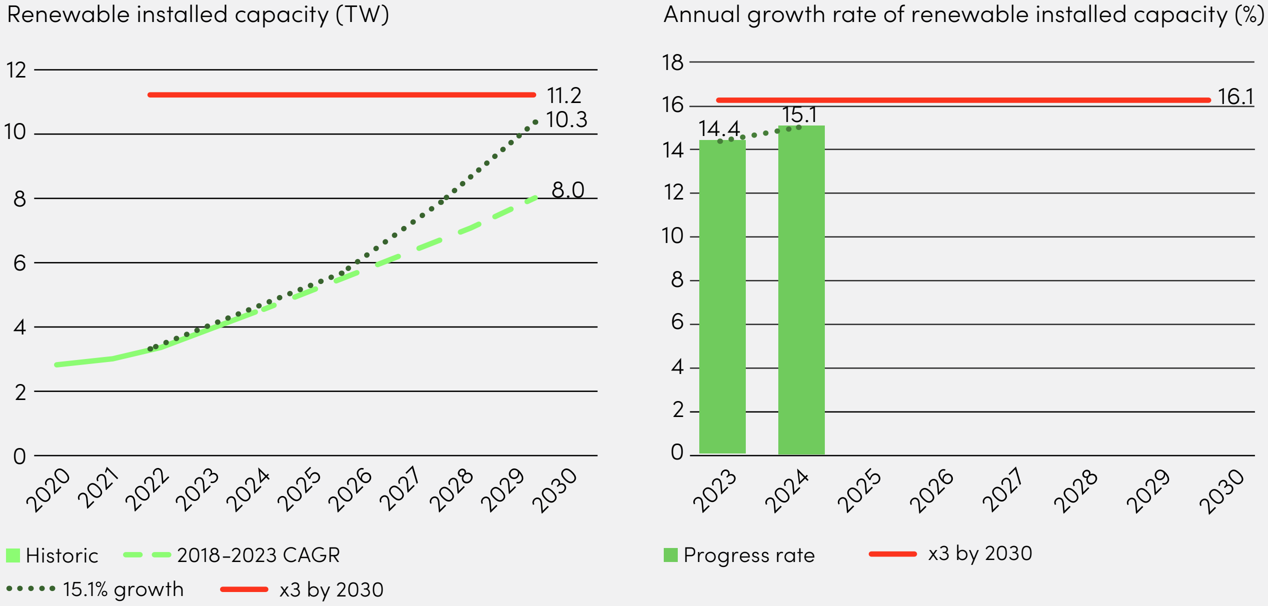
Analysis of emission intensity trends (Figure 1-8) indicates that intensity must fall by approximately 54% from 2018 levels by 2030, and by a further 44–55% between 2030 and 2035. This would reduce emission intensity to around 20–26% of 2018 levels. This suggests that renewable expansion alone will not be sufficient. Additional measures, including accelerated coal phase-out, improved grid efficiency, and system-level reforms, will be required to deliver the necessary reductions.

Overall, the strengthened 2035 NDC exposes a clear misalignment with the current 11th BPLE. The forthcoming 12th BPLE (expected in 2026) will therefore need to revise demand projections, the generation mix, and emissions pathways to ensure consistency with the NDC.

Achieving the required reduction rates will depend on aligning renewable deployment, coal phase-out, grid investment, and demand-side management strategies. Without such alignment, structural constraints are likely to limit progress in the power and heat sector after 2030. This misalignment has also become a subject of public debate. Civil society organizations have criticized the 11th BPLE for insufficient ambition for renewable energy and have called for greater transparency and participation in the development of the 12th BPLE.

At the same time, some industry stakeholders and system operators have raised concerns about grid stability, citing the variability of renewable generation and the risks associated with rapid coal phase-out. Balancing renewable expansion with system reliability and supply security will therefore be a central challenge for future power-sector planning.

Figure 1-9. Global Renewable Installed Capacity Growth and the Gap to the 2030 Tripling Target



Notes: CAGR = compound annual growth rate; TW = terrawatt.

Source: IRENA (2025), Renewable Energy Highlights from Renewable Energy Statistics 2025

1.3.2 Global Benchmarks and NDC Targets

This section assesses how Korea's 2030 and 2035 renewable energy targets align with global benchmarks and deployment trends. This target is derived from analyses of 1.5°C pathways conducted by major international organizations—including the IPCC, IEA, and IRENA—as well as the findings of the first Global Stocktake (GST). It calls for expanding global cumulative renewable energy capacity to more than 11.2 TW by 2030, approximately three times the 2022 level of 3.7 TW.

Global renewable capacity is expanding rapidly, with 582 GW added in 2024 and average annual growth reaching 15.1% (IRENA, 2025).[23] However, according to major international energy organizations such as IRENA (2024)[24] and the IEA (2024)[25], fossil fuels still account for more than 70 percent of primary energy supply across major global economies. Achieving global tripling would therefore require an average annual growth rate of roughly 16.1 percent, indicating that additional acceleration is needed.

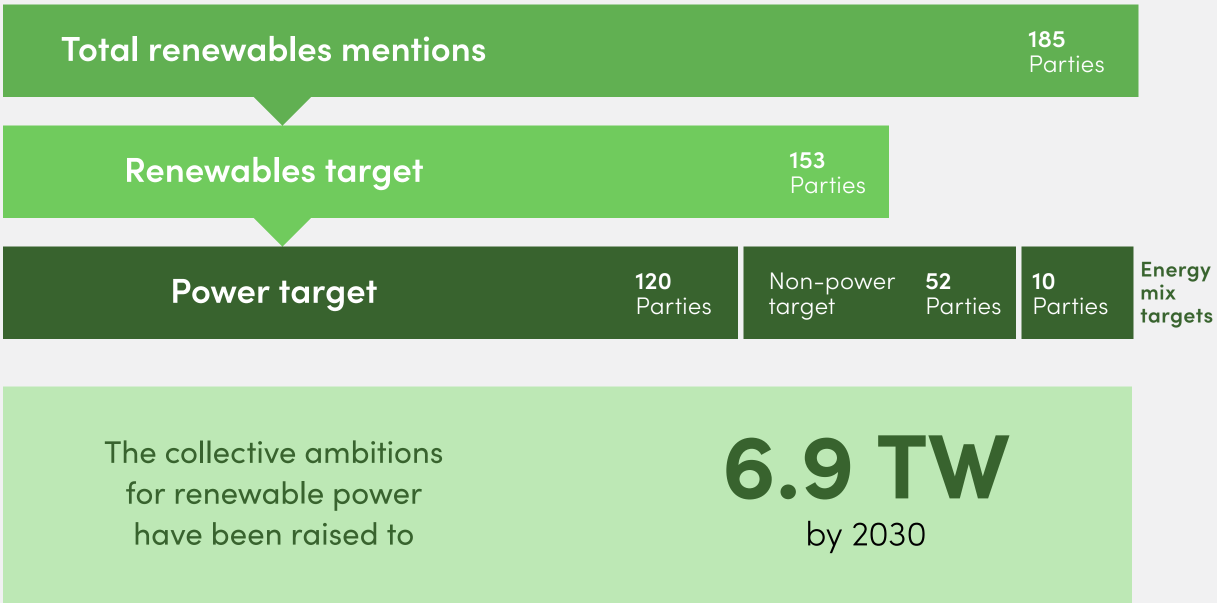
Analysis of submitted NDCs suggests that current global commitments remain insufficient. Even if fully implemented, projected renewable capacity falls significantly short of the level required to meet the 2030 tripling target. Nevertheless, UNEP concludes that the current level of ambition reflected in NDCs remains insufficient to ensure achievement of the global 2030 renewable energy tripling target.

23 IRENA (2025), Renewable Energy Highlights from Renewable Energy Statistics 2025

24 IRENA (2024), World Energy Transitions Outlook 2024: 1.5°C Pathway, International Renewable Energy Agency, Abu Dhabi.

25 IEA (2024), Renewables 2024, IEA, Paris www.iea.org/reports/renewables-2024, Licence: CC BY 4.0

Figure 1-10. Renewable Energy Targets in NDCs Globally



As of 5 November 2025

Source: IRENA article (2025.11.12)

The IRENA article (Nov 12, 2025), which analyzed NDC 2.0 submissions and 72 NDC 3.0 submissions filed as of Nov 5, 2025, reports that 185 NDCs reference renewable energy and that 153 of them include quantifiable renewable energy targets (see Figure 1-10). When aggregating the renewable capacity targets included in these NDCs, global renewable energy capacity is projected to rise from approximately 4.4 TW in 2024 to around 6.9 TW in 2030. This indicates a gap of roughly 4–4.5 TW relative to the level required to achieve the global RE Tripling target - even if all countries fully implement their stated goals[26].

1.3.3 Korea in its International Context

Against this backdrop, it is necessary to assess whether Korea's renewable energy expansion targets align with global targets and deployment trends. The Korean government officially finalized the sectoral reduction targets for the 2035 NDC on Nov 11, 2025 (Ministry of Climate, Energy and Environment, Nov 11, 2025). According to the power-sector mitigation targets presented during the public consultation process for the 2035 NDC, the government plans to substantially expand renewable energy generation capacity to 100 GW by 2030 and to 150–160 GW by 2035.

Specifically, the plan calls for installing approximately 11 GW of new renewable capacity per year through 2030 to reach a cumulative 100 GW, followed by an additional 10–12 GW annually over the subsequent five years to reach 150–160 GW by 2035 (Joint Ministries,

26 IRENA's analysis is based on NDC 3.0 submissions received as of November 5, 2025. Subsequent submissions around COP30 are not reflected in Figure 1-10; therefore, the aggregate renewable energy capacity target may be subject to revision as additional NDCs are incorporated.

Table 1-7. Korea's Renewable Power Expansion: Status and Required Growth Rates

<table>
<tr><th colspan="2">Category</th><th>Cumulative Capacity (GW)</th><th>Annual Additions (GW)</th><th>Multiple vs. 2022</th><th>Annual Growth Rate (%)</th></tr>
<tr><td colspan="2">2022 Actual</td><td>31.996</td><td>3.678</td><td>1.00</td><td>10.1%</td></tr>
<tr><td colspan="2">2023 Actual</td><td>35.962</td><td>4.002</td><td>1.12x</td><td>12.4%</td></tr>
<tr><td rowspan="3">NDC 3.0</td><td>2030 Target</td><td>100</td><td>9.15/yr (23→30)</td><td>3.13x</td><td>15.6%/yr (23→30)</td></tr>
<tr><td rowspan="2">2035 Target</td><td>150</td><td>10/yr (30→35)</td><td>4.69x</td><td>13.0%/yr (23→35)</td></tr>
<tr><td>160</td><td>12/yr (30→35)</td><td>5.00x</td><td>13.6%/yr (23→35)</td></tr>
</table>

Source: Author's calculation based on Joint Ministries (2025.09.23) and KEA (2024)

Table 1-8. Progress in Renewable Electricity Shares over 2015–2024 and 2030 Target

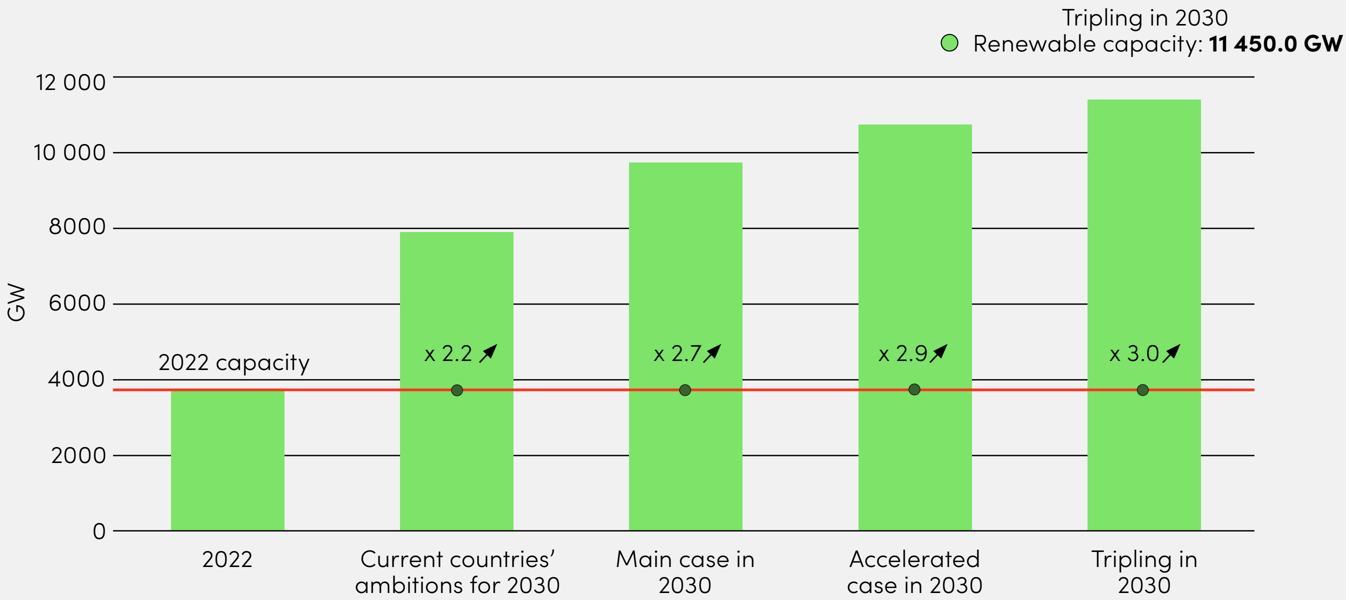
Country	RE Share in 2015	RE Share in 2024	Ratio (2024/2015)	10-year CAGR (2015-2024)	RE Share Target (2030 or 2035)
G20	22.44%	32.25%	1.44	4.11%/yr	-
USA	13.63%	24.07%	1.77	6.52%/yr	(2030) 50-60%
EU	29.82%	47.74%	1.60	5.36%/yr	(2030) 69%
UK	24.59%	50.65%	2.06	8.36%/yr	(2030) CE 95+%
Germany	29.44%	58.32%	1.98	7.89%/yr	(2030) 80%
France	16.0%	26.21%	1.64	5.63%/yr	(2030) 35%
Poland	13.81%	29.84%	2.16	8.95%/yr	(2030) 51.8%
Japan	14.96%	22.94%	1.53	4.86%/yr	(2030) 36 - 38%
Mexico	15.54%	21.12%	1.36	3.47%/yr	(2030) 34.7 %
South Korea	2.77%	9.71%	3.51	14.94%/yr	(2035) 32 -37%

Source: Ember (2025) Electricity Data Explorer

Sep 23, 2025). This represents more than a threefold increase by 2030 and a fivefold increase by 2035 compared with the 2022 capacity level of 31.996 GW. These targets are significantly higher than the 78 GW projected for 2030 in the 11th BPLE and reflect a more aggressive deployment strategy consistent with Korea's carbon neutrality commitment and the administration's policy pledges.

To achieve the 100-GW target for 2030 set out in NDC 3.0, Korea would need to add approximately 9.15 GW of new capacity per year on average between 2023 and 2030, equivalent to a **compound annual growth rate (CAGR)** of 15.6 percent. This growth rate is closely aligned with the global average annual increase of around 16.1 percent required to achieve the RE Tripling target (IRENA, 2025) (see Figure 1-9). If this target is met, Korea's renewable energy capacity would increase by approximately 3.13 times between 2022 and 2030 and by around 4.7 to 5 times by 2035. This expansion rate significantly exceeds the global averages projected by the IEA - 2.7 times under the reference scenario and 2.9 times under a more accelerated effort scenario (see Figure 1-11). In other words, while

Figure 1-11. 2030 Renewable Capacity Growth by IEA Scenarios



Source: (IEA, 2024)[27]

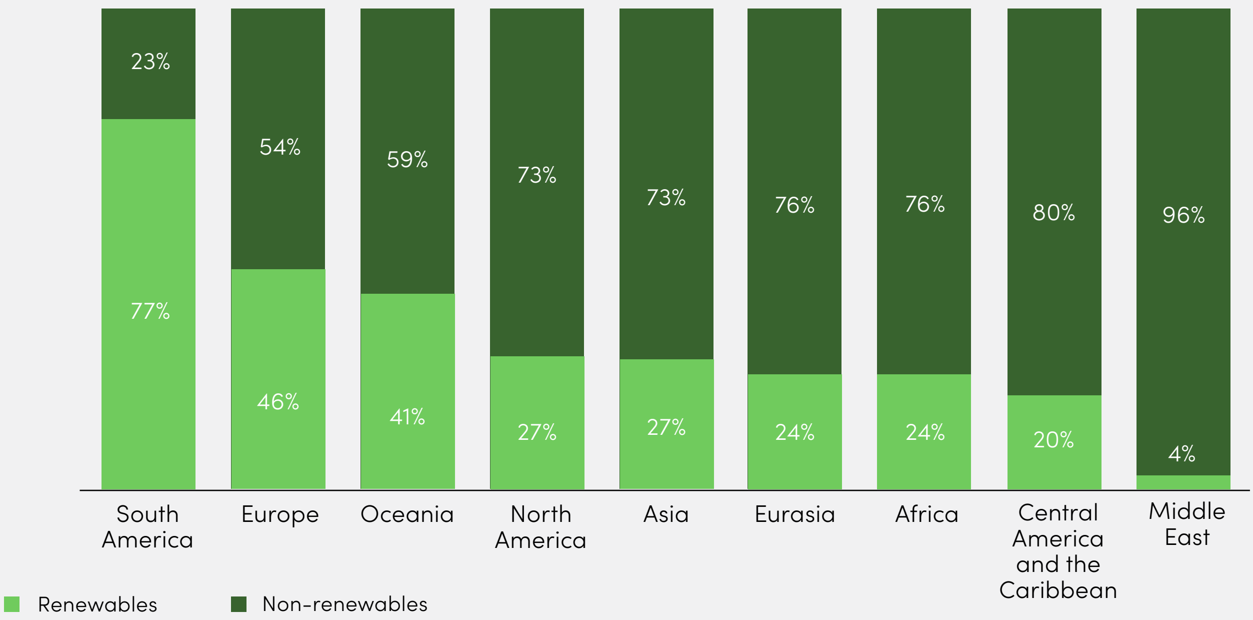
Korea's absolute level of renewable capacity remains lower than that of major economies, the relative speed of its energy transition is assessed to be broadly consistent with the global RE Tripling trajectory toward 2030.

In addition to installed capacity, renewable energy generation share provides another indicator for comparing Korea's targets with international levels. As shown in **Figures 1-12** and **1-13**, substantial differences exist across continents and countries in terms of renewable energy generation shares (IRENA, 2025). Korea's renewable energy generation share remains below 10 percent as of 2024, placing it at a significantly lower level compared with most countries (see **Figure 1-13**)

Figure 1-13 and **Table 1-8** present changes in the renewable energy generation share over the past decade (2015–2024) for the G20, US, EU, major European countries, Japan, Korea, and Mexico. The G20 is included as the core group shaping global economic, energy, and emissions structures, while the EU and the United States are considered comparative benchmarks as climate leaders driving the global energy transition. In addition, the United Kingdom and Germany - representative European countries that have advanced power-sector decarbonization - are included, as well as France, which

27 IEA (2024), Renewable capacity growth and the gap to global tripling, 2022-2030, IEA, Paris www.iea.org/data-and-statistics/charts/renewable-capacity-growth-and-the-gap-to-global-tripling-2022-2030, Licence: CC BY 4.0

Figure 1-12. Renewable Electricity Generation by Region in 2024



Source: (IRENA, 2025)

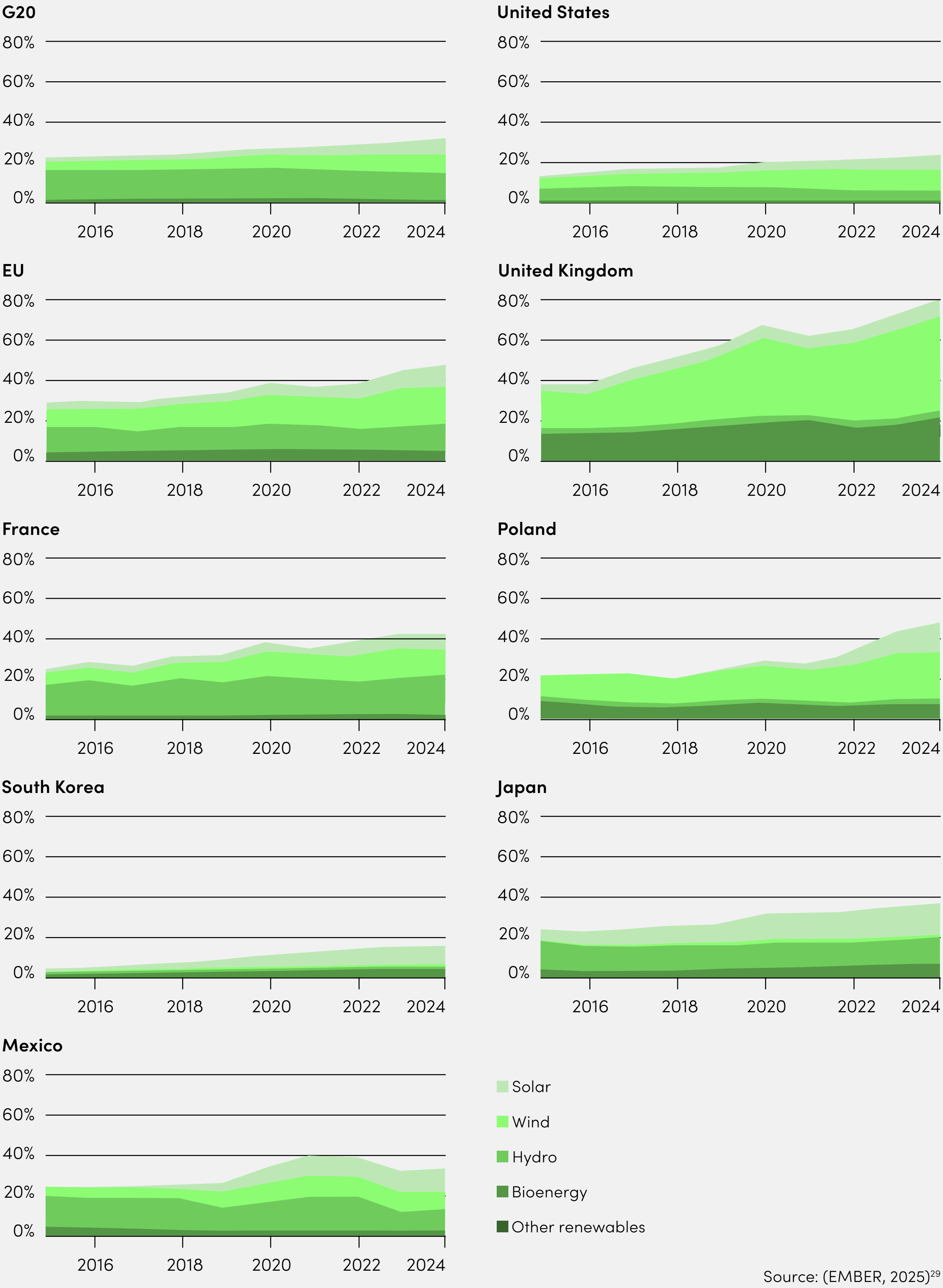
has renewable capacity targets of around 100 GW for 2030, broadly comparable to Korea's. Poland and Mexico are included due to their current renewable capacity levels being most similar to Korea's as of 2024, and Japan is included due to its energy and industrial structure being most aligned with Korea's. Data on renewable energy shares (2015–2024) and related trends are taken from Ember (2025).

A comparison with major economies provides important context for assessing Korea's renewable energy trajectory. International comparisons highlight both the scale of Korea's gap and the pace of its transition. In the G20, the average renewable generation share increased from 22.4% in 2015 to 32.3% in 2024, reflecting steady but moderate progress. In the United States, the share reached approximately 24% in 2024 and is targeted to rise to 50–60% by 2030. The European Union has achieved a renewable share of around 47–48% and is targeting approximately 69% by 2030 under the REPowerEU Plan.[28]

Among leading European economies, the UK has already exceeded 50% renewable generation and is targeting more than 95% by 2030, while Germany has increased its share to over 58% and aims to reach at least 80% by 2030. France, while maintaining a strong nuclear base, has expanded renewables to around 26% and is targeting over 35% by 2030.

28 European Commission (2023.03.30) Joint Statement by the Director-General of the International Renewable Energy Agency La Camera and EU Commissioner Simson: 'The time for speeding up renewables is now', energy.ec.europa.eu/news/joint-statement-director-general-international-renewable-energy-agency-la-camera-and-eu-commissioner-2023-03-30_en.

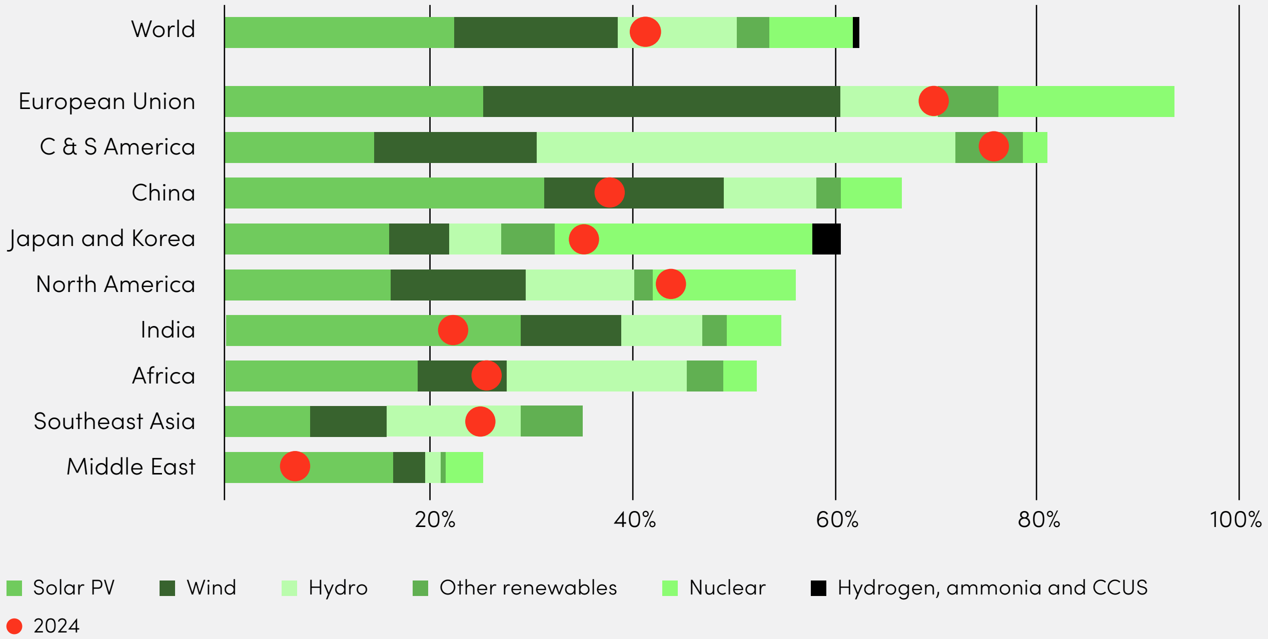
Figure 1-13. Share of Electricity Generation from Renewables 2015-2024



Source: (EMBER, 2025)[29]

29 Ember (2025) Electricity Data Explorer, ember-energy.org/data/electricity-data-explorer/

Figure 1-14. Shares of Low-Emissions Electricity by Regions in 2035 (IEA STEPS)



Source: IEA World Energy Outlook (2025)

Among more comparable economies, Japan has increased its renewable share to around 23% and is targeting 36–38% by 2030, while Poland has rapidly expanded renewables to nearly 30% and is targeting over 50% by 2030.[30] Mexico has seen slower progress, reaching around 21% in 2024 and targeting approximately 35% by 2030.[31]

By contrast, Korea's renewable generation share remains below 10% as of 2024, significantly lower than most OECD and G20 countries. According to the government's plan announced during the preparation of the 2035 NDC, the Korean government aims to increase renewable energy capacity to 100 GW by 2030, up from the original 78 GW target set in the 11th BPLE, and to expand this to over 150 GW by 2035. Under this plan, the renewable energy generation share is expected to rise to 32–37 percent by 2035[32]. This target assumes an annual capacity increase of about 15.6 percent from 2023 to 2030, which significantly exceeds the growth rates of the countries compared (approximately 3.5-9 percent) and represents a very rapid expansion rate.

Regarding the forecast for the share of clean energy in 2035, the IEA's World Energy Outlook 2025 (IEA, 2025)[33] projects that, under the Stated Policies Scenario (STEPS), the share of low-emissions sources in power generation will increase to over 50 percent in most regions by 2035 (Figure 1-14).

30 Enerdata (2025.07.30) Poland approves draft revised NECP with 2030–2040 outlook, www.enerdata.net/publications/daily-energy-news/poland-approves-draft-revised-necp-2030-2040-outlook.html

31 Mexico Ministry of Energy (2024), National Electrical System Development Program 2024-2038 (PRODESEN)

32 However, the government has not released an official plan indicating the extent to which the share of renewable electricity generation would increase with the deployment of 100GW of renewable energy capacity. Figures for the 2030 generation mix by source should be included as the detailed elements of the final 2035 NDC or specified in the 12th BPLE planned to be released in 2026.

33 IEA (2025), World Energy Outlook 2025, IEA, Paris www.iea.org/reports/world-energy-outlook-2025, Licence: CC BY 4.0 (report); CC BY NC SA 4.0 (Annex A)

Along with the acceleration of renewable energy deployment, including solar and wind, the IEA anticipates a structural transition driven by the simultaneous expansion of various low-carbon technologies, such as nuclear power, hydropower, hydrogen, and CCUS, region by region. The IEA (2025) highlights Australia, India, China, Africa, Japan, and Korea as the regions where the share of low-emissions sources is expected to increase the most, with increases of more than 25 percentage points compared to 2024. From an international comparison perspective provided by the IEA, Korea's projected increase in the share of low-emissions sources by 2035 is expected to show improvements on par with or exceeding those of major emerging economies and OECD countries.

The comparison across countries shows that Korea's renewable energy transition targets remain relatively low in absolute terms compared with major economies. Leading countries, including the United Kingdom, key EU member states, and the United States, have set targets for near-complete power sector decarbonisation by 2035 and are rapidly expanding renewable energy, primarily through solar and wind, alongside broader carbon-free energy portfolios.

By contrast, Korea's current renewable capacity and generation share remain significantly below international leaders, as well as OECD and G20 averages. However, when considering the pace of transition and structural change, a more positive assessment emerges. Korea's targets of 100 GW by 2030 and over 150 GW by 2035, while modest in absolute terms, imply a rapid rate of expansion. With an estimated annual growth rate of around 15.6%, Korea's trajectory is broadly aligned with the global objective of tripling renewable energy capacity by 2030.

If achieved, renewable capacity would increase more than threefold by 2030 and nearly fivefold by 2035 relative to 2022 levels. The planned increase in renewable generation share - from around 10% in 2024 to 32–37% by 2035 - is therefore highly ambitious given current policy and system constraints. Overall, Korea's power sector decarbonisation strategy lags behind leading countries in absolute terms but is broadly aligned with global trends in the pace of transition.

However, the emissions and power mix pathways set out in the 11th BPLE are not aligned with the strengthened 2035 NDC. The forthcoming 12th BPLE will therefore need to raise renewable targets and address key structural constraints, including grid capacity, long-distance transmission, storage integration, and demand-side flexibility, to ensure consistency with national climate goals.

If these bottlenecks are addressed, Korea is well positioned to emerge as a leading fast follower in global power sector decarbonisation.

2 Assessment of Renewable Energy Sufficiency

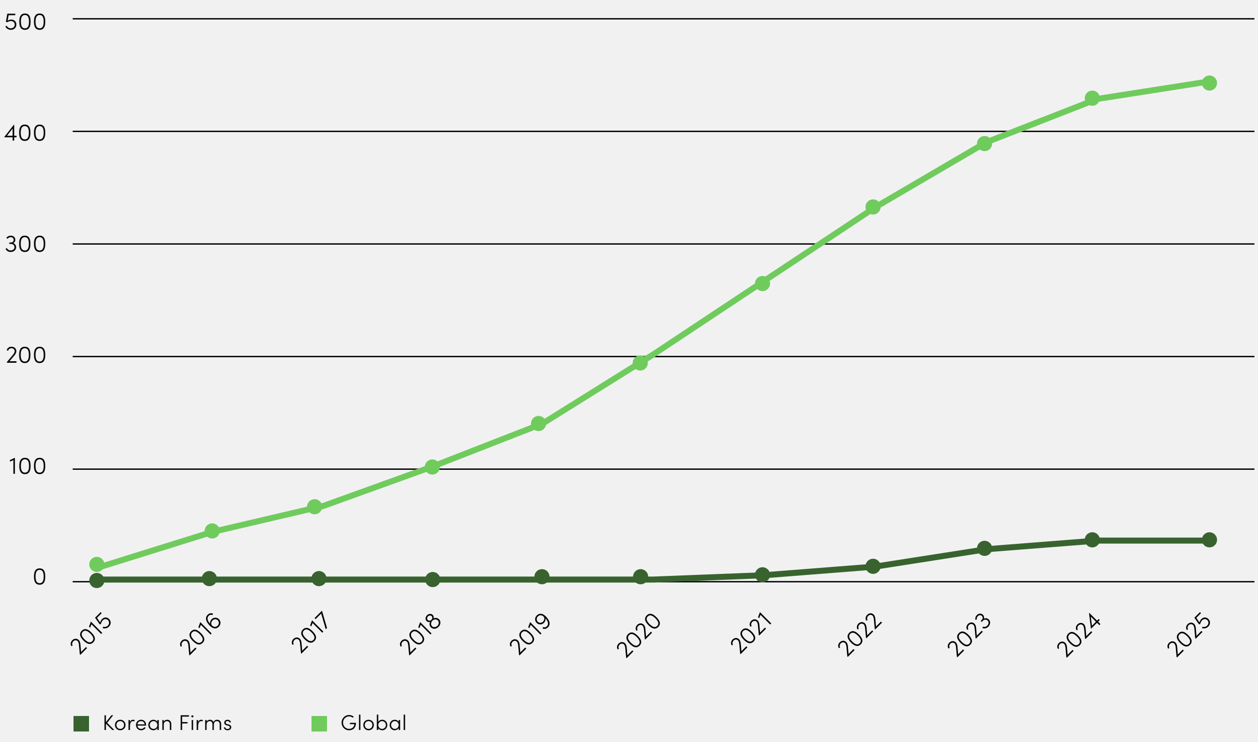
2.1 Korean RE100 Firms and Renewable Demands

This section estimates renewable energy demand based on the growth of Korean companies participating in RE100. The resulting demand projections are then compared with renewable energy deployment forecasts to assess the feasibility of corporate RE100 commitments under Korea's energy infrastructure plans.

As of 2024, 183 Korean companies are known to be enrolled in the global RE100 initiative. This figure refers to the number of operating companies, while the number of companies based on headquarters stands at 36.[34] The rate of increase in the number of participating companies has been gradual but consistently growing, indicating sustained engagement in RE100 commitments. **Figure 2-1** shows the overall increase in the number of global RE100 companies as well as the increase in the number of participating Korean companies. Since 2015, the number of global RE100 participants has steadily risen, with over 440 joined as at 2025. From 2019 onwards, the annual growth rate of participants has accelerated at an average rate of around 20 percent, marking a steeply growing market. In Korea, companies began joining in 2021, and the average annual growth rate of participants over the last five years has been about 57 percent.

34 Although the RE100 2025 Annual Report records 37 Korean headquartered companies, Samsung SDS was excluded from this analysis as it has not made an official RE100 commitment.

Figure 2-1. Global and Korean Firms for RE100 Enrollment



According to the 2025 RE100 Annual Report, Korean companies are using 12 percent renewable energy. The total electricity consumption of the 36 participating companies is 67.7 TWh, including 47.6 TWh from manufacturing, 7.6 TWh from services, 6.7 TWh from materials, 1.7 TWh from infrastructure, and 3.9 TWh from food and beverages and other sectors. To meet the goal of sourcing all of their electricity from renewable energy, these companies would need to procure an additional 59.6 TWh of renewable energy. Referring to the 2024 generation statistics by source (Korea Electric Power Corporation, 2025), the combined output of hydro power and new and renewable energy is 60.8 TWh, which highlights the challenges faced by domestic companies in procuring renewable energy. While it is not yet required for all RE100 companies to source 100 percent of their energy from renewables, it is essential to explore strategies for achieving full renewable energy procurement in the future.

The demand for renewable energy from RE100 companies can be referenced from the "Renewable Energy Demand in South Korea: A 2030 Forecast and Policy Recommendations" by Plan 1.5 et al. (2023). The study compared the demand for renewable energy from domestic companies in 2030 with the projected generation based on the 10th Basic Plan for Long-term Electricity Supply and Demand, concluding that there will be a shortfall in renewable energy supply in 2030. However, this study does not consider the electricity consumption of voluntary renewable energy target-setting companies, companies with Scope 2 targets, or other companies with RE targets beyond RE100 participants. According to Plan1.5 et al. (2023), the baseline scenario for renewable energy demand from domestic and global RE100 companies in 2030 is projected to be 38.6 TWh. However, applying the 60 percent renewable energy procurement share target for 2030, as set by the RE100 initiative, this demand is expected to reach 42.3 TWh.

However, the renewable energy demand mentioned above is based on 29 RE100 companies, whereas this study aims to estimate demand based on 36 companies, which creates a discrepancy. As of the end of 2023, there are 31 companies participating in RE100 in Korea, so it would be appropriate to consider the report by Plan1.5 et al. (2023) as written during this period. The electricity demand of the 31 companies at the time of joining was approximately 60 TWh, while the demand of the 36 companies in 2024—the basis for this study—reaches 67.7 TWh. Therefore, the RE100 renewable energy electricity demand in 2030 and 2038 will increase further.

The renewable energy electricity demand of RE100 companies is primarily influenced by the rate of increase in electricity consumption by each company and the number of participating companies. BNEF has been providing the RE100 Data Viewer since 2025. This viewer forecasts the electricity demand and renewable energy demand by market (or country) for companies, as well as supply forecasts by procurement method, for 37 companies.[35] However, the data from this source shows the electricity demand of 36 companies in 2023 and 2024 as 111.6 TWh and 113.2 TWh, respectively, which significantly deviates from the RE100 Annual Disclosure Report.

35 The number of participating companies is consistent with the 2025 RE100 Annual Disclosure Report. However, JYP Entertainment is additionally included, while Samsung SDS is omitted. As Samsung SDS has not made an official RE100 commitment, it is excluded from this report, and the analysis is conducted based on 36 companies, excluding Samsung SDS from the RE100 Annual Disclosure Report.

This discrepancy arises from the following reasons. The electricity demand in the RE100 Annual Report includes the total electricity consumption of Korean companies headquartered in Korea, along with the electricity consumption of global companies' subsidiaries in Korea. In contrast, BNEF data refers to the total electricity consumption of Korean-headquartered companies. The renewable energy required for RE100 compliance in Korea will be the combined electricity consumption of these Korean-headquartered companies and the electricity consumption of global companies' subsidiaries in Korea. Of course, Korean-headquartered companies' overseas subsidiaries can procure renewable energy from local electricity markets, but for stable RE100 compliance, it is necessary to consider the electricity demand in a conservative manner.

This study uses a broader dataset based on 36 companies, with total electricity demand increasing from approximately 60 TWh (31 companies) to 67.7 TWh in 2024. Differences between RE100 and BNEF data arise from differing scopes: RE100 includes both Korean-headquartered firms and local operations of global companies, while BNEF focuses on Korean-headquartered firms only. For a conservative estimate of domestic procurement needs, this study adopts the RE100-based approach.

Electricity consumption data were collected from company sustainability reports, supplemented by RE100 disclosures. Where necessary, assumptions were applied, and data were harmonised (e.g., conversion from TJ to TWh). Growth projections use BNEF trends up to 2030 and 11th BPLE assumptions thereafter. Based on this approach, total electricity demand is projected to reach 156.7 TWh in 2030 and 184.0 TWh in 2038.

Company-specific adjustments were applied where relevant. For example, independently forecast demand was used for Incheon International Airport, while stable demand assumptions were applied for Korea Water Resources Corporation. Additional demand from data centres (e.g., Kakao, Samsung SDS) was incorporated based on BPLE projections. Additionally, for companies with data centers (e.g., Kakao and Samsung SDS), the projected increase in data center electricity demand was separately incorporated, based on the 11th BPLE.

While deriving the electricity demand until 2038, it is also necessary to realistically estimate the renewable energy demand that will be required to be procured by 2038. Since each company has its own timeline for voluntarily achieving its RE100 targets, it is possible to uniformly apply the RE100 initiative's recommended target levels of 60 percent by 2030, 90 percent by 2040, and 100 percent by 2050.

However, some Korean companies have set more ambitious goals. For example, Amorepacific and Mirae Asset Securities' 2025 target, as well as 2040 targets set by Incheon International Airport Corporation and some Hyundai affiliates, represent cases where companies have set goals earlier than the initiative's standard. **Table 2-1** summarizes the target years for RE100 initiative participating companies.

Table 2-1. RE100 Initiative Enrollment and Target Year

Company name	Enrollment year	Target year
Amorepacific	2021	2025
Hyundai Mobis	2022	2040
Hyundai Wia	2022	2045
Kakao corporation	2023	2040
Kia Corporation	2022	2040
Korea Zinc	2021	2050
LG Electronics	2023	2050
LG Innotek	2022	2030
Lotte Chilsung Beverage	2021	2040
LS Electric	2023	2040
Naver	2022	2040
Samsung Display	2022	2050
Samsung Electronics	2022	2050
Samsung Life Insurance	2023	2040
SK Inc.	2020	2040
SK ie Technology	2021	2030
SK Siltron	2020	2040
SKC	2020	2040
HD Hyundai XiteSolution	2023	2040
Hyundai Motor Company	2022	2045
Incheon International Airport	2022	2040
KB Financial Group	2021	2040
K-Water	2021	2050
KT Group	2022	2050
LG Energy Solution	2021	2030
Lotte Chemical	2023	2050
Lotte Wellfood	2023	2040
Mirae Asset Securities	2021	2025
Samsung Biologics	2022	2050
Samsung Electro-Mechanics	2022	2050
Samsung Fire & Marine Insurance	2023	2040
Samsung SDI	2022	2050
Shinhan Financial Group	2023	2040
SK Hynix	2020	2050
SK Materials (SK Specialty)	2020	2030
SK Telecom	2020	2050

Source: 2024 RE100 Annual Disclosure Report

Table 2-2. Interim Target of RE100 Corporates

Company name	Target year	Interim target
HD Hyundai XiteSolution	2040	20% by 2026, 60% by 2030
Incheon International Airport	2040	60% by 2030
Kakao	2040	60% by 2030
K-Water	2050	60% by 2030, 90% by 2040
LG Electronics	2050	60% by 2030, 90% by 2040
Lotte Chemical	2050	60% by 2030, 70% by 2040
LS Electric	2040	60% by 2030
Samsung Electronics	2050	100% by 2027 (business divisions)
Samsung SDI	2050	26% by 2023, 68% by 2025, 76% by 2030, 90% by 2040
Shinhan Financial Group	2040	60% by 2030, 80% by 2035
SK Inc.	2040	60% by 2030
SK Telecom	2050	75% by 2030 (business divisions), 65% by 2030

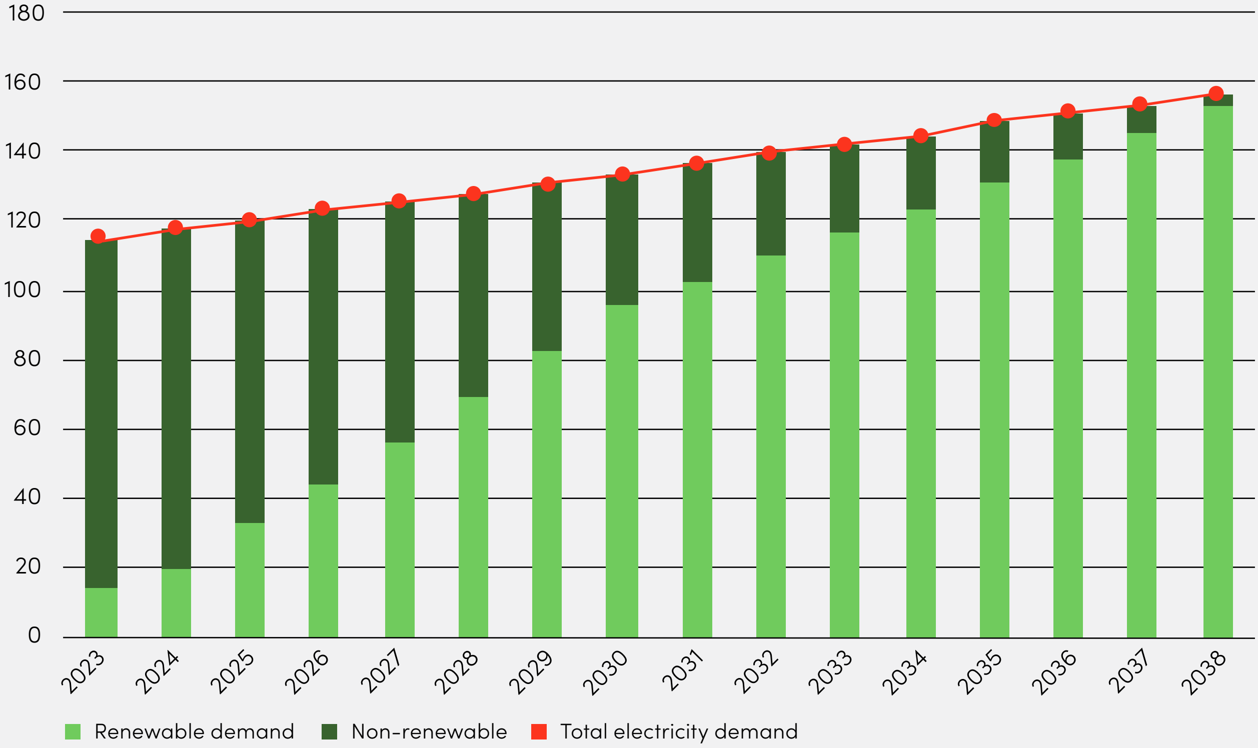
Source: 2024 RE100 Annual Disclosure Report

Given that the RE100 initiative recommends setting intermediate targets and aims for full RE100 achievement by 2050, it can be said that many Korean companies have set ambitious targets. Additionally, most companies that have set a 2050 RE100 target also include intermediate goals. **Table 2-2** separately outlines the target years for these companies. Aside from the electricity demand of RE100 companies, renewable energy demand must be assumed to be a certain percentage of electricity demand. Therefore, this study uses these intermediate targets to estimate renewable energy demand. In cases where intermediate targets are not available or not specified in the sustainability management reports, the RE100 initiative's recommended targets are uniformly applied.

The results of extending the electricity demand and renewable energy demand for each company up to 2038 are shown in **Figure 2-2**. The electricity demand for 2023 and 2024 represents actual figures, while the data from 2025 onward reflects the assumptions made for this study. Compared to the actual electricity demand figures of 114.5 TWh and 117.8 TWh in 2023 and 2024, the demand is projected to increase to 133.3 TWh by 2030, and further to 156.4 TWh by 2038. The renewable energy targets calculated by applying the RE100 goals are estimated at 81.8 TWh for 2030 and 130.1 TWh for 2038. If the targets are fully met, the RE achievement rate for Korean companies will be 61.3 percent by 2030, and 83.2 percent by 2038.

The renewable energy demand estimated in this study applies to Korean companies and global companies with subsidiaries in Korea already participating in the RE100 initiative, without considering future increases in the number of participants. Additionally, as the

Figure 2-2. Projected Annual Electricity and Renewable Demand of RE100 Companies (unit: TWh)



Note: this does not include potential future demand from new RE100 members

intermediate targets are based on the commitments already declared by companies, if these intermediate targets are strengthened, the demand for renewable energy is likely to increase. The RE100 initiative encourages companies to advance their targets under the "Increasing Ambition" project.[36]

Therefore, the currently estimated renewable energy demand for RE100 implementation can be considered a minimum scenario. The most influential factor could be the increase in RE100 participating companies, but as this remains uncertain at present, it has not been considered in this study. However, a sensitivity analysis will be discussed in the conclusion section.

The estimated renewable energy demand should be considered a minimum scenario, as it does not account for potential increases in RE100 participation or further strengthening of corporate targets. Given this uncertainty, sensitivity analysis is discussed in conclusion. Figure 2-2 presents the projected electricity and renewable energy demand.

The next section compares this demand with Korea's renewable energy supply under the 11th BPLE to assess adequacy. This is particularly important given existing gaps in renewable deployment and the more ambitious requirements under the enhanced NDC.

36 Climate Group, "Increasing Ambition"

Table 2-3. Annual Generation and Renewable Sources (unit: TWh)

Year	Total generation volume	Renewable energy			Share (%)
		Renewables	Clean hydrogen, ammonia	Total	
2023	588.0	49.4	0	49.4	8.4
2024	595.6	53.7	0	53.7	9.0
2030	642.6	120.9	15.5	136.4	21.2
2032	665.1	149.1	22.8	171.9	25.8
2034	681.7	169.1	28.5	197.6	29.0
2035	691.5	179.9	32.8	212.7	30.7
2036	693.3	190.4	36.1	226.5	32.7
2038	704.5	205.7	43.9	249.6	35.4

Source: 11th BPLE

2.2 Renewable Energy Sufficiency

2.2.1 Supply Outlook under the 11th BPLE

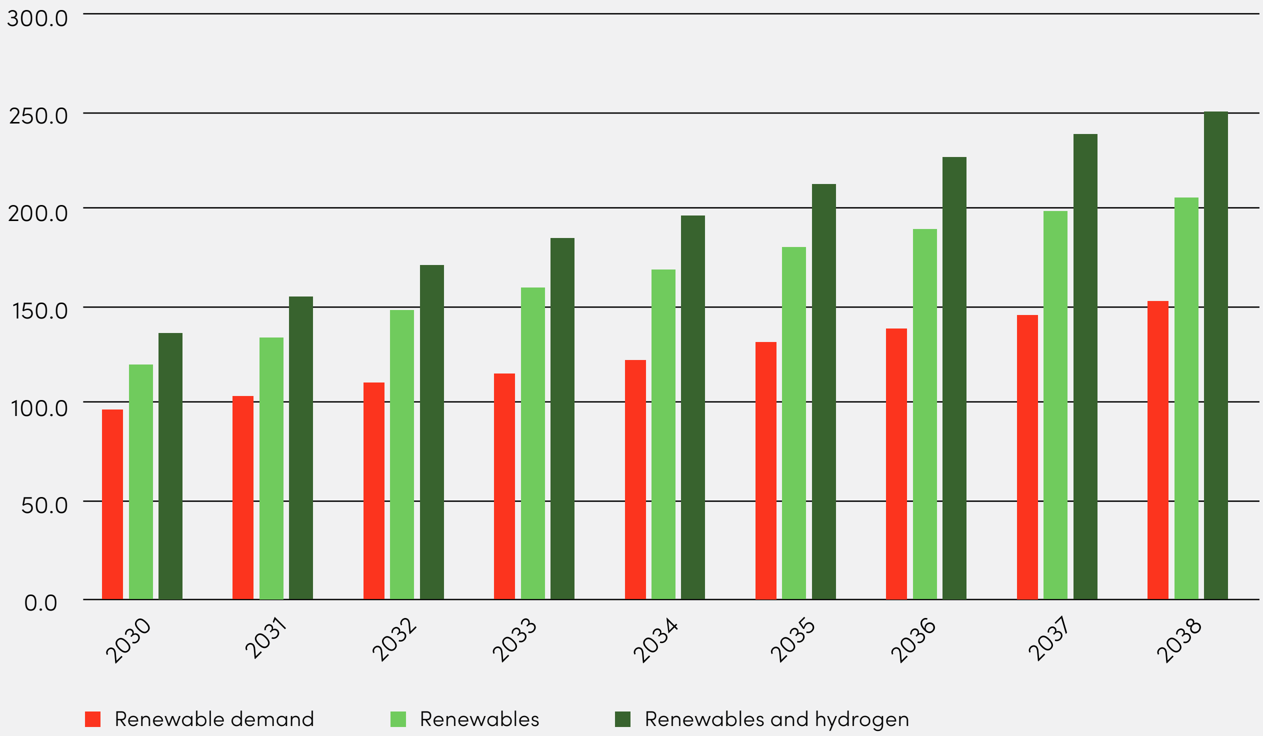
Table 2-3 summarizes projected renewable electricity supply under the 11th BPLE. Including renewable energy, clean hydrogen, and ammonia, the share of total generation is projected to reach 21.2% by 2030 and 35.4% by 2038. However, because RE100 does not generally recognize "new energy" sources such as fuel cells and IGCC—and would only count hydrogen or ammonia if certified as green[37].—renewable energy available for RE100 compliance must be assessed more conservatively.

As Table 2-3 shows, excluding clean hydrogen and ammonia significantly reduces the volume of generation relevant for RE100 compliance. Renewable generation alone is projected to reach 120.9 TWh in 2030, 179.9 TWh in 2035, and 205.7 TWh in 2038.

Figure 2-3 also compares projected renewable supply and RE100 demand between 2030 and 2038, using linear interpolation and company-specific target years. Under a base-case scenario,aggregate supply may appear sufficient. However, this picture changes if companies accelerate progress toward 100% renewable procurement.

37 Note, ammonia-to-power electricity is currently globally priced between $180–$300+/MWh, compared to $34–$43/MWh for direct wind and solar – approximately 5 to 9 times more expensive (IEA, 2025). Therefore, 43.9 TWh of clean hydrogen and ammonia is an extremely ambitious policy and much more challenging than solely using wind and solar.

Figure 2-3. Annual Renewable Generation and RE100 Demand (unit: TWh)



Of course, not all RE100 participating companies will accelerate their procurement of 100% renewable energy, so based solely on the comparison of renewable energy demand and supply, it may appear that there is no shortage. The key issue for RE100 compliance is not only the overall volume of renewable electricity, but also the availability of procurement options at competitive prices. Although renewables are now the cheapest source of new power generation in many markets, that cost advantage is not always passed through to end users. In Korea, where electricity prices remain exposed to imported fossil fuel costs, expanding renewable procurement could also improve price stability and reduce long-term cost uncertainty Therefore, it is necessary to increase the amount of renewable energy procurement to a level where the procurement costs of renewable energy can be lowered, not just the simple quantity of renewable energy. This is particularly relevant in the Korean context, where a high dependence on imported fossil fuels exposes electricity prices to significant volatility in global energy markets. In this regard, expanding renewable energy procurement can also contribute to enhancing price stability and reducing long-term cost uncertainty.

2.2.2 Procurement Methods and Cost Implications

To consider the procurement cost of renewable energy, it is necessary to perform an analysis of procurement costs by method. Since renewable energy procurement costs are related to electricity fees, the analysis should be combined with recent industrial electricity tariff data. There are four main methods of procurement that are recognized by the RE100 initiative. First, there is the Green Premium, which is the renewable energy certification system used in Korea. Second, there is the Renewable Energy Certificate (REC) generated from Korea's Renewable Portfolio Standard (RPS) system. The third

Table 2-4. RE100 Implementation Costs by Method (unit: KRW/kWh)

Category	Green Premium	REC	PPA	Benefits (reduction of greenhouse gases)
Highest	178.87	255.12	195	5.77
Lowest	178.17	209.49	182	3.73

Table 2-5. Recent electricity unit tariffs by use (unit: KRW/kWh)

Year	Residential	General	Educational	Industrial	Agricultural
2022	121.32	139.10	111.53	118.66	56.89
2023	149.75	169.46	138.83	153.71	75.10
2024	156.91	172.99	143.00	168.17	82.12

Source: KEPCO (2025)

method is Power Purchasing Agreements (PPAs), and the last method is self-generation or self-installation. However, this study excludes self-generation and analyzes only these three methods. Within PPAs, there are direct PPAs and third-party PPAs depending on the contractual structure.

As shown in **Table 2-4**, Green Premium was historically regarded as the lowest-cost compliance option. However, rising industrial electricity tariffs have narrowed this advantage, making PPAs increasingly competitive. In some cases, PPAs are already cheaper than Green Premium once electricity tariffs and carbon-related benefits are taken into account.[38]

This matters because Green Premium and RECs are effectively certification-based mechanisms layered on top of electricity purchases, whereas PPAs provide direct access to renewable electricity. As industrial tariffs continue to rise, the relative importance of PPAs is likely to increase.

The reason for investigating the costs by method, as outlined above, is that the benefits and cost structures vary by procurement method. First, with Green Premium and REC, companies are purchasing a "certification" indicating the use of renewable energy, rather than purchasing renewable energy directly, meaning electricity should be purchased separately. When considering industrial electricity, which is representative of most RE100 participating companies, the costs of the Green Premium and REC should be assessed by adding the electricity tariff to the base compliance cost. Secondly, unlike other methods, the Green Premium does not provide greenhouse gas reduction benefits.

38 For industrial electricity tariffs, the 2024 statistics from Korea Electric Power Corporation (2025) are used. These prices are combined with the indirect emissions factor of electricity to present the benefits per unit of electricity.

While REC purchases and PPAs should factor in the benefits of reducing greenhouse gases, the Green Premium only generates net costs. Therefore, this was considered in the comparison.

The Green Premium scheme was originally considered the most affordable method for achieving RE100. Although PPA prices have not decreased significantly, industrial electricity rates have risen dramatically in recent years, making PPAs relatively more competitive. Specifically, when comparing the highest cost of the Green Premium, which accounts for the greenhouse gas reduction benefit, with the minimum cost of a PPA, the figures are 178.87 KRW/kWh and 176.23 KRW/kWh, respectively, indicating that a price reversal has already occurred.

While Green Premium aggregates multiple renewable sources, the PPA market in practice is dominated by solar and wind. Excluding clean hydrogen and less market-relevant technologies, the analysis suggests a shortage of renewable supply for PPA-based procurement by 2030.

In the end, it is anticipated that the importance of PPAs will increase to procure renewable energy at a reasonable price, and several reports have already expressed the same view. As mentioned above, while the domestic supply of renewable energy may exceed the demand of RE100 participating companies, if the proportion of renewable energy available through PPAs at a reasonable price is not high, the RE100 compliance environment will inevitably become challenging.

A further constraint is that not all renewable generation is equally relevant for corporate procurement. While Green Premium aggregates multiple renewable sources, the PPA market in practice is dominated by solar and wind. Excluding clean hydrogen and less market-relevant technologies, the analysis suggests a shortage of renewable supply for PPA-based procurement by 2030.

2.2.3 PPA Availability and Sufficiency Scenarios

Under Korea's Renewable Portfolio Standard (RPS), the renewable procurement obligation for obligated suppliers increases over time, reaching 25% from 2030 onward. As this obligation rises, a larger share of renewable generation is absorbed into the Green Premium mechanism, reducing the volume available for other procurement routes such as RECs and PPAs.

The actual volume of RPS supply depends on the share of total generation accounted for by obligated suppliers, which has ranged between approximately 75% and 82% in recent years. Assuming this trend continues, a three-year moving average is used to estimate future RPS volumes (Table 2-6). Because RPS electricity is purchased by Korea Electric Power Corporation and resold as Green Premium, the remaining renewable generation represents the pool available for market-based procurement, including PPAs.

Table 2-6. Annual Green Premium Projection (unit: TWh)

Year	Total generation volume	RPS obligated suppliers' generation	RPS obligation ratio	Green Premium volume	Remaining renewable energy (including clean hydrogen)	Remaining renewable energy (excluding clean hydrogen)
2030	642.6	512.7	25.0 %	128.2	8.2	-7.3
2032	665.1	531.0		132.8	39.1	16.3
2034	681.7	544.3		136.1	61.5	33.0
2035	691.5	552.1		138.0	74.7	41.9
2036	693.3	553.5		138.4	88.1	52.0
2038	704.5	562.4		140.6	109.0	65.1

Note: The remaining renewable energy volume is calculated by subtracting the Green Premium volume from total renewable electricity generation.

A further constraint is that not all renewable generation is equally relevant for corporate procurement.[39] While Green Premium aggregates multiple renewable sources, the PPA market is in practice dominated by solar and wind.[40] Excluding clean hydrogen and less market-relevant technologies, the analysis suggests a potential shortage of renewable supply for PPA-based procurement by 2030.[41]

Table 2-6 presents projected Green Premium volumes under the 11th BPLE. Remaining renewable energy is calculated by subtracting Green Premium volumes from total renewable generation.

The assumptions underlying this projection are as follows: (1) the RPS obligation ratio remains at 25% from 2030 onward; (2) RPS-obligated suppliers account for approximately 80% of total generation; (3) all RPS volume is resold as Green Premium; and (4) this volume is not diverted to other procurement routes such as PPAs. These assumptions are considered broadly realistic.

Under these assumptions, a large share of renewable generation is absorbed into the Green Premium mechanism, limiting the volume available for market-based procurement. This suggests that renewable energy available within the power market

39 RE100 recognizes six renewable energy sources, including geothermal; however, geothermal power generation does not exist in Korea.

40 Even within the Green Premium scheme, when bidding is conducted by energy source, preferences are overwhelmingly concentrated on solar and wind.

41 While volumes may not appear insufficient when considering the Green Premium alone, RE100 companies face limited flexibility in choosing compliance instruments.

Table 2-7. Korea PPA by Electricity Sources (unit: MW)

Energy source	Signed capacity
Solar power	1,236.85
Wind power	280.8
Hydropower	2.3

Source: BNEF (2025b) "Power Purchase Agreements"

Table 2-8. Renewable Sufficiency for RE100 Implementation (unit: TWh)

Year	Renewable energy demand	Green Premium	Clean hydrogen	PPA procurement
2030	96.2	128.2	15.5	-
2032	109.8	132.8	22.8	16.3
2034	123.1	136.1	28.5	33.0
2035	130.9	138.0	32.8	41.9
2036	137.7	138.4	36.1	52.0
2038	153.0	140.6	43.9	65.1

Note: PPA procurement is not a forecast; rather, it represents an estimate based on the assumption that companies make economically rational decisions.

may be insufficient by 2030, requiring RE100 companies to rely increasingly on PPAs or self-generation.

To date, around 30 renewable PPAs have been signed in Korea, with total contracted capacity of approximately 1.52 GW, largely concentrated in solar projects (Table 2-7). All contracts are long-term, typically extending beyond 2040. As these figures are based on installed capacity, conversion to electricity output requires applying technology-specific utilization rates.

Based on projected RE100 demand, renewable generation, and assumptions regarding procurement *behavior*, Table 2-8 estimates renewable energy sufficiency between 2030 and 2038. Given recent trends, PPAs are expected to become the preferred procurement route, as they are increasingly cost-competitive relative to industrial electricity tariffs. This trend is likely to strengthen further if carbon pricing increases under international scenarios. Accordingly, the analysis assumes that renewable energy not absorbed by Green Premium or clean hydrogen is procured primarily through PPAs.

The results suggest that PPAs could meet only around half of RE100 demand by 2038, with even tighter constraints in earlier years. Between 2030 and 2037, PPA availability is likely to remain below 50% of total demand. These estimates reflect a minimum scenario. If companies expand direct PPAs or self-generation, procurement costs could be reduced, and volumes could increase. However, current projections suggest that direct PPA volumes will remain limited—for example, reaching approximately 3.5 TWh annually by 2030 (Kang So-yeon et al., 2024).

Table 2-9. Renewable Demand by RE100 Enrollment Scenarios (unit: TWh)

Year	Scenario 1	Scenario 2	Total renewable energy	PPA
2030	105.6	111.9	120.9	-
2032	124.2	133.8	149.1	16.3
2034	143.3	156.7	169.1	33.0
2035	154.6	170.3	179.9	41.9
2036	164.7	182.8	190.4	52.0
2038	188.1	211.5	205.7	65.1

Note: PPA procurement is not a forecast; rather, it represents an estimate based on the assumption that companies make economically rational decisions.

A key structural issue is that renewable supply itself remains insufficient to drive down costs. Since PPA pricing is closely linked to levelized cost of electricity (LCOE), increasing renewable deployment is essential to reduce procurement costs over time. In this study, PPA prices have been calculated considering the grid usage fees and other related costs based on LCOE. Therefore, to lower PPA prices, renewable energy supply must continue to increase so that the LCOE can be reduced.

In this chapter, the renewable energy surplus and shortage were calculated by comparing the potential renewable energy generation based on the facility plan for the central power grid and power market, Green Premium, and the companies' renewable energy demand. It is important to note that the companies' renewable energy demand was calculated using a minimum scenario, and the assumptions regarding the Green Premium volume were reasonably constructed. Therefore, the estimated PPA procurement volume represents the minimum volume required by companies. Particularly, it was difficult to incorporate the increase in the number of RE100 initiative participants, which is the most unrealistic assumption; if this were considered, renewable energy demand would increase even further. In other words, there is a high possibility that the required new renewable energy volume and PPA will be insufficient for domestic companies to reasonably fulfill their RE100 obligations. When scenarios assuming an annual increase of three or five RE100 participating companies from 2025 onward are applied, the results are as shown in **Table 2-9**.

For the scenario of an increase in the number of RE100 participating companies, two scenarios were derived: an increase of 3 companies per year (Scenario 1) and 5 companies per year (Scenario 2). As shown in **Table 2-9**, according to the current power

supply and demand plan estimates, by 2038, the PPA available volume will only be 65.1 TWh. Of course, if private sector self-generation of renewable energy is included, the volume could increase, but this is based on the facility plan. However, if the number of RE100 participating companies (including global companies with branches in Korea) increases by 3 companies per year (Scenario 1) or 5 companies per year (Scenario 2), especially in Scenario 2, it could lead to a situation where the total renewable energy generation in Korea by 2038 will fall short of the companies' renewable energy demand.

In summary, even though this study's base scenario assumes the minimum renewable energy demand for RE100 companies (without considering an increase in the number of participating companies), the volume of PPA procurement, which is a reasonable means for companies to source renewable energy, is insufficient.

Looking at a more realistic future, the demand for renewable energy from companies will likely increase much further, and there is a high likelihood that the overall renewable energy supply will be insufficient, with the PPA volume being extremely limited.

Addressing this gap will require expanding market-based renewable deployment, including faster permitting for solar and wind projects, stronger policy support in project approval processes, and measures to enable developers to diversify their business models. Key policy options currently under discussion include RE100 industrial complexes and regulatory sandboxes under the Distributed Energy Special Act. The next chapter examines how these mechanisms could unlock additional renewable supply and support RE100 implementation.

3 Policy Implications for Deploying Renewable Energy

3.1. Industrial Complex RE100

The concept of 'RE100 Industrial Complexes' aims to support tenant companies in achieving RE100 commitments by leveraging locally available renewable energy and providing support at the industrial complex level. This concept was a campaign pledge of President Lee Jae-myung, and as of November 2025, preparations are underway to expand RE100 industrial complexes and increase renewable energy use.

These include the proposed Special Act on the Establishment and Support of RE100 Industrial Complexes and Energy New Towns (hereinafter the 'RE100 Industrial Complex Special Act') [Translator's note…], as well as the formation of a joint task force by the Ministry of Trade, Industry, and Energy. A related bill - Special Act on the Establishment of Ultra-Large Renewable Energy Autonomous Cities and the Transition to RE100 Industrial Complexes' - has also been proposed.[42]

The proposed or soon-to-be-proposed special acts related to RE100 industrial complexes contain the necessary policies for expanding renewable energy, as discussed in Chapter 2. First, the core aspect is to establish exceptions for preliminary feasibility studies on renewable energy-related businesses and provide the legal basis for expedited permitting processes to support the creation of renewable energy autonomous cities and support the free business activities of tenant companies. Secondly, the *RE100 Industrial*

42 For these two bills "Special Act" is the proposed English translation, as it is still under deliberation and there is no official English translation yet

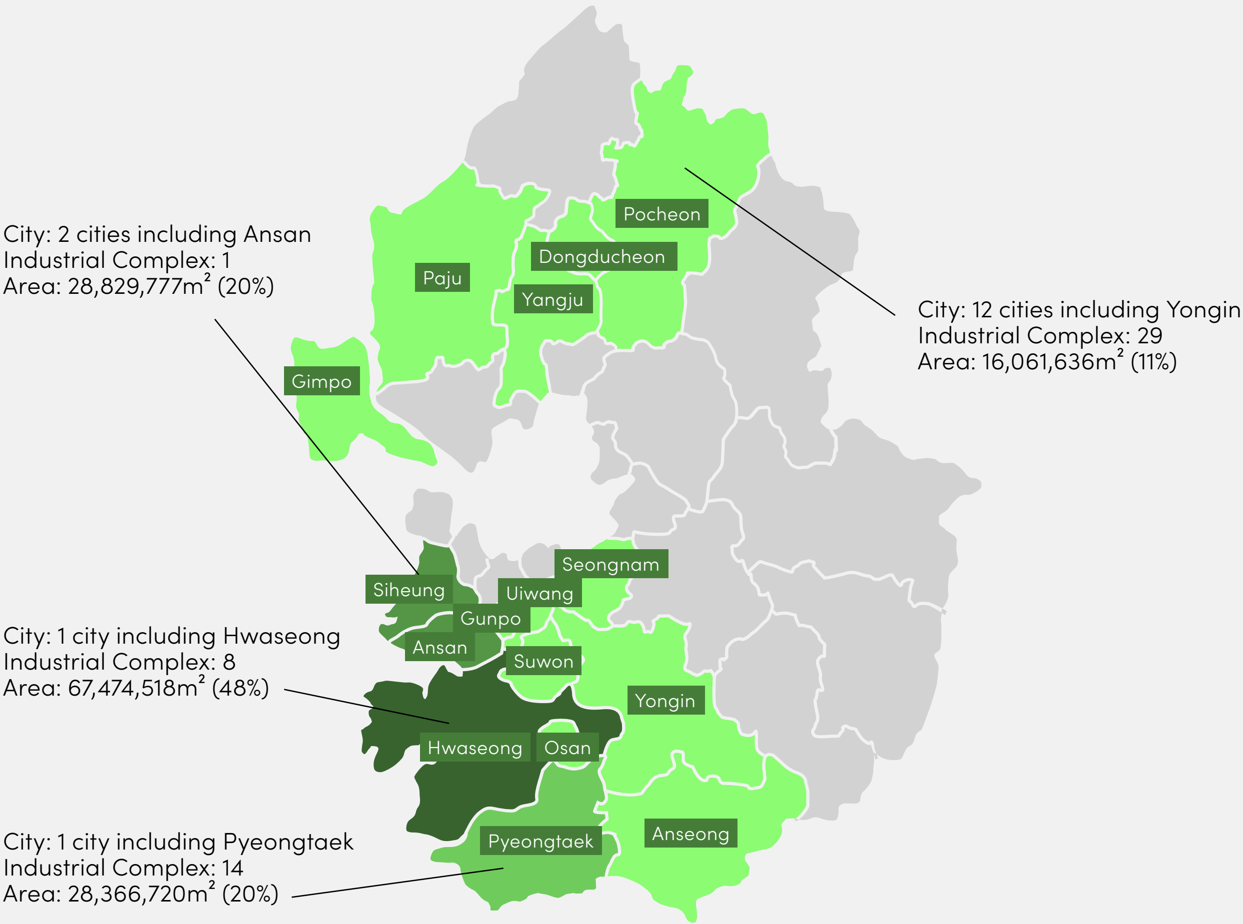
Complex Special Act aims to create an industrial complex with a harmonious RE100 implementation support system by establishing renewable energy zones with large-scale renewable energy generation facilities, power grid zones responsible for stable transmission and distribution, and industrial zones with RE100 companies. Considering the current obstacles to RE100 implementation in Korea - specifically, the shortage of renewable energy and issues arising from the lack of transmission and distribution networks and the mismatch between supply and demand locations- this special act for RE100 industrial complexes holds significant meaning. It aims to eliminate obstacles to additional renewable energy deployment and, at the same time, increase the utilization of distributed energy by matching supply and demand within the industrial complexes. This aligns with the purpose of the *Distributed Energy Special Act* to be discussed later, making it a very meaningful bill in the context of Korea's current energy policy direction.

As the *RE100 Industrial Complex Special Act* or the exact business model for RE100 industrial complexes has not been proposed yet, it is difficult to conduct quantitative analysis or provide specific details. However, if combined with the *Distributed Energy Special Act*, the concept of "energy self-sufficiency by region" is highly likely to emerge. The distributed industrial complexes will absorb some of the renewable energy generation, reduce transmission congestion, and generate various additional benefits. Ultimately, this could contribute to strengthening the renewable energy deployment goals presented in the 11th BPLE to support the achievement of NDC goals.

A good example to preview the future blueprint is the 'Gyeonggi RE100.' Gyeonggi Province has consistently worked to increase its energy self-sufficiency based on renewable energy at the local government level and has been promoting an industrial complex RE100 support project since 2023. In particular, since more than 24 RE100 participating companies have their headquarters or business operations in Gyeonggi Province, policy implementation is expected to be easier. The Gyeonggi RE100 industrial complex support project aims to form company consortiums by dividing the Gyeonggi industrial complexes into four regions, as shown in **Figure 3-1**, and support the attraction of companies and RE100 achievement for tenant companies.

What can be seen from the Gyeonggi RE100 support project is that the collaboration between local governments and industrial complex companies within their jurisdiction is key. In this year's national-level RE100 industrial complex initiative, the characteristics of each local government differ, so it is expected that transferring some of the authority for the creation of RE100 industrial complexes from the central government to local governments can help facilitate the promotion of RE100 industrial complexes by region. An urgent issue is securing a successful business model, and the Gyeonggi RE100 project can be considered a good example. The key point is that if the RE100 industrial complex becomes established as a successful business model, it will be much easier to deploy new renewable energy facilities. At the same time, it will help resolve one of the major barriers to renewable energy deployment in Korea, which is the transmission congestion issue. Lastly, when creating RE100 industrial complexes, it is important to develop specific RE100 business models tailored to each local government and industrial complex location.

Figure 3-1. Gyeonggi Industrial Complex RE100 Support



Investors (Consortium)	Region	Cities and Industrial Complexes (16 cities, 52 industrial complexes)
LS Electric **SK E&S**	A	Region A – Hwaseong National Industrial Complex (2) [Banwol Song-san, Asan Woonjung District] +General Industrial Complex (6)
I-solar Energy **ENlighten** **Korea East-West Power**	B	Region B - Ansan, Siheung National Industrial Complex (1) [Banwol, Siwha, Siwha MTV]
Enel X Korea **Korea Midland Power** **Shinsung E&G**	C	Region C - Pyeongtaek National Industrial Complex (1) [Asan Poseung, Wonjeong District] + General Industrial Complex (13)
KC Solar & Energy **DL Energy** **Samchully Asset Management**	D	Region D - Gunpo, Gimpo, Seongnam, Suwon, Anseong, Osan, Yongin, Uiwang, Yangju, Paju, Pocheon, Dongducheon

(Source: Gyeonggi Province (2024))

Table 3-1. Definition of Distributed Energy in the Enforcement Decree of the Distributed Energy Act

Relevant Act	Article	Name of installation	Capacity	Provision
Electric Utility Act	Article 2-17	Electric installations for electric utility business	40 MW or below	-
	Article 2-18	Electric installations for general use	-	-
	Article 2-19	Electric installations for private use	-	Excluding electricity market transactions
Integrated Energy Supply Act	Article 2-1	Electric installations for integrated energy	500 MW or below	Proximity to the energy usage area
	Article 2-3	Business entities and others	430 Gcal/h or below	Heat energy producers

3.2. Key Features of the Distributed Energy Act (DEA)

In Korea, the electricity system was initially developed under a centralized governance model to leverage economies of scale and reduce costs. However, as population density has increased, the mismatch between generation and demand locations has widened, prompting a shift toward more decentralized energy systems in which electricity is produced closer to where it is consumed. The primary driver of this shift is not transmission losses over distance, but transmission constraints. When demand is concentrated in specific regions, electricity must be transported from generation sites, but transmission capacity is limited, preventing the delivery of sufficient supply.

Even if renewable energy facilities are widely deployed, if there is a distance between the supply and demand sites and transmission constraints arise, the use of renewable energy generation is likely to be limited. If transmission networks could be continuously expanded, transmission would be possible even if the physical distance between the demand and supply sites is far, but in Korea, NIMBY (Not in My Back Yard) issues occur near transmission lines, and delays in the construction of transmission networks are also a serious issue.

To partially address this, the *Special Act on Distributed Energy* (hereafter the *Distributed Energy Act*) was announced in June 2023. This law was implemented along with the *Enforcement Decree of the Distributed Energy Act* in June 2024. The goal of the *Distributed Energy Act* is to break away from the centralized electricity market and system, aiming to expand decentralized energy sources, solve transmission constraints, and discover distributed demand and generation sources for sustainable development. The fundamental premise of the Distributed Energy Act is to minimize the construction of transmission infrastructure through miniaturization and decentralization and to integrate supply and demand areas, making it particularly optimized for solar and wind power, the most representative decentralized energy sources.

The Distributed Energy Act defines decentralized energy as energy produced or supplied within, or near, the area where it is consumed, within a scale determined by Presidential Decree. The Enforcement Decree further specifies eligible technologies and facilities, as summarized in Table 3-1.

Table 3-2. Distributed Energy Regulation Exemption by Sandbox Types

Type	Definition	Objective	Special Provisions
Demand attraction-type	Excess supply compared to demand	Promoting the relocation of new demand, such as data centers, to areas with surplus power supply	Preferential power system impact assessment, priority expansion of electric supply facilities such as substations
Supply resource attraction-type	Enhances power self-sufficiency in regions with concentrated demand	Promoting the construction of new power generation resources in areas with power grid congestion	Points granted under LNG capacity market bidding system, priority support for renewable energy financial support programs
New industry activation-type	Addresses regional energy regulation issues and stimulates industries through special district designation in the short term	Promoting the introduction of region-specific decentralized energy systems	Adoption of negative regulatory approach, V2G (Vehicle-to-Grid), regional DR, virtual power plant transactions, real-time pricing, industrial park microgrids, VPP

Sources: Ministry of Trade, Industry and Energy, Korea Energy Agency (2024)

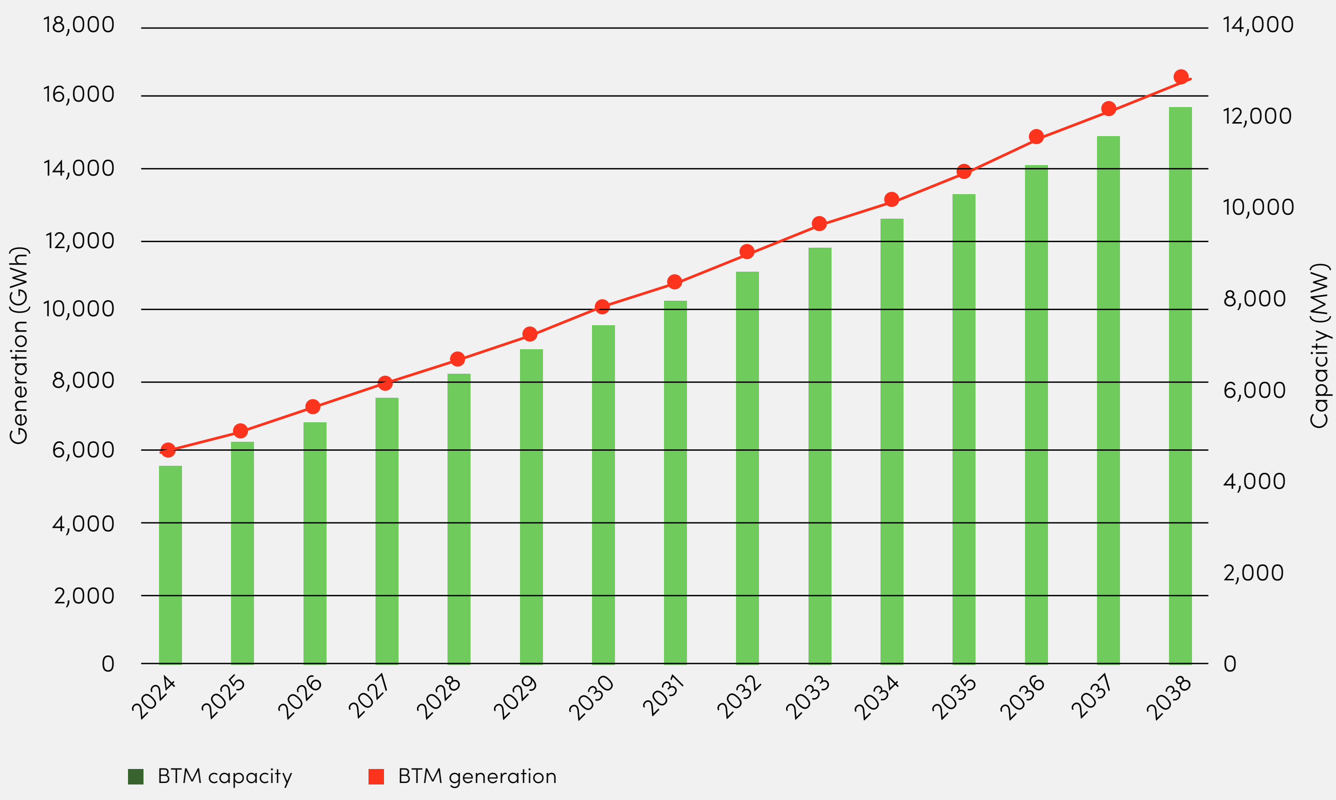
The *Distributed Energy Act* stipulates two mandatory requirements for the activation of distributed energy. The first is the basic plan for the activation of distributed energy. This plan serves as a basic framework for promoting the deployment of distributed energy, covering long-term activation goals, deployment amounts, and systematic promotion measures. This plan is expected to hold the same level of authority as the BPLE.

Second, the Act introduces mandatory installation requirements. Under Article 13, large-scale development projects and high-consumption facilities must meet a minimum share of their energy demand through distributed energy. This applies to developments exceeding 1 million m^2 or buildings with annual electricity demand above 200 GWh. The required share will vary by region, with stricter application in the Seoul Metropolitan Area. The minimum requirement is expected to be around 2% until 2026, increasing to at least 20% after 2040. This mechanism effectively ensures that renewable energy is integrated into new large-scale developments.

A further key mechanism is the designation of specialized distributed energy zones (Article 33), which provide regulatory flexibility and incentives to attract both supply and demand. These zones are categorized into demand-attraction, supply-attraction, and new industry activation types (**Table 3-2**).

In particular, supply-attraction zones in high-demand areas can support local generation and improve energy self-sufficiency. The use of regulatory sandboxes, especially in the Seoul Metropolitan Area, could play an important role in accelerating renewable energy deployment.

Figure 3-2. Behind-The-Meter Capacity and Generation Projection



3.3. Potentials and Implications of Renewable Energy Expansion

The use of mechanisms such as regulatory sandboxes and mandatory distributed energy installation under the Distributed Energy Act is expected to support more effective renewable energy deployment. In particular, distributed systems below 40 MW are predominantly solar and wind, suggesting strong potential for direct expansion of renewable supply. These decentralized resources are likely to be deployed as Behind-the-Meter (BTM) installations, rather than captured within the centralized power market discussed in Chapter 2. While Korea historically lacked systematic statistics on BTM installations, growing grid impacts have led to increasing efforts to develop such data.

The 11th BPLE separately reports the installation capacity and generation forecast for residential solar power. The results, as shown in Figure 3-2, indicate that the BTM generation is estimated to be around 5.9 TWh in 2024, and is expected to reach 16.5 TWh by 2038. As for the installation capacity, it is projected to be 4.4 GW in 2024, increasing to 12.2 GW by 2038. The relationship between installation capacity and generation appears to be based on the current average solar utilization rate of 15.4%, as applied in the BPLE. However, the potential increase in BTM due to the implementation of the *Distributed Energy Act* has not been specifically accounted for, meaning that the BTM supply is likely to be even higher.

The business models and systems that should be activated with the implementation of the *Distributed Energy Act* are VPPA (Virtual Power Purchase Agreement) and the private REC certification market. Currently, the Korea Energy Agency is monitoring renewable energy

Figure 3-3. Renewable Energy Monitoring System of Korea Energy Agency

facilities linked to the agency's system through the Renewable Energy Monitoring System (REMS). This system reports in real-time the installation status, generation volume, and operational status (whether non-operational or not) of renewable energy facilities. In the future, it is expected to play a crucial role when designing systems that utilize BTM. Figure 3-3 shows a screenshot of the actual interface of the Korea Energy Agency's REMS.

Despite the growing volume of BTM capacity, RE100 companies currently face limitations in accessing this energy due to the absence of supporting market mechanisms. One proposed solution is a self-use certification system, similar to REGO (Renewable Energy Guarantees of Origin), which would allow renewable electricity generated by self-use facilities to be certified and traded for RE100 compliance. Such a system could expand available supply, reduce procurement costs, and incentivise further investment in distributed generation, contributing to a virtuous cycle of lower LCOE and declining PPA prices.

Lastly, the business model directly aimed at utilizing self-generated renewable energy for RE100 compliance is the VPPA (Virtual Power Purchase Agreement). This model involves multiple individual self-generating renewable energy producers (i.e., prosumers) coming together to form a virtual power plant, pooling their surplus electricity and entering into a large-scale power purchase agreement with businesses. By consolidating self-generated renewable energy sources and entering into a renewable energy supply contract with a VPPA operator, RE100 can be achieved while also procuring renewable energy at a reasonable price.

4 Conclusion

In conclusion, renewable energy deployment in Korea has been constrained by structural, regulatory, and system-level barriers. Given transmission constraints and delays in grid expansion, reliance on the centralized power market alone is unlikely to deliver the required scale of renewable supply. Current plans under the 11th BPLE depend heavily on timely transmission infrastructure development, which remains uncertain.

This highlights the need to expand alternative pathways for renewable deployment. This study identifies several priority measures, including the mandatory installation of distributed energy under the Distributed Energy Act, the use of regulatory sandboxes, the introduction of a Korean-style REGO system, and the expansion of VPPAs. Together, these mechanisms could increase renewable supply, improve market access for RE100 companies, and help reduce procurement costs.

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