

The Renewable Energy Sector in South Korea between Policy Support and Market Constraints

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Abstract. *In this article the authors present South Korea's renewable energy industry over the period 2020–2024, focusing on the main sources – solar, wind, hydro, bioenergy and nuclear – and the associated supporting policies. As a highly industrialized and energy-import-dependent economy, South Korea faces the challenge of expanding renewable energy deployment while maintaining system reliability and economic competitiveness. The existing literature emphasizes the central role of policy instruments such as the Renewable Portfolio Standard, Renewable Energy Certificates, feed-in mechanisms and corporate procurement schemes, while also identifying persistent constraints related to grid congestion, regulatory uncertainty, social acceptance and investment risk. To address these issues, the study adopts a mixed methodological approach combining descriptive quantitative analysis of installed capacities and electricity generation for solar, wind, hydropower, bioenergy and nuclear energy with a qualitative assessment of the legislative and institutional framework. A SWOT analysis is further employed to evaluate the strategic positioning of the renewable energy sector. The research focuses on the effectiveness of support mechanisms, the performance dynamics of renewable technologies and the structural barriers affecting sectoral expansion. The findings indicate that solar photovoltaics have been the primary driver of renewable growth, although declining capacity factors after 2022 signal increasing grid integration challenges. Wind energy has shown limited capacity expansion but gradual efficiency improvements, while hydropower and bioenergy provide stabilizing contributions to the energy mix. Nuclear energy continues to function as a core low-carbon baseload source. The paper contributes to the literature by offering an integrated and up-to-date assessment of South Korea's renewable energy transition, highlighting policy implications for enhancing system integration, regulatory stability and long-term investment attractiveness.*

Keywords: South Korea; renewable energy transition; solar photovoltaics; offshore wind; Renewable Portfolio Standard; grid congestion; decarbonisation.

Introduction

The energy transition becomes nowadays one of the biggest challenges which entire world and each country should follow to reduce greenhouse gas emissions and achieve the climate goals assumed by the Paris Agreement. South Korea, Asia's fourth largest economy and one of the world's most industrialized countries, faces two main challenges: cutting back on fossil fuels, while at the same time making sure energy supplies are secure and the economy remains competitive.

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The South Korea energy mix contains a high share of conventional resources, especially coal and liquefied natural gas (LNG), to which nuclear energy is added. This structure reflects a level of dependence on imports of more than 90%, which gives a structural vulnerability to the energy sector. In parallel, international pressure to reduce emissions and the need to align with climate neutrality goals have led the South Korean government to develop ambitious energy policies, summarized in strategic documents such as "5th Basic Plan on Renewable Energy (2020–2034)". This plan establishes the development priority directions and identifies quantitative objectives regarding the increase in the share of renewable sources in the energy mix, in correlation with the gradual decrease in the use of coal and other fossil fuels.

The structure of South Korea's renewable energy industry is shaped around four main areas: solar photovoltaics, wind energy (especially offshore), biomass and, more recently, green hydrogen. The development of renewable energies in South Korea is limited by a number of structural challenges, like grid connections, curtailment phenomenon, social opposition to some projects which increase risks for the investors of the sector.

Therefore, South Korea's renewable energy industry is in a phase of consolidation, marked by a combination of significant opportunities and structural challenges. A detailed understanding of the legislative framework, support instruments and existing barriers is fundamental for assessing the sector's prospects. In this context, this article aims to present the evolution of the renewable energy industry in South Korea, highlight its structural strengths and vulnerabilities, and public policies aimed to accelerate the energy transition.

Literature review

In recent years, more and more studies have looked at renewable energy in South Korea, focusing on how policies are designed, whether renewable technologies are practical, and how the energy transition affects the economy and society.

The South Korean renewable energy sector has been strongly shaped by the Renewable Portfolio Standard (RPS) and Renewable Energy Certificates (REC). Kim and Cho (2025) assessed the efficiency of the RPS mechanism using a Nonlinear Autoregressive Distributed Lag (NARDL) model on monthly data (2017–2024). Their findings suggest that while REC and System Marginal Price (SMP) were expected to display an inverse relationship, in practice SMP did not significantly influence REC prices over the long term. Instead, price asymmetries emerged in periods of supply–demand imbalance, leading to policy recommendations favoring long-term fixed contracts and auction-based mechanisms.

Similarly, Cho, Kim and Lim (2024) developed an integrated Levelised Cost of Energy (LCOE) and Analytic Hierarchy Process (AHP) framework for optimising REC multipliers. Their results illustrate how recalibrated multipliers could better align technological development with security of supply and institutional stability.

A recurring theme in the literature is the centrality of subsidies in enabling renewable deployment. Lee and Jung (2024) conducted a cost analysis of required subsidies to replace nuclear capacity with renewables, estimating that subsidies would need to cover approximately 54% of consumer prices to reach grid parity by 2030. They advocated for a transition from RPS to a voluntary Feed-in Tariff (FiT) model to stimulate investment.

Choi (2018) emphasized the household level, showing that government subsidies were crucial for the viability of small-scale PV and fuel cell investments, though these required periodic recalibration. Offshore wind represents a cornerstone of South Korea's energy transition. Na et al. (2025) applied a real options approach to evaluate offshore wind feasibility under price and

regulatory uncertainty. Their analysis revealed that profitability was highly sensitive to energy prices and production levels, with stable regulatory frameworks decisively improving net present value (NPV) and internal rate of return (IRR). Lee and Xydis (2023) explored floating offshore wind projects, concluding that in the absence of subsidies such ventures face significant financial hurdles, although integration with hydrogen production could offer partial mitigation.

Technical studies further complement these policy analyses. Han et al. (2025) applied environmental contour methods to assess extreme wave conditions at offshore sites, providing essential input for cost and safety considerations. Ohn and Namgung (2025) investigated maritime navigation routes to minimize risks from offshore wind deployment, suggesting adaptive routing schemes for safety and acceptance. Public acceptance is increasingly recognized as a determinant of policy success. Seol and Kim (2025) employed willingness-to-pay (WTP) analysis, finding that South Korean citizens were willing to financially support higher renewable shares in public buildings, with preferences influenced by income, age, and climate change perceptions. Cho et al. (2024) examined communication strategies for hydrogen, concluding that addressing technological weaknesses and energy dependency was more persuasive than focusing solely on benefits.

Several studies link renewable deployment with broader economic and environmental outcomes. Oh et al. (2020) employed a computable general equilibrium (CGE) model, reporting that renewable expansion policies yield long-term economic benefits but entail short-term transition costs. International perspectives also highlight the redistributive potential of subsidy design. Gharigh et al. (2024) proposed a combined tax–subsidy scheme, emphasizing the internalization of environmental externalities and the calibration of subsidies to maximize social welfare, a model adaptable to the South Korean context. A growing body of literature also addresses curtailment and grid limitations. Noh et al. (2025) proposed systematic compensation strategies for curtailed renewable energy, arguing that compensatory tariffs and risk-sharing instruments are vital to protect developers and sustain investment flows. These findings intersect with broader discussions of financing and subsidy design, as grid bottlenecks increasingly determine investment risk profiles.

The literature underscores the complexity of South Korea’s renewable transition, marked by regulatory experimentation, reliance on subsidies, and the interplay between economic, technical, and social factors. Research shows that South Korea’s transition to renewable energy is a complex process, shaped by ongoing policy, heavy reliance on subsidies, and the interaction of economic, technical, and social factors. While significant progress has been made in understanding the determinants of policy effectiveness, gaps remain in integrating subsidy schemes with grid management, addressing socio-political resistance, and ensuring financial sustainability in the absence of government support. Future research should thus prioritize cross-sectoral approaches, combining technical feasibility with economic modelling and public policy design.

Methodology

This study adopts an integrated research design in order to examine the evolution of South Korea’s renewable energy industry during the period 2020–2024. The methodological approach combines quantitative analysis of electricity-sector indicators with qualitative examination of policy instruments and institutional arrangements. Such a design is appropriate because the development of renewable energy in South Korea cannot be explained solely through changes in installed capacities and electricity generation. It must also be interpreted in relation to the regulatory framework, the structure of market incentives, and the infrastructural and social constraints that influence implementation. The selected timeframe makes it possible to capture recent changes in the national energy mix, the

expansion of key renewable technologies, and the effects of support mechanisms introduced or adjusted in the context of decarbonization and energy security objectives.

The quantitative component of the research is based on annual data regarding installed capacity and electricity production for the principal energy sources included in the study, namely solar photovoltaics, wind, hydropower, bioenergy, and nuclear energy. Installed capacity is examined in gigawatts, while electricity generation is assessed in terawatt-hours. These indicators were selected because they allow a simultaneous evaluation of infrastructure expansion and actual system performance. The analysis follows the evolution of each source year by year and compares the pace of capacity growth with the corresponding dynamics of electricity output. In order to deepen the interpretation of these developments, the study also considers relative changes and sectoral performance indicators, especially the capacity factor, which provides additional insight into the degree of utilization of the installed assets. This makes it possible to identify situations in which capacity expands rapidly but output grows more slowly, as well as cases where stable or declining capacities are accompanied by higher production. Through this approach, the paper distinguishes between nominal expansion and effective operational performance across the main segments of South Korea's low-emission electricity system.

The qualitative component of the methodology focuses on the examination of the legislative and institutional framework supporting renewable energy deployment in South Korea. Particular attention is given to the main policy instruments shaping the sector, including the Renewable Portfolio Standard, Renewable Energy Certificates, feed-in arrangements, direct power purchase agreements, the K-RE100 scheme, the Green Premium mechanism, hydrogen-related regulations, and measures designed to encourage storage integration and reduce curtailment risk. This part of the analysis aims to clarify how public policy influences investment incentives, technology choice, private-sector participation, and the overall attractiveness of the renewable energy market. At the same time, the study considers the role of structural constraints such as grid bottlenecks, curtailment, permitting delays, social opposition, and the high capital intensity of offshore wind and related infrastructure. By placing the statistical trends alongside these institutional and market factors, the research develops a broader interpretation of the opportunities and limitations shaping South Korea's energy transition.

The final stage of the methodology consists of a SWOT analysis used to synthesize the empirical and institutional findings into a strategic assessment of the sector. Through this framework, the internal characteristics of the renewable energy industry are examined together with the external conditions that may accelerate or hinder future development. In this way, the analysis does not remain limited to the description of recent energy trends, but extends toward an evaluation of South Korea's broader transition potential, the resilience of its support architecture, and the strategic risks affecting long-term expansion. Although the study relies on secondary data and does not employ econometric modeling, the combined use of descriptive statistics, policy interpretation, and strategic synthesis provides a coherent basis for assessing the current state and medium-term prospects of South Korea's renewable energy industry.

Results and discussion

Renewable industry evolution 2020–2024

Analysis of the evolution of installed capacities and wind energy production (2020–2024)

The data presented in figure 1 for the period 2020–2024 highlights a relatively modest evolution of installed capacities in South Korea's wind sector, in contrast to a significant increase in energy production and capacity factor.

Installed capacities remained almost stagnant, standing in the range of 3.15–3.39 GW. In 2020, the level was 3.15 GW, reaching a maximum of 3.39 GW in 2023, and in 2024 there was a slight decrease to 3.36 GW. These limited dynamics suggest structural difficulties in the implementation of new wind projects, most likely associated with regulatory barriers, geographical constraints or social opposition to the expansion of onshore and offshore wind farms.

In contrast, wind energy production has seen steady growth, from 1.64 TWh in 2020 to 2.30 TWh in 2024, equivalent to an increase of more than 40% in four years. This trend reflects an improvement in the performance of existing plants, possibly due to both favorable weather conditions and operational optimization.

A relevant indicator of the efficiency of the sector is the capacity factor. In the analyzed period, it increased from 5.94% in 2020 to 7.81% in 2024. Although the upward trend indicates a more efficient use of infrastructure, absolute values remain considerably below the global average for wind energy (25–40%). This discrepancy highlights the structural and technological limitations of the South Korean wind sector, which fails to fully harness the potential of the wind resource.

The analysis of the period 2020–2024 shows that, despite a clear stagnation in installed capacities, wind production and the capacity factor have registered significant increases. However, the low level of efficiency suggests that the wind sector cannot, in its current form, be a central pillar of South Korea's energy transition. To achieve its decarbonization and energy security goals, the country will need to accelerate the development of new projects, especially in the offshore wind field, and implement measures to increase the competitiveness and efficiency of this renewable source.

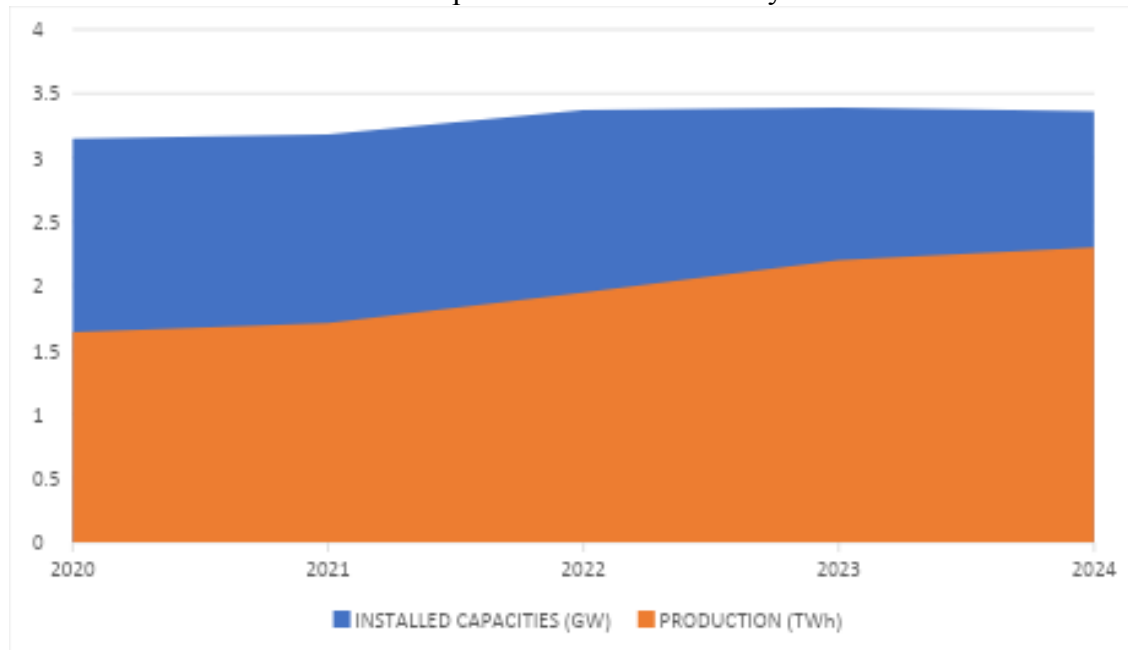


Figure 1. Evolution of eolian installed capacities and production

Source: Own research based on www.ember-energy.org.

Analysis of the evolution of installed capacities and solar energy production (2020–2024)

Data for the period 2020–2024, figure 2. reveal a significant expansion of installed capacities and solar energy production, confirming the dominant role of this technology in South Korea's energy transition.

Installed capacities have grown steadily and accelerated, from 14.76 GW in 2020 to 26.65 GW in 2024, which represents a doubling in just four years (+80.6%). The increase reflects both government support through subsidy schemes and green certificates, as well as the decrease in the costs of photovoltaic technologies, which has encouraged massive investment in the sector.

Solar energy production followed a similar trend, increasing from 19.34 TWh in 2020 to 32.72 TWh in 2024 (+69.2%). Production didn't grow as fast as installed capacity, which likely reflects some underlying issues, such as grid congestion, more frequent curtailment, or newer installations being less efficient than expected.

The capacity factor starts at 15.0% in 2020, it increased to 15.8% in 2021 and peaked at 17.1% in 2022, suggesting improving operational performance in the early years. However, this trend did not last. The capacity factor fell to 16.3% in 2023 and dropped further to 14.0% in 2024. This downward shift points to broader structural issues rather than short-term fluctuations, including grid saturation, limited storage capacity, weaker financial incentives, and possibly less favorable weather conditions, all of which constrain how effectively installed capacity can be used.

Solar energy was the main force behind South Korea's renewable growth, with installed capacity doubling over the period. Even though electricity production rose strongly, performance per unit of capacity dropped after 2022, pointing to grid and integration issues. To keep the momentum going, South Korea needs stronger grids, more storage, and better-tuned support policies to cut curtailment and make better use of solar output.

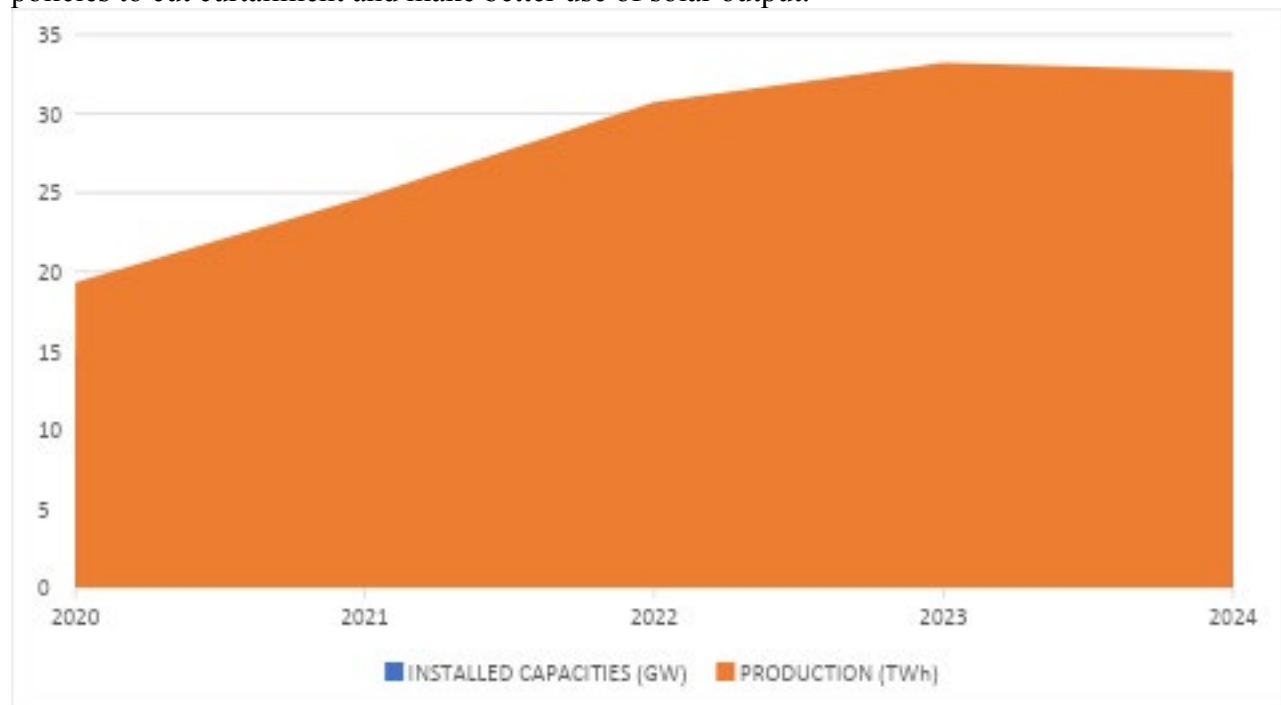


Figure 2. Evolution of solar installed capacities and production

Source: Own research based on www.ember-energy.org.

Analysis of the evolution of installed capacities and hydro energy production (2020–2024)

The analysis of data for the period 2020–2024, figure 3, indicates that hydropower in South Korea has had a stagnant dynamic at the level of installed capacities, but a variable evolution of energy production, depending on hydrological conditions.

Installed capacities remained virtually unchanged, oscillating slightly between 1.80 and 1.82 GW. In 2020, there were 1.81 GW, a value that varied insignificantly throughout the period, reaching 1.80 GW in 2024. This stagnation can be explained by the lack of major new projects, given that South Korea has a geographically limited hydro potential.

Hydropower production fluctuated quite a bit over the period, falling from 3.88 TWh in 2020 to 3.05 TWh in 2021, before recovering to 3.54 TWh in 2022 and 3.72 TWh in 2023. Output peaked in 2024 at 4.30 TWh. These variations are mainly driven by rainfall patterns and water availability, rather than changes in hydropower infrastructure.

The capacity factor was between 19% and 27%, with minimum values in 2021 (18.9%) and maximum values in 2024 (27.3%). This demonstrates that hydropower, although limited in terms of installed potential, can provide significant variations in production depending on climatic conditions.

Overall, South Korea's hydropower capacity is already close to being fully utilized, leaving little room for meaningful expansion in the future. As a result, hydropower generation depends heavily on hydrological conditions, which adds an extra layer of volatility to the country's energy mix. Despite these structural limitations, hydropower continues to play an important role by providing flexibility and balancing services, helping to stabilize the power system as the share of variable renewable sources such as solar and wind continues to grow.

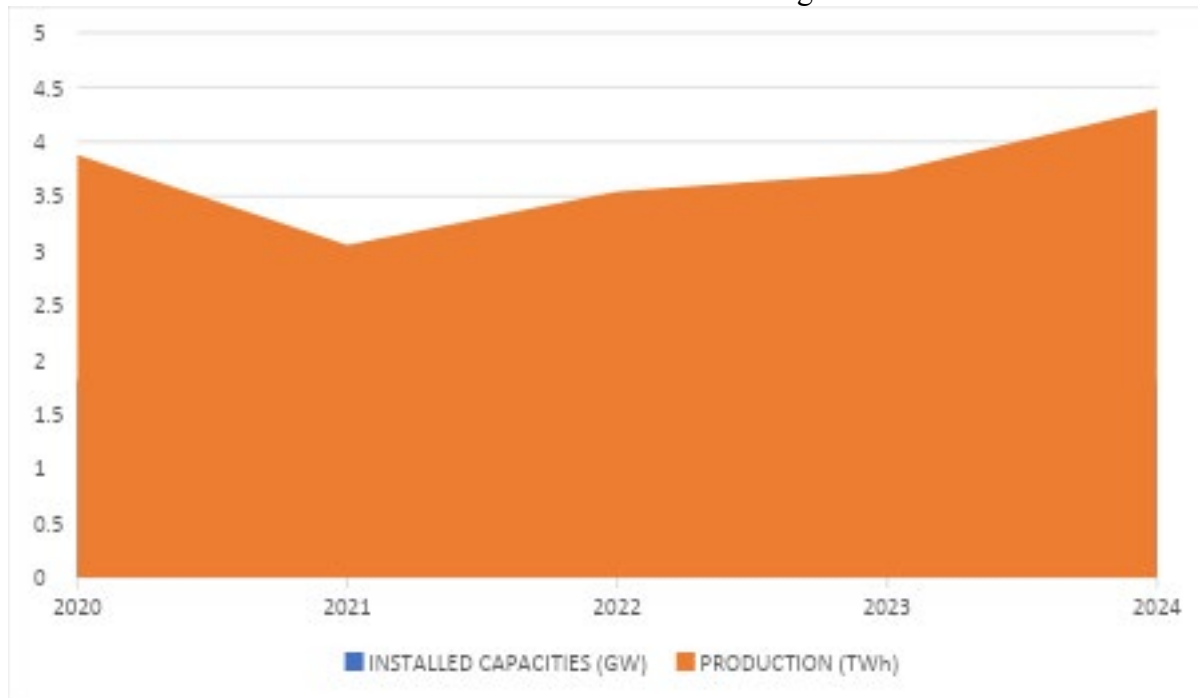


Figure 3. Evolution of hydro installed capacities and production

Source: Own research based on www.ember-energy.org.

Analysis of the evolution of installed capacities and bioenergy production (2020–2024)

The data for the period 2020–2024, figure 4, highlight a particular dynamic of the bioenergy sector in South Korea, characterized by oscillations in installed capacities and a steady upward trend in energy production.

In terms of installed capacities, they peaked at 3.54 GW in 2020, followed by a sharp decline in 2021 to 2.64 GW, a level at which they subsequently remained with minor variations until 2024 (2.68 GW). This reduction can be explained either by the withdrawal of older units or by methodological adjustments in statistical reporting.

On the other hand, energy production has seen a steady increase, evolving from 14.03 TWh in 2020 to 20.34 TWh in 2024, which is an increase of approximately 45% over the period analyzed. The trend indicates that existing capacities are being used more effectively, alongside technological improvements.

A key element is the capacity factor, which increase from around 45% in 2020 to almost 87% in 2024. These high values, significantly higher than those recorded for variable renewable sources (wind and solar), indicate an intense and constant exploitation of bioenergy plants, which gives them a stabilizing and predictable role in the energy mix.

However, the dependence on biological resources and their sustainability issues require a careful assessment of the long-term role of bioenergy in South Korea's energy transition.

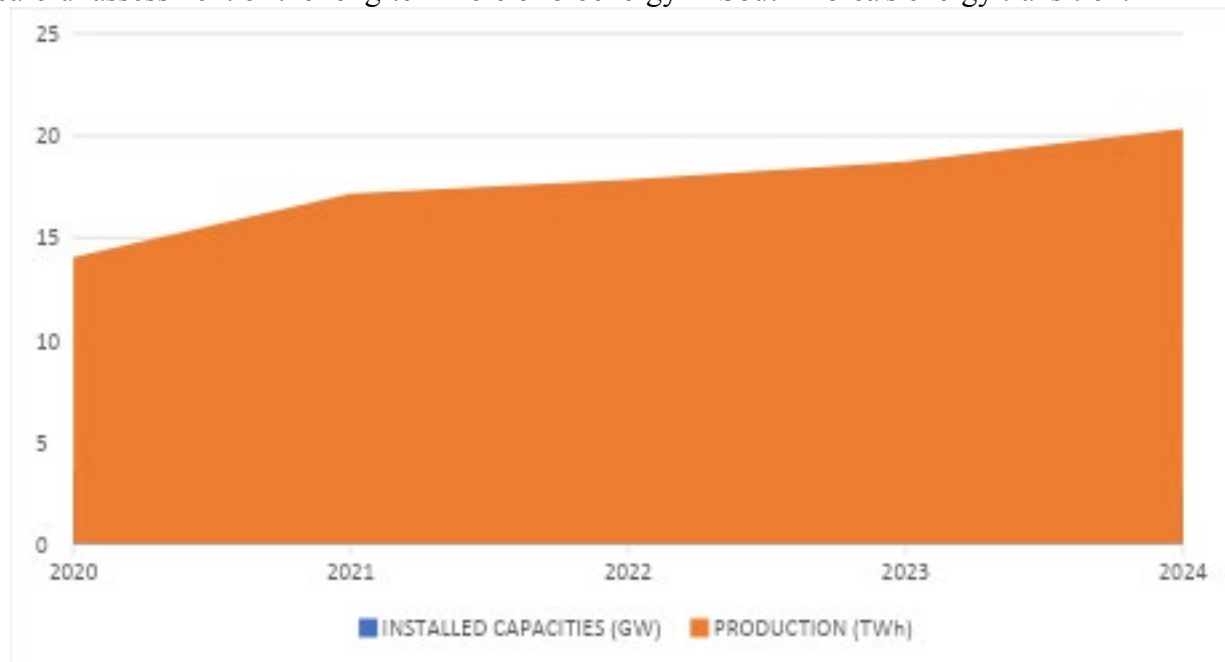


Figure 4. Evolution of bioenergy installed capacities and production

Source: Own research based on www.ember-energy.org.

Analysis of the evolution of installed capacities and nuclear energy production (2020–2024)

Nuclear energy was one of South Korea's main sources of electricity in 2020–2024, figure 5, maintaining its strategic role as a low-carbon core technology. The available data show relative stability of installed capacities and a high and constant production, with moderate variations from one year to another.

Installed capacities were in the range of 23.25 GW – 26.05 GW, with a moderate upward evolution during the period. This trend reflects both the modernization and retrofitting of existing units and government policies that support nuclear energy as a central pillar of national energy security.

Nuclear power production has increase from 160.18TWh to 188.75 TWh annually, representing one of the largest contributions to South Korea's energy mix. The fluctuations observed during the analyzed period can be explained by scheduled maintenance works, variations in the utilization factor and operational adjustments to balance the energy system.

The capacity factor was high (78–84%), confirming the reliability and competitiveness of nuclear energy compared to other energy sources. This high level of use of nuclear infrastructure indicates that the installations are operated to high technical and safety standards, making a decisive contribution to ensuring the stability of the electricity grid.

Nuclear energy remains the dominant source in the South Korean energy mix, offering stability, energy security and a high level of capacity utilization.

The relatively constant evolution of production and installed capacities demonstrates its essential role as a low-emission transition technology in the context of decarbonization objectives.

In the perspective of the energy transition, the maintenance and modernization of the nuclear fleet will continue to be essential to compensate for the intermittency of solar and wind energy and to reduce dependence on fossil fuels.

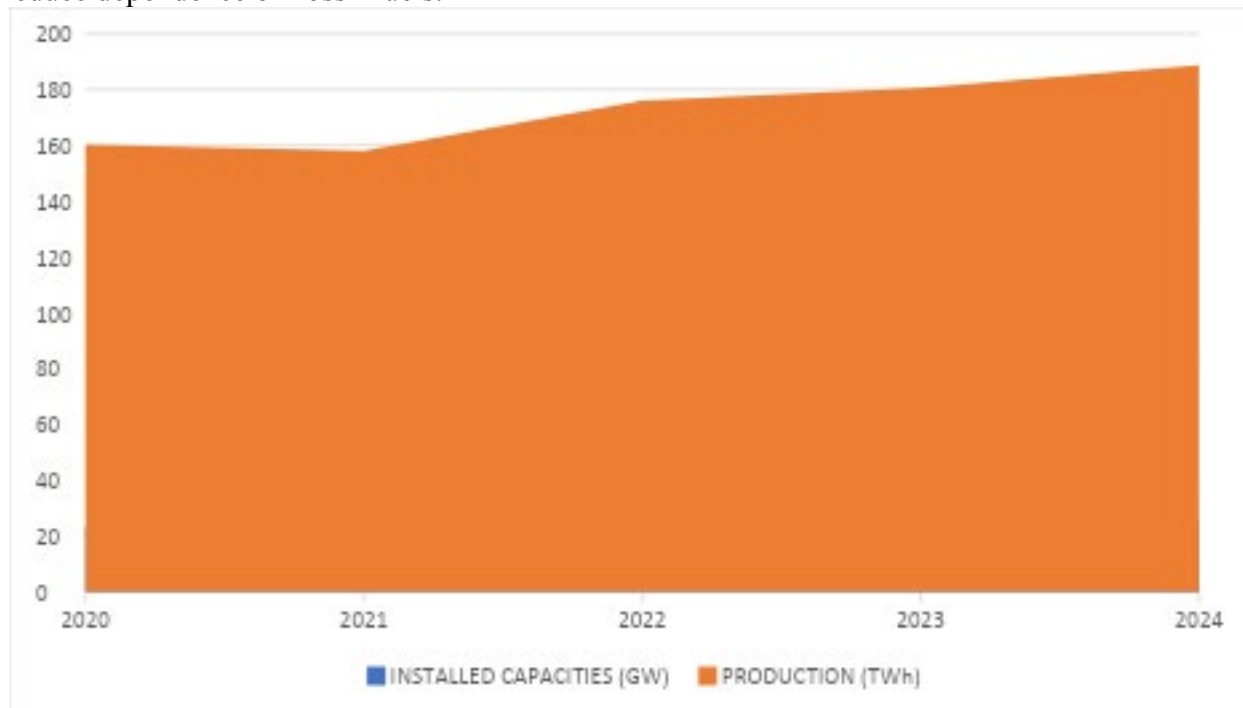


Figure 5. Evolution of nuclear installed capacities and production

Source: Own research based on www.ember-energy.org.

SWOT analysis of the renewable energy industry in Korea

Strengths 1. Relatively mature policy framework (RPS+REC). South Korea has a strengthened legislative framework to support renewables, implemented since 2012 through the Renewable Portfolio Standard (RPS). Under this system, large power producers (over 500 MW) are required to steadily increase the share of renewable energy they use, creating stable and predictable demand. At the same time, the Renewable Energy Certificate (REC) market offers a transparent trading framework that helps reduce investor risk. Together, the consistency and range of these tools give South Korea an edge over many other emerging economies. 2. Robust private demand through K-RE100. The K-RE100 program, inspired by the global RE100 initiative, allows companies to achieve their 100% renewable consumption goal through four paths: direct PPA contracts, the purchase of REC, "Green Premium" tariffs or self-production. Large conglomerates (Samsung, LG, Hyundai) are actively participating, which creates additional private demand that complements public policy instruments. 3. Potential in offshore wind and related industrial expertise. South Korea has a high potential for offshore wind energy development, thanks to its coastline expansion and expertise in the shipbuilding industry and offshore platform construction. Recent tenders (2024–2025) have already allocated gigawatt capacity, including for the first floating wind farm. This direction confirms an integration between energy policy and the country's traditional industrial advantages. 4. National Hydrogen Strategy. The Law on the Promotion of the Hydrogen Economy and the Safety of Its Use (2020, amended in 2022) establishes a unique framework in Asia for clean hydrogen certification, usage obligations, and infrastructure subsidies. This gives South Korea a pioneering advantage in building a domestic market for hydrogen, in parallel with the development of the market for renewables that will provide energy for electrolysis.	Opportunities 1. Expansion of tenders for renewable projects. The Ministry of Trade, Industry and Energy (MOTIE) has instituted recurring auction rounds, which provides investors with visibility and predictability. These tenders attract both local developers and foreign investors, strengthening the industrial ecosystem. 2. Storage integration (ESS). The inclusion of ECN (energy storage coefficient) multipliers for projects using energy storage solutions stimulates the adoption of the ESS (energy storage solutions). This helps to reduce intermittency and curtailment problems, improving network stability. The increase in demand for ESS is in turn creating opportunities for the battery industry, a sector in which Korea already has a strong global position (LG Energy Solution, Samsung SDI). 3. Hydrogen economy and electrolysis. Targets to increase green hydrogen production by 2030 create an anchor demand for renewable energy, as electrolysis requires green electricity. This synergy between RE and hydrogen can generate integrated investments and international partnerships. 4. Increase in corporate demand. Multinational companies, under pressure from investors and foreign markets, are increasingly demanding renewable energy through K-RE100 and direct PPAs. This trend supports the development of a private renewable energy market while gradually reducing dependence on public subsidies.
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Weaknesses 1. Network constraints and courtship. The expansion of photovoltaic and wind capacity has exceeded the pace of transmission and distribution upgrades, leading to curtailment in some regions and negatively affecting project profitability. The lack of clear compensation schemes discourage investment and increases the risk perceived by financiers. 2. Regulatory volatility and complexity. Although RPS and REC are solid schemes, other programs have been paused or changed suddenly. An example is the feed-in tariff for small PV installations, which was eliminated in 2023 due to fraud and market manipulation. Such changes reduce investor confidence and can discourage the involvement of small prosumers. 3. High costs for offshore wind. Even though the technical potential is high, the capital costs (CAPEX) for offshore wind, especially for floating technologies, remain high. Projects require significant funding, adapted port infrastructure and additional local know-how. In the absence of risk-mitigation tools, these projects remain weak from a financing perspective. 1. Geographical limitations and local opposition. Land availability for onshore developments is constrained by dense settlement patterns and community opposition based on environmental and aesthetic considerations. In rural areas, opposition to solar projects on agricultural land and wind farms is growing, which prolongs permitting procedures.	Threats 1. Policy changes and recalibration of support. The government has announced the phasing out of support for certain types of biomass and may adjust other schemes in the future. These sudden policy changes can destabilize investors' business plans. 2. Unfavorable macroeconomic conditions. Rising interest rates and exchange rate volatility can affect the cost of capital for projects with large investments (offshore wind, electrolyzes). In addition, global competition, especially from China, may reduce the competitiveness of Korean industry in the PV and battery value chains. 3. Delays in obtaining permits. Permitting procedures for offshore projects include numerous assessments (impact on navigation, fisheries, marine biodiversity), which extends implementation times. In the context of the pressure to achieve climate neutrality objectives, these delays represent a major risk. 4. Uncertainties regarding clean hydrogen. Although the hydrogen law provides a general framework, the actual implementation depends on secondary normative acts, in particular for the definition of "clean hydrogen" standards. Delays or ambiguities in setting these criteria may discourage investment in the sector.
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The SWOT analysis highlights that South Korea's renewable industry has a solid foundation for development, built on a mature legislative framework and robust private demand. Nevertheless, network constraints, regulatory uncertainty, and high costs associated with some technologies limit expansion prospects. While offshore wind, storage, and green hydrogen present substantial opportunities, their successful deployment will depend on policy stability and the government's capacity to ensure effective system integration.

Conclusions

The analysis of South Korea's renewable energy industry for the period 2020–2024 highlights several results and trends with strategic relevance. Firstly, South Korea's energy transition has a

key role to play both in reducing dependence on fossil fuels and nuclear energy, as well as in strengthening energy security and economic competitiveness.

At the level of renewable sources, **solar photovoltaic energy** has emerged as the main growth vector, with a doubling of installed capacities and a substantial increase in production. However, the decrease in the capacity factor after 2022 indicates structural limitations, such as network congestion and *curtailment phenomena*. **Wind energy** has stagnated in capacity development, but has seen moderate production growth, with yields well below the international average. **Hydropower** remained at a constant level, with variable production determined by hydrological conditions, playing a complementary role in balancing the system. **Bioenergy** has undergone a paradoxical evolution: the reduction of installed capacities, but the increase in production, supported by very high-capacity factors, which consolidates it as a stable and predictable source. In parallel, **nuclear energy** continued to be the central pillar of the energy mix, with constant production and utilization factors of 78–84%, confirming its reliability and strategic importance.

The legislative framework and public policies include various instruments – Renewable Portfolio Standard (RPS), Green Certificates (REC), Feed-in Premium, PPA direct contracts, the K-RE100 program and the Green Premium scheme – which have helped to stimulate investment and demand. However, regulatory volatility and the suspension of support schemes, such as the Feed-in Tariff for small PV plants, generate uncertainty and limit investment attractiveness.

Despite the progress, the industry faces **major structural challenges**: grid limitations, congestion and losses through *courtship*, social opposition to certain projects, high costs for offshore wind and legislative instability. These barriers reduce predictability and may delay the achievement of decarbonization goals.

At the same time, South Korea has significant **competitive advantages**, particularly in the areas of offshore wind, hydrogen economy development and energy storage system (ESS) integration. In addition, the demand generated by the K-RE100 program and international pressures on climate neutrality create opportunities for accelerated expansion.

Overall, South Korea's renewable energy industry is in a phase of consolidation, marked by significant achievements but also persistent barriers. To achieve climate neutrality objectives and ensure a sustainable energy transition, it is essential that national energy policy focuses on scaling up offshore projects, modernizing network infrastructure and ensuring a stable and predictable legislative framework.

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During the preparation of this work, the author(s) utilized ChatGPT 4 to enhance readability and language clarity. Following the use of this tool, the author(s) meticulously reviewed and revised the content as necessary and assume(s) full responsibility for the final content of the publication.

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