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Solutions for Our Climate (SFOC) is a South Korea-based group that advocates for stronger climate change policies and transition towards a fossil-free society. SFOC is led by legal, economic, financial, and environmental experts with experience in energy and climate policy and works closely with domestic and overseas nonprofit organizations.

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## Breezing Past Wind: How Korea's RPS is Sidelining the Wind Energy Market

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**Publication Date** September 2021  
**Authors** Kyungrak Kwon, Yeji Kim  
**Design** NEMOLAB  
**Contact** solutions@forourclimate.org



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# I. Renewable Energies: Where We Are Today

## 1 Higher Renewable Energy Targets Called for in Tandem with Toughening 2030 NDCs

Last October, the South Korean government announced the 2050 Carbon Neutral Strategy for the Republic of Korea and declared a shift of focus in its energy system toward renewable energies. This choice came in the midst of mounting awareness at home and abroad of the need for aggressive responses to the threats of climate change.

Major advanced countries declared their pressing journeys toward carbon neutrality and are formulating practical action plans. A case in point is the US. The Biden administration, which was inaugurated last year, is bent on laying the groundwork for the ambitious vision. At the Climate Summit 2021, which was held last April, US President Joe Biden vowed to halve US greenhouse gas (GHG) emissions by 2030 compared to 2005 levels, and British Prime Minister Boris Johnson pledged to reduce UK greenhouse gas emissions by 78 percent versus 1990 levels by 2035. Japan also sharply raised its GHG reduction target from a cut of 26 percent against 2013 levels by 2030 to a 46-percent cut.



Figure 1 Major Countries' Toughening of 2030 NDCs

In comparison, South Korea has been dithering about its nationally determined contribution (NDC). NDCs signify interim GHG reduction targets to be delivered by 2030 in order to achieve carbon neutrality by 2050. Korea has submitted a target of slashing GHG emissions by 24.4 percent from its 2017 levels by 2030 to the Secretariat of the United Nations Framework Convention of Climate Change (UNFCCC). The target is practically the same as the target that the PARK Geun-hye administration announced, a 37-percent cut against a 2030 business-as-usual (BAU) scenario.

South Korea's NDC has been decried as highly insufficient. Climate Analytics, a global thinktank, supposes that global warming would proceed even by a 3- or 4-degree rise, double the target of limiting global warming to well below 2, preferably 1.5 degrees Celsius, if countries around the globe were to set their climate change targets as low as South Korea's.<sup>1</sup> Due to this highly insufficient NDC, the country faces the criticism that it has not brought forward any effective targets despite its pledge of carbon neutrality. In addition, when the country hosted the Partnering for Green Growth and the Global Goals 2030 (P4G) summit last May, it still hesitated to come up with any specific targets and was condemned for turning a blind eye to its responsibility to tackle the climate crisis. The National Assembly recently debated a bill for the Framework Act on Carbon Neutrality and Green Growth (Carbon Neutrality Framework Act), and in the course of the deliberations, a lukewarm suggestion that the act provide for an NDC of at least a 35-percent cut in GHG emissions from 2018 levels was made. It has since been denounced as extremely insufficient in light of the recommendations by the Intergovernmental Panel on Climate Change (IPCC) and major countries' aggressive efforts for GHG reduction.

With the ever-increasing need for energy transition, the voices calling on the South Korean government to substantially enhance the country's renewable energy action plan are getting louder. The December-2017 version of the country's renewable energy action plan, which is dubbed the Renewable Energy 3020 Plan or simply the 3020 Plan, envisions that renewable energy generation should account for 20 percent of total power generation by 2030. More specifically, solar, wind, and other clean energy sources will represent at least 95 percent of the new and renewable energy generation equipment (48.7 GW), if the 3020 Plan achieves its goals. The South Korean government is also proceeding with its third Energy Master Plan and its 9th Basic Plan for Electricity Supply and Demand. The former seeks to increase the percentage of renewables in power generation to 30-35 percent by 2040, and the latter proposes to increase the new and renewable energy power generation capacity to 77.8 GW by 2034.

1. Climate Analytics, "Transitioning towards a zero-carbon society: science-based emissions reduction pathways for South Korea under the Paris Agreement," 2020.

However, the year 2021 sees the widespread skepticism that achievement of the 20-percent-by-2030 and the 30-45-percent-by-2040 targets will not get the country to carbon neutrality. It is called on to leave behind such fossil fuels as coal and gas more quickly than planned and mark a more decisive transition to renewables. In particular, one study after another recommends that unrelenting efforts be made for complete carbon-free power generation.

	Wind	Solar
Renewable Energy 3020 Plan (2017)	17.7 GW (by 2030)	36.5 GW (by 2030)
2030 GHG Reduction Roadmap (2018)	7% cut from energy transition	
Third Energy Master Plan (2019)	Increase of renewables to 30-35% of total power generation (by 2040)	
Green New Deal (2020) <sup>2</sup>	42.7 GW from solar and 12.7 GW from wind (by 2025)	
Ninth Power Supply Master Plan (2020)	77.8 GW from new and renewables (by 2034)	
Fifth New and Renewable Energy Master Plan (2020)	22.2% of power generation from renewables (80.8 GW by 2034)	
2050 Carbon Neutrality Scenarios (2021) <sup>3</sup>	Scenario 1: Renewable energy ratio: 56.6% (121.4TWh) Scenario 2: Renewable energy ratio: 58.8% (121.4TWh) Scenario 3: Renewable energy ratio: 70.8% (891.5TWh)	

**Table 1 The South Korean Government's Renewable Energy Targets**

Studies have consistently suggested that in order to successfully limit global warming to 1.5 degrees Celsius, South Korea should not only spur its race toward decarbonization by bringing an end to coal-fired power generation, but also adjust its renewable energy targets upward. Climate Analytics states, "South Korea must phase out coal, the most polluting source of electricity generation, by 2029, while rapidly scaling up its use of renewable energy technologies," in order to help limit global warming to 1.5 degrees Celsius as per the Paris Agreement.<sup>4</sup> Many Korean research institutes have also proposed how much power should be generated from renewable energy sources to reach carbon neutrality by 2050. The Green Energy Strategy Institute reports that solar power generation capacity of at least 365 GW and wind power generation capacity of at least 132 GW should be built by 2050. In addition, GCAM-KAIST estimates that the solar power generation capacity and the wind power generation capacity should be increased by 348 GW and 139 GW, respectively.<sup>5</sup> GCAM-KAIST is Korea's first-ever integrated assessment

2. Ministry of Trade, Industry and Energy, "First Step toward a Carbon Neutral Society", press release, July 16, 2020.  
 3. 2050 Carbon Neutrality Committee, first draft of "Scenarios for Carbon Neutrality by 2050", 2021.  
 4. Climate Analytics, "Transitioning towards zero-carbon society: science-based emissions reduction pathways for South Korea under the Paris Agreement", 2020.  
 5. Green Energy Strategy Institute, "Deep Decarbonization of the Korea's Energy System", 2021.

model for GHG emissions analysis jointly developed by Solutions for Our Climate (SFOC) and the Korea Advanced Institute of Science and Technology (KAIST).

	Chang-hoon LEE, et al. (2019) <sup>6</sup>	Energy Transition Korea / Seong-ho LEE(2020) <sup>7</sup>	Green Energy Strategy Institute(2021) <sup>8</sup>	SFOC-KAIST (2021)
Solar	305 GW	400 GW	365 GW	348 GW
Wind	152 GW	100 GW	132 GW	139 GW
Total	457 GW	500GW	497GW	487 GW

**Figure 2 Additional Renewable Energy Capacity Required for 2050 Carbon Neutrality**

6. Chang-hun LEE, Tae-hyeon KIM, Hyeon-ju PARK, Nam-il KIM, Myeong-deok PARK, Min-chan LEE, "Sustainable Development and Energy Transition: 1.5 Degrees Target", Series of Books by the National Research Council for Economics, Humanities and Social Sciences (NRC), 2019.  
 7. Seong-ho LEE, "Strategies and Policy Development to 2050 Carbon Neutrality in the Korea", Energy Transition Korea, 2020.  
 8. Green Energy Strategy Institute, "Deep Decarbonization of the Korea's Energy System", 2021.

## 2 Penetration of Renewable Energy in Korea

A 2020 OECD reports shows South Korea positioned at the bottom of renewable energy penetration in primary energy consumption at a mere two percent.

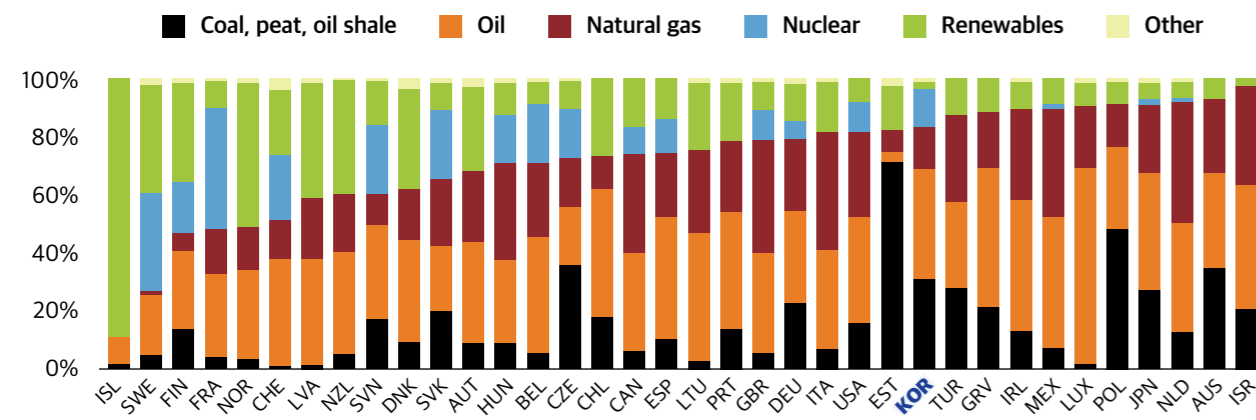


Figure 3. Shares of Renewables in Primary Energy Supply of Different Countries<sup>9</sup>

Type of Energy Source	Capacity (MW)	Percentage
New energies	815	0.62%
Solar	11,768	50.8%
Wind	1,494	6.4%
Hydro	1,809	7.8%
Wave and tidal	256	1.1%
Biomass	3,141	13.6%
Waste	3,888	16.8%
<b>Total</b>	<b>23,171</b>	<b>100%</b>

Table 2 Penetration of New and Renewable Energies in Korea: Cumulative Capacities (as of 2019)<sup>10</sup>

10. KEA, "2019 New and Renewable Energy Statistics," 2020

Government statistics show that supply of new and renewable energies reached 23.1 GW in 2019. Besides the fossil fuels-based new energy sources, renewables stood at 22.3 GW. It is noteworthy that solar and wind were slightly more than a meager 11.7 GW and 1.49 GW, respectively.

According to renewable energy statistics that the Korea Energy Agency (KEA) releases every quarter, the cumulative solar and wind power generation capacities amounted to 15.8 GW and 1.7 GW, respectively, in 2020. These KEA statistics, combined with the 2019 statistics in the preceding paragraph, indicate how little progress has been made while the country's renewable energy supply targets reflect its enhanced 2030 NDC, as previously discussed.

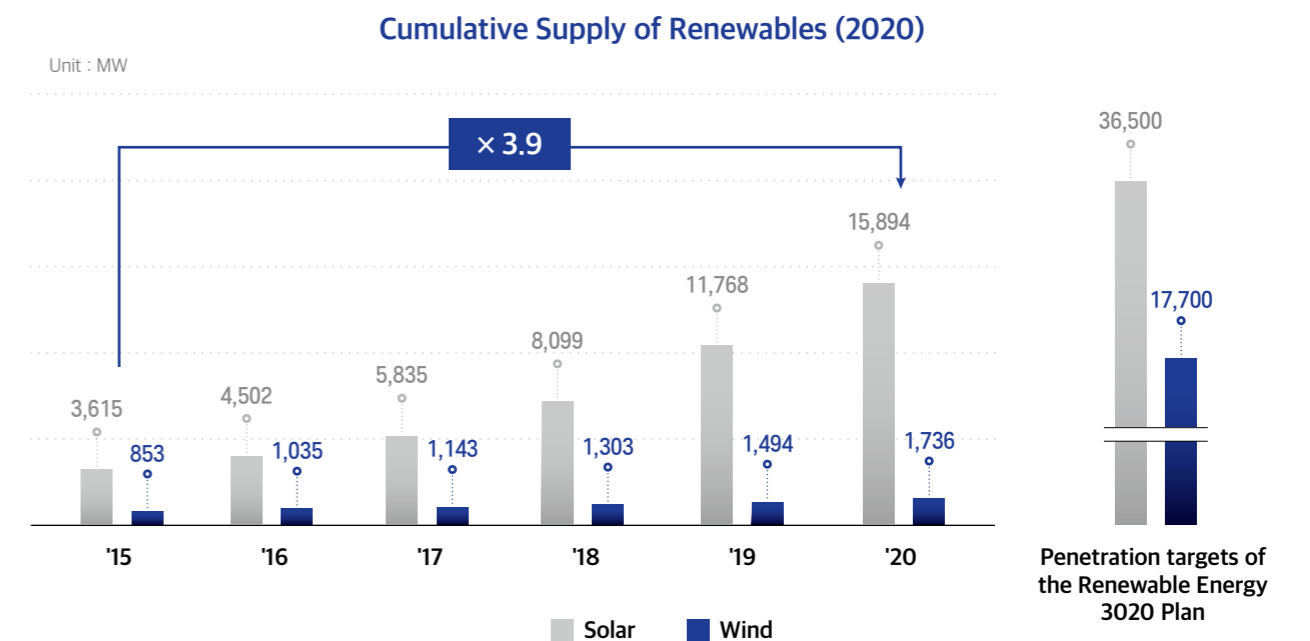


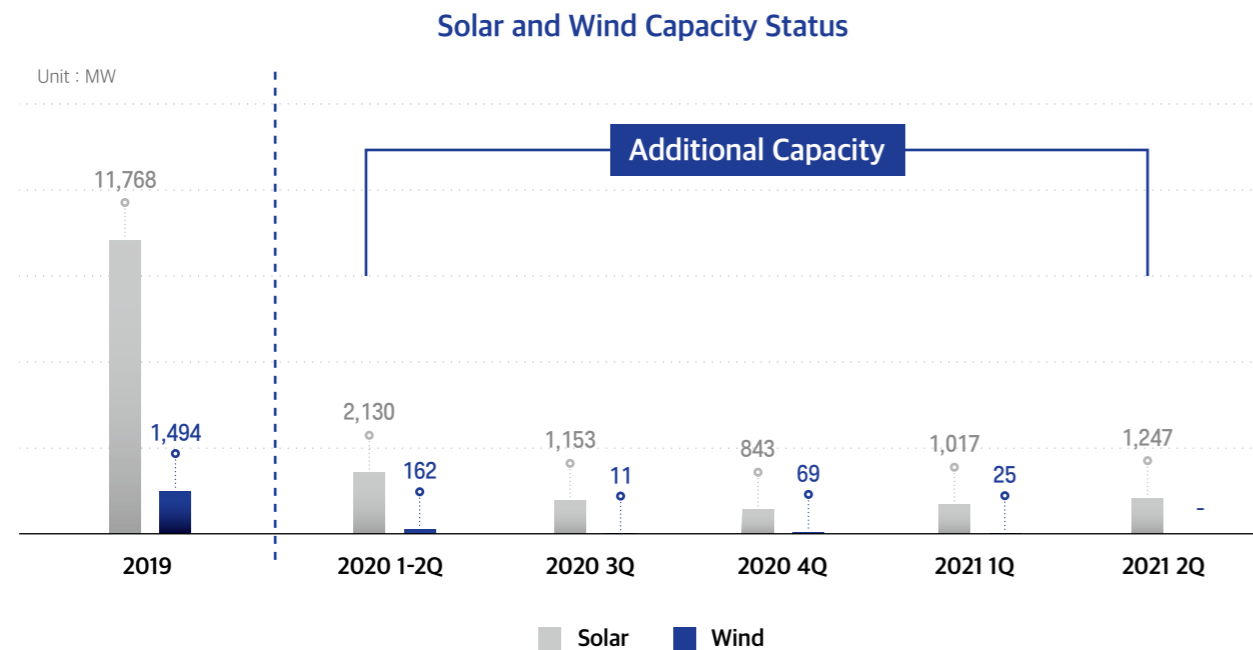
Figure 4 Statistics on Annual Cumulative Supply of Renewables

At the current pace of penetration, the South Korean government would find it impossible to deliver its targets as per Renewable Energy 3020 Plan. It should be noted that, the pre-existing NDC target levels are linked with this 3020 Plan, so if the NDC is sharply enhanced in the course of enacting the Carbon Neutrality Framework Act, the NDC targets will have to be raised substantially. Some simple assumptions estimate that approximately an annual 11-12 GW and 4-5 GW increase in capacity will be required of solar and wind, respectively, to have total renewable capacity of about 460-510 GW by around 2050.

The supply of wind power is rising at a snail pace compared with that of solar, posing a serious problem. The Renewable Energy 3020 Plan set the penetration target of wind energy generation at a modest 17.7



GW, but the country is likely to fall short of the target as the 2020 wind penetration was only 1.7 GW, less than ten percent of the target which will have to be considerably raised if the NDC target for wind energy is raised as discussed in the preceding paragraph.



**Figure 5 Quarterly Capacity Increase in Renewables**

The actual quarterly capacity increases in 2020 betray how inadequate the wind penetration is. By 2019, the wind energy power penetration reached 1.5 GW, but wind energy capacity has hardly increased since the third quarter of 2020—totaling less than 100 MW. Worse yet, none was added in the second quarter of this year.

### 3 Structural Problems of the RPS System: Its Impact on Wind Power Generation

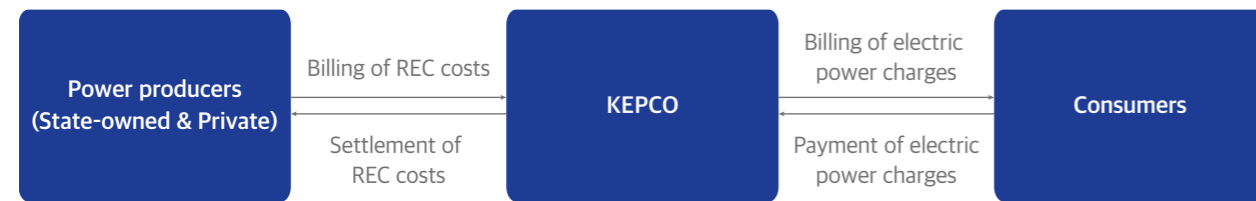
The South Korean government introduced a Renewable Portfolio Standard (RPS) system in order to bolster the penetration of renewables in 2012. A feed-in tariff (FIT) had been around, but it was found to be problematic in many respects, prompting the introduction of RPS. By the FIT, the government funded the price difference if the sale price of a renewable was lower than the government-set price with the aims of encouraging market competition and technological development in solar, wind, and other renewables. However, the government had to replace the FIT system with an RPS system because of its failure to encourage competition among power producers and incentivize technology development, among many other problems.

The RPS system requires power producers of 500 MW or more (which are dubbed mandatory suppliers) to ensure a certain share of renewables in their total power generation. Mandatory suppliers must either purchase renewable energy certificates (RECs) or obtain ones by generating renewable energy. This provides renewable power producers with two primary sources of revenue: sale of renewable energy and sale of RECs. A renewable power producer's total revenue equals the wholesale price (which is also dubbed the system marginal price or SMP) times the amount of power sold to Korea Electric Power Corporation (KEPCO) plus the REC unit price times the volumes of RECs sold to mandatory suppliers. In the process, incentives are given depending on the types of renewables and the installation methods, and those incentives are also added to those power producers' total revenue.

A salient feature of the South Korean RPS system is about who bears the burden of supplying new and renewable energy. Due to the country's monopolistic retail market structure (in which KEPCO is the sole retailer), the burden has not been placed on the retailer but on power producers. This has forced the state-owned power companies of new and renewable energy (which are mandatory suppliers) to play a dual role of being REC purchasers and compete with private power producers to generate RECs, thereby giving rise to unreasonable ways in which REC contracts are made, an increasing lack of transparency, and so forth. These problems have greatly discouraged the penetration of renewables.

The roots of these structural problems trace back to the power industry restructuring that took place in 2001 and was prematurely brought to an end in 2004, leaving KEPCO as virtually the one and only power retailer. Imposing the obligation of supplying new and renewable energy on KEPCO (which is the monopolistic retailer) would make it impossible to ensure fairness in the market. With such an arrangement, the government would find it difficult to induce competition and declines in new and renewable energy costs. Hence, the RPS system imposes the obligation of supplying new and renewable

energy not on the retailer but on power producers. A deformed industry structure like this is hardly found elsewhere.



**Figure 6** Flows of Cost Settlement of the South Korean RPS System

These characteristics have acted as obstacles to the penetration of wind power. The way a wind power project is pursued in South Korea is as follows: a private power producer first proceeds with business development activities, such as obtainment of the necessary permits and licenses and performance of an environmental impact assessment (EIA), and then seeks to enter into a long-term fixed-price contract with a state-owned power company (which is a mandatory supplier). The fixed price here equals the system marginal price (SMP) plus the REC unit price. The REC costs incurred in the process to the state-owned power company is charged against KEPCO, which in turn charges the costs against consumers and settles them with the state-owned power company.

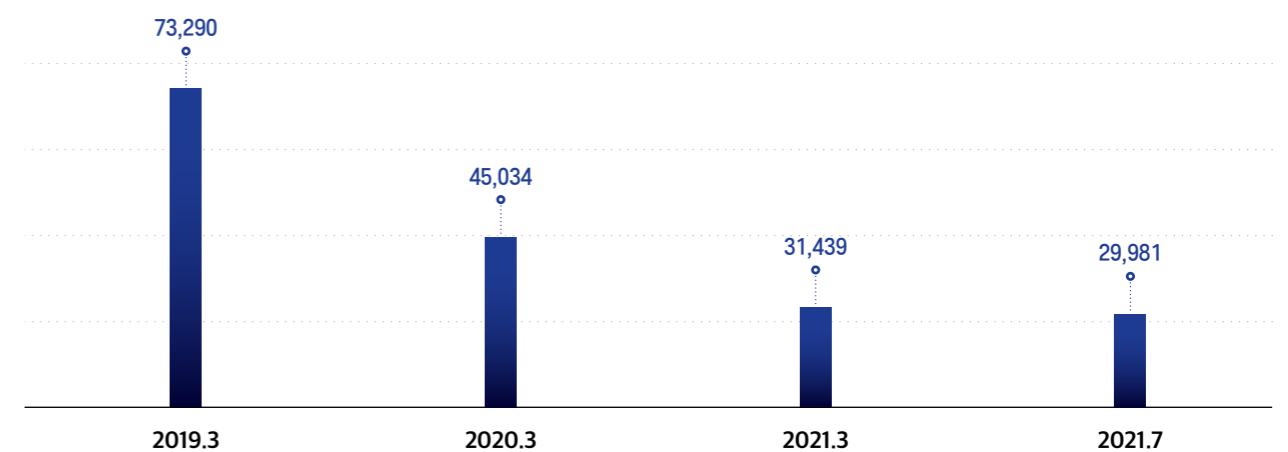
This process is problematic for several reasons, however. A private power producer needs customers with which it can sign long-term, fixed-price REC sale contracts, but the customer pool is limited: it does not even include all the mandatory RPS suppliers, only the state-owned power companies. Put differently, there are only the state-owned power companies that can buy wind power RECs. The state-owned power companies are public agencies controlled by the government, so the government has a justifiable reason to intervene in the determination of the contractual unit prices of fixed-price contracts. Attention has been repeatedly drawn to the persistent problems that the process involves about the appropriateness of the latest unit contract price and the opaque contracting process.

Moreover, the fact that the South Korean RPS system squashes all different renewable energy sources—biomass, solar, wind, and more—into a single REC market has been denounced as a hindrance to the growth of wind power. Given that the largest factor of the profitability of wind power projects is REC prices, a consolidated REC market means that the economic feasibility of wind power projects is swayed by supply and demand for other renewable energy sources. The table below shows statistics on the volumes of RECs issued for different renewables:

Type of Renewable	RECs Issued (2016)	RECs Issued (2020)	Percentage (2020)
Solar	3,605,930	20,764,073	48%
Wind	802,123	2,863,173	7%
Hydro	1,137,121	1,491,821	3%
Fuel cells	1,051,536	6,475,570	15%
Biomass	5,299,921	9,956,421	23%
Waste	1,024,982	1,008,776	2%
IGCC	105,101	392,566	1%
<b>Total</b>	<b>13,026,713</b>	<b>42,952,400</b>	<b>100%</b>

**Table 3** RECs Issued (2020)<sup>11</sup>

The 2020 REC statistics show that solar represented about a half of the total RECs issued, but biomass and fuel cells amounted to big shares of 23 percent and 15 percent, respectively. A comparison between 2016 and 2020 REC statistics finds growth of solar power generation to be the most striking change. Among other factors, the unit cost for solar generation has plunged on account of falling prices of modules. The stellar growth of solar power has led to a decline in REC prices.



**Figure 7** Spot REC Price (KRW/REC)<sup>12</sup>

<sup>11</sup> 11 Statistics from the Public Data Portal as of July 2021.

<sup>12</sup> Energy & Environment News, "REC Tumbles Below KRW 30,000... Power Producers Heave a Sigh of Frustration for Declining Profitability", August 2021.



The high ratios of biomass and fuel cells (which have adverse effects on GHG reduction) also have a bearing on the decline in REC prices. Supply and demand for RECs are the dominant factor that determines REC prices, which explains why biomass and solar (of which the unit REC production costs are lower) represent large percentages of REC supply. Moreover, RECs for fuel cells (which are made from fossil fuels) still change hands. All of these factors are responsible for the nosediving prices of RECs.

The government is making a range of attempts to stabilize the plummeting REC prices by, for example, raising the cap on the mandatory supply ratio of renewable energy from the current ten percent to 25 percent over time and adjusting REC weights. However, they are hardly fundamental solutions; they are no more than makeshifts.<sup>13</sup> To wind power producers, tumbling REC prices may mean downward pressure on contractual prices at the negotiation table with state-owned power companies because lower REC prices lead to lower standard settlement prices for compensation for REC purchase costs that the state-owned power companies receive from KEPCO ex de facto. All are obstacles to activation of investment in wind power and it is no wonder that wind power has difficulties attracting investment.

To sum up, the impact of the current RPS system on wind power generation can be explained in the following three respects:

- 1) The irregular manner by which REC contracts are entered into due to the structural limitations of the power industry
- 2) Extreme government intervention in the contractual REC unit price and an increasing lack of transparency
- 3) Deteriorating profitability and increasing uncertainty due to a single REC market

This report will elaborate on the three issues above with focus on the problems involved and explore possible improvements.

<sup>13</sup>. Energy & Environment News, "Mandatory RPS Supply Ratio to Be Raised to 25% by 2030", March 2021

## II. Major Issues of the South Korean RPS System Regarding Wind Power

### 1 Irregular REC Contracting

As discussed earlier, the RPS system of South Korea was made much more complex (even to the point of deformity) than those of other countries due to the structure of the country's power industry. Namely, the burden of supplying renewable energy is imposed on power producers, not on the power retailer, requiring state-owned power companies to act as off-takers or purchasers of RECs from private power producers. Thus, the state-owned power companies need to both compete with private power producers and to purchase RECs from them.

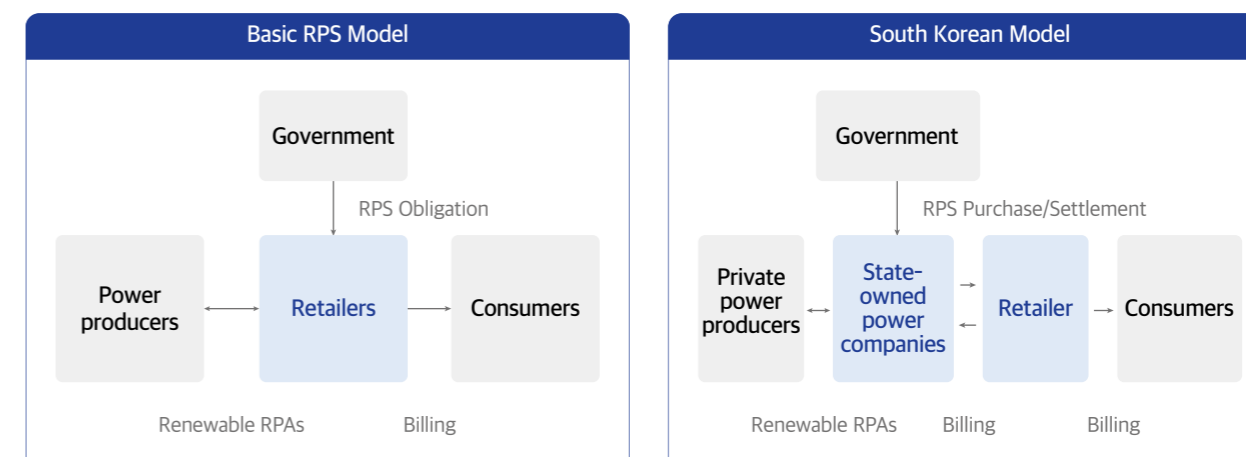
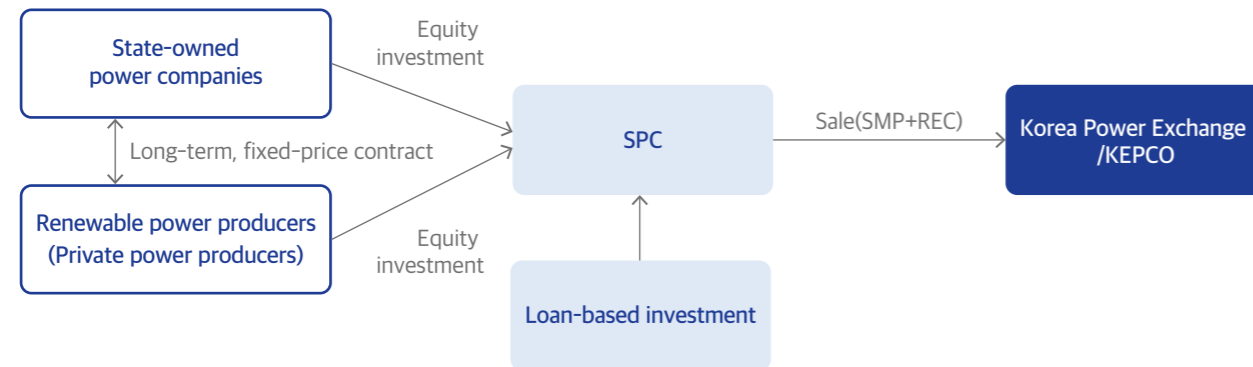


Figure 8 Unique Structure of the South Korean RPS System

It is noteworthy that most business development projects for onshore wind power generation are not led by state-owned power companies but private power producers from the early stage. That is, after a private power producer completes the business development phase, which involves obtainment of the necessary permits and licenses, the private entity in most cases enters into an REC purchase contract with state-owned power company in regards to the project.

Until 2016, private power producers and state-owned power companies freely and individually signed contracts, but the Board of Audit and Inspection of Korea (or the BAI) suggested that the free contracting procedure between the two types of power companies be improved, resulting in a new industry-wide practice where a state-owned power company enters into a free contract for a power project only if it has

a stake in the project.<sup>14</sup> Afterwards, private power producers began to establish special purpose companies (SPCs) aimed at wind power generation in order to win REC contracts with state-owned power companies, and state-owned power companies intending to open REC contracts for SPCs began to invest equity in them. This has now become an entrenched industry practice.



**Figure 9** Equity Investment Structure of Wind Power Generation Business in South Korea

A private power producer needs to make a long-term, fixed-price REC contract with a state-owned power company if it expects to receive project financing (PF) for the SPC concerned. Financial institutions are generally willing to finance an SPC for which an REC contract has been made in order to reduce the risk of sales fluctuations during the wind power generation business period of the SPC and minimize volatility in revenue.

The fact that long-term, fixed-price REC sale contracts make it easier for private power producers to receive loans, together with the BAI's audit opinion, the Ministry of Industry's guidelines, and a range of stakeholders' needs, for example, stable project financing, helped the practice of the structure illustrated above take root in the industry.

<sup>14</sup> A BAI audit report published in December 2016 points out, "When the six power subsidiaries of KEPCO conduct their own REC contracts besides transactions in the REC market in order to fulfil their supply obligation, they do not fall under any reason for free contracting as per the Contract Administration Rules for State-Owned Companies and Quasi-Governmental Agencies. Therefore, the Ministry of Industry should devise a measure to prevent them from executing free contracts and thereby hindering the creation of a market environment for fair and active transactions," adding, "However, the Ministry of Industry has not produced any management and supervision measures regarding how REC purchase agreements should be entered into." Later, the Ministry of Industry recommended that state-owned power companies enter into an REC contract involving an SPC when they invest equity in the SPC, and this has become an entrenched industry practice.

The business structure above may be ascribed, at least in part, to the unique limitations of the South Korean RPS system, in which the state-owned power companies have to be the final purchasers of RECs and private power producers cannot directly sell RECs to the power retailer. Of course, it is not impossible for private power producers to sell power in the wholesale market and RECs in the spot market, but as explained earlier, in each of the markets, prices fluctuate widely, making it highly unfeasible for power generation projects, which need to raise funds of hundreds of millions, or even billions, of Korean won.

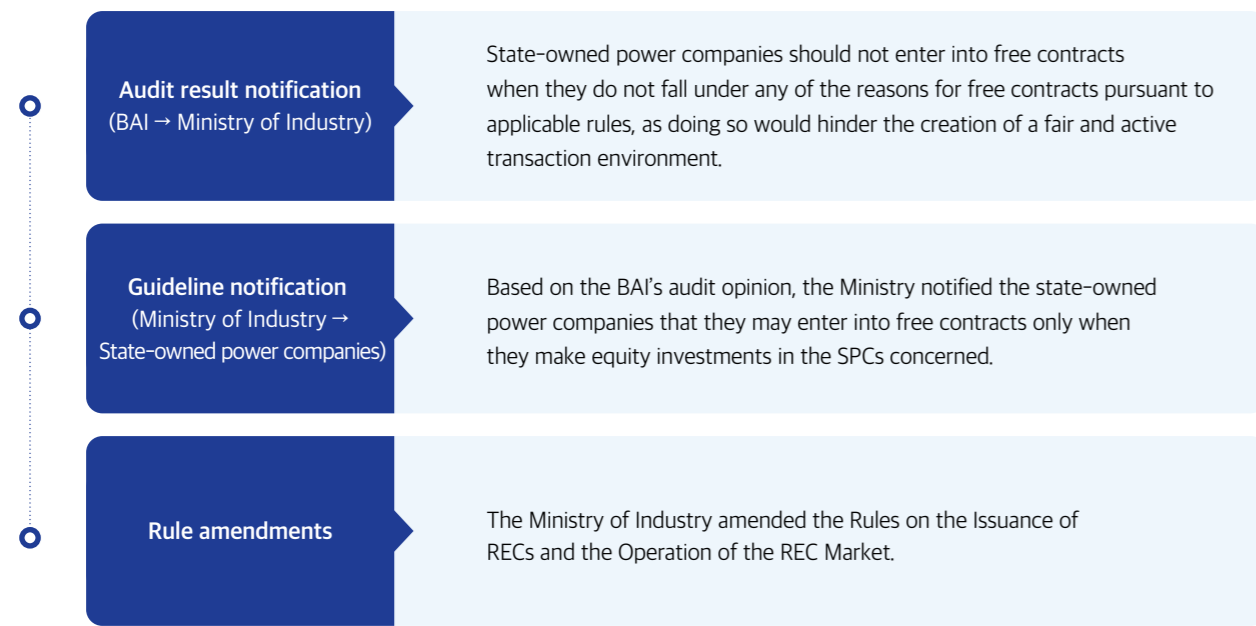


Figure 10 Forced Equity Investments Based on BAI's Audit Opinion

The structure by which the government directly controls the entire process of power purchase agreements (PPAs) has recently become even more powerful. The government's amendments to the Rules on the Issuance of RECs and the Operation of the REC Market as of April 2020 established the contracting procedure requiring that when a state-owned power company makes an equity investment in a new and renewable project, the board of directors of the state-owned company must make the final decision after consultation with the Ministry of Industry and the Ministry of Economy and Finance following consultation with the Korea Power Exchange (KPX) and the KEA.<sup>15</sup> This structure can hardly be found in other countries that have introduced RPS, and at the root of it is the requirement that

15. Rules on the Issuance of RECs and the Operation of the REC Market (amended on April 17, 2020)

**Article 42. Steering Committee**

- ① The head of the New and Renewable Energy Center shall form a Steering Committee of experts from industry, academia, and research institutes for efficient operation of the RPS system.
- ② The Steering Committee shall comprise no more than 12 commissioners including the chair appointed pursuant to Paragraph 3, and it may provide advice, conduct reviews, and make resolutions on the following:

6. Review of establishment of organizations that the Ministry of Trade, Industry and Energy funds or invests in or review of projects that the Ministry funds or invests in as per Article 51-2 of the Act on the Management of Public Institutions and that are new and renewable energy projects either by a subsidiary of KEPCO (hereinafter "power generation subsidy") as per the Korea Electric Power Corporation Act or by Korea District Heating Corporation (hereinafter "KDHC") as per the Integrated Energy Supply Act.

**Article 42-2. Review of Adequacy of Projects Considered for Equity Investment**

A cost review as per Paragraph 1, Subparagraph 1 shall be conducted based on the results of a review by the Working Committee for New and Renewable Energy Business Feasibility Reviews (which is operated in accordance with detailed operating guidelines set by the Korea Power Exchange) with flexibility in consideration of the project's possible contributions to the industry and government policy, among other factors; provided that the Steering Committee shall complete such a review within two weeks.

state-owned companies make direct equity investments in power plant projects that the private sector develops. Because of the requirement, the Ministry of Economy and Finance's guideline that the government must assess the adequacy of projects in which public agencies have stakes became the ground for the government's assessment of the adequacy of PPAs.



Figure 11 Procedure for Power Generation Contract Deliberation and Execution

In South Korea, all wind power producers need to enter into contracts abiding by the procedure above, which is very redundant and complex and, therefore, taxing to private power producers. Wind power producers express their concerns about increasing uncertainty surrounding business costs and earnings forecasts because they are influenced by government policy. In a wind power project, how great the initial cost estimates are does not affect the contractual unit price, which is to be set later by the government. According to the contracting procedure above, cost evaluation is conducted after all the necessary permits and licenses are obtained. For the process, the costs of turbine supply, construction, and installation, as well as costs of obtainment thereof, must be submitted, but they are prone to be changed in the course of signing a contract with a state-owned power company, posing an enormous risk to the private power producer.

Another big problem is a lack of transparency concerning the relevant committees of the KPX and the KEA. Their cost evaluation procedures, contractual price decision criteria, and detailed evaluation results, as well as the makeup of those committees, are not disclosed. The private power procedure that develops a project is left outside the cost evaluation of the project and is not given an opportunity to defend its project to those committees, whereas the state-owned power company considering an equity investment

in the SPC can take part in the evaluation process.

Moreover, not only the KPX but also the KEA, the Ministry of Industry, the Ministry of Economy and Finance, the board of directors of the state-owned power company, and so forth evaluate the costs, repetitively and redundantly, most likely resulting in an unnecessary delay in business. A private power producer pursuing wind power generation has to spend at least eight months or so<sup>16</sup> raising funds for investment for an SPC and inking an REC contract under the current rules. If one of the necessary consultations for cost evaluation does not work out in the first session, the period could be lengthened indefinitely. Cost evaluation for a certain project reportedly takes about two years. Even if a project has found an appropriate site for wind power generation and obtained all necessary permits and licenses, about one year will still be required to execute a contract with a state-owned power company. This is a major drag on the penetration of wind power.<sup>17</sup>

<sup>16</sup>. Reportedly, a period of one month typically passes with the Committee for Evaluation and Management of Risks of State-Owned Power Corporations; about three months are spent on consultations with the KPX, the KEA, and the Ministry of Industry; about another one month is spent consulting with the Ministry of Economy and Finance; and about another three months are required for the state-owned power company's internal investment deliberation and its board of directors' resolution.

<sup>17</sup>. Generally speaking, in a wind power generation project, it takes four to five years, or even longer, until cost evaluation starts, prior to which the power producer needs to assess the feasibility of the project, obtain the necessary permits and licenses, and ensure local residents' acceptance. Thus, it is likely that the longer the cost evaluation, the lower the profits (forecasts).

While consultations for cost evaluation become drawn out, costs may rise due, for example, to rising prices of raw materials, but it is structurally difficult to reflect such cost increases in the cost evaluation.

- Korean Power Producer A

Rules require that the RPS committee of the KEA complete a consultation for cost evaluation within two weeks, but the committee often fails to meet the deadline. The system must be improved by removing as many repetitive or redundant elements as possible.

- Korean Power Producer B

Our company has not faced such situation, but looking around, we have seen many cases in which ground breaking was delayed for nearly one year because of REC price consultations with state-owned power companies. A project of which groundbreaking was expected to happen two years ago actually did the groundbreaking last year; a project of which ground breaking was planned to take place last year is seeing groundbreaking take place later this year, for instance.

- Overseas Power Producer C

Table 4 Interviews of Wind Power Producers #1

## 2 Lack of Transparency Surrounding REC Unit Prices and Excessive Government Intervention

Another issue is the process by which the government deliberates on the REC unit prices of contracts between private power producers and state-owned power companies. It is surmised that there are two broad reasons for which the government intervenes about the appropriateness of the contractual REC unit prices. First, the government appears intent on preventing state-owned power companies from setting purchase prices in contracting too high. Second, the government is apparently incentivized to suppress REC costs as much as possible in order to suppress consumer prices of electric power because REC costs are ultimately transferred to consumer prices.

Even though the government's intervention is well-intended as above, the questions of how properly the deliberation on REC unit prices is conducted and how much the intervention contributes to boosting the penetration of wind power supply need to be considered, separately from those good intentions.

Evaluation of the appropriateness of the unit price of a contract between a private power producer and a state-owned power company is reportedly conducted mostly by the Working Committee for New and Renewable Energy Business Feasibility Reviews of the KPX. Then, the case is passed from the Working Committee to the Steering Committee of the KEA, and there are regulatory grounds on which the latter, too, may evaluate costs. However, the Steering Committee does not conduct so serious an evaluation as to make any practical changes to the results of the KPX's cost evaluation.<sup>18</sup>

The criteria for the KPX's cost evaluation concern the results of analysis of the levelized cost of electricity (LCOE) for each energy source. At this stage of cost evaluation for a project, the KPX requires that the private power producer and the state-owned power company set the contractual unit price below a certain level, and if the parties fail to meet the criterion, it is extremely difficult for them to pass the stage.<sup>19</sup>

Under these circumstances, private power producers draw attention to the opacity and vagueness of the KPX's evaluation criteria for wind power generation unit costs and contractual unit prices. According to the materials that the KPX submitted to Assemblywoman So-young LEE, the criteria for contractual unit prices that the KPX presents to private power producers are set based on research findings on the LCOE of wind power by the Korea Energy Economics Institute (KEEI).<sup>20</sup> The following table shows LCOE estimates by the KEEI.

<sup>18</sup>. The KEA's reply to Assemblywoman So-young LEE's request for materials, July 2021.

<sup>19</sup>. Out of the total 27 cases that have been deliberated on by the KPX for cost evaluation, ten cases passed the stage without meeting the unit price cap criterion, only one of which was a wind power case.

<sup>20</sup>. The KEEI's reply to Assemblywoman So-young LEE's request for materials, July 2021.

Classification	Solar	Onshore Wind	Offshore Wind	Small Hydro	Biomass	Waste	Wave & Tidal	Fuel Cells
2020	155.1	169.9	282.1	252.6	156.5	95.9	233.3	220.0
2021	145.7	163.6	249.7	252.6	156.5	95.9	233.3	205.6
2022	138.6	157.6	227.0	252.6	156.5	95.9	233.3	197.3
2023	132.8	151.7	207.5	252.6	156.5	95.9	233.3	191.8
2024	126.4	150.3	194.6	252.6	156.5	95.9	233.3	187.5
2025	121.2	149.0	188.1	252.6	156.5	95.9	233.3	184.1
2026	116.8	147.8	181.6	252.6	156.5	95.9	233.3	181.2
2027	112.5	146.7	175.1	252.6	156.5	95.9	233.3	178.8
2028	108.8	145.8	171.9	252.6	156.5	95.9	233.3	176.6
2029	105.6	144.8	168.6	252.6	156.5	95.9	233.3	174.7
2030	102.4	144.0	165.4	252.6	156.5	95.9	233.3	173.0
2031	99.2	143.7	162.1	252.6	156.5	95.9	233.3	171.8
2032	96.0	143.3	158.9	252.6	156.5	95.9	233.3	170.7
2033	93.5	143.0	155.6	252.6	156.5	95.9	233.3	169.7
2034	91.3	142.7	152.4	252.6	156.5	95.9	233.3	168.7
2035	89.3	142.4	152.4	252.6	156.5	95.9	233.3	166.9
2036	87.3	141.4	149.2	252.6	156.5	95.9	233.3	164.3
2037	85.3	140.3	145.9	252.6	156.5	95.9	233.3	161.3
2038	83.3	139.3	142.7	252.6	156.5	95.9	233.3	158.1
2039	81.3	138.3	142.7	252.6	156.5	95.9	233.3	154.9
2040	79.3	137.3	139.4	252.6	156.5	95.9	233.3	151.9
2041	77.3	136.3	139.4	252.6	156.5	95.9	233.3	149.0
2042	75.3	135.3	139.4	252.6	156.5	95.9	233.3	146.3

Table 5 Estimated LCOE for Each Renewable Energy Source (KRW/kWh)<sup>21</sup>

<sup>21</sup>. KEEI, "Mid- and Long-Term REC Price Forecast Analysis," July 2021

A KEEI research study paints a rather stark cost picture for the other renewable energy sources than solar and wind. That is, technological advances are not likely pull down the unit power generation costs for them. In South Korea, in particular, the unit cost of solar power generation is expected to decline faster than that of wind power generation, and the gap in the unit power generation cost between onshore and offshore will be almost bridged by 2040. The unit cost of onshore wind power generation stood at KRW 169.9/kWh in 2020, almost the same as the estimate from another KEEI study, which was KRW 166.8/kWh. This implies how realistic KEEI estimates are.<sup>22</sup>

The most serious problem of the KPX's cost evaluation process stems from its application of the same contractual price criteria for all types of power producers. Unlike solar power generation, wind power generation costs (which include direct installation and materials costs, indirect costs, costs of connecting to KEPCO's supply grids, land rents, and compensation for civil complaints) vary widely depending on the region, wind conditions, and so forth. The government's imposition of uniform contractual unit price criteria (which disregard the characteristics of wind power generation) on a project that has already obtained all necessary permits and licenses poses a great economic risk to the project.

A recent news report states that the KPX set the contractual unit price for onshore wind power at KRW 164.9/kWh for 2020, KRW 147.1/kWh for May 2021, and KRW 137/kWh for September 2021. A comparison between the LCOE levels by the KPX and KEEI research findings reveals that the KPX is presently applying the levels of power generation costs of around the year 2033.<sup>23</sup> If this situation is not addressed, private power producers' distrust in power authorities will persist on the grounds of the determination of contractual unit prices.

The KEEI-proposed blanket application of returns of investment calculated based on LCOE estimates is not free from criticism. Private power producers argue that use of the weighted average cost of capital (WACC) as a criterion for a fair return on investment for wind power generation<sup>24</sup> has reduced the WACC required for a project replacing coal power to a mere 4.6 percent, which should be for state-owned power companies, not for private power producers. It is only natural that the two groups have different expectations for profits. The application of a uniformly calculated WACC, disregarding the differences between the two types of business, requires private power producers to settle for levels of profitability

22. KEEI, "Implementation and Operation of Mid- and Long-Term LCOE Estimating System for Greater Supply of Renewable Energy," 2021.

23. E2News, "Wind Trickery of Raising REC Weight in Front and Lowering Contractual Price Behind the Back", August 2021.

24. The WACC is calculated by weighting each element of a company's cost of capital (liabilities, preferred stock, common stock, retained earnings, etc.) proportionally to its ratio in the total capital in terms of market value and averaging them.

that state-owned companies should pursue. There should be some premiums that would balance out the risks that private power producers must embrace at the early stages of projects, but this inflexible policy has not left any room for it.

Furthermore, there is uncertainty about the grounds on which the KPX and the KEEI make LCOE estimates, because it is unknown whether their studies for LCOE estimation involved large enough populations. The unit power generation cost varies more wildly for wind than for solar or other renewable energy sources, depending on the site conditions and how the equipment is used. In addition, wind penetration is far lower than solar penetration, so the components of the unit power generation cost are also believed to vary widely.<sup>25</sup>

The fact that the KPX sets certain levels of standard unit prices for contracts between private power producers and state-owned power companies is not something new. Under the obsolete FIT system, the government announced contractual unit prices every year, and projects that could not satisfy the unit prices could not go any further. With FIT gone, one might expect things to be better, but is not the case. In a sense, things are worse. The government's contractual REC unit price deliberation process marks a retrogression rather than progress. Under FIT, the unit prices were announced at least in advance so that private power producers could assess the feasibility of projects more accurately based on more transparent grounds. However, the present RPS system casts a cloud of uncertainty because private power producers are left in the dark about the possible contractual unit prices until just before they sign the contracts after obtaining all necessary permits and licenses.

25. An interview with Korea Wind Energy Industry Association (KWEIA), 2021



### 3 Profit Erosion due to Compensation Losses

Another impediment to the economic feasibility of wind power generation under the South Korean RPS system is the unreasonableness of standard settlement prices for compensation for RPS obligation fulfillment costs (simply “standard compensation prices” or more simply “standard prices”). Namely, the state-owned power companies are entitled to be compensated for the costs of fulfillment of their RPS obligations in accordance with the KPX’s Detailed Rules on Cost Evaluation, and the way of calculating the standard compensation prices is an issue.

The aforementioned Detailed Rules on Cost Evaluation of the KPX provide that the costs incurred to a state-owned power company for the fulfillment of its RPS obligation with regard to an REC contract are compensated for, not at the contractual price that is set after the KPX’s cost evaluation, but at the so-called *first fixed REC price*, which is the fixed REC price set first in the year of evaluation, of the REC contract. The rules dictate that this price encompasses both wind and solar power generation.

Classification	Purchase from Outside (i.e., from the REC Spot Market)	Construction	Fixed-Price Contracting		
			Direct Contracting*	Indirect Contracting**	Contracting for Small Solar
Quantity for Settlement	$Q_o$	$Q_R$	$Q_T$	$Q_S$	$Q_V$
Weighted Average Unit Price	$P_o$	$P_R$	$P_T$	$P_S$	$P_V$
Standard Compensation Prices	$\frac{P_o \times Q_o + P_R \times Q_R + P_T \times Q_T + P_S \times Q_S + P_V \times Q_V}{Q_o + Q_R + Q_T + Q_S + Q_V}$		Article 18.5.1, Paragraph ①	Article 18.5.1, Paragraph ②	Article 18.5.1, Paragraph ③

\* In direct contracting, a mandatory supplier directly purchases RECs from power producers as needed.  
 \*\* In indirect contracting, the KEA selects REC sellers to help mandatory suppliers enter into long-term contracts with them.

**Table 7 The KPX’s Criteria for Standard Compensation Prices<sup>26</sup>**

The rules require that the standard compensation price for direct contracting (which is the type of contracting for all wind power projects) for a year be determined by calculating the weighted average of the prices of all direct contracts, indirect contracts, and small solar contracts signed in that year for their quantities. This calculation method is apparently intended to fuel competition between different sources in a single REC market and thereby incentivize lower obligation performance costs.

<sup>26</sup> Article 18.5-1, Paragraph 1 of the Detailed Rules on Cost Evaluation of the KPX:

Reportedly, the KPX recently said to state-owned power companies that they need to meet a price (KRW 147/kWh) when signing REC contracts with SPCs. If the price is this low this year—and it will go down further next year—the contractual REC unit price will become too low, and there is still uncertainty over how much further it will go down in the future. – Korean Power Producer D

The government thinks that contractual prices should not be higher than the corresponding LCOE levels. The board of directors [of the company] takes a skeptic stance toward a wind power generation project at the report of the price consultation process because such a project would generate losses without doubt. At the same time, the government says, “Apparently, the contractual prices still are bubbly. – Korean Power Producer E

Economic feasibility should be assessed in consideration of the market, and firm and clear REC guidelines should be given. Then, let the power producers make choices. It should be the market that determines economic feasibility. Imposition of a certain percentage of return on investment across the board means forcing [power producers] to meet even economically unfeasible [prices], doesn’t it? Contrary to what is intended, this will backfire by encouraging reckless development. – Overseas Power Producer C

[The government’s forceful] attempts at item-by-item verification of investment costs will naturally encourage power producers to exaggerate their costs. There is no need to verify the costs; [the government] only needs to determine the way to set prices. Then, those who can do business will do business; those who cannot will leave the industry. – Overseas Power Producer D

It is difficult to uniformly set the investment cost items for wind power projects. Different sites have different topography, and the costs of civil engineering vary from one project to another. It is not understandable that [the government] presents LCOE levels, with the knowledge of such uniqueness [of wind power projects]. – State-Owned Power Company A

The grounds on which the LCOE levels for offshore wind power generation were determined are not known. They did not ask any question to the companies; nor did they ask for any materials. [We want to ask] how on earth they conducted investigations for the prices. It is suspected that they in fact did not listen to those who are actually in the business. – State-Owned Power Company B

**Table 6 Interviews of Wind Power Producers #2**

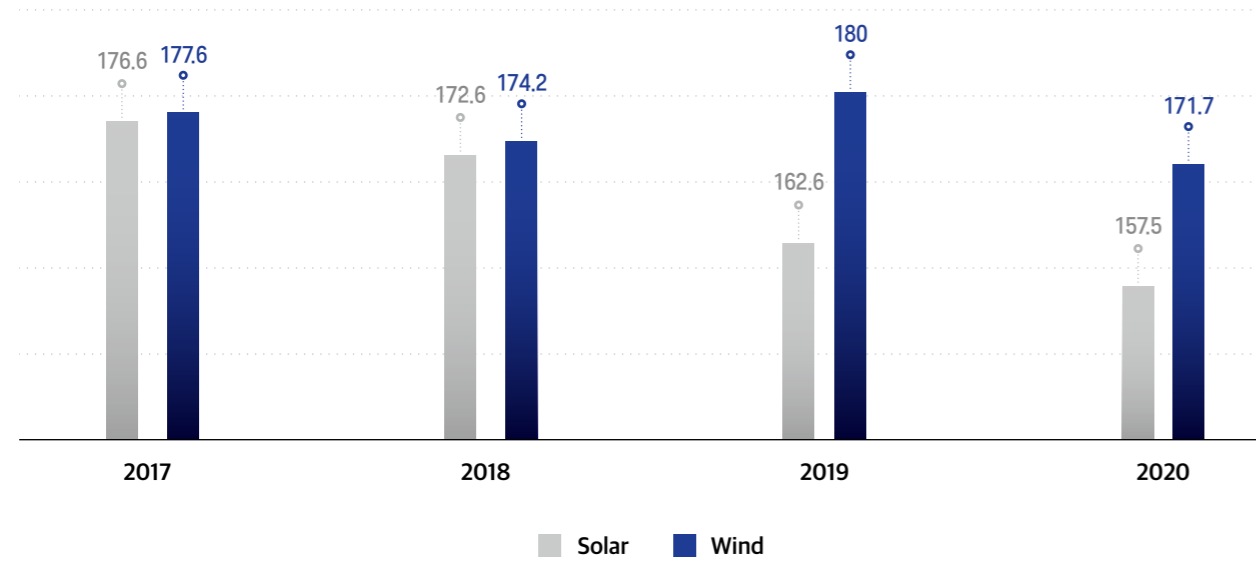


Figure 12 Average Contractual Prices for Solar and Wind over Years (KRW/kWh)<sup>27</sup>

It should be noted, however, that of the total renewable capacity under the RPS system, the ratio of wind is a meager 5.0 percent, compared to the staggering 83.8 percent for solar. It is also noteworthy that the power generation unit cost is lower for solar than for wind. These facts inevitably translate into a standard compensation price (which is set by the KPX) lower than the LCOE for wind.<sup>28</sup> The graph above shows how the average prices of the fixed-price direct solar and wind contracts changed over the years from 2017 to 2020. The gap between the two, which was negligible in 2017, yawned to exceed ten percent in 2020 (and now). The falling solar module prices and the deepening competition among small solar power producers have been pulling down the solar cost per unit, but structurally, a price decline is not likely for wind power any time soon. The tables below show how the standard compensation prices for fixed-price contracts (the so-called first fixed prices) changed over the years from 2018 to 2020:

	2018	2019	2020
Onshore (KRW/kWh)	180.032	169.626	159.161

Table 8 Standard Compensation price for Fixed-Price Contracts in 2018-2020 (SMP + REC)<sup>29</sup>

	2018	2019	2020
First Half (KRW/kWh)	167.276	151.493	136.128
Second Half (KRW/kWh)	159.269	143.682	-

Table 9 Average Winning Bids for Fixed-Price Contracts in Competitive Biddings Held by the KEA

The wider the gap between the standard compensation price and the contractual prices, the deeper the decline in profitability for the private wind power producer. For example, let us suppose that in 2020, a state-owned power company and a private power producer signed a contract at KRW 170/kWh, and in the same year, the first fixed price of the year was set at KRW 159/kWh, which is lower than the contractual price above and in which the solar unit price of the year was also incorporated. If the wind power project concerned produces 100,000 MWh every year, an annual loss from settlement will reach KRW 1.5 billion. If the life span of the wind power generation equipment is 20 years, a total loss of KRW 30 billion is expected if the price gap remains.

In other words, power producers structurally have to suffer a double blow to their profitability because solar unit prices are also incorporated into standard compensation prices even if the KPX's cost evaluation pulls down the contractual LCOE prices set by the government. If this situation is not addressed, the ambitious goals for wind power will be gone with the wind.

27. The KPX's reply to Assemblywoman So-young LEE's request for materials, July 2021.

28. KEEL, "Mid- and Long-Term REC Price Forecast Analysis," June 2021.

The standard compensation price at which the mandatory suppliers are compensated is not determined by calculating an average for each energy source, so the standard compensation price also reflects solar prices and therefore is set below wind power generation costs, giving rise to a structural misrepresentation of wind power generation costs. So, it is necessary to determine the standard price for compensation for each energy source.

- Korean Construction Firm A

Unless the structure of the current RPS system is changed, problems surrounding the compensation for RPS obligation fulfilment costs will not go away. The falling REC prices have made the problem of losses from the compensation more visible. The problem stems from the structure of the RPS system, so the system itself should be rectified. In particular, the LCOE of wind energy is not likely to fall as fast as that of solar power. In a single RPS market as now, this kind of unintended discrimination against wind is unavoidable.

- Overseas Power Producer B

The state-owned power companies stand to lose from onshore wind power business, but they acquire approval from their boards of directors in consideration of dividends and so forth. If the focus moves from onshore to offshore in the future, compensation losses will become by far greater than for onshore, causing a problem.

- State-Owned Power Company

For now, the state-owned power companies do not have any particular problem in securing RECs, so the issue has not become visible, but if the current level of the standard compensation price is to be maintained, the day will surely come when they can no longer engage in wind power business. If later reported to their boards of directors, it is certain that the issue of compensation losses will certainly be placed on the table and they will ask, "Do we have to stay in this business?"

- State-Owned Power Company

Table 9 Interviews of Wind Power Producers and the Like #3

### III. Proposed Improvements

As has been discussed thus far, wind power lags far behind the South Korean government's renewable penetration targets, and one of the major reasons behind this flagging penetration of wind power is the pricing process. Creation of a gust of wind power requires a simple and transparent permit and licensing process, as well as long-term stable revenue streams ensured for wind power producers. Yet, no system improvements have been made yet for the latter. Most noteworthy is the redundant and opaque decision-making structures for contractual unit prices involving the KPX, the KEA, the Ministry of Trade, Industry and Energy, the Ministry of Economy and Finance, and others as decision makers. If this issue remains unaddressed, it will be impossible to achieve the 2030 NDC targets and the country will be left with little hope of carbon neutrality by 2050.

To help address the issue, SFOC would like to propose the following short-term and longer-term solutions:

#### 1 Reconciliation of Contractual Prices with Standard Compensation Prices

Supposing the continued existence of the RPS system, the most pressing problem to deal with is the structural compensation losses from discrepancies between standard compensation prices and contractual prices.

Standard compensation prices in excess of actual contractual prices make it practically difficult for private power producers to ensure even the minimal economic feasibility of wind power business.

As a short-term solution to this issue, it is recommended that standard compensation prices be completely reconciled to actual contractual prices to prevent compensation losses to wind power producers. It should be noted, however, that this move may (1) further toughen the KPX's and the KEA's price criteria and lengthen the time needed for cost evaluation and (2) fail to incentivize private power producers to lower the contractual prices. In addition, (3) it is difficult to apply uniform LCOE criteria for wind power projects. Therefore, this approach cannot be desirable from a longer-term perspective, but is meaningful only as a short-term solution.

## 2 A Separate REC Market for Wind Power

Both solar and wind unit power generation costs have been declining but not at the same rate. This gap is one of the culprits behind the compensation issue regarding wind power. Specifically, solar module prices have been falling rapidly for years,<sup>30</sup> and the power generation unit cost has also fallen sharply. In addition, it is easier and simpler to construct, install, operate, and standardize equipment and everything for solar than wind, so the decline in solar costs is expected to continue. In contrast, wind power in South Korea appears to be sailing nearly into the wind. Excessive costs for obtaining permits and licenses and cumbersome regulation render the rapid decline in wind power generation costs very unlikely in the near future.

Under these circumstances, operation of a single REC market that encompasses both solar and wind, among other energy sources as now does not fully reflect the reality in which competition among different energy sources is not expected. Furthermore, it is necessary to protect wind power to a certain extent in consideration of the fact that not only solar, but also wind, are indispensable to deliver the 2030 NDC targets and achieve carbon neutrality by 2050. At the early stages of the RPS system, the government did not operate a single REC market but separate markets for solar and non-solar in a way to provide a partial protection for the solar industry, which did not see decent economic feasibility at the time. It is now necessary to refer to the indirect contracting market that the KEA operates, among other examples, and based on the takeaways from them, form separate markets for indirect contracts not only for solar but also for wind. It is also worth considering imposing separate purchase quotas on power RECs for mandatory suppliers.

<sup>30</sup>. The per-watt unit price of solar modules nearly halved from USD 0.64 in 2014 to USD 0.33 in 2017.

## 3 FIT or PPAs with the Retailer

The ultimate solution to the issue should be an overhaul of the RPS system in a manner that will ensure long-term stable revenue streams for renewable power producers.

Mandatory renewable supply ratio is imposed on the state-owned power companies and so forth in consideration of the current structure of the power industry, which has only one retailer, KEPCO, but this scheme is not likely to greatly help activate the renewable energy market. The dual role of the state-owned power companies, as final REC purchasers and as business developers in the market, may cause conflicts of interest with private power producers. The scheme also discourages aspiring private power producers from entering the market.

In no countries, including Germany and the US where investment in renewables is active, do state-owned power companies act as final purchasers of RECs. In those countries, it is common and natural that electricity from renewable sources is sold directly to retailers.

The RPS system originally intended to use the unified REC market to fuel competition among different energy sources, but the system is not working as intended. Thus, the RPS system should be overhauled so that the burden of purchasing will be placed not on state-owned power companies and the like, but on the retailer and so that renewable energy producers will directly sell power to the retailer. To that end, it is worthwhile to consider the reintroduction of FIT for power producers and the introduction of open bidding-based long-term, fixed-price contracts.



Solutions for Our Climate (SFOC) is a South Korea-based group that advocates for stronger climate change policies and transition towards a fossil-free society. SFOC is led by legal, economic, financial, and environmental experts with experience in energy and climate policy and works closely with domestic and overseas nonprofit organizations.