

# South Korea's Power Trilemma

Unravelling the root causes of rising electricity bills

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## Key Findings

**High electricity prices during the global energy crisis attributed to fossil fuel reliance in the power mix, lack of power market competitiveness, and delayed energy transition.**

**South Korea was burdened with US\$17 billion of additional costs for electricity in 2022 due to utilities' overreliance on fossil fuels.**

**Slow adoption of renewable energy is a missed opportunity to reduce power prices, increasing South Korea's exposure to environmental externality.**

**South Korea's misplaced faith in fossil fuels could create a vicious cycle of spiraling energy costs, as global trade partners impose carbon tariffs and investors back the transition to renewable energy.**



**The rationale for South Korea's reliance on fossil fuels in the name of energy security began to unravel when Russia invaded Ukraine in 2022, shocking global energy markets. This report exposes the fundamental flaws in the financial case for the country's dogged adherence to fossil fuel imports. Power price freezes and other politically expedient measures to cap consumer bills only postpone the problem. The debt snowballing while South Korea's delays its transition to renewable energy will ultimately have to be paid. Meanwhile, key trade partners and major investors are imposing carbon tariffs and other sustainability requirements that could leave South Korea out in the cold, and create a vicious cycle of spiralling prices for generations.**

## Executive Summary

This report examines how and why South Korea's "power tariff trilemma" – the interconnected challenges of energy security, competitiveness and sustainability – has contributed to rising electricity bills, analyzing the root causes of high power prices through the lens of these three key energy policy perspectives.<sup>1</sup>

Firstly, South Korea has long pursued fossil fuel-oriented energy security under the strong belief that securing fossil fuels will guarantee a stable and affordable supply of electricity. However, this view faced headwinds as the Russia-Ukraine war in early 2022 upended global gas markets.

Soaring fossil fuel prices, especially liquefied natural gas (LNG), triggered sharp increases in both fuel costs and wholesale electricity prices. South Korea's heavy reliance on a fossil fuel-intensive power mix (58.5% in 2023), coupled with a high share of LNG (26.8%)<sup>2</sup>, made LNG price spikes a key determinant of the wholesale electricity market's system marginal price (SMP), pushing up electricity tariffs.

IEEFA estimates South Korea's total LNG fuel cost in the power sector in 2022 was ₩33 trillion (US\$25 billion). Based on three scenario analyses, IEEFA found that South Korea was burdened with additional costs of ₩22 trillion (US\$17 billion) for electricity in 2022 compared with 2021, or ₩432,015 (US\$326) per person due largely to South Korea's overreliance on fossil fuels.

Secondly, a lack of competitiveness in South Korea's domestic power market, coupled with the global energy crisis, exacerbated surging wholesale power prices and worsened the already tenuous financial situation of the state-run power utility, Korea Electric Power Corporation (KEPCO).

This report identifies South Korea's regulated power pricing mechanism as one of the root causes of KEPCO's mounting debts. Since 2022, the South Korean government opted to combat inflationary

<sup>1</sup> Energy Policy. [The Kyoto protocol—a victim of supply security?: or: if Maslow were in energy politics](#). July 2004.

<sup>2</sup> KEPCO. [Monthly Power Statistics](#). February 8, 2024.

impacts of the global energy crisis by maintaining low end-user power tariffs, which ultimately required KEPCO to sell electricity to consumers at prices that did not fully cover skyrocketing fuel costs.

Low regulated prices aggravated KEPCO's financial troubles, leading the company to issue more government-backed bonds. This situation raises concerns that KEPCO might be less incentivized to reduce costs, such as strategic fuel procurement, and prioritize short-term solutions over long-term investments, including fuel-pricing mitigating additions of renewable energy. Meanwhile, creditors might overlook effectively monitoring KEPCO's financial performance and risk management practices amid government backing.

As a result, KEPCO's debts mounted to ₩202.5 trillion in 2023.<sup>3</sup> Meanwhile, the renewable power capacity of KEPCO and its subsidiary generation companies (GENCOs) was just 1.9% of the country's total power capacity. By contrast, Independent Power Plants (IPPs) held more than 10 times the renewable energy capacity of GENCOs and KEPCO combined, which was 19.8%. This underscores the lack of product innovation efforts by the KEPCO and GENCOs. Worsening financial instability and lagging decarbonization efforts by KEPCO could increase the government deficit and potentially tax and utility bills for future generations.

As a result, the lack of competitiveness in the power sector hinders sustainability goals, undermining the transition to more affordable, reliable and clean energy sources.



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Regarding the third facet of South Korea's power tariff trilemma, the delayed transition to renewable power generation has contributed to rising climate-environmental tariffs, a component of the country's power pricing formula. Instead of directly investing in renewable energy generation, KEPCO and GENCOs have often chosen to purchase Renewable Energy Certificates (RECs), leading to higher costs amidst limited supply.

Lackluster renewable energy investment in South Korea carries opportunity costs for the country since renewable technologies are increasingly at cost parity with conventional energy sources. By not transitioning more quickly, the country may miss out on significant power generation cost reductions. Additionally, growing international climate initiatives, such as the Renewable Energy 100 (RE100), Europe's Carbon Border Adjustment Mechanism (CBAM) and the Sustainable Finance Disclosure Regulation (SFDR), could impose increasing negative externality costs on South Korea due to its delayed energy transition.

<sup>3</sup> KEPCO. [Annual Financial Report](#). March 18, 2024.

In summary, this report identifies three key factors keeping South Korea's power costs high. First, the approach to energy security based on fossil fuel importation has proved vulnerable to global market disruptions. Second, structural issues in South Korea's power market have hindered competitiveness, exacerbated financial troubles at state-owned energy companies, and dampened incentives for innovation and cost reductions. Third, the slow adoption of renewable energy sources is a missed opportunity to reduce power prices and has increased South Korea's exposure to environmental externality costs.

Further, IEEFA is presenting the following recommendation:

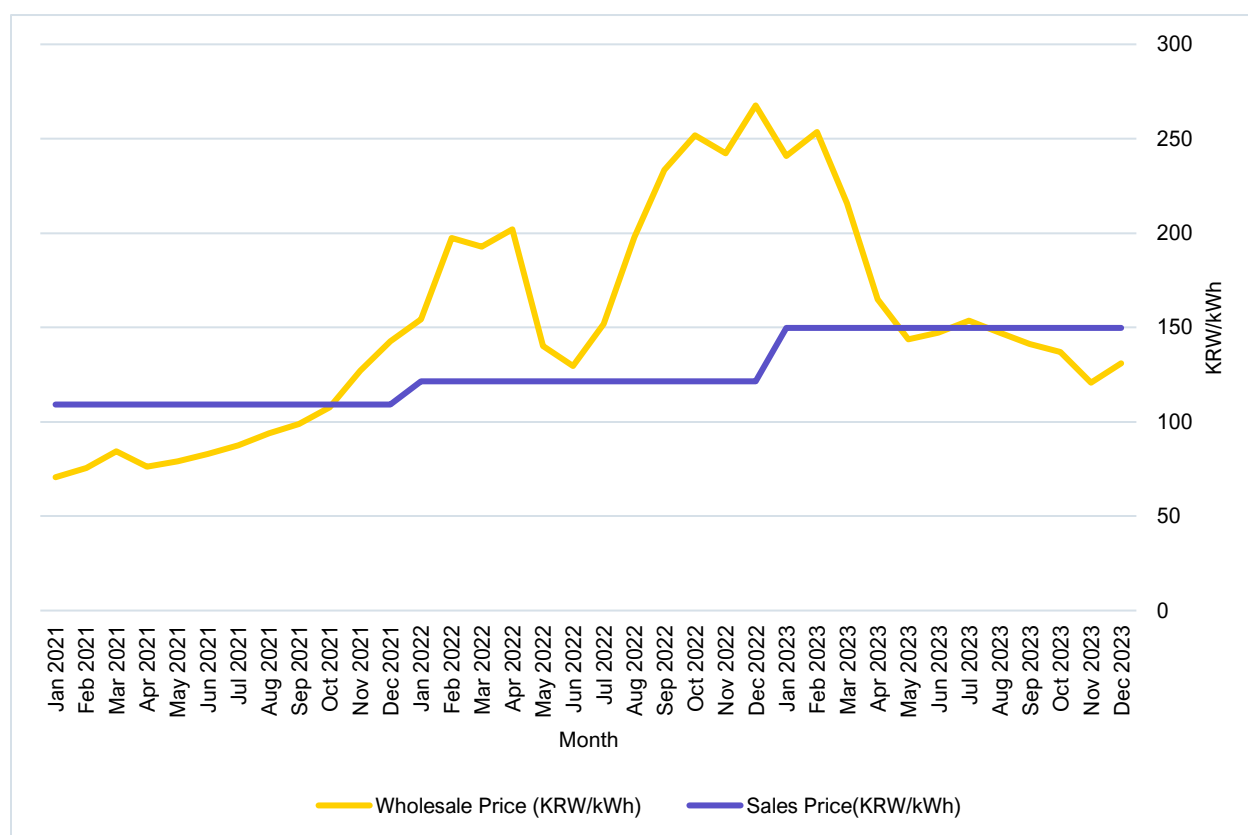
- Reduce reliance on fossil fuels in the power mix and expedite the transition to clean energy sources.
- Reform power pricing to reflect actual costs and avoid politically motivated determination of electricity tariffs.
- Address KEPCO's financial challenges through cost-cutting measures and innovation focused on renewable energy.
- Accelerate the renewable energy transition to mitigate rising power costs associated with delays and achieve declared decarbonization goals.

## Introduction

Following Russia's invasion of Ukraine in early 2022, South Korea and other nations have grappled with rising electricity bills due to soaring fossil fuel prices, particularly LNG.

South Korea's wholesale power price surged to a record ₩267.6/kWh (US\$0.20/kWh) in December 2022, nearly double the price a year earlier.<sup>4</sup> However, KEPCO's power sales price to consumers increased by only 11.1% from 2021 to 2022, reaching ₩121.32/kWh (US\$0.09/kWh).<sup>5</sup> This suggests rising fuel costs were not fully reflected in the sales prices.<sup>6</sup>

**Figure 1: Wholesale Power Prices vs KEPCO's Sales Prices (KRW/kWh)**



Sources: KESIS, KEPCO.

Note: KEPCO's sales price is based on residential tariff. Wholesale price is Total SMP.

<sup>4</sup> Electric Power Statistics Information System (EPSIS). [Website](#).

<sup>5</sup> KEPCO. [Quarterly Financial Report](#). 14 November 2023. Page 18.

<sup>6</sup> KEPCO. [Quarterly Financial Report](#). 14 November 2023. Page 16.



Despite South Korea implemented a “Fuel Cost Pass-Through Mechanism” in January 2021,<sup>7</sup> which intended to mitigate KEPCO’s financial burden by reflecting the fluctuation of fuel prices for power generation, its long history of control over electricity bills has nullify the new policy. This approach aims to mitigate inflationary pressures and ensure stable, affordable access to essential goods and services, prioritizing “fossil fuel-intensive energy security” as part of its pursuit of both energy security and affordability.

However, this approach has contributed to unprecedented debt and financial instability for state-owned utilities such as KEPCO and Korea Gas Corporation (KOGAS).<sup>8</sup> Retail prices have remained significantly lower than costs, prompting calls for the South Korean government to consider reforming utility tariffs.

In early 2024, the South Korean government froze power tariffs for the first quarter of the year, citing concerns about inflation.<sup>9</sup> Some analysts speculate the decision may have also been influenced by the upcoming general election in April 2024.<sup>10</sup>

Rising calls to accelerate South Korea’s energy transition and address the financial instability of state-run energy companies have increased attention on the power tariff trilemma, which includes the challenges of:

- Ensuring stable and affordable power supplies, i.e., energy security.
- Rationalizing electricity bills and stabilizing state-run utilities, i.e., competitiveness.
- Accelerating the energy transition to achieve climate-aligned development pathways, i.e., sustainability.

## Misinterpreted Energy Security

South Korea, lacking abundant natural resources, imports about 96% of its energy supply.<sup>11</sup> The country’s resource self-sufficiency rate, including overseas energy development, was just 13.3% in 2019, significantly lower than neighboring Japan’s 34.7%.<sup>10,12</sup>

<sup>7</sup> KEPCO. [Electricity Standard Terms and Conditions](#). Page 153.

<sup>8</sup> IEEFA. [KEPCO’s fossil fuel problem](#). June 16, 2023.

<sup>9</sup> CBS. [Freezing power and gas tariffs until June 2024, considering general election](#). January 3, 2024.

<sup>10</sup> Financial News. [Public tariffs freeze in H1 2024, power bills likely surge after general election](#). January 4, 2024.

<sup>11</sup> Korea Export-Import Bank of Korea. [The role of public finance in procuring sustainable energy resources, with a focus on the development of overseas energy sources](#). July 4, 2022, p. 1.

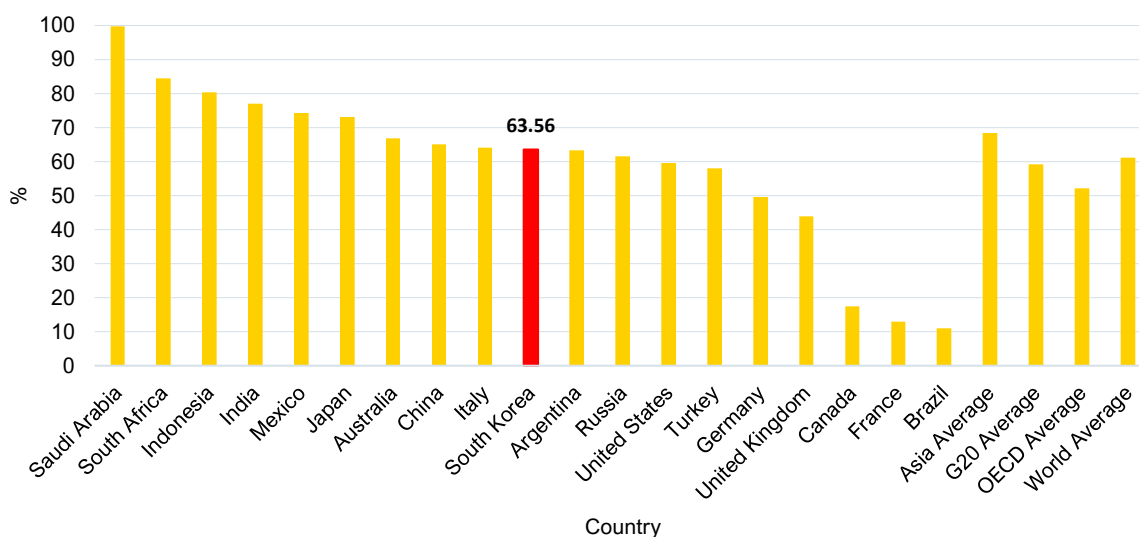
<sup>12</sup> Korea Export-Import Bank of Korea. [The role of public finance in procuring sustainable energy resources, with a focus on the development of overseas energy sources](#). July 4, 2022, p. 14.

Against the backdrop, South Korea's energy security policies and business strategies have been misconstrued to focus on securing fossil fuels for power supply stability and affordability.

In 2017, for example, then-President Moon Jae-in emphasized the importance of LNG as a primary fuel for power generation by announcing a "Coal and Nuclear-free Economy" policy during the G20 summit in Germany. This policy aimed to increase the use of LNG in power generation from 16.9% in 2017 to 18.8% by 2030.<sup>13</sup>

In 2022, fossil fuels, including LNG, accounted for 63.6% of South Korea's power generation, according to Ember data.<sup>14</sup> This share is lower than the Asian average (68.4%) but higher than both the G20 (59.3%) and OECD (52.2%) averages.<sup>15</sup>

**Figure 2: Fossil Fuel-Based Power Generation by Country in 2022 (%)**



Source: Ember

South Korea's transition away from fossil fuels has been slow, despite ambitious targets set in its Nationally Determined Contribution (NDC) to reduce fossil fuel use in the power sector to 23.7% and increase renewable energy to 30.6% by 2036.<sup>16</sup> In 2023, fossil fuels still accounted for 58.5% of the power mix, while renewable energy contributed only 9.64%.<sup>17</sup>

<sup>13</sup> Ministry of Trade, Industry and Energy (MOTIE). [8th PSDP](#). December 29, 2017, p. 44.

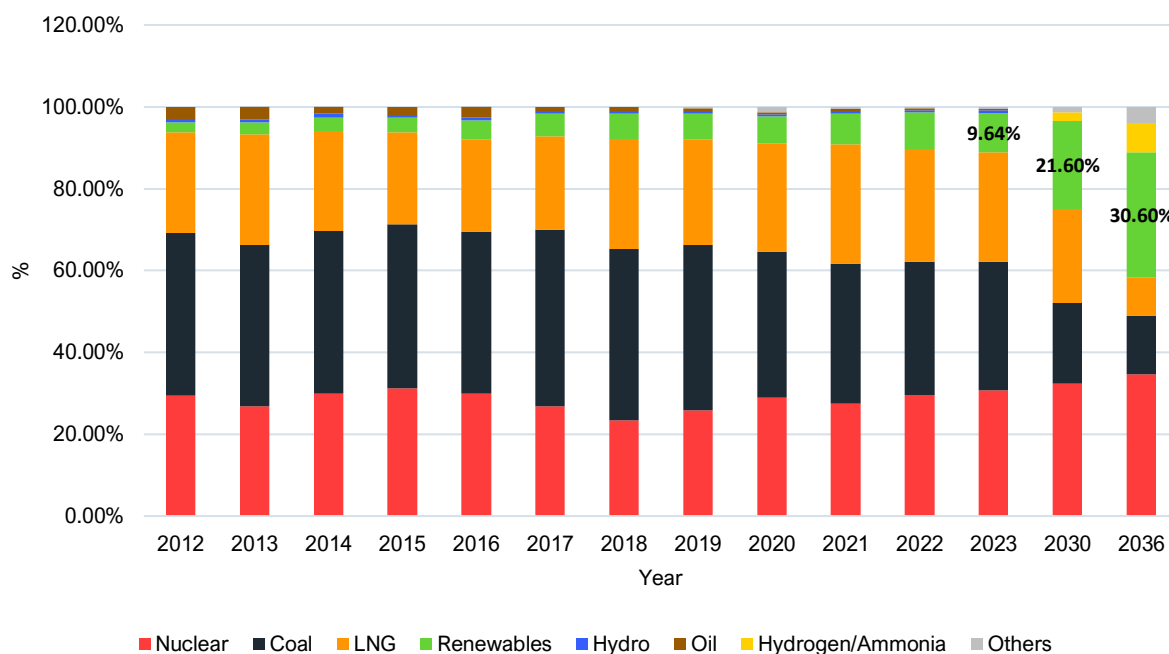
<sup>14</sup> Ember. [Website](#).

<sup>15</sup> Ibid.

<sup>16</sup> MOTIE. [10th Power Market Supply-Demand Plan \(PSDP\)](#). January 12, 2023, p. 7.

<sup>17</sup> KEPCO. [Monthly Power Statistics](#). February 8, 2024.

**Figure 3: South Korea's Power Mix by Energy Resources by Year (%)**



Sources: MOTIE, KEPCO

Note: Data for 2023 estimated from monthly KEPCO updates; 2030 and 2036 projections include hydrogen and ammonia co-firing in power generation, Others include hydropower.

South Korea's investment patterns also reflect a continued emphasis on fossil fuels. From 2016 to 2021, its financial institutions invested 1.3 times more in coal than in renewable energy, contrasting with the global trend of three times higher investment in renewables compared with fossil fuels over the same period.<sup>18,19</sup>

Since Russia's invasion of Ukraine in February 2022 disrupted global natural gas supplies, South Korea's reliance on fossil fuels has faced significant headwinds due to high and volatile LNG prices. South Korea's heavy dependence on fossil fuels in its power mix, compounded by geopolitical crises, has been a key factor in the surge in power tariffs.

Driven by rising international LNG prices,<sup>20,21</sup> the unit cost of LNG-fired power generation in South Korea doubled to a record ₩270.38/kWh (US\$0.21/kWh) in the year to November 2022, according to Korea Power Exchange (KPX) data.<sup>22</sup>

<sup>18</sup> Korea Sustainability Investing Forum (KoSIF). [White paper on fossil fuel finance](#), June 22, 2022, p. 21.

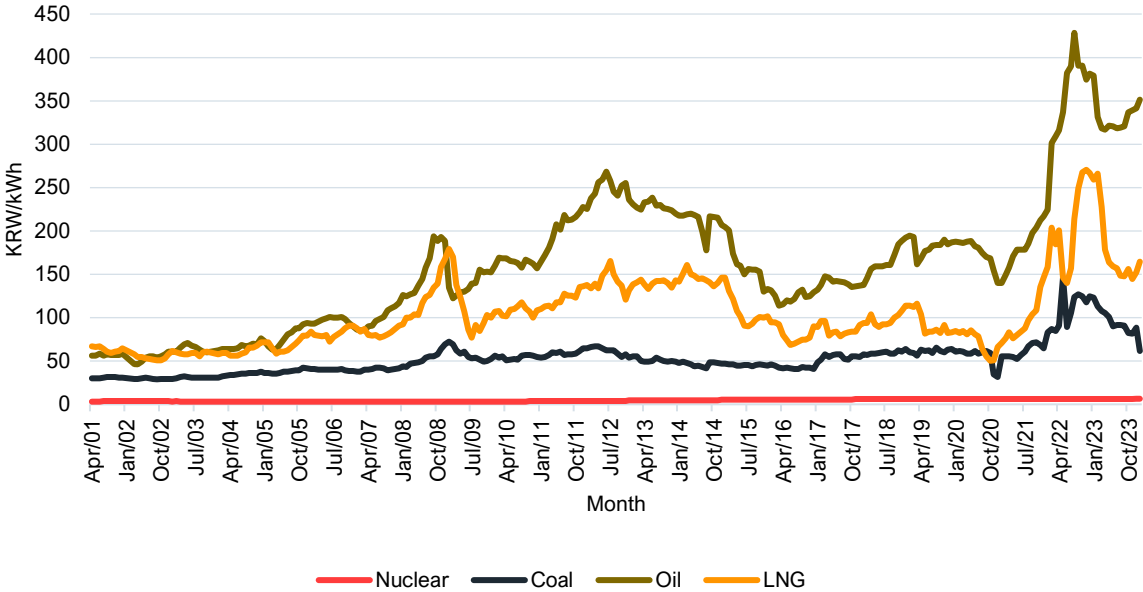
<sup>19</sup> International Energy Agency (IEA). [Global investment in the power sector by technology](#), 2011-2021.

<sup>20</sup> The S&P Global Japan-Korea Marker, a common spot market pricing benchmark in Northeast Asia, hit a record US\$84.76 per million British thermal units.

<sup>21</sup> S&P Global. [Asian LNG demand for industry continues falling, despite prices moderating, as output shrinks](#). November 18, 2022.

<sup>22</sup> EPSIS. [Website](#).

Figure 4: Monthly Fuel Unit Cost for Power Generation (KRW/kWh)



Source: KPX

Despite LNG fuel costs for power generation nearly doubling amid the energy crisis, the levelized cost of electricity (LCOE) for solar and wind power generation only increased slightly year-on-year, according to the Korean Energy Economics Institute (KEEI).<sup>23</sup> Solar LCOE rose 4%-8% while wind LCOE edged up 1%-4%.<sup>24,25</sup>

Soaring fossil fuel prices, particularly LNG, due to geopolitical turmoil, also pushed South Korea's system marginal price (SMP) to record high ₩267.6/kWh (US\$0.20/kWh) in December 2022. The SMP reflects the wholesale price KEPCO pays to electricity generators, and is influenced by fuel costs, operating costs and supply-demand dynamics.

<sup>23</sup> Korea Energy Economics Institute (KEEI). Establishment and Operation of Long-term LCOE Forecast System for Expansion of Renewable Energy (3/5). December 31, 2022.

<sup>24</sup> KEEI. Establishment and Operation of Long-term LCOE Forecast System for Expansion of Renewable Energy (3/5). December 31, 2022, p. 78.

<sup>25</sup> Onshore wind power generation.

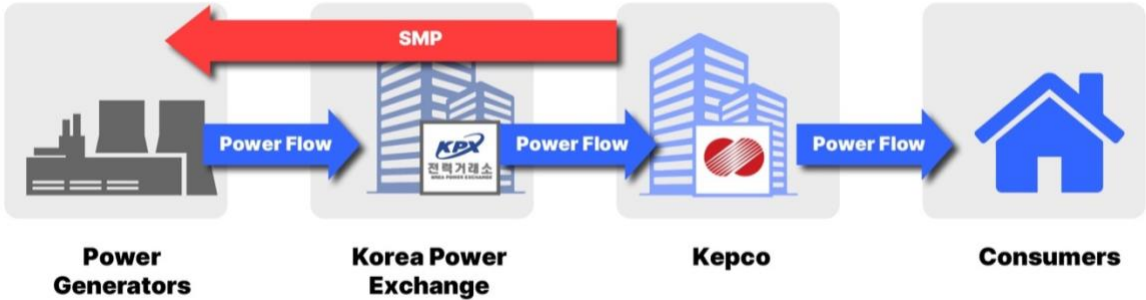
Figure 5: Monthly SMP in South Korea (KRW/kWh)



Source: KPX

South Korea's power market operates on a day-ahead basis. KEPCO procures electricity through the KPX, after forecasting demand and placing emergency power generation orders towards power generators for the following day.

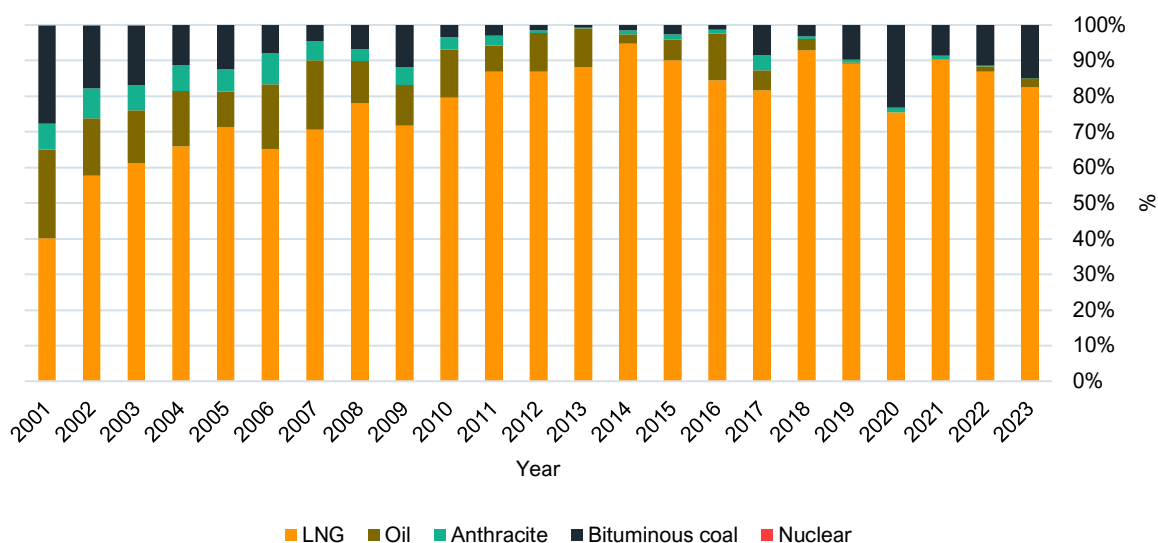
Figure 6: South Korea's Power Market Mechanism and SMP



Source: SK E&S

During emergency power generation orders, KEPCO prioritizes using the most cost-effective power plants from GENCOs and Independent Power Plants (IPPs). Therefore, the SMP, determined by supply-demand equilibrium, is often set by the highest-cost operating power plants, typically fueled by LNG, coal or oil (Figure 7).

Figure 7: SMP Determinations by Fuel (2001-2023)



Source: KPX

The surge in LNG prices during 2022 and 2023 has driven up fuel costs for power generation and pushed SMP to record highs due to the fossil fuel-heavy power mix, significantly affecting retail power prices despite government controls such as SMP caps<sup>26</sup> and tariff freezes.<sup>27</sup> These measures aim to mitigate the effect of sudden price hikes on consumers and the economy.

Had South Korea swiftly transitioned its power mix from fossil fuel-centric generation under the guise of energy security, to carbon-neutral and renewable energy power generation, the surge in electricity tariffs since 2022 could have been mitigated. With more renewable energy deployed, more of the daytime peak demand could have been met with renewable energy, which would have reduced the need for fossil fuels and saved power.<sup>28</sup>

South Korea's limited adoption of renewable energy sources hinders the full potential of solar for midday peak shaving and wind for evening power balancing. However, evidence from countries with higher renewable energy penetration, such as Australia and the United States, suggests these sources can significantly contribute to meeting electricity demand.<sup>29</sup>

<sup>26</sup> In cases where there is a sudden surge in System Marginal Prices (SMP) due to uncertainties in the prices of power generation materials, a cap on emergency settlement prices can be set to alleviate instability in the lives of citizens or the national economy. (MOTIE. [Notice Regarding the Upper Limit of Electricity Trading Prices](#). December 2022)

<sup>27</sup> In case of significant fluctuations or potential fluctuations in fuel costs due to international fuel prices or exchange rate fluctuations, for the stability of citizens' lives and smooth operation of the national economy, if notified by the Minister of Trade, Industry and Energy of the postponement of the application of all or part of the fuel cost adjustment unit prices, we will comply accordingly. (KEPCO. [Standard Power Supply Terms and Conditions](#). November 9, 2023)

<sup>28</sup> Electronics 2020. [Analysis of Challenges Due to Changes in Net Load Curve in South Korea by Integrating DERs](#). August 14, 2020.

<sup>29</sup> IEEFA. [Saturation DER modelling shows distributed energy and storage could lower costs for all consumers if we get the regulation right](#). Aug 27, 2023.

While it is difficult to predict the exact impact of a rapid transition to carbon-neutral and renewable energy power generation, and the impact if Russia had not upended global gas market, there is little doubt that surging LNG prices have triggered soaring LNG fuel cost for power generation, which is closely correlated to power tariffs.

South Korea's total LNG fuel cost for power generation in 2022 reached ₩33 trillion (US\$25 billion), translating to an estimated cost of ₩648,062 (US\$489) per person in 2022, a 114% spike from 2021, assuming constant power generation output.<sup>30</sup>

IEEFA's analysis shows that reducing South Korea's reliance on LNG for power generation by 10 percentage points from its 2022 level of 27.5% to 17.5% – bringing the country's gas generation in line with the average among G20 countries<sup>31</sup> – would have lowered LNG fuel costs by an estimated ₩12 trillion (US\$9 billion).<sup>32</sup> This translates to a potential per capita saving of about ₩235,477 (US\$178) a year.

**Table 1: LNG Cost for Power Generation in 2022, Energy Transition, No War Scenarios**

Scenarios	2022 (Current Basic Scenario)	Scenario 1: Power Mix 10% Point Cut	Scenario 2: Average LNG Prices Pre- Ukraine War	Scenario 3: Scenarios 1&2
<b>Total LNG Fuel Cost for Power Generation (KRW)</b>	33.5 Trillion	21.3 Trillion	17.5 Trillion	11.2 Trillion
<b>Total LNG Fuel Cost for Power Generation per Capita (KRW)</b>	648,062	412,585	339,352	216,047
<b>Extra LNG Fuel Cost for Power Generation per Capita (KRW)</b>	N/A	235,477	308,709	432,015

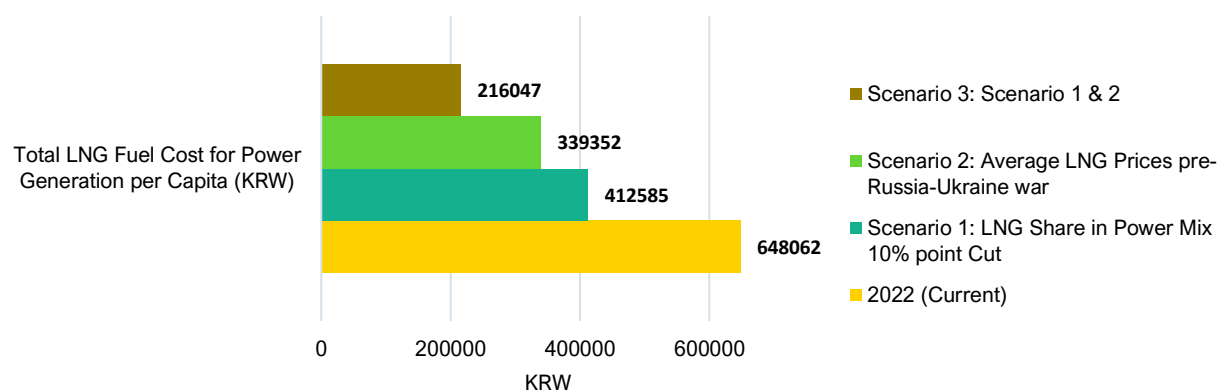
Source: IEEFA calculations based on data from KEPCO, KPX, EPSIS.

Note: Scenario simulation based on total power generation 594.4TWh and population of 51.7 million as of 2022.

<sup>30</sup> South Korea generated around 163,574,687MWh of electricity via LNG-fed power generations in 2022. (KEPCO. [2022 Power Market Statistics](#), May 31, 2023)

<sup>31</sup> The share of gas in power mix of G20 countries in 2022 was estimated at 18.9%. (Ember. [Electricity Data Explorer](#).)

<sup>32</sup> KEPCO. [2022 Power Market Statistics](#), May 31, 2023.

**Figure 8: LNG Fuel Cost for Power Generation Per Capita in 2022 under 3 Scenarios**

Sources: IEEFA calculations based on data from KEPCO, KPX, EPSIS

Analysis by IEEFA estimates that South Korea incurred an additional ₩16 trillion (US\$12 billion) nationwide in 2022 due to the surge in international LNG prices following the Russian invasion of Ukraine. This translates to an estimated ₩308,709 (US\$233) per person, assuming LNG fuel costs remained consistent with the 10-year average (2011-2021) of ₩107.2/kWh, compared with the actual cost of ₩204.7/kWh in 2022.<sup>33</sup>

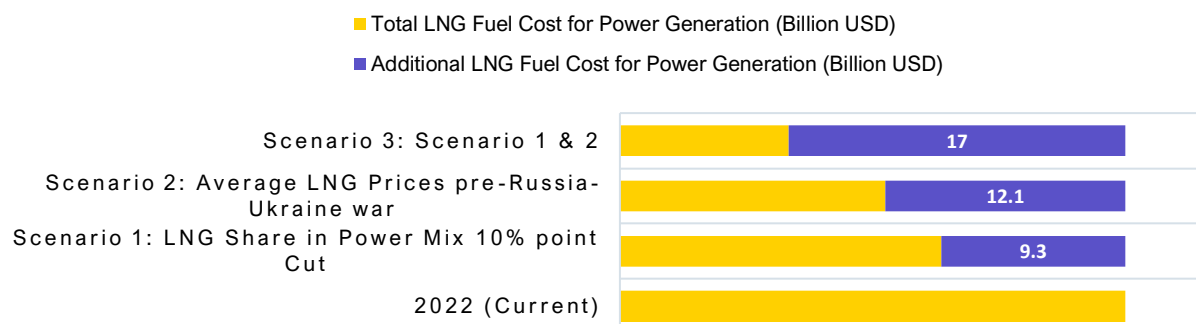
Assuming average LNG Prices Pre-Russia-Ukraine War and LNG usage being at the G20 average level (Scenario 3), South Korea could have avoided an estimated ₩22 trillion (US\$17 billion) in additional LNG fuel costs for power generation in 2022. This translates to potential per capita savings of ₩432,015 (US\$326).



**Assuming average LNG Prices Pre-Russia-Ukraine War and LNG usage being at the G20 average level (Scenario 3), South Korea could have avoided an estimated ₩22 trillion (US\$17 billion) in additional LNG fuel costs for power generation in 2022. This translates to potential per capita savings of ₩432,015 (US\$326).**

<sup>33</sup> The LNG fuel cost in 2022 was at ₩204.72/kWh, while the 10-year average from 2011-2021 was ₩107.2/kWh. (KPX. [Website.](#))



**Figure 9: Additional LNG Fuel Cost for Power Generation in 2022 under 3 Scenarios**

Sources: IEEFA, KEPCO, KPX, KESIS.

Furthermore, the geopolitical tensions triggered by Russia-Ukraine war are ongoing, followed by aggravating international conflicts, such as the Israel-Palestine conflict and the Houthi rebels' attacks on shipping assets could disrupt key LNG production facilities and shipping routes. Potential operational shutdowns, strikes in Australia, and permit pause and delays in the US and many other various supply regions are projected to contribute to persistent volatility and instability in LNG prices and supply.

IEEFA asserts that South Korea's heavy reliance on fossil fuels for power exacerbates energy insecurity. Moreover, the high dependence on expensive and unreliable LNG within the power mix is a primary cause of the recent spikes in both end-user power bills and KEPCO's financial troubles (discussed in the next section).

## A Lack of Market Competitiveness

Competitiveness, a core goal of energy policy, has long been overlooked in South Korea. Instead, the energy policy discourse has been dominated by the prioritization of fossil fuel-oriented energy security over the creation of a competitive and efficient energy market structure.

Understanding the reasons behind the link between the lack of competitiveness in the power market structure and the mounting debt of KEPCO and higher consumer electricity bills is crucial. IEEFA has determined that South Korea's uncompetitive energy market has caused significant financial strain on state-run energy companies, especially KEPCO, and increased power bills for ratepayers.

Competitiveness in the energy sector is often measured by efficiency,<sup>34</sup> which can be largely assessed through two metrics: (1) the price-to-cost ratio,<sup>35</sup> or (2) the degree of cost reduction and

<sup>34</sup> Review of Environmental Economics and Policy. [Bridging the Energy Efficiency Gap: Policy Insights from Economic Theory and Empirical Evidence](#), 2014. Vol. 8, pp. 18-38.

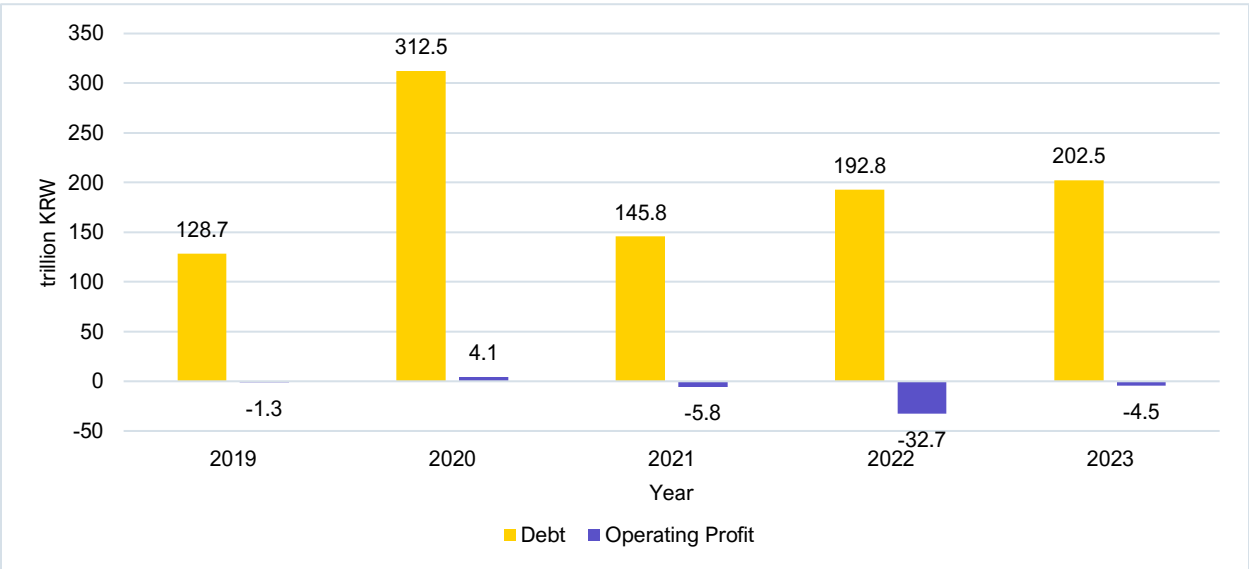
<sup>35</sup> According to the school of neoclassical economics and equilibrium modeling, this static efficiency can be measured by total utility gained from the transaction, and supplier behavior and market structure determine the amount of utility. The amount of utility can be measured by the price and quantity, and making the price-to-cost ratio low can be translated into the outcome of the efficiency.

product innovation by suppliers.<sup>36</sup> As efficiency increases, customer surplus grows,<sup>37</sup> leading to lower utility prices and stable energy supplies.

Analyzing South Korea's power market using these concepts could provide valuable insights, where the power market structure is characterized by lack of competitiveness and efficiency dominated by a few state-run energy corporations.

With the exogeneous energy crisis triggered by Russia's invasion of Ukraine, combining with endogenous problem of inefficient power market structures and a lack of competitiveness, South Korea's state-run power utility, KEPCO, faced significant financial challenges. In 2023, KEPCO's debt reached ₩202.5 trillion while operating at a loss of ₩4.5 trillion.<sup>38</sup>

Figure 10: KEPCO's Debt and Operating Profit (KRW trillion)



Sources: IEEFA, KEPCO.

KEPCO's unprecedented financial instability in recent years is primarily attributed to the rising SMP set by expensive LNG-fired power plants. This, as discussed earlier, is a consequence of South Korea's fossil fuel-centric power mix.

The high SMPs paid by KEPCO to GENCOs and IPPs on the KPX have significantly increased its power purchase costs. However, KEPCO's electricity sales prices, charged to consumers, haven't

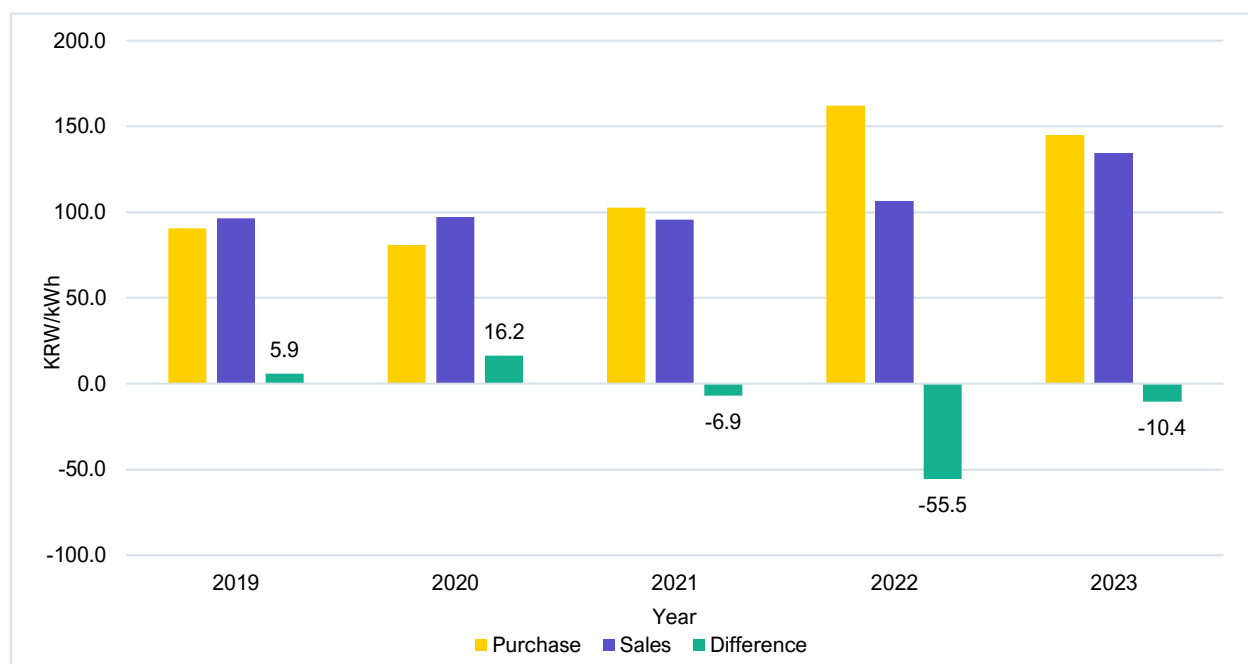
<sup>36</sup> In relation to the dynamic efficiency, which is the school of Austrian economics, evolutionary economics and classical liberalism, the efficiency can be quantified by the degree of the cost reduction and product innovation.

<sup>37</sup> Customer surplus is an economic concept that measures the benefit that consumers receive from purchasing a good or service at a price lower than their willingness to pay for it.

<sup>38</sup> KEPCO. [Annual Financial Report](#). March 18, 2024.

risen as much as its purchase costs (Figure 11). Consequently, KEPCO sold electricity to retail customers at massive losses.

**Figure 11: KEPCO's Power Purchase and Sales Prices (KRW/kWh)**



Sources: IEEFA, KEPCO.

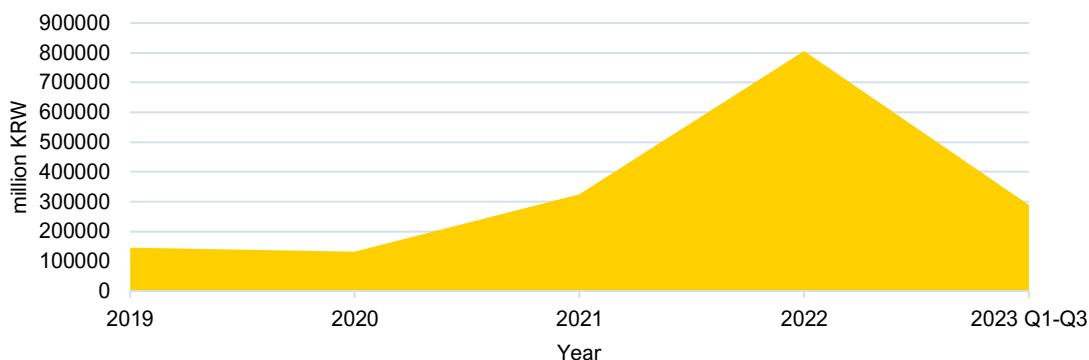
Note: The power sales prices listed here are averages across KEPCO's various rate categories, including residential, commercial, and industrial.

In 2022, as global fuel prices skyrocketed, the gap between KEPCO's power purchase and sales unit prices reached ₩55.5/kWh. This indicates that for each kWh bought by a customer, KEPCO effectively incurred a loss of about ₩55.5.

South Korea's state-run gas utility, KOGAS, encountered similar financial challenges. In 2022, its accounts receivable reached ₩805,999 million, a 148.7% spike year-on-year. (Figure 12) This occurred mainly due to the discrepancy between gas sales price and the LNG purchase price.<sup>39</sup>

<sup>39</sup> KOGAS. [Quarterly Financial Report](#). November 14, 2023.

**Figure 12: KOGAS's Accounts Receivable (million KRW)**



Sources: IEEFA, KOGAS

Note: Accounts receivable in the current assets, which the amounts of money owed to a company by its customers for goods or services that have been delivered or provided but not yet paid for.

South Korea's power pricing structure has traditionally been government-regulated to prioritize price stability, with aims of reducing the burden on taxpayers, supporting industrial production, and promoting economic growth. Maintaining low power tariff is also politically significant, particularly leading up to elections.

Despite implementing the Fuel Cost Pass-Through Mechanism in 2021,<sup>40</sup> intended to reflect fluctuations in fuel costs and ease KEPCO's financial burden, the system has had limited impact. Although a Fuel Cost Adjustment Tariff was incorporated into the power tariff formula (Figure 13), KEPCO cannot solely determine changes in power prices based on its financial results.

**Figure 13: South Korea's Power Tariff Structure**



Sources: IEEFA, KEPCO

<sup>40</sup> KEPCO. [Electricity Standard Terms and Conditions](#). p. 142.

When KEPCO's power purchase price surpasses the sales price,<sup>41</sup> as observed in 2022 (Figure 11), KEPCO requests tariff hikes. However, it requires approval from the Ministry of Trade, Industry and Energy (MOTIE) and the Ministry of Economy and Finance (MOEF).<sup>42</sup>

In addition, the Fuel Cost Adjustment Tariff has limitations, including a  $\pm$ ₩5/kWh adjustment band each quarter and a ₩1/kWh minimum threshold for implementation.<sup>43</sup> Additionally, the government holds the authority to postpone adjustments during exceptional circumstances, as seen during the Russia-Ukraine war.<sup>44</sup>

The Fuel Cost Adjustment Tariff has seen only modest adjustments since early 2022, despite the need for larger increases due to surging international fossil fuel prices, particularly LNG. It was set at ₩5/kWh for the third quarter of 2022 and remained unchanged for the fourth quarter of 2022 and the first quarter of 2023.<sup>45</sup> This resulted in moderate adjustments to overall electricity prices during the 2022-Q1 2024 period, even as international fossil fuel prices fluctuated (see Figure 14).

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<sup>41</sup> KEPCO. [Website](#).

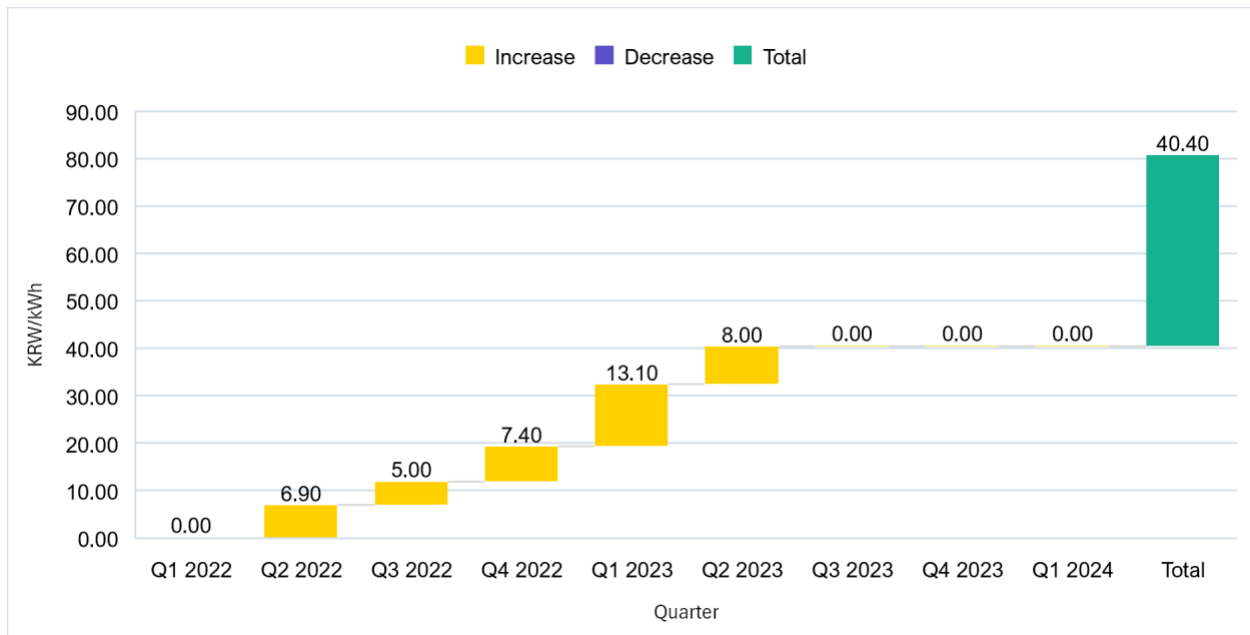
<sup>42</sup> Ibid.

<sup>43</sup> KEPCO. [Electricity Standard Terms and Conditions](#). p. 153.

<sup>44</sup> Ibid. p. 154.

<sup>45</sup> KEPCO. [Annual Financial Report](#). May 25, 2023. p. 41.

**Figure 14: Power Tariff Adjustment from Q1 2022 to Q1 2024 (KRW/kWh)**

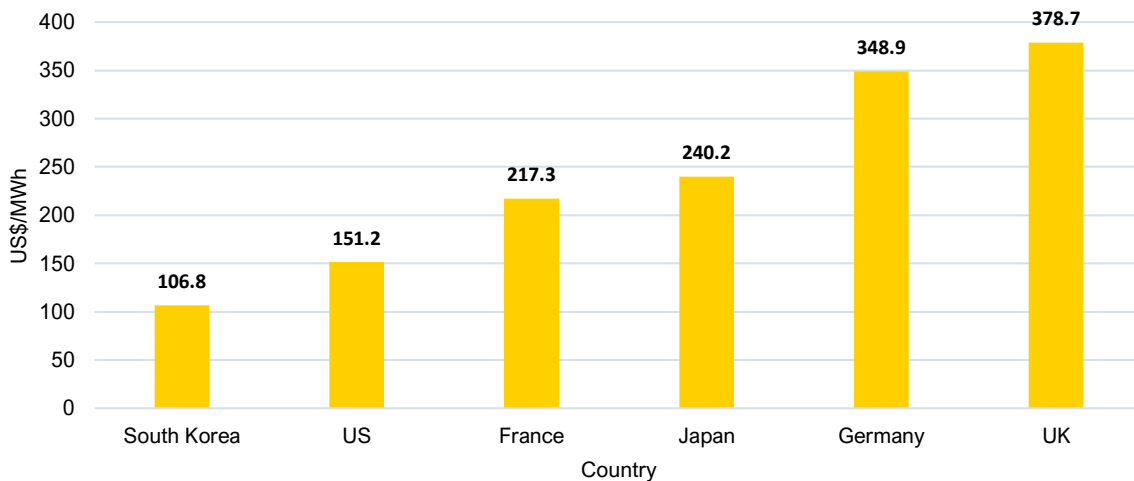


Sources: IEEFA, KEPCO

Note: In Q4 2023, only industrial power tariff was raised by an average of ₩10.6/kWh.

Consequently, although power tariffs have increased in South Korea since Russia’s invasion of Ukraine, they remain relatively lower than those of other countries due to the government-regulated electricity tariff system (Figure 15).

**Figure 15: Electricity Tariff Comparison by Country (US\$/MWh)**

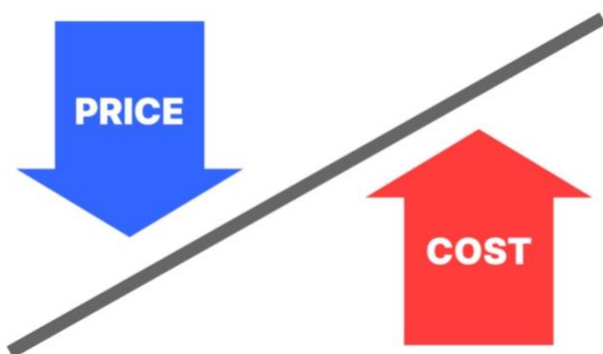


Source: IEEFA, KEPCO, IEA, Energy Prices and Taxes Statistics Database.

Note: The data is based on residential power tariffs in 2022. Japan is based on 2021.

South Korea has implemented the strategy of artificially lowering the price-to-cost ratio of power tariffs to control inflation and for political purposes, as “pseudo competitiveness” (Figure 16).

**Figure 16: Pseudo Competitiveness with artificially lowering Price-To-Cost ratio**



Source: IEEFA.

Against this backdrop, in early 2024, the South Korean government announced a freeze on energy tariffs for the first quarter of the year.<sup>46</sup> Speculation suggests that this decision may have been influenced by political considerations before the upcoming general election in April 2024, as well as fiscal measures aimed at mitigating inflationary pressures.<sup>47</sup>

As a result, KEPCO, already burdened with debt, was unable to reflect the surge in fuel costs in power tariffs, and had to resort to issuing corporate bonds as a temporary measure to avoid financial difficulties.

These “KEPCO bonds”<sup>48</sup> reached around ₩23.9 trillion in 2022<sup>49</sup> and ₩80.1 trillion in 2023.<sup>50</sup> In South Korea, about half of the debts of public corporations, including KEPCO, were by construction bonds, which are implicitly backed by government.<sup>51</sup> Despite concerns about KEPCO’s debt levels eroding capital, the government revised the KEPCO Act in December 2023, raising the company’s bond issuance limit from two to five times its capital and reserves.<sup>52,53</sup>

The reliance on bond issuance by state-run energy companies such as KEPCO and KOGAS to address their financial challenges raises significant concerns about a potential “double moral

<sup>46</sup> CBS. [Freezing power and gas tariffs until June 2024, considering general election](#). January 3, 2024.

<sup>47</sup> Financial News. [Public tariffs freeze in H1 2024, power bills likely surge after general election](#). January 4, 2024.

<sup>48</sup> It is one of the construction bonds.

<sup>49</sup> Korea Sustainability Investment Forum (KOSIF). [Fossil Fuel Finance White Paper](#). June 22, 2023.

<sup>50</sup> Maeil Economic Daily. [KEPCO's bond issuance surpasses cap by ₩10 Trillion, raising concerns about debt repayment](#). December 13, 2023.

<sup>51</sup> Korea Development Institute (KDI). [Solutions for the debts of public corporations and construction bonds](#). April 20, 2021, p. 3.

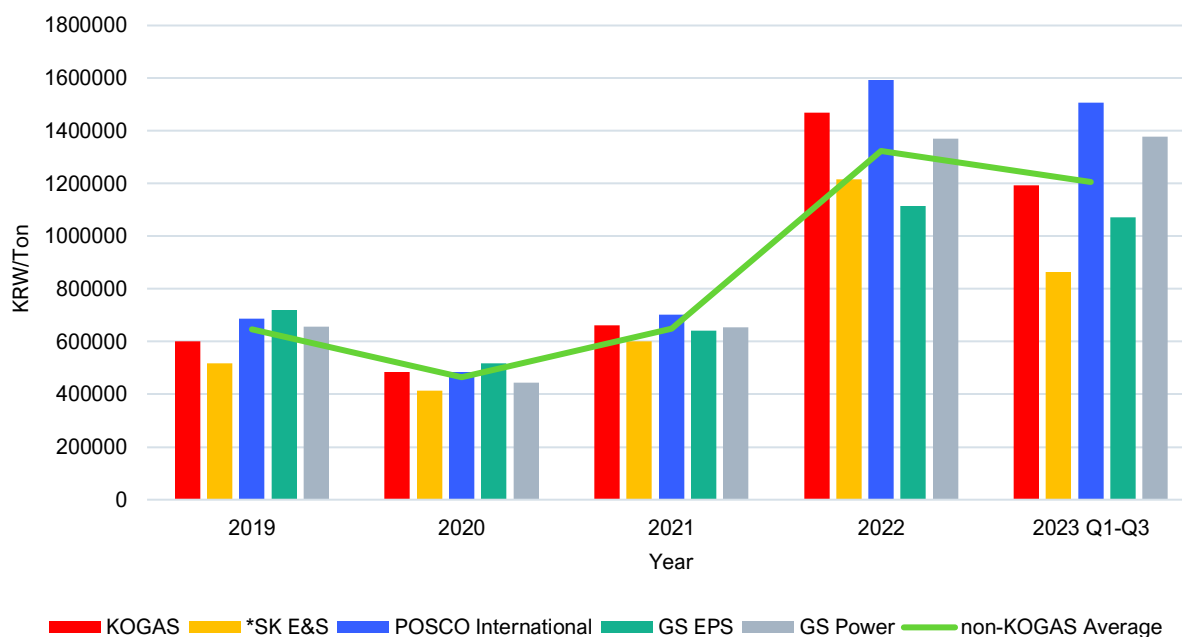
<sup>52</sup> Chosun Ilbo. [Revised KEPCO Act, semi-conductor special act passed in national assembly](#). December 28, 2023.

<sup>53</sup> IEEFA. [KEPCO cannot keep resorting to bonds to pay fossil-linked debt](#). December 14, 2022.

hazard.”<sup>54</sup> Given implicit government guarantees of financial support, debtors have no incentive to put efforts into cost reduction and product innovation to boost their competitiveness and efficiency. Additionally, implicit government guarantees could decrease creditor scrutiny, and discourage them from being more selective when investing in assets, potentially leading to continued investment in outdated fossil fuel assets.

In the absence of cost-reduction efforts, KOGAS’s gas procurement costs often exceed those of other importers (Figure 17). This lack of competitiveness in gas procurement contributes to higher electricity tariffs, as KOGAS dominates about 80% of South Korea’s gas market. As a result, the higher gas price elevated the SMP, which tended to be set by costly LNG-fired power generators in 2022-2023.

**Figure 17: LNG Procurement Costs KOGAS vs Direct-LNG Importers (KRW/ton)**



Sources: IEEFA, KOGAS, SK E&S, POSCO International, GS EPS, GS Power.

Note: The data from SK E&S has been converted from KRW/GJ to KRW/Ton based on the assumption of typical conversion rate of 52GJ/Ton. The LNG procurement costs of direct-LNG importers are an average of direct procurement from various companies and KOGAS.

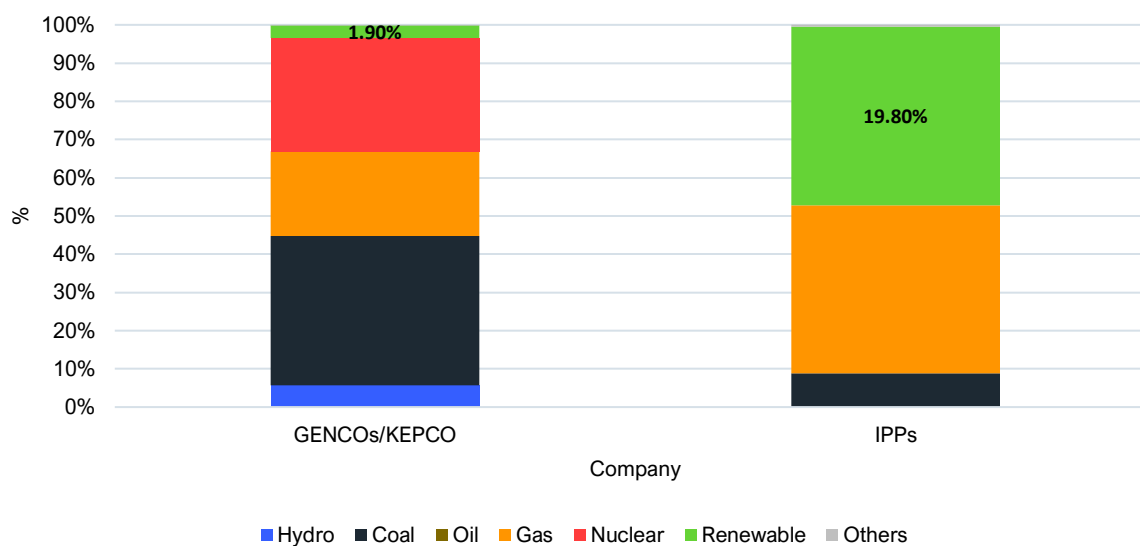
While investments in renewable energy sectors, both domestically and internationally, have been gaining momentum, the focus of many public energy companies in South Korea has remained largely on fossil fuel-based sources. This is reflected in the significantly higher renewable energy generation capacity held by IPPs compared with state-owned GENCOs and KEPCO (Figure 18).

<sup>54</sup> Korea Development Institute (KDI). [Solutions for the debts of public corporations and construction bonds](#). April 20, 2021. p. 3.



As of 2023, IPPs held more than 10 times the renewable energy capacity compared with GENCOs<sup>55</sup> and KEPCO<sup>56</sup> combined, which accounted for only 1.9% of the total national capacity, while IPPs held 19.8%. This underscores the lack of product innovation efforts by the debtors.

**Figure 18: Share of Renewable Power Generation Capacity GENCOs/KEPCO vs IPPs (%)**



Sources: IEEFA, KEPCO.

Note: Data is based on installed capacity as of December 2023. Others include internal combustion power generation. Gas includes gas and heat combined cycle power generation and group power generation.

Meanwhile, creditors of state-run energy companies may have less incentive to rigorously monitor these companies' efforts to improve competitiveness and efficiency due to the perceived implicit government guarantee. This perception, stemming from past practices, has led to higher credit ratings for companies such as KEPCO and KOGAS compared with lower ratings based solely on their individual financial performance.

The potential for a "double moral hazard"<sup>57</sup> involving both debtors and creditors, as discussed earlier, may contribute to inefficient resource allocation, such as investments in fossil fuels that may not effectively reduce costs or foster product innovation.

Against the backdrop, state-run energy companies have undertaken overseas fossil fuel development projects, despite their low success rates (under 10%) and significant financial

<sup>55</sup> Five subsidiaries of KEPCO, include Korea Midland Power (KOMIPO), Korea Western Power (KOWEPO), Korea Southern Power (KOSPO), Korea South-East Power (KOEN) and Korea Hydro & Nuclear Power (KHNP).

<sup>56</sup> The renewable power generation capacity at IPPs was 28,618GW as of 2023 while the one at GENCOs and KEPCO was 2,777GW. (KEPCO. [Monthly Power Statistics](#), February 8, 2024.)

<sup>57</sup> KDI. [Solutions for the debts of public corporations and construction bonds](#). April 20, 2021, p. 5.

requirements. These projects were often funded through the issuance of construction bonds as well, which may benefit from implicit government backing.<sup>58</sup>

Since 2018, more than 100 South Korean financial institutions, including the national pension fund, have pledged to phase out fossil fuel investments. Despite this, South Korea's financial sector held ₩118.5 trillion in fossil fuel investments in June 2022. This is more than three times the total accumulated investment in the renewable energy sector over the preceding decade.<sup>59</sup>

“Pseudo competitiveness” –low, politically motivated regulated retail power tariffs within a non-competitive wholesale market structure – can result in negative externalities too, including:

- Increased debt for state-run energy companies struggling to cover their costs.
- Potential for higher electricity consumption due to lower prices, which could exacerbate financial and environmental concerns.<sup>60</sup>
- Reduced government budget allocation for investments in the energy transition, potentially hindering progress towards sustainability goals.

Indeed, all of these results of pseudo competitiveness are playing out in the country's state-owned energy companies.

The increasing debt burdens of state-run fuel energy companies such as KEPCO could necessitate further government-backed debt issuance. This creates a potential “double moral hazard” where implicit guarantees might reduce incentives for both debtors (energy companies) to prioritize cost-cutting and innovation, and for creditors to conduct diligent oversight.

IEEFA warns that “pseudo competitiveness” and “double moral hazards” may have significant repercussions, such as increased government debt, resulting in higher taxes for future generations. Under the guise of controlling inflation, politicizing power tariffs and reliance on bond issuance for loss mitigation, may create a “vicious cycle” that inadvertently exacerbates existing financial challenges.

It is crucial to realize that maintaining artificially low electricity tariffs presents a trade-off, as benefits for consumers may come at the expense of significant financial burdens for public energy companies, the government deficit and ultimately future taxpayers.

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<sup>58</sup> KDI. [Solutions for the debts of public corporations and construction bonds](#). April 20, 2021, p. 6.

<sup>59</sup> Kyunghyang. [Korean national pension fund's fossil fuel investment, contrary to global trend](#). December 4, 2023.

<sup>60</sup> South Korea ranked 3<sup>rd</sup> in Asia for electricity consumption per capita. (IEA. [Data Service](#).)

## Sustainability Overlooked

Sustainability has long been overlooked in South Korea's energy policy considerations. Renewable power generation has been perceived as intermittent and expensive, threatening energy security and competitiveness.

Long-held prejudices against renewable energy sources hampered their fast deployment, resulting in a mere 9.64% share of renewable power in the 2023 power mix, despite South Korea's pledges to increase it to 21.6% by 2030 and 30.6% by 2036.<sup>61</sup>

However, IEEFA finds that the long-delayed energy transition is a major factor in high energy bills. Delayed renewable power deployment has added to system costs for three key reasons:

- The climate-environmental surcharge.
- The impending grid parity of renewables.
- Negative externality costs resulting from international environmental regulations.

### 1. Climate-Environmental Surcharge

The rising climate-environmental surcharge, a component of South Korea's power tariff formula (Figure 19), consistently adds upward pressure to electricity bills due to the delayed energy transition.

**Figure 19: Climate-Environmental Surcharge in Power Tariff Formula**



Source: KEPCO

Implemented in 2021, the climate-environmental surcharge<sup>62</sup> aims to support KEPCO's energy transition by incorporating costs associated with various initiatives, including the Renewable Portfolio Standard (RPS), Emission Trading System (ETS), reduction of coal-fired power generation, and

<sup>61</sup> MOTIE. [10th PSDP](#). January 12, 2023, p. 7.

<sup>62</sup> KEPCO. [Electricity Standard Terms and Conditions](#), p. 139.

energy cashback voucher issuance. The added costs of these initiatives are calculated based on formulas shown in Table 2.<sup>63</sup>

**Table 2: Climate-Environmental Surcharge Calculation**

**RPS unit cost (KRW/kWh) = Annual RPS Cost (KRW)/Annual Power Sales (kWh)**

**ETS unit cost (KRW/kWh) = Annual ETS Cost (KRW)/Annual Power Sales (kWh)**

**Coal-fired Power Generation Reduction unit cost (KRW/kWh) = Annual Reduction Cost (KRW)/Annual Power Sales (kWh)**

**Energy Cashback Voucher unit cost (KRW/kWh) = Annual Energy Cashback Voucher Issuance Cost (KRW)/Annual Power Sales (kWh)**

*Source: KEPCO.*

The RPS,<sup>64</sup> implemented in 2012,<sup>65</sup> mandates power generators<sup>66</sup> exceeding 500MW capacity (excluding renewable generators) to maintain a specific proportion of renewable energy in their generation mix.<sup>67</sup> As of April 2023, 25 GENCOs and IPPs fall under this mandate.<sup>68</sup>

The mandated proportion of renewable power generation under the RPS has steadily increased, rising from 2% in 2012 to 14.5% in 2023 as decarbonization goals strengthen. The target is projected to reach 25% after 2026 (Figure 20).<sup>69</sup> However, due to lagging renewable energy deployment since 2019, the gap between the RPS target and actual generation is widening.

<sup>63</sup> KEPCO. [Website](#).

<sup>64</sup> Korean Law Information Center. [Website](#).

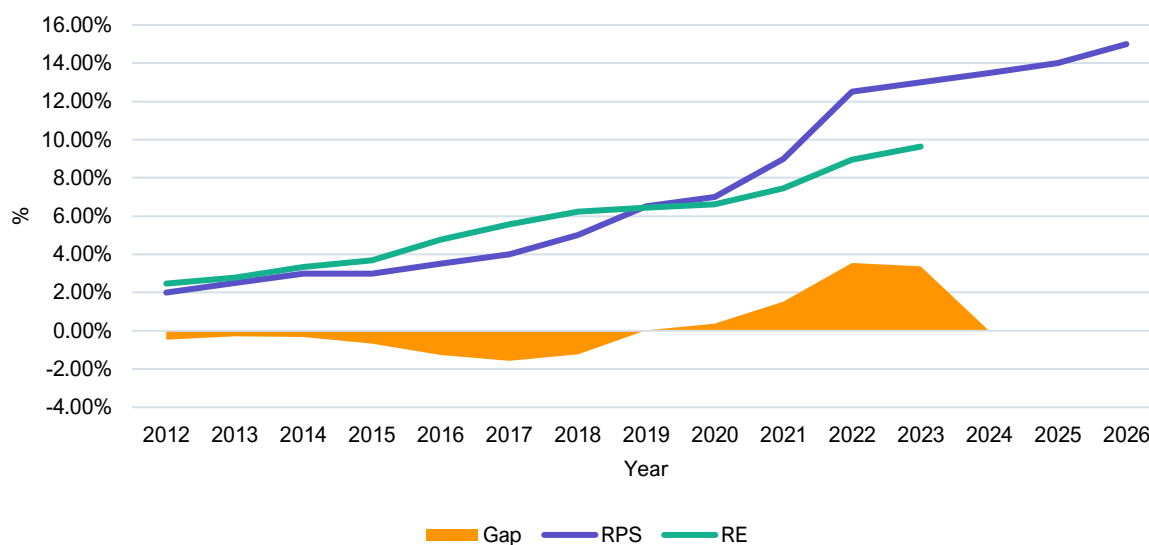
<sup>65</sup> Korea Energy Agency. [Website](#).

<sup>66</sup> Except for renewable energy power generators.

<sup>67</sup> Korea Energy Agency. [Website](#).

<sup>68</sup> Ibid.

<sup>69</sup> Ibid.

**Figure 20: RPS mandate vs Renewable Energy Power Generation (%)**

Source: Korea Energy Agency, KEPCO.

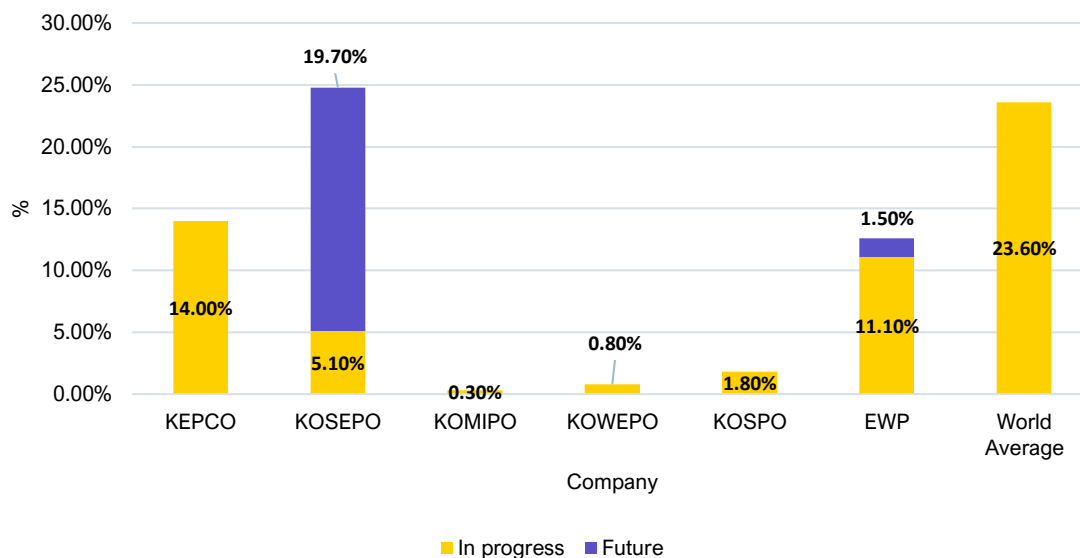
Power generators can fulfill their RPS obligations either by directly increasing their own renewable energy generation or by purchasing Renewable Energy Certificates (RECs) in the Korea Power Exchange (KPX). RECs are tradable instruments that certify renewable electricity generation.

Many GENCOs and KEPCO's power generators have primarily relied on purchasing RECs to meet their RPS obligations, rather than directly increasing their own renewable power generation. This approach has contributed to the low share of renewable energy capacity in the national power mix held by GENCOs and KEPCO at 1.9%.

Regarding the investment pattern, the share of renewable power investment of KEPCO and its subsidiaries GENCOs was averaged at 12.7%, much lower than global average of 23.6% in 2023<sup>70</sup> (Figure 21).

<sup>70</sup> IEA. [World Energy Investment](#). May 2023.

**Figure 21: Share of Renewable Energy Investment KEPCO/GENCOs vs World Average (%)**



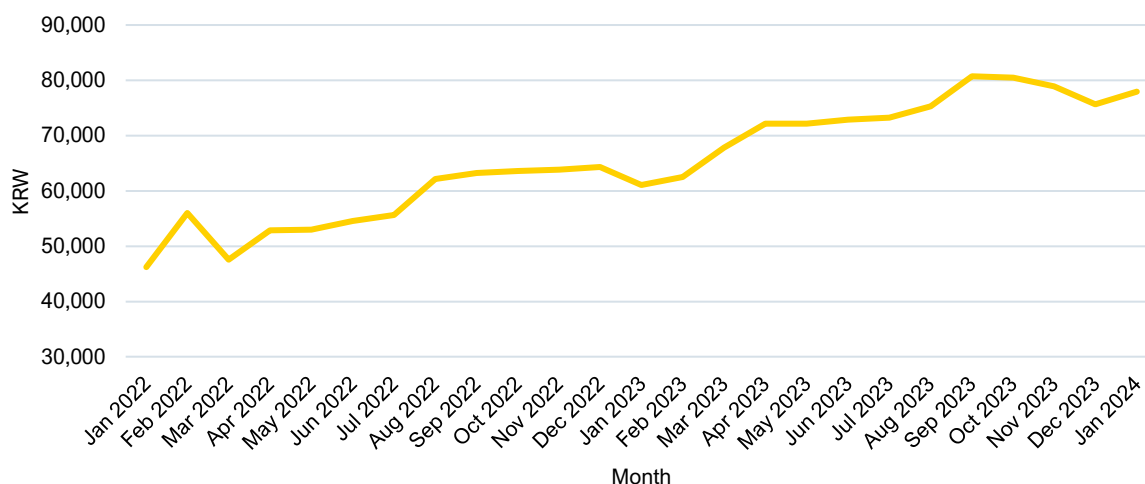
Source: IEEFA calculations based on data from KEPCO, International Energy Agency.

Despite the mandated proportion of renewable power generation increasing to 14.5% in 2023, KEPCO and GENCOs' own renewable energy capacity lagged at 3.3% in 2023. This reliance on purchasing RECs to fulfill their RPS obligations has resulted in rising costs, with KEPCO's provision for RPS liabilities reaching ₩36 billion<sup>71</sup> in 2023.

Furthermore, South Korea's sluggish renewable energy deployment has tightened the supply of RECs in the spot market, pushing their prices sharply higher (Figure 22). This has significantly driven up KEPCO's costs associated with RPS compliance.

<sup>71</sup> KEPCO. [Annual Financial Report](#). May 25, 2023. p. 287.

**Figure 22: Monthly Average REC Price (KRW)**



Source: Korea Energy Agency.

Moreover, the continued reliance on coal-fired power generation, which constitutes 39.1%<sup>72</sup> of KEPCO and GENCOs' total capacity in 2023, could exert additional upward pressure on electricity tariffs. This is because the cost of reducing coal-fired power generation<sup>73</sup> is factored into the climate-environmental surcharge.

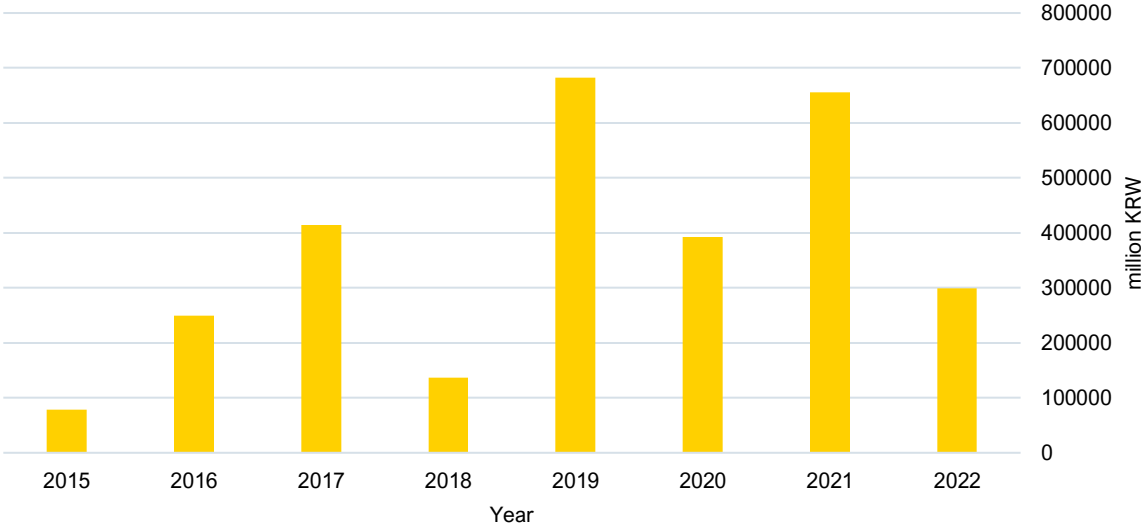
South Korea's reliance on fossil fuels, which accounted for 58.5% of its power generation portfolio in 2023, also contributes to increased costs through the Emission Trading System (ETS) due to higher greenhouse gas emissions. KEPCO's provision for ETS liabilities in 2022 reached ₩299 billion, representing 12% of its total current liabilities.<sup>74</sup> This highlights how a fossil fuel-intensive portfolio can lead to higher ETS compliance costs, as the system charges higher prices for carbon emissions as decarbonization accelerates.

<sup>72</sup> KEPCO. [Monthly Power Statistics](#).

<sup>73</sup> Still relatively high coal-fired power generation in the power mix incurred substantial coal-fired power generation reduction costs, incorporated in the climate-environmental surcharge.

<sup>74</sup> KEPCO. [Annual Financial Report](#). May 25, 2023.

Figure 23: KEPCO's provision for liabilities ETS (million KRW)



Source: KEPCO.

Against this backdrop, the delayed deployment of renewable energy and rising costs associated with RPS, ETS and coal-fired power reduction, KEPCO increased the climate-environmental surcharge unit cost from ₩7.3/kWh in 2022 and to ₩9/kWh in 2023<sup>75</sup> Due to the delayed energy transition, South Korean consumers were estimated to burden around ₩4.3 trillion in 2022, ₩5.8 trillion in 2023<sup>76</sup> for the climate-environmental surcharge.

State-owned utilities' heavy reliance on purchasing RECs rather than investing in renewables might create an ongoing strain on their operating expenses (OPEX). This approach prioritizes recurring annual costs over more strategic, one-time capital expenditures (CAPEX) in renewable energy infrastructure. Such CAPEX investments could ultimately reduce the need for REC purchases. Additionally, the continued dependence on fossil fuels further increases cash-flow outlays related to earnings per share (EPS) expenses.

In essence, two mechanisms designed to incentivize efficient allocation of capital and cash towards lower-emission and more sustainable energy sources appear to be underutilized by state-owned utilities. This strategy ultimately harms both the utilities' financial health and, by extension, the government's, as it may be called upon to provide financial support.

<sup>75</sup> KEPCO. [Electricity Standard Terms and Conditions](#).

<sup>76</sup> Figures calculated based on the total power generation multiplied climate-environmental surcharge.



IEEFA warns that if South Korea continues to delay in renewable power deployment, the climate-environmental surcharge could lead to further increases, ultimately contributing to higher electricity tariffs as a delayed energy transition penalty.

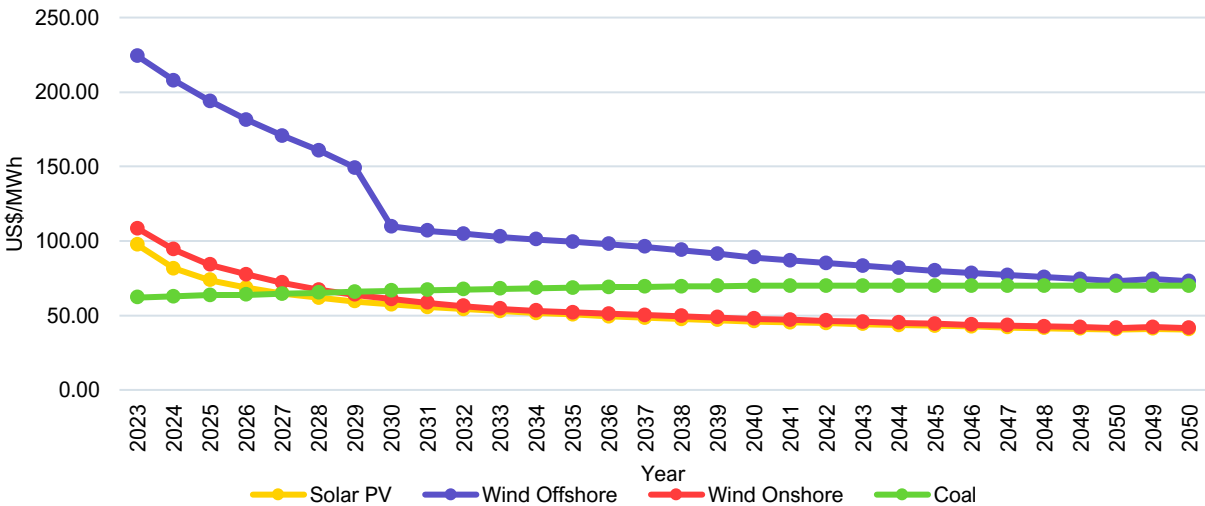
## 2. Impending Grid Parity

While technological innovation and economies of scale could accelerate grid parity for renewable energy, South Korea's power tariffs might still rise if renewable deployment remains slow. This is because of the continued reliance on costly fossil fuels, and the associated missed opportunity to leverage cheaper renewable energy sources. Reliance on fossil fuels diverts capital away from renewable energy investments that could ultimately generate long-term cost savings.

Grid parity refers to the point at which the levelized cost of electricity (LCOE)<sup>77</sup> for renewable energy sources becomes equal to the LCOE of fossil fuels. At this point, renewable energy becomes commercially competitive with traditional sources.

According to Bloomberg New Energy Finance (BNEF), South Korea is expected to achieve grid parity by 2027, when the electricity generation costs for solar PV to equate that of coal-fired power.<sup>78</sup> The solar PV LCOE is expected to fall exponentially to \$64.76/MWh in 2027, with coal LCOE at US\$64.6/MWh. Meanwhile, the onshore wind LCOE is also expected to reach grid parity in 2029, with the onshore wind LCOE (US\$64.8/MWh) to fall below coal at US\$65.9/MWh.

Figure 24: LCOE Forecast in South Korea (US\$/MWh)



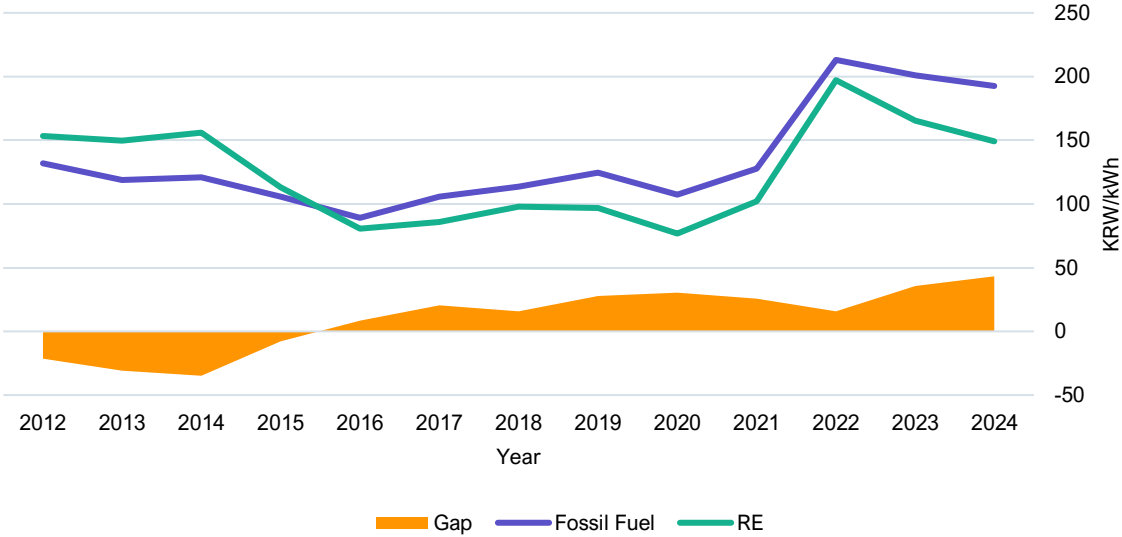
Sources: IEEFA, BNEF.

<sup>77</sup> KOSIF. *Renewable Energy Demand in South Korea*. March 2023, p. 11.

<sup>78</sup> KEEL. *Data on the mid- to long-term LCOE outlook*. 2021.

While estimates for grid parity vary based on methodology, KEPCO's declining settlement prices for renewable energy compared with fossil fuels suggest progress towards parity (Figure 25). In 2022, the renewable energy settlement price<sup>79</sup> was ₩197/kWh, 8% lower than fossil fuels.

Figure 25: KEPCO's Settlement Price Renewable Energy vs Fossil Fuels (KRW/kWh)



Source: KEPCO.  
Note: Settlement price excludes RPS and ETS costs paid to the renewable power generators.

IEEFA believes that South Korea's delayed energy transition could lead to missed opportunities for cost reduction as renewable technologies continue to improve. Consequently, consumers in South Korea may face persistently higher electricity tariffs compared with countries that embraced renewable energy sources more rapidly.

<sup>79</sup> The settlement price is determined monthly by estimating the wholesale electricity market price and fuel costs, incorporating regulatory charges and other factors, and then finalizing it based on the actual market price disclosed by KPX.

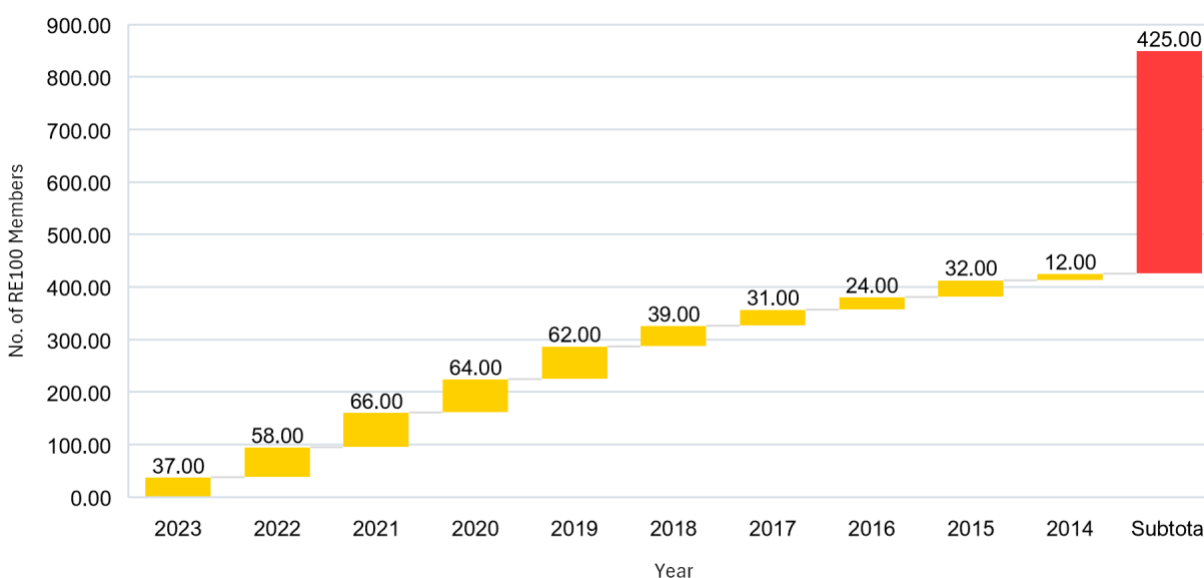
### 3. Negative Externality Costs

The delayed deployment of renewable energy, coupled with continued reliance on fossil fuels, could lead to significant financial consequences due to rising negative externality costs.<sup>80</sup> These include costs related to carbon tariffs, trade barriers, limited access to capital, and higher energy production costs – all of which could increase power costs in South Korea.

#### a. RE100

RE100 is a global corporate renewable energy initiative led by the Climate Group in partnership with the Carbon Disclosure Project (CDP).<sup>81</sup> Its primary objective is to accelerate the transition to a zero-carbon grid by bringing together influential businesses worldwide committed to switching their entire electricity usage to renewable sources by 2050.<sup>82</sup> The influence of RE100 has grown in South Korea, with 36 companies committed to using 100% renewable energy by 2050. Companies involved in the initiative increasingly require supply chain partners to adopt similar climate commitments, to mitigate climate-related costs and risks.

**Figure 26: Increase in RE100 Membership Globally**



Source: Climate Group RE100

<sup>80</sup> The externality cost here encompasses broader ideas of direct and indirect costs incurred by delayed energy transition, such as third-party impact, unpriced costs, carbon tax, inefficiency, and trade barriers etc.

<sup>81</sup> The Carbon Disclosure Project (CDP). [Website](#).

<sup>82</sup> RE100. [Website](#).

Increased RE100 membership is expected to create significantly higher demand for Renewable Energy Certificates (RECs), one of the key methods for companies to comply with the initiative's requirements.<sup>83</sup>

Rising REC demand, along with a limited supply of renewable power, could exert upward pressure on REC prices (as discussed earlier in [A Lack of Competitiveness](#)). This could increase KEPCO's RPS compliance costs, as it relies heavily on RECs to meet its mandated renewable energy targets. This could result in increased pressure on South Korea's climate-environmental tariff, a component of the country's electricity pricing.

Rising RPS costs, driven by higher REC prices, could harm KEPCO's environment, sustainability, and governance (ESG) ratings, particularly relating to carbon emissions. As the increase in RPS costs can be translated into delayed energy transition in KEPCO and its subsidiaries, GENCOs' portfolios are heavily reliant on fossil fuels. Consequently, this could create reputational risks, limit access to capital, and hinder future investments in clean energy.

IEEFA believes that this vicious circle will increase power generators' financial instability and taxpayer's burden through high-power tariffs.

## b. CBAM

The Carbon Border Adjustment Mechanism (CBAM) introduced by the European Commission (EC) in 2021 aims to prevent "carbon leakage" by imposing a tax on goods imported into Europe based on their embedded carbon emissions.<sup>84</sup>

Specifically, CBAM requires exporters of goods such as iron, steel, aluminum, cement, hydrogen, electricity, and fertilizer to the EU to report embedded carbon emissions from October 2023 to December 2025. This initial reporting phase precedes the full implementation in 2026, when importers will be required to purchase CBAM certificates.

The cost of CBAM certificates will be calculated by multiplying the weekly average EU ETS (Emissions Trading System) price with the embedded emissions per ton of imported goods. The cost is directly tied to the difference between the exporter's domestic carbon price and the EU's ETS price. A larger gap in carbon pricing will result in higher CBAM costs for importers of South Korean products. On March 11, 2024, the KAU23,<sup>85</sup> a South Korean Emissions Trading System (ETS) index price, was ₩9,100/tCO<sub>2</sub>e,<sup>86</sup> a massive 89% disparity with the EU ETS price.<sup>87</sup>

<sup>83</sup> Other ways of complying with the RE100 include green premium, power purchase agreement (PPA), share investment and independent renewable power generations.

<sup>84</sup> European Commission (EC). [Carbon Border Adjustment Mechanism](#).

<sup>85</sup> Korea Exchange (KRX). [Website](#).

<sup>86</sup> One ton of carbon dioxide equivalent.

<sup>87</sup> Ember. [Carbon Price Tracker](#). Accessed March 13, 2024.

The CBAM is one form of carbon tariff aimed at addressing concerns about carbon leakage and potentially equalizing carbon pricing between the EU and non-EU countries.<sup>88</sup> If other countries adopt similar mechanisms and the scope of CBAM expands, it could lead to a convergence in carbon prices across different countries.

As such, South Korea's comparatively low ETS price may face upward pressure after 2026, driven by the EU's CBAM certificate system. This could lead to higher climate-environmental tariffs, as KEPCO needs to pay higher costs for the ETS, potentially affecting electricity prices.

Additionally, the CBAM implementation could increase production and trade costs of emission-intensive fossil fuels in the international supply chain, potentially leading to higher import costs for fossil fuels used in South Korea's power generation. Consequently, increased reliance on fossil fuels could further elevate power generation costs, putting upward pressure on electricity prices.

IEEFA highlights potential negative externality costs for South Korean industry and trade due to CBAM, stemming from KEPCO's delayed renewable energy transition. These costs could intensify as similar regulations expand in scope and adoption globally.

### c. SFDR

The EU's Sustainable Finance Disclosure Regulation (SFDR), introduced in 2021, aims to increase transparency and accountability in the financial sector's reporting of sustainability risks and factors. Under the SFDR, all financial entities operating within the EU, including asset managers, financial advisers, and investment banks, must disclose sustainability risks and factors in their investment decisions.

While the EU's SFDR doesn't directly affect South Korean power utilities, it could indirectly affect KEPCO's access to capital by raising negative externality costs. As of December 2023, foreign equity investors held a combined stake of 14.71% in KEPCO. Regardless of being registered in the EU, companies must adhere to the SFDR mandate by enhancing their ESG disclosure practices and developing SFDR-compliant investment products for EU investors amid increasing pressure from investors globally.

KEPCO also has US\$1.5 billion in foreign currency debt amounting to 21% of its total debt.<sup>89</sup> These foreign bondholders, including those holding KEPCO bonds, could potentially divest their holdings if stricter ESG reporting mandates become widespread globally. Despite government backing, stricter global ESG regulations could raise challenges for investors holding KEPCO bonds, given the company's reliance on fossil fuels.

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<sup>88</sup> World Bank. [Trade Watch](#). December 2021, p. 3.

<sup>89</sup> *Ibid.* p. 206.

The expanding “Green Finance” movement could persistently challenge KEPCO’s funding abilities. Brazil, China, Taiwan, the UK, and the EUs SFDRs have already mandated ESG reporting regulations. Many other countries, including South Korea, are considering similar measures. Strengthening global ESG regulations will not only limit KEPCO’s access to global capital, but also damage its reputation and expose the company to regulatory penalties.

Rising external costs associated with the RE100, CBAM, SFDR and many other sustainability initiatives and regulations could exacerbate KEPCO’s financial challenges, leading to higher operational costs and upward pressure on electricity prices.

**Table 3: Negative Externality Costs of Delayed Energy Transition**

Name	Type of Externality Costs	Negative Externality Costs from delayed ET
RE100	Reputation	<ul style="list-style-type: none"> <li>Downgraded ESG rating</li> </ul>
		<ul style="list-style-type: none"> <li>Limited access to capital</li> </ul>
		<ul style="list-style-type: none"> <li>Increased REC costs burden</li> </ul>
CBAM	Industry & Trade	<ul style="list-style-type: none"> <li>Conversing ETS prices</li> </ul>
		<ul style="list-style-type: none"> <li>Increased ETS costs burden</li> </ul>
		<ul style="list-style-type: none"> <li>Higher imported fossil fuel prices</li> </ul>
SFDR	Finance	<ul style="list-style-type: none"> <li>Limited access to capital</li> </ul>
		<ul style="list-style-type: none"> <li>Regulatory penalties</li> </ul>
		<ul style="list-style-type: none"> <li>Damaged reputation</li> </ul>

Source: IEEFA.

IEEFA warns that South Korea’s delayed energy transition could lead to significant negative externality costs, affecting power prices from reputational, industrial, trade and financial perspectives. A rapid transition to renewable power generation could be the solution, helping to mitigate the rising costs associated with sustainability regulations.

## Conclusion

### Ending the Vicious Cycle of High Power Prices

This report has examined South Korea's power tariff trilemma through the lens of three intertwined energy policy perspectives: energy security, competitiveness, and sustainability.<sup>90</sup> This analysis underscores the negative impact of South Korea's fossil fuel-intensive power mix on energy security and power tariffs. Specifically, surging LNG prices due to the Russia-Ukraine conflict have resulted in a sharp increase in wholesale electricity prices (SMP), disrupting stable and affordable power supply.

South Korea's power sector faces a complex challenge due to its reliance on fossil fuels, lack of market competitiveness and delayed energy transition. These factors create a vicious cycle, contributing to rising electricity bills such as those experienced in 2022-2023.

The continued dependence on fossil fuels exposes the market to price volatility, as evidenced by the recent surge in LNG prices. Additionally, the lack of competitiveness hinders efficient pricing mechanisms and innovation within the sector. Furthermore, delays in the energy transition make South Korea vulnerable to stricter global regulations, potential opportunity and externality costs.

Breaking this vicious cycle requires addressing all three elements simultaneously. Transitioning to cleaner energy sources such as renewables can enhance energy security and reduce reliance on volatile fossil fuels. Fostering a more competitive market environment can incentivize cost-effectiveness and innovation within the power sector. By tackling these challenges holistically, South Korea can achieve a sustainable and secure energy future.

While recent stabilizing trends and lower global LNG prices offer some relief, geopolitical risks such as the Red Sea crisis and Houthi attacks, among other global commodity market disruptions, remain a potential source of disruption for the gas industry. These threats could persistently destabilize the global LNG market, causing renewed price spikes.

The shift towards a buyer's market amid declining prices could prompt gas suppliers to restrict supply, and potentially trigger market instability. Additionally, the diverse strategies of major producers, such as Qatar's gas production expansion and the US's temporary LNG export suspension, further add to the complexity of the market, contributing to potential future volatility.

The energy crisis of 2022-2023 could serve as a stark reminder of the vulnerabilities associated with a fossil fuel-dependent power mix. South Korea must acknowledge the critical importance of transitioning from its fossil fuel-dominant power mix and reducing its reliance on volatile fossil fuels.

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<sup>90</sup> Energy Policy. [The Kyoto protocol – a victim of supply security?: or: if Maslow were in energy politics](#). July 2004.

The only viable path to end the vicious cycle and achieve energy security, market competitiveness and sustainable development is to break free from fossil fuel dependence. South Korea must rapidly invest in renewable energy sources, and accelerate the transition to a clean and sustainable energy system.

IEEFA offers the following key takeaways in light of the issues discussed:

### Key Recommendations

- Reduce reliance on fossil fuels in the power mix and expedite the transition to clean energy sources.
- Reform power pricing to reflect actual costs and avoid politically motivated determination of electricity tariffs.
- Address KEPCO's financial challenges through cost-cutting measures and innovation focused on renewable energy.
- Accelerate the renewable energy transition to mitigate rising power costs associated with delays and achieve declared decarbonization goals.



## About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. [www.ieefa.org](http://www.ieefa.org)

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