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**2050 South Korea-Japan  
Cooperation in Energy and  
Climate Change-related Areas:  
Beyond Energy Security**

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# 2050 South Korea–Japan Cooperation in Energy and Climate Change–related Areas: Beyond Energy Security



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## I. Response to Global Energy Transition

In 2025, South Korea and Japan celebrate the 60th anniversary of the normalization of diplomatic relations. The two countries, or rather, two regions, have influenced and been influenced by each other for millennia, or even longer. The past 60 years is only a small part of the history of their relationship. As long as the two countries are still there, they will continue to have a significant impact on each other, for better or worse.

What does it mean for these two countries to think about 2050 together? While 2050 may seem like a long way off, if we look back at the relationship between South Korea and Japan 25 years ago, in 2000, 2050 may not seem so far away. The purpose of this paper is to envision the future of 2050 and suggest what South Korea and Japan might pursue in the energy and climate change sectors in that future.

The world is undergoing a profound transformation as it grapples with the dual imperatives of mitigating climate change and ensuring sustainable energy supply. By 2050, the energy landscape will be substantially reshaped, and countries like South Korea and Japan will be at the forefront of this shift. These nations, both technologically advanced and economically significant, face overlapping challenges but also share unique opportunities for collaboration.

The importance of South Korea and Japan’s cooperation extends beyond bilateral benefits. As leaders in innovation and renewable energy technologies, their joint efforts can serve as a model for the global community. This paper explores the key challenges and opportunities for South Korea and Japan in the energy and climate sectors, evaluates the prospects for bilateral cooperation, and provides strategies to deepen their partnership by 2050.

This paper is organized as follows. The next chapter analyzes what South Korea and Japan will look like in 2050 and the challenges they will face in common. Chapter 3 analyzes the benefits and limitations of the two countries working together to overcome the challenges they share. In Chapter 4, I will make policy recommendations centered on areas where the two countries can and should

collaborate to achieve positive results. Finally, Chapter 5 summarizes the contents of this paper and concludes with recommendations for a new South Korea-Japan relationship in 2050.

## II. Key Challenges for South Korea and Japan in 2050

As early as 2017, PricewaterhouseCoopers (PwC), a global accounting and management consulting firm headquartered in London, made a forecast for 2050. According to their projections, China and India will surpass the United States in economic size by 2050, while emerging economies such as Indonesia, Brazil, Russia, and Mexico will also enter the top 10 in terms of economic size. By comparison, the countries currently categorized as the so-called Group of Seven (G7) will drop out of the top 10, with the exception of the U.S., Japan, the United Kingdom, and Germany. PwC dubbed China, India, Indonesia, Brazil, Russia, Mexico, and Türkiye the E7, meaning the seven emerging market countries, and by 2040, it predicted that the E7 would already be twice the size of the current G7 (PwC 2017, 3-4).

In the meantime, both South Korea and Japan are facing shrinking economies. According to PwC's projections, Japan's economy, which is ranked fourth in 2030, will drop to eighth by 2050, while South Korea's economy, which is ranked 14th in 2030, will drop to 18th by 2050. Between South Korea and Japan in 2050 will be the traditional G7 countries of Germany, the UK, and France, but also the emerging economies of Türkiye, Saudi Arabia, Nigeria, Egypt, and Pakistan, PwC estimated (Ibid. 7).

The relative decline in the economies of the two countries is deeply related to the changing demographics. At the time of the report, PwC projected that South Korea's population would grow by 0% in real terms between 2016 and 2050, while Japan's would shrink by 0.5% over the same period (Ibid. 33). As of December 2024, both countries are "super-aged societies" by the United Nations' standards,<sup>1</sup> with South Korea's 2024 birth rate estimated at 0.68 (Morse 2024) and Japan's at 1.374 (Macrotrends n.d.).

One of the challenges that both societies face in common with demographic change is the gap between the center and the provinces. As of 2023, South Korea's urbanization rate is 81.46% (Statista 2024b) and Japan's is 90.04% (Statista 2024a), and in both countries, the disparity between metropolitan areas and rural areas is so severe that the term "local extinction (地方消滅: 지방소멸)"<sup>2</sup> has emerged, with population decline accelerating much faster in rural areas. This growing regional disparity is also related to the question of how balanced the use of land is. Even in 2050, urbanization

<sup>1</sup> A "super-aged" society is a society with one in five people aged 65 or older, according to the UN's criteria.

<sup>2</sup> In May 2014, the Japan Founding Conference and Subcommittee to Study the Problem of Population Decline, chaired by Masuda Hiroya, a Japanese construction bureaucrat who served as chief cabinet secretary in the first Shinzo Abe cabinet and the Fukuda Yasuo cabinet, published a list of 896 potentially vanishing cities, and in the same year, Masuda published a book entitled *Local Extinction! The Plummeting Population Caused by Tokyo's Unipolar Concentration (in Japanese)* was published, sparking a public debate (Hiroya 2014).

rates and population concentration in South Korea and Japan are unlikely to improve dramatically. In fact, urbanization is likely to accelerate, especially when considering access to public services that are essential for the aging population, such as healthcare.

Climate change is another major challenge for both South Korea and Japan. According to the Climate Change Knowledge Portal, the average temperature in South Korea was 11.03°C in 1965, when diplomatic relations with Japan were normalized, and 13.32°C in 2023, an increase of 2.29°C in just less than 50 years. Japan's average temperature was 10.04°C in 1965 and 12.99°C in 2023, an increase of 2.95°C in the same period.

The 2015 Paris Agreement, which marked a milestone in the global governance of climate change, committed parties to limit the increase in the average global temperature to 2°C above pre-industrial levels, with a goal of 1.5°C. However, the Paris Agreement's goal is becoming irrelevant as it is estimated that the average global temperature increase will have already exceeded 1.5°C by 2024 (WMO 2024). Furthermore, South Korea and Japan are on track to experience higher temperature increases than the global average as mentioned above. Since climate change is a global phenomenon, the effects of rising global temperatures will affect everyone, and the impact on South Korea and Japan in 2050 could be greater than in other parts of the world. Therefore, adaptation is becoming an increasingly important issue for both societies.

The damage caused by climate change will be multifaceted. First and foremost, natural disasters will not only become more frequent, but also more intense. Japan has always been prone to earthquakes and volcanoes due to its location on the Pacific Ring of Fire, but typhoons and heavy rains are likely to be even more damaging. South Korea, which is less prepared for natural disasters than Japan, could also be at increasingly serious risk.

Second, climate change also affects food security. Living in temperate regions with four distinct seasons, people in both countries need a variety of proteins from meat and seafood, not just grains like rice, to sustain their diets. Rising land and sea temperatures are already changing the types of crops and fish that can be produced in both countries. By 2050, this will only accelerate, deepening food security concerns.

Another challenge that both countries share in common is the security situation. Both countries are allies of the world's most powerful nation, the U.S., and share the burden of security based on the alliances, and both have relied on strategic assets such as the nuclear umbrella provided by the U.S. to drive their economies forward. The year of 2023 was a particularly significant year for the South Korea-U.S.-Japan triangle, as the three leaders met at Camp David in August to solidify their commitment to security cooperation. This was an effort to effectively respond to the escalating nuclear threat from North Korea and to provide a deterrent against China's increasingly coercive behavior in the region. In short, the three countries' security cooperation was driven by the common threat of North Korea and, by extension, China. Assuming that this situation will not have changed significantly in 2050, arguably, it can be expected that the three countries will maintain or even develop their security cooperation further.

Meanwhile, technology is bound to become increasingly important in the security cooperation of the three countries, South Korea, Japan, and the U.S.. In particular, Artificial Intelligence (AI) and space technology are key parts of the competition for future technological supremacy, and securing a stable energy supply, or energy security, is an indispensable condition. As digitalization and electrification progress, the demand for energy in both nations is projected to rise significantly. AI-driven systems, data centers, and electric vehicles (EVs) will exacerbate the strain on energy systems. The International Energy Agency (IEA) emphasizes that the backbone of this transition must include scalable renewable energy sources (IEA 2021, 73-74).

In particular, South Korea and Japan have virtually no resources within their territory, and assuming that relations with continental countries have not improved dramatically in 2050, it is less likely that they will be able to share energy infrastructure with the Eurasian continent, so we can expect that they will continue to rely heavily on importing energy sources through maritime transportation.

However, as mentioned earlier, combating climate change is a very urgent issue for both countries, so it is important to accelerate the energy transition. In addition, the two countries announced their “carbon neutrality by 2050” goals within days of each other in 2020. They also enacted this goal into law. IEA notes that achieving net zero (being used interchangeably with carbon neutrality) by 2050 will require an extraordinary alignment of policies, technologies, and investments (Ibid. 14). For South Korea and Japan, these challenges are amplified by their dependence on imported energy, aging populations, and increasing urbanization. In short, the future of both countries in 2050 will depend on how quickly and steadily they move forward with the energy transition while ensuring energy security.

The shift to green energy technologies has intensified global competition for critical minerals and renewable energy components. South Korea and Japan rely heavily on imports for these resources, making them vulnerable to supply chain disruptions. In 2019, Arup, a British multinational company that provides engineering, design, and project management services for the environment, published a report providing scenarios for 2050. Arup presents four scenarios for the future of the world, including (1) post anthropocene, (2) greentocracy, (3) extinction express, (4) humans inc. One of the key variables that distinguishes these scenarios is global cooperation, and scenario 3, with low global cooperation, is the most damaging, as it will ultimately hinder the energy transition and accelerate temperature rise (Schemel et al. 2019). In a scenario where international cooperation is not as smooth as it could be, the energy transitions in South Korea and Japan are also unlikely to move as quickly as desired.

It is hard to say how fast the energy transition can be, but as long as both countries are committed to tackling climate change with the goal of being carbon neutral by 2050, it will continue to happen. In addition, as the energy transition coincides with the fourth industrial revolution, the transformation to a hyper-connected society, both countries will be concerned about cybersecurity. The integration of smart grids and Internet of Things (IoT)-based energy systems, while enhancing efficiency,

exposes critical infrastructure to cyberattacks. IEA also emphasizes that cybersecurity is an increasingly important issue for electricity systems and that policymakers have a critical role to play (IEA 2021, 174).

### III. Prospects for Bilateral Cooperation

Based on the common challenges outlined in the previous chapter, I believe that both South Korea and Japan should aim for either the first or second of Arup's scenarios as they move toward 2050.

The first scenario, post anthropocene, is described by Arup's report as "The world of 2050 boasts a balanced biosphere: humanity and 'spaceship Earth' are thriving in harmony." There is a high level of global cooperation, clean energy penetration is very high (over 90%), income inequality is low, and weather variability is stable. To realize this scenario, advances in science and technology are key, jobs are created through the green economy, and public-private partnerships prioritize the sustainability of the planet (Schemel et al. 2019, 12-23).

For the second scenario, greentocracy, Arup's report describes it as "In 2050, societies are highly divided, unequal and suppressed. Most of the Earth's ecosystems are on a clearly chartered recovery plan." In this scenario, global cooperation for the environment is moderate, so clean energy utilization is high, but the gap between rich and poor is wide because some people are unwilling to trade off opportunity costs for a higher standard of living, and population is concentrated in urban areas, making space very expensive (Ibid. 24-35).

The scenario that South Korea and Japan should pursue is more likely to be the first, but given the realities that South Korea and Japan face as of January 2025, the second seems more likely. To avoid a worst-case scenario like extinction express, global cooperation will be a key variable. Accordingly, I would argue efforts to move closer to scenarios 1 and 2 through collaboration between the two most physically close countries, South Korea and Japan, are necessary.

The positive effects of cooperation between South Korea and Japan can be summarized as follows. First, the cooperation between the two countries can contribute to the expansion of the culture and norms of global cooperation. Although their economies will be relatively smaller in 2050, as described in the previous chapter, the fact that two countries that are not only ahead of the E7 in economic development but also have a certain advantage in future technologies could have significant implications for other countries in the E7 and beyond.

Second, if the two countries, which have historically had many twists and turns, can work together on energy and climate change, it will contribute to the improvement of their relationship, and a sustainable friendship between the two countries can contribute to the stability of East Asia as a whole. If we remember that the history of European integration began with the establishment of the European Coal and Steel Community, by European leaders who recognized that coal and steel were

the fuels of World War II, the French and German experience of flying the flag of European integration can be replicated by South Korea and Japan in Asia.

Third, as the economies of these two countries continue to shrink, their cooperation could expand the economic benefits of economies of scale: examples are the supply of natural gas, which is likely to remain an important energy source even during energy transition (Maxwell 2023, 5-6; 9-10), the supply of critical minerals, essential for the expansion of renewable energy, and the supply of nuclear fuel for nuclear power plants, expected to become an increasingly important source of decarbonized energy, cooperation between the two countries to strengthen their purchasing power and expand their markets can contribute to enhancing their energy security and accelerating decarbonization.

But even so, there are many factors that limit cooperation between the two countries. First and foremost, I cannot but emphasize the variables arising from the differences in the political systems of the two countries. After the Democratic Party of Korea's landslide victory in the April 2024 general election, the presidential and parliamentary conflicts and confrontations that followed culminated in President Yoon Suk-yeol announcing emergency martial law on December 3. The subsequent impeachment was a demonstration of the risks of a divided and politically polarized South Korea. This, in turn, highlights the limitations of the presidential system and the fact that the two-party system is prone to large swings in policy as social divisions and conflicts become more acute. This is also the case in the U.S..

By comparison, Japan, which operates a parliamentary system, is much more stable than South Korea in terms of policy coherence. Of course, Japan has its share of problems, and Prime Minister Ishiba Shigeru is currently struggling to lead the Liberal Democratic Party, which has become a minority party in the Japanese Diet, but it has not seen as many policy swings as South Korea. While it cannot be said that the policy-making process in Japanese society is the same as it was in the past, when Japanese experts such as Chalmers Johnson illuminated the role of Ministry of International Trade and Industry (MITI) in Japan's industrial policy and emphasized that Japanese policies are made by elite bureaucrats rather than politicians (1982), I would say that Japan's policy stability is higher than that of South Korea, at least in the sense that the policies of the previous government do not change to the point of being completely overturned. Japan is also limited by the fact that change and reform are slower than in South Korea. In the end, this difference is a factor that makes cooperation between the two countries difficult.

The second is the structural difference between the two countries' energy markets. While Japan's energy market is fully liberalized,<sup>3</sup> South Korea's is still vertically integrated and more centralized, with public energy corporations as the main actors. Moreover, the leadership of public corporations tends to change significantly depending on the government, which adds to the aforementioned political instability and can lead to large swings in policy direction. Adding to this is the huge amount

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<sup>3</sup> For a study of Japan's energy market liberalization, see the following paper by the author. Eunjung Lim. 2018. "Japan's Energy Policy under Abe: Liberalization of the Energy Market and Nuclear U-turn." *Seoul Journal of Japanese Studies* 4(1): 103-131.

of debt that South Korea's public energy corporations are carrying (The Korea Times 2024). While there may be structural changes to South Korea's vertical and rigid energy market in 2050, it is clearly different from Japan's market, where private companies are the main actors, making coherent cooperation difficult.

Finally, there is a risk that nationalistic tendencies, which are latent in both countries, could come to the forefront of policymaking, making it difficult for the two countries to cooperate if they are driven by national emotions rather than economic realities or strategic interests.

Despite these challenges, South Korea and Japan are well-positioned to leverage their complementary strengths for mutual benefit. Both nations have demonstrated leadership in renewable energy technologies and have ambitious goals for carbon neutrality. In the next chapter, I will propose policies that could help South Korea and Japan move closer to Arup's scenario 1.

#### **IV. Proposed Areas for Korea-Japan Cooperation in Energy and Climate**

South Korea and Japan, as technologically advanced nations and key players in the East Asian region, are uniquely positioned to lead global efforts in the energy transition and climate adaptation. By cooperating across a range of strategic areas, they can enhance mutual energy security, contribute to global sustainability goals, and set a standard for bilateral partnerships worldwide. Below, I elaborate on the ten proposed areas of cooperation.

##### **1. Building a Common Market for Natural Gas**

Natural gas remains a critical transitional energy source in the journey to carbon neutrality, offering a relatively lower carbon alternative to coal and oil. A common market for natural gas between South Korea and Japan can enhance energy security by pooling resources, stabilizing prices, and diversifying supply chains. Joint procurement initiatives could reduce costs and mitigate risks associated with geopolitical disruptions, such as tensions in the Middle East, a key supplier region.

It was recently reported that Korea Gas Corporation (KOGAS), originally planned to withdraw from the upstream (development) business of the Senoro gas field in Indonesia after 2027, extended the contract until 2047, and the KOGAS-Mitsubishi 20th Regular Meeting resumed for the first time in five years after the pandemic (Choi 2024). Business-to-business cooperation should continue despite potential political instability. Additionally, integrating natural gas storage and distribution networks would improve resilience against supply shocks while encouraging LNG infrastructure development across the region.

##### **2. Sharing Battery Tracking Information for Recycling**

Both nations are leaders in battery technology, with industries heavily investing in EVs and renewable energy storage systems. Establishing a shared battery tracking system would facilitate recycling and the recovery of critical materials such as lithium, cobalt, and nickel.

Europe is already designing a battery passport scheme. Starting in February 2027, all electric vehicles and industrial batteries over 2 kWh on the EU market will be required to have a unique battery passport that can be searched using a unique product identifier in the form of a QR code. The idea is to increase the recovery rate of key minerals, which is expected to be 50% for lithium, 90% for nickel, 90% for cobalt, and 90% for copper (Stretton 2023).

By leveraging digital tools like blockchain, South Korea and Japan can create a transparent tracking mechanism that monitors the lifecycle of batteries from production to disposal. This collaboration not only addresses resource scarcity but also promotes circular economic practices, reducing environmental harm from mining and waste.

### 3. Enhancing Enrichment Capacity for Stable Nuclear Fuel Supply

With nuclear power remaining a key component of their energy mix, stable access to enriched uranium is vital for both nations. Already, since Russia caused the war in Ukraine in 2022, enriched uranium, the fuel for nuclear power generation, has emerged as a new thorn among major powers. With the U.S. legislating a ban on imports of enriched uranium from Russia starting in 2028 (U.S. Congress 2024), and Russia responding with export restrictions (Reuters 2024), an invisible war is being waged over the nuclear fuel supply chain. The problem is that Russia has the largest uranium enrichment capacities, while the U.S., UK, and France have inferior capacities.<sup>4</sup>

Joint efforts to enhance enrichment capacity or secure diversified sources of nuclear fuel between South Korea and Japan can reduce dependency on external suppliers and geopolitical vulnerabilities. This cooperation could involve shared research facilities, technology transfer agreements, and collaboration with global partners to meet international safety and non-proliferation standards. Enhanced enrichment capacity will also support the safe expansion of nuclear energy, contributing to long-term carbon neutrality goals.

In addition, the type of fuel will change in the future as new reactors such as Small Module Reactors (SMRs) emerge, so if the two countries and their ally, the U.S., can take the lead in technological cooperation and market expansion, including in High-assay low-enriched uranium (HALEU) manufacturing process, it will be a significant contribution to energy security of the two countries.

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<sup>4</sup> For information on the enrichment capacities of major countries, refer to the following resource. World Nuclear Association (WNA). 2024. "Uranium Enrichment (Updated Nov. 19)." <https://world-nuclear.org/information-library/nuclear-fuel-cycle/conversion-enrichment-and-fabrication/uranium-enrichment> (Accessed on Dec. 30, 2024).



#### 4. Joint Renewable Energy Projects Such as Offshore Wind Farms

Offshore wind presents a significant opportunity for renewable energy generation in East Asia, with both countries boasting substantial technical expertise. In May 2023, Shizen (自然), a private Japanese company, formed a joint venture called Shizen International with South Korean companies to expand its renewable energy business. Shizen is already working on offshore wind projects around the Japanese island of Kyushu and plans to apply this experience to renewable energy projects in Korea (Jang 2023).

Collaborative offshore wind projects in the East Sea could reduce costs through shared infrastructure development and economies of scale. By coordinating on grid connections, turbine manufacturing, and operation and maintenance protocols, South Korea and Japan can unlock the full potential of this resource. These projects would not only provide clean energy but also foster regional cooperation and economic growth in coastal areas.

The importance of offshore wind is already emphasized in Japan's green growth strategy (METI 2021), and it is an area of great interest and focus for South Korea as well.

#### 5. Building a Common Market for Hydrogen Trading

Hydrogen is a cornerstone of both nations' energy transition strategies, offering a pathway to decarbonize industries and heavy transport. In November 2023, President Yoon and Prime Minister Kishida Fumio announced their agreement to cooperate on hydrogen and ammonia during a sit-down meeting at Stanford University.

Establishing a common market for hydrogen trading would facilitate the development of hydrogen supply chains and infrastructure. By standardizing hydrogen production, storage, and distribution technologies, South Korea and Japan can enable seamless cross-border trade. Collaborative investments in green hydrogen production, particularly through renewable-powered electrolysis, can further strengthen their positions as global leaders in the hydrogen economy.

#### 6. Promoting Circular Economies through Technologies such as CCUS

Carbon Capture, Utilization, and Storage (CCUS) technologies are critical for decarbonizing industries that are hard to electrify, such as cement and steel production. South Korea and Japan can jointly develop and deploy CCUS technologies, sharing costs and technical expertise. Additionally, the promotion of circular economic practices, such as using captured CO<sub>2</sub> to produce synthetic fuels or building materials, can reduce waste and drive innovation. These efforts would help both nations meet emissions reduction targets while creating new business opportunities in carbon-based products.

## 7. Expanding Joint Projects for Green ODA

As leading economies in Asia, South Korea and Japan are well-positioned to extend green Official Development Assistance (ODA) to developing nations. By pooling resources and expertise, they can jointly fund renewable energy projects, climate resilience initiatives, and clean technology transfers in Indo-Pacific and Africa. This collaboration not only strengthens their diplomatic influence but also contributes to global climate goals by supporting sustainable development in vulnerable regions. Establishing a Korea-Japan Green ODA Fund could institutionalize these efforts and ensure long-term impact.

## 8. Cybersecurity Collaboration

With the increasing digitization of energy systems, including smart grids and IoT-based infrastructure, the threat of cyberattacks poses a significant risk. As cyberattacks from hostile actors such as North Korea become increasingly sophisticated, a joint response to cybersecurity could also be beneficial to the social stability of both countries.

Cybersecurity collaboration between South Korea and Japan could involve sharing threat intelligence, developing joint response protocols, and investing in advanced encryption technologies. Collaborative research in quantum cryptography and AI-driven threat detection systems would further enhance the resilience of critical infrastructure. This partnership would not only secure energy systems but also build trust and interoperability in other sectors reliant on digital networks.

## 9. Nuclear Safety Cooperation

As both nations continue to rely on nuclear energy, ensuring the highest standards of safety is paramount. As China's nuclear power plant construction is underway on a very large scale,<sup>5</sup> if South Korea and Japan can work well together in this area and bring China along with them, it will contribute significantly to the safe use of nuclear energy in East Asia, which will have the highest concentration of nuclear power plants in the world.

Joint efforts in nuclear safety could include shared research on reactor designs, improved waste management technologies, and coordinated emergency response protocols. Collaborative training programs for nuclear engineers and regulators would further enhance safety standards.

Additionally, South Korea and Japan could work together to establish a regional nuclear safety framework, promoting best practices and fostering transparency in the nuclear sector.

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<sup>5</sup> As of January 25, China had 58 nuclear reactors in operation and 29 under construction. In addition, more than 80 reactors are proposed for construction. WNA. 2025. "Nuclear Power in China (Updated Jan. 14)." <https://world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power> (Accessed on Feb. 12, 2025).

## 10. Joint Investment in Future Green Technologies

To maintain their leadership in the energy transition, South Korea and Japan must invest in cutting-edge green technologies. Joint R&D initiatives in areas such as solid-state batteries, advanced solar panels, and next-generation wind turbines could accelerate innovation and reduce costs. By establishing bilateral innovation hubs or funding mechanisms, they can support startups and research institutions working on transformative technologies. These investments would not only benefit both nations but also position them as global hubs for green technology development.

These ten areas of cooperation illustrate the immense potential for South Korea and Japan to lead in the energy transition and climate response. By working together on projects that leverage their technological expertise and shared goals, they can address critical challenges such as energy security, resource scarcity, and climate risks. Beyond bilateral benefits, these initiatives have the potential to set a global standard for international collaboration in sustainable development. Through sustained commitment and mutual trust, South Korea and Japan can pave the way for a greener, more resilient future.

## V. Conclusion

The cooperation between South Korea and Japan in the energy and climate sectors is not only essential but also a strategic necessity for addressing shared challenges and achieving mutual benefits. Despite historical tensions, political differences, and structural dissimilarities in their energy markets, the two countries have demonstrated the potential for collaboration that transcends these barriers. This paper underscores the importance of such cooperation, emphasizing that a strong partnership is indispensable for advancing sustainable development and ensuring regional stability in the face of an uncertain future.

The challenges outlined in this paper, including energy security, climate change adaptation, and the global competition for critical resources, highlight the urgency for joint action. South Korea and Japan share many of the same vulnerabilities—aging and shrinking populations, reliance on imported energy, and exposure to climate risks—which necessitate a collective response. Cooperation in these areas offers an opportunity to leverage complementary strengths and foster innovation that can benefit not just these two nations but also the global community.

However, successful cooperation will require a pragmatic and step-by-step approach. It is essential to focus on areas of mutual benefit, starting with niche strategies where collaboration can yield tangible results. For example, building a common market for hydrogen trading, sharing battery tracking systems for recycling, and jointly investing in renewable energy projects such as offshore wind farms are practical and achievable starting points. These initiatives can serve as trust-building exercises, paving the way for broader and deeper partnerships.

Moreover, a step-by-step approach acknowledges the limitations of existing cooperation and works to mitigate them incrementally. Establishing pilot projects, such as joint green ODA in developing regions or collaborative research in carbon capture technologies, can provide valuable lessons and set the stage for larger-scale initiatives. This method not only reduces risks but also allows for adaptive policymaking based on real-world outcomes.

In parallel, both nations must embrace the concept of niche strategies to address the structural and political disparities that complicate their partnership. For example, while South Korea's energy market remains centralized, Japan's liberalized system could be leveraged to create hybrid models that bridge these differences. Similarly, bilateral collaboration in cybersecurity and nuclear safety can bypass market constraints, focusing instead on shared vulnerabilities and goals.

Ultimately, the success of South Korea-Japan cooperation will depend on a shared vision for the future. By working toward a balanced and sustainable relationship, the two countries can not only overcome immediate challenges but also set a global example of how historical adversaries can transform their relationship into one of strategic partnership and mutual benefit. Through sustained efforts, South Korea and Japan can position themselves as leaders in the global energy transition, contributing to a greener, more resilient, and cooperative future. ■

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