FROM PARTNERSHIP TO LEADERSHIP: ENERGISING EU-KOREA COOPERATION ON THE ROAD TO NET ZERO

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SUMMARY

Like-minded partners have never been more needed than they are today. During a time of turbulent change, the EU and South Korea have solid foundations to cooperate more closely on climate, the energy transition and industrial decarbonisation, both sharing the vision of green growth and ambitions to accelerate cleantech deployment and innovation.

This CEPS In-Depth Analysis report has two key objectives.

First, it introduces European stakeholders to Korea's vision of pathways to carbon neutrality, highlighting the complexities of its economic development that have shaped its policy choices. The premise is that greater awareness and familiarity in Brussels can foster a more meaningful and better-informed dialogue between EU policymakers and businesses – and their Korean counterparts. While South Korea's global innovation capacity and its leadership in certain forms of cleantech need no introduction, a deeper understanding of its political economy and climate governance could help build a foundation for stronger bilateral cooperation.

Second, the report explores tangible opportunities for deeper collaboration under the broad umbrella of the EU-Korea Green Partnership. It identifies avenues for cooperation, spanning industrial and energy system decarbonisation, advancing global climate ambition and fostering sector-specific technology cooperation, alongside enabling regulatory and diplomatic frameworks.

Two years after the launch of the EU-Korea Green Partnership, the clean industrial transition agendas in both Seoul and Brussels are increasingly shaped by competitiveness and economic security concerns. In this context, it is time to deepen EU cooperation with trusted, like-minded partners.

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In this report, the terms 'Republic of Korea', 'South Korea' and 'Korea', as well as the corresponding adjectives 'South Korean' and 'Korean', are used interchangeably. This usage reflects the specific focus of the report on the Republic of Korea (ROK), and does not imply any position statement regarding the Korean Peninsula as a whole.

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Abbreviations

BAU	Business as usual
BTR1	Biennial Transparency Report 1
CBAM	Carbon Border Adjustment Mechanism
CCS	Carbon capture and storage
CCU	Carbon capture and utilisation
CCUS	Carbon capture utilisation and storage
COP	Conference of the Parties (to the UNFCCC)
CRM	Critical raw material
DPK	Democratic Party of Korea
ETS	Emissions trading system
EV	Electric vehicle
F-gases	Fluorinated gases
FAEP	Framework Act on Environmental Policy
FTA	Free trade agreement
GHG	Greenhouse gas
HFC	Hydrofluorocarbon
IPPU	Industrial Processes and Product Use
ITMO	Internationally transferred mitigation outcomes
KEPCO	Korea Electric Power Corporation
K-ETS	Korean Emissions Trading System
KNGD	Korean New Green Deal
KRW	South Korean won (₩)
K-RE100	Korean RE100 Initiative
LCGG	Framework Act on Low-Carbon Green Growth
LNG	Liquified natural gas
MRV	Monitoring, reporting and verification
Mtoe	Million tonnes of oil equivalent
NDC	Nationally Determined Contribution
PFC	Perfluorocarbon
PPP	People Power Party
PV	Photovoltaic
R&D&I	Research, development and innovation
RE3020	Renewable Energy 3020 Plan
SDA	Sustainable Development Act
SGIC	Smart and green industrial complexes
SME	Small to medium-sized enterprise
TSD	Trade and sustainable development
UNFCCC	United Nations Framework Convention on Climate Change

Introduction: now is the time to double down on EU-Korea clean industrial cooperation

Only a few years ago, a wave of net-zero pledges swept across the world, crafted during a very different geopolitical and macroeconomic context – one marked by relative stability. Since then, the global playing field for decarbonisation has shifted dramatically: climate ambitions are increasingly uneven, protectionism is on the rise, multilateral institutions are under strain, and energy and supply chain dependencies are being weaponised. While these dynamics are not entirely new, there has been a renewed momentum with Donald Trump's return to office in January 2025. His administration has ushered in trade disputes, redrawing the contours of the global trade *modus operandi*, and cast a long shadow over net-zero pathways by ramping up fossil fuels production and reversing US climate commitments.

The Clean Industrial Deal, a political umbrella of the second von der Leyen Commission, reflects this shifting reality – it explicitly embraces a 'Made in Europe' approach, signalling recalibrated industrial and climate ambitions in a fractured global context. This recalibration comes with difficult choices and hard trade-offs. Amidst a bitter divorce from the US – in terms of values but also increasingly in terms of the transatlantic defence umbrella – the EU is under growing pressure to reinforce its economic resilience and to deepen strategic ties with trusted, like-minded partners.

Like-minded partners have never been more needed than they are today – and the Republic of Korea (South Korea) is truly one of them. This is more than just mere diplomatic language: the relationship rests on firm foundations, including the EU-Korea Free Trade Agreement, joint peacekeeping cooperation, a recently signed Digital Partnership, and – since November last year – a Security and Defence Partnership. South Korea is the only country in the world with all five formal agreements in place with the EU, a testament to the depth and breadth of the EU-Korea strategic partnership.

Meanwhile, South Korea entered 2025 amidst a profound political reckoning and a leadership vacuum following the December 2024 martial law crisis. In this period of domestic volatility, the EU stands out as an island of stability for the country. Remarkably, there is strong cross-party consensus in South Korea around the idea of aligning more closely with the EU – as a partner whose economic and industrial frameworks reflect shared values. While the EU's policymaking machinery may at times be slow and its regulation overly detailed, its predictability and policy consistency are widely viewed as strategic strengths, especially during a period of turbulence and short-termism.

'Reconciling decarbonisation and competitiveness' may be one of the new catchphrases in Brussels, but for South Korea and the EU, which have both embraced 'green growth' as a central pillar of their future development models, this attempt to balance the two has become a defining strategic goal. This stands in sharp contrast to the resurgent 'drill, baby, drill' narratives in the US. South Korea's enduring orientations towards 'green growth' also resonates – the EU has been discussing how to reconcile decarbonisation and competitiveness and Korea has treated 'Low Carbon Green Growth' as a guiding policy paradigm since the late 2000s. As a global innovation leader with substantial technological capacity, South Korea's relevance to Europe's climate and industrial ambitions is only set to grow. At the same time, there is broad consensus within Korea that the EU is a key political and business partner for the future.

Steadfast in these contentious times, the EU-Korea strategic partnership is continuing to deepen. The recent Security and Defence Partnership and Korea becoming an associate member of Horizon Europe have further embedded decarbonisation within a broader strategic logic – namely anchoring the energy transition and industrial innovation as shared security matters. As the Green Partnership enters its third year and Korea approaches another political turning point, a clear window of opportunity has opened to strengthen cooperation on decarbonising energy systems and industrial sectors.

This CEPS In-Depth Analysis report is grounded in a central question: How can collaboration on industrial decarbonisation and clean energy technologies become a unifying pillar of bilateral and multilateral cooperation with South Korea, despite rising geopolitical tensions, divergent regulatory approaches and economic pressures?

The report examines the EU-Korea partnership through the lens of the transition to a low-carbon economy, anchored in shared interests around clean technology and climate ambition. Rather than detailing EU policies, it focuses on mapping South Korea's trajectory, highlighting areas of convergence with European priorities and identifying opportunities for meaningful cooperation. Specifically, it aims to:

(i) present a clear and concise overview of South Korea's green policy landscape for EU-based stakeholders, grounded in the belief that a greater awareness of South Korea's political economy and policy frameworks can enhance bilateral cooperation.

(ii) analyse the structure of South Korea's economy and its decarbonisation pathways, with a focus on the energy sector and energy-intensive industries, and the evolution of its climate policy framework.

(iii) identify opportunity areas for cooperation, from sector-specific cooperation to enabling frameworks and diplomatic mechanisms.

This scoping exercise adopts a multidisciplinary lens, encompassing climate, energy, environment, foreign policy, economic security and diplomacy. Drawing on recent research and insights from Korean and European stakeholders, the report outlines 12 actionable areas for collaboration offering a starting point for deeper policy alignment – from industrial decarbonisation to innovation-driven business, R&D&I and enhanced diplomacy.

1. Understanding the green transition in South Korea

South Korea's path to climate action has been marked by sharp policy turns, reflecting changing political leadership and shifting ideas about growth and sustainability. Reviewing these evolutions could equip European readers with a better understanding of the country's political economy and climate governance and would help to strengthen the EU-Korea strategic partnership as a whole.

What began as a clear divide between rapid industrial development and neglected environmental concerns in the 1980s, has evolved into a more complex and contested policy domain. Democratisation in 1987 brought constitutional recognition of environmental rights, and the 1990s saw the formation of stronger environmental institutions. Yet liberalisation and the response to the 1997 financial crisis kept economic imperatives dominant, often sidelining sustainability efforts.

In the 2000s, two consecutive liberal governments introduced sustainable development into the national agenda, albeit without strong enforcement. A clear turning point came in 2009 with the Green Growth strategy promoted by conservative leadership, positioning green policy as a tool for industrial competitiveness and embedding it in export-led economic planning. This marked the beginning of Korea's strategy to attain and maintain global clean technology leadership.

The centre-left Moon administration (2017-22) redefined climate policies, this time with a focus on decarbonisation, energy safety, and public participation. Policies such as the Renewable Energy 3020 Implementation Plan (RE3020), the Korean Green New Deal, and the Carbon Neutrality Act were intended to guide Korea towards a low-carbon economy. However, implementation fell short, and political turnover in 2022 brought another recalibration. The right-wing Yoon administration (2022-25) embraced a carbon neutrality framework that it portrayed as more 'realistic', emphasising nuclear power, deprioritising renewables, and removing the Green New Deal from national planning. Today, South Korea's green transition stands at another crossroads. The political turmoil surrounding the 2024 martial law crisis and the June 2025 elections, while not directly focused on the green transition, have nonetheless brought climate issues into the broader debate over Korea's future direction. Competing visions now centre on how to align trade, industry and energy policies in a politically polarised landscape.

1.1. FROM THE KOREAN DEVELOPMENTAL STATE TO GREEN GROWTH (1980S-2017)

From an era when industrialisation and environmental protection were largely disconnected, Korean policies have evolved under the pressures of the 'developmental state' to promote economic growth and integration into global markets. The 1987 democratic transition gave rise to constitutional environmental rights, as the country grappled with the social and ecological costs of rapid growth. Key environmental legislation and institutions were created in the 1990s, spurred by rising public awareness and international norms. Yet economic globalisation, deregulation, and the 1997 Asian financial crisis kept growth and liberalisation at the top of the agenda.

In the early 2000s, liberal governments introduced sustainable development and civic participation into the policy discourse, with limited enforcement. In the late 2000s, under conservative leadership, the state reframed environmental goals as drivers of competitiveness, substituting sustainability narratives for industrial policies. The 2009 Green Growth strategy integrated climate policy with economic development, using legislation and industrial support to establish South Korea as a global leader in cleantech. A new generation of institutions embedded green growth policy into a market-oriented, export-driven framework.

1.1.1. Industrial and environmental legacies of the developmental state (1980s-90s)

The 1980s: Dealing with the costs of rapid industrialisation

The rapid government-led industrialisation of the 1960s-70s under Park Chung-hee (1962-79), the president then military dictator, left the young Republic of Korea reckoning with the results of its growth-first, state-led development strategy. Among them was the establishment of large business conglomerates that still concentrate economic power to this day: the *chaebol,* engines for the outsized development of energy-intensive manufacturing industries. By the late 1980s, the government was stepping back from interventionist economic-stabilisation strategies, instead emphasising private sector-led development and market liberalisation measures.

At the same time, steps were taken towards more energy autonomy in response to the 1973 oil crisis and the growing needs of industry. The government had accelerated nuclear energy programmes and consolidated, in 1982, the country's electricity sector into a single government-owned corporation: the Korea Electric Power Corporation (KEPCO). This bore fruit: from 1.5 % in 1978, nuclear energy supplied 13.3 % of total domestic energy consumption in 1988[1]. Concurrently, the Korean government made the

decision to start importing liquefied natural gas in 1981 to further diversify energy sources, with actual delivery beginning several years later[2].

Throughout the 1980s, 'negligible' political and institutional weight was given to environmental concerns despite growing pollution from heavy and chemical industries, coal power generation and rapid urbanisation. Environmental policy before democratisation was underdeveloped, hindered by a lack of cooperation from the rest of the government, outright non-compliance from businesses, and a low budget[3].

Yet, Korea's *economy-first* policy direction was challenged by the country's democratisation, which enshrined environmental accountability in the constitution. The country's economic transformation under authoritarian rulers from **Park Chung-hee** to **Chun Doo-hwan (1980-88)** came with heavy social and political costs, leading to people's mass mobilisation despite violent repression[4]. The pro-democracy movement culminated in 1987 with the June Democratic Struggle, constitutional revision in October and direct presidential elections in December.

The **Constitution of the Republic of Korea**[5], revised and ratified by national referendum in October 1987 and still in force today, carries the mark of this social unrest. It includes amendments that were adopted as direct concessions to the Korean people's mass protests to obtain a democratic breakthrough and direct presidential elections. Constitutional amendments included the protection of human rights and civil liberties, but also the seed of social, environmental and institutional reform[6].

Conservative figure, former military general and then-ruling party candidate **Roh Tae-woo (1988-93)**, who had promised democratic reforms in response to public pressure over the summer 1987, was narrowly elected president in December 1987 through a first-past-the-post system, beating a divided opposition despite contested credibility among democracy activists. The two major opposition candidates, both democracy movement leaders, cumulated a majority of votes between them but failed to unite the pro-democracy crowds by presenting a single candidate.

The 1990s: Stronger environmental laws, economic globalisation and the 1997 crisis

By paving the way for civil rights and stronger state-society accountability, the end of authoritarian rule in 1987-88 challenged the government's undivided focus on pure economic policy. The Constitution paved the way for a plethora of new environmental laws throughout the 1990s, including, in 1990 alone, the **Framework Act on Environmental Policy (FAEP)** and five sectoral laws ruling on air and water quality, noise, chemicals and environmental disputes. The same year, the marginal and nominal Environment Administration was upgraded into a full-blown Ministry of Environment, with new and expanded authority. While sectoral laws have since been replaced, the

FAEP[7] still stands, is regularly amended and continues to provide overarching principles for environmental policy across multiple sectors. The polluter pays principle (Article 7 FAEP) already featured in the original legislation of 1990.

After participating in the 1992 Earth Summit in Rio de Janeiro and signing and ratifying the UN Framework Convention on Climate Change (UNFCCC), South Korea joined the global momentum for climate cooperation and shared responsibility, even as it was still a developing country by UN standards. In 1998, South Korea signed the Kyoto Protocol, though as a non-Annex B party. Meanwhile, public environmental awareness grew in the years following democratisation, with issue-based movements emerging and opposing various infrastructure projects (e.g. large-scale river dams and nuclear projects after Chernobyl). The Korea Federation for Environmental Movements was formed in 1993 as a national coalition of grassroots advocacy groups.

The implementation of green policies still grappled with a low level of compliance and cooperation, and a relatively low budget: 0.61 % of GDP in 1997, even prior to the Asian economic crisis[8]. Regardless of political lines, the priority remained economic policy, often at the expense of the environment – for example through government-backed large-scale infrastructure projects. Under international influence and pressure from the *chaebols*, the 1990s saw Korean economic policy commit itself entirely to globalisation, financial and trade liberalisation. A member of the General Agreement on Tariffs and Trade (GATT)since 1967, South Korea was a founding member of the WTO and undertook to join the OECD in 1996, despite its developing country status and related concerns for trade and environmental standards[9]. The country was hit hard by the 1997 Asian financial crisis, which was caused by weak financial regulation, excessive corporate debt and vulnerability to foreign capital outflows. Despite the severity of the crisis, the government quickly restored economic stability under IMF guidance.

1.1.2. Post-crisis but pre-'Green Growth': Liberal leadership in a market economy (1998-2008)

In the early 2000s, the young South Korean democracy was experiencing its first **political swing** (see Box 1): from 1998 to 2008, as liberal presidents **Kim Dae-jung (1998-2003)** and **Roh Moo-hyun (2003-08)** took charge. The government under **Kim Dae-jung** was preoccupied with responding to the 1997 crisis through monetary, fiscal, financial sector, corporate sector, labour market, public sector and welfare reforms. Recovery was swift. While Korea experienced slower growth rates compared with 1990s levels, it was now established as an advanced and open market economy, capable of resilience. Even after the 2008 global financial crisis, which hurt Korea's exports and investments, the economy bounced back to growth in early 2009.

Yet after the 'Miracle on the Han River' of the second half of the 20th century (see Section 1.1.1), new concerns loomed: declining employment growth, widening income and social inequality and growing productivity gaps between manufacturing and service industries – as well as between the large *chaebol* and small to medium-sized enterprises (SMEs). There was unease about vulnerability to future external shocks and the government's waning financial power amid increasing debt and demographic challenges. Experts advising the government began to emphasise total-factor productivity as the next engine for growth[10]. While both liberal presidents distanced themselves from the governance issues that had led to the 1997 crisis, they did not radically depart from the neo-liberal economic policies and growth focus of their conservative predecessors – coupled with limited enforcement mechanisms for environmental policies.

Among post-1997 reforms, the **Kim Dae-jung** administration aimed to strengthen the energy sector, including through the restructuring and partial privatisation of KEPCO[11], sectoral deregulation[12] and domestic nuclear energy development. It took initial steps in renewable energy development[13] and kickstarted overseas resources development projects[14, 15]. The Kim Dae-jung administration also introduced the Energy and Greenhouse Gas (GHG) Target Management System in 1998, a non-market mechanism based on top-down government coordination of large GHG emitters, a predecessor of the Korean Emissions Trading System (K-ETS) (discussed in Section 2.3)[16]. Both the Kim and Roh administrations supported Korea's growing nuclear energy sector as a way to sustain growth, energy autonomy and emissions reduction, and facilitated natural gas imports.

However, the **Kim Dae-jung** and **Roh Moo-hyun** governments also introduced the global sustainable development narrative and participatory decision-making processes. Under the Kim Dae-jung administration, the Presidential National Commission on Sustainable Development was established in 2000. The Roh Moo-hyun government adopted the **Sustainable Development Act (SDA)** in 2007[17]. The SDA committed Korea to 'accomplishing sustainable development and participating in international efforts' to achieve sustainable outcomes[18], taking into account the interests of both present and future generations. Its combination of social, economic, environmental and civic elements echoed the promises of the 1987 version of the Constitution (see Section 1.1.1.).

The adoption of the SDA was timely. Korea's 2006 OECD Environmental Performance review[19] underlined Korea's progress in decoupling certain environmental pressures from GDP growth. But it also warned of coming challenges due to Korea's CO_2 emissions and intensities of energy, water, pesticide and fertiliser use being 'among the highest in the OECD' as rapid economic growth continued. Gradually, the country's environmental democracy[20] was nevertheless strengthened, especially under the presidency of Roh Moo-hyun. The Roh Moo-hyun government also championed state-civil society relations,

engaging with increasingly visible NGOs, and emphasised equity through welfare spending and support for SMEs, differing from the previous growth-at-all-costs approach.

1.1.3. The turn to Green Growth: Cleantech and global ambitions (2009-17)

The conservative presidency of **Lee Myung-bak (2008-13)** did not pursue the participatory approach to sustainable development of his liberal predecessors. Lee Myung-bak's administration focused on economic revitalisation and the aim to make Korea the world's seventh largest economy, a symbolic ranking to be achieved with 7 % growth. The chosen means were deregulation, job creation and large-scale investment. In addition, the need for technological innovation and industrial stimulus was revealed after the 2008 global financial crisis, which had hit Korea shortly after Lee Myung-bak's inauguration. Therefore, one key challenge for the conservatives was to reconcile climate and environmental policies with an economic growth agenda. Defined as 'Green Growth', this policy vision was championed throughout the 2010s.

The 2010 **Framework Act on Low-Carbon Green Growth**[21] **(LCGG)** enshrined this concept into law for the first time, as 'growth achieved by saving and using energy and resources efficiently to reduce climate change and damage to the environment' with the additional factors of green job creation and green technology investment[22]. While the Korean government was no longer heading 'comprehensive macro-economic planning', the LCGG has been characterised by some political scientists[23, 24] as an attempt from the neo-developmental state to incite private sector buy-in of green industrial policies. Businesses were incentivised to follow the government's lead on the green growth 'policy niche' in order to benefit from its support and remain competitive on the international stage.

The LCGG Act was operationalised in a National Strategy for Green Growth (2009-50)[25]. This was followed by a Five-Year Plan for Green Growth (2009-13) endowed with USD 100 billion, around half of which went to infrastructure and support for green industries. One highly visible 'green growth' initiative was the Four Major Rivers Restoration Project, which has since been widely assessed negatively due to causing environmental degradation[26]. Another substantial proportion of the budget went to research and development (R&D) support for government-funded research institutes, *chaebol* conglomerates, SMEs and academia, primarily for 27 key green technologies[27] such as solar panels and batteries –technologies that have become the flagship of Korea's innovation policy (discussed in Section 2.2.2).

South Korea's green growth strategy was above all internationally oriented. The policy's most notable results throughout the 2010s were leaps in green technology development and the growth of an export-oriented green industry. The government founded the Global Green Growth Institute (GGGI) in 2010, as a non-profit that would later become an

international organisation headquartered in South Korea. In promoting Korea's green growth model, its audience was emerging economies that wished to keep developing, while developed economies were advocating for global climate mitigation efforts. This also translated into Korea's Official Development Assistance. In 2012, South Korea was selected by the UNFCCC to host the headquarters of the Green Climate Fund (GCF), further strengthening the country's role in international climate diplomacy and climate finance.

Yet in the context of this pro-business and export-driven agenda, Lee Myung-bak's administration announced South Korea's first 'voluntary and unilateral pledge'[28] at COP15 in 2009, as part of the Copenhagen Accord[29] (discussed in Section 2.2.1). This pledge stimulated policy reflection on structural changes needed in the energy, industry and transport sectors – and caused worry for Lee Myung-bak's private sector supporters[30]. Still, relying on Article 46 of the LCGG[31] to provide a legal foundation for the government to operate a GHG emissions market system, the Lee Myung-bak administration took a step further and introduced the K-ETS to stimulate investment into low-carbon solutions[32]. Based on the GHG Target Management System already in place since 1998, after the two-year pilot period to collect baseline data, K-ETS went into full effect in 2015. K-ETS was the first ETS in Asia and gradually expanded to an almost economy-wide coverage. Even so, weak price signals and market oversupply of allowances have remained chronic problems, discussed in Section 3.3.

Under the Park Geun-hye presidency (2013-17), conservative like her predecessor, the Korean government 'doubled down on Green Growth'[33] which was proving economically successful. South Korea joined the Paris Agreement in 2015 and followed up with the first binding Nationally Determined Contribution (NDC) (discussed in Section 2.2.1). Ban Ki-moon, former UN Secretary-General (2007-16) and a South Korean national, was a strong supporter[34] of the Paris Agreement and broadly contributed to elevating Korea's diplomatic standing. After the end of his UN term, he became GGGI President and Chair of the Council[35], lending international credibility to the Korean green growth strategy.

The Park Geun-hye administration also unveiled a 'Strategy for Nurturing New Energy Industries 2030' for encouraging R&D investment, supported the development of new energy ventures and promoted public-private partnerships[36]. At the same time, civil society, including environmental NGOs, were largely marginalised during this period[37]; and President Park herself would later be impeached owing to political scandals, against the backdrop of increased state surveillance on national security grounds and declining press freedom[38, 39].

Box 1. Political alternance and green policies in South Korea

While a multi-party system, South Korean politics are mobilised around two mainstream parties, which hold most of the seats in the National Assembly: the current **liberal, centre to centre-left Democratic Party of Korea (DPK)** and the **conservative, right-wing People Power Party (PPP)**. Both political forces have been around since democratisation and the establishment of the Sixth Republic (1987-ongoing), having since undergone various mergers and name changes (see Annex A).

As South Korea is a strong presidential republic with single-mandate five-year presidential terms (for details see Annex B), each president is eager to leave their mark on national policies and – especially if their predecessor came from the opposition – to discard and/or repackage previous policy visions and achievements. This political back-and-forth affects all policy areas, including foreign policy, for example relations with North Korea and the US-ROK security alliance. This system also means that the country's political fluctuations can generally be traced through the succession of presidents and their respective party affiliations. The executive branch was conservative for the 1988-98, 2008-17 and 2022-25 periods. It was liberal for the 1998-2008 and 2017-22 periods.

From the first president of the Sixth Republic, Roh Tae-woo (1988-93), to Yoon Suk-yeol's impeachment in 2024, a few trends can be observed. Presidents from both sides have had to interact with a group of economic actors that already existed before democratisation: the ***chaebol* conglomerates**, inseparable from Korea's economic development, but also contributing to economic concentration, social inequality and unfair competition[40]. These homegrown multinationals are present in all industries and often centralise the ownership of numerous affiliates, such as the Samsung Group's Samsung Electronics, the SK Group's SK Innovation, or Hyundai Motor's Hyundai Steel. In the energy sector, there are among others Hyundai Heavy Industries Group, the GS Group, and the Hanhwa Group.

Since most *chaebols* operate in carbon-intensive sectors, their activities have large climate and environmental impacts. However, due to the government-*chaebol* nexus that lives on[41], their accountability is a challenge for both liberal and conservative governments. Liberal presidents who have attempted, with mixed results, to reform this relationship include Kim Dae-jung after the 1997 financial crisis, successor Roh Moo-hyun (2003-08) to promote fair competition for SMEs, and Moon Jae-in (2017-22) to crack down on corruption. Conservative presidencies have instead largely reinforced this nexus. Lee Myung-bak (2008-13) was a former *chaebol* CEO and Park Geun-hye (2013-17) was impeached in part due to collusion with *chaebols*. Conservative support for the *chaebol* is more structural than symbolic. The main beneficiaries of Lee Myung-bak's Green Growth strategy were *chaebols*, which used this momentum to expand into global value chains[42], obtain large procurement contracts and retain R&D leadership – all without significant constraints on their energy consumption (see also discussion in Section 2.2.2).

Clear reversals in climate and energy policies between DPK and PPP presidents can be identified since the late 2000s. Lee Myung-bak aimed for a sharp increase of nuclear energy. Liberal Moon Jae-in (DPK) announced a nuclear phase-out and doubled down on renewables. Then, the conservative Yoon Suk-yeol (2022-25, PPP) promoted a nuclear revival and brought the renewable energy targets down. Liberals have arguably nurtured stronger relations with civil society, including environmental movements and NGOs.

Meanwhile, ties between conservative presidencies and civic movements have been more occasional and at times tense. Yet on the international stage, South Korea has become a highly visible climate actor, under both conservative and liberal leadership. There, the conservative rhetoric is to present international climate action as an opportunity for business ventures and investment[43].

Comparatively less powerful than the executive, the legislative branch also experiences frequent political turnover, with elections held every four years 'on the first Wednesday from the 50th day before the expiration of the terms of office'[44], and is thus independent from the executive's calendar. The legislative calendar was shifted after ex-president Park Geun-hye's impeachment in 2017, causing National Assembly elections to be scheduled approximately midway into a five-year presidential term. This resulted in them being essentially transformed into a midterm-style evaluation of the president's performance. With Yoon's impeachment and the June 2025 presidential elections, the electoral schedule is set to shift once again, with the next legislative elections technically set for April 2028.

1.2. From the Korean Green New Deal to carbon neutrality: Climate policies under the Moon administration (2017-22)

The liberal Moon Jae-in administration (2017-22) adopted ambitious climate and green policies: the Renewable Energy 3020 plan and a nuclear phase-out; the Korean Green New Deal to make Korea a low-carbon economy through investment; the 2021 Carbon Neutrality Act setting the objective to become carbon neutral by 2050 and the correlated increase in NDCs; as well as the revival of the sustainable development narrative. These policies were supported by a new climate governance framework, including climate budgeting, impact assessments, and gradually more stringent K-ETS.

Developments under Moon reflected a stronger emphasis on climate neutrality, energy safety, and citizen participation. After ten years of conservative presidencies (2008-17), these measures marked a shift from the previous 'green growth only' and nuclear energy-centred strategies. Still, green growth remained a key element of Korea's climate trajectory, put into practice with Korean Green New Deal investment in infrastructure, technologies, jobs and innovation.

Implementation challenges and changing political leadership limited the effectiveness and continuity of Moon Jae-in's policies after his term ended in 2022. The renewable energy targets were missed, offshore wind expansion lagged, and nuclear phase-out efforts faced resistance. Some projects continued under the Yoon Suk-yeol administration (2022-25), while others were scaled back or rebranded.

1.2.1. A 'nuclear-free' Korea?

Nuclear energy policy has been a strong partisan issue in South Korea, at least since the Lee Myung-bak presidency. Political tensions have often revolved around an arguably zero-sum contest between the shares of nuclear versus renewable energy in the future electricity mix. Those favouring nuclear energy emphasise that South Korea is a 'resource-poor' country[45] which cannot afford a nuclear exit. Nuclear power was positioned as the central pillar of Lee Myung-bak's Low Carbon, Green Growth strategy and these ambitions remained unchanged even in the aftermath of the 2011 Fukushima disaster in neighbouring Japan. His administration also actively promoted nuclear technology exports.

This promotion of nuclear energy as the priority low-carbon technology went unchallenged until the election of liberal President Moon Jae-in. In 2017, the 2030 targets for generation output shares shifted: 20 % for renewables and 23.9 % nuclear[46] – reflecting a large decrease in the projected nuclear share compared with Lee Myung-bak's targets.

To achieve its nuclear phase-out goals, the Moon administration reversed plans for new reactors introduced under Lee Myung-bak and pledged not to extend the lifespan of existing plants. Nevertheless, implementation proved difficult: a mix of public opinion divisions, legal and administrative issues slowed down phase-out plans, enabling the construction and approval of several nuclear power plant units. Moon's nuclear exit policy was criticised by the People Power Party (PPP) and conservative media, citing it as a 'perilous' move endangering a successful, globally competitive industry, with risks of increasing electricity prices and jeopardising the country's energy security[47].

Moon's 2017 speech[48] at the closure of the Kori-1 nuclear plant provides the keys to understanding such a divisive move. The 2011 Fukushima disaster was present in the political discourse, and South Korea's own vulnerability to natural disasters, such as earthquakes, presented a strong argument against nuclear power. The emphasis on Fukushima was complemented by references to corruption scandals[49] in the nuclear industry and pointed to a change in rhetoric. Moon's liberal discourse emphasised that 'the safety and lives of people are more important than anything else', more than low electricity prices and efficiency at all costs; and that 'nuclear reactors are neither safe, economical nor environmentally friendly'[50].

In order to compensate for the nuclear phase-out, Moon not only advocated for renewable energy expansion, energy efficiency and demand reduction, but also for natural gas as a transitional fuel. Natural gas has thus preserved an important role in the energy mix, largely avoiding the polarising debates that surrounded nuclear power and

renewables. It has enjoyed support across presidencies irrespective of their political affiliations – though liberal voices tend to advocate for long-term reduction.

While Moon's Democratic Party officially endorsed this move as part of its climate agenda, internal consensus remained weak, and the nuclear phase-out was not codified into law[51]. Influential civil society organisations such as Greenpeace Korea, strongly in favour, attempted to face the conservative backlash by debating the perception that nuclear phase-out would threaten the country's energy security[52]. Meanwhile, labour unions in the nuclear and utility sectors raised concerns over job losses during the transition[53].

In an effort to build social consensus in a polarised political climate, Moon initiated a public deliberation process to decide whether to continue or halt the Shin-Kori 5 and 6 nuclear reactor construction. This level of public participation in energy policy was unheard of[54]. The final results came in October 2017: 59.5 % voted to resume construction, but 53.2 % also supported reducing nuclear power in the energy mix, while only 35.5 % favoured long-term reliance on nuclear energy[55]. The Shin-Kori nuclear power plant survey highlighted the complexity and nuance of public opinion on nuclear energy in South Korea.

1.2.2. Ambitious renewable energy policies and the RE3020 plan

The Moon administration's push for a nuclear phase-out was accompanied by an ambitious turn towards renewable energy. In December 2017, the government adopted the **Renewable Energy 3020 Implementation Plan[56],** aiming to increase the share of renewables in total electricity generation to 20 % by 2030[57]. To achieve this, the plan also set a target of installed capacity from 15.1 GW (in 2017) to 63.8 GW (by 2030), mainly focusing on wind and solar photovoltaic (PV) (28 % and 57 % of total installed capacity, respectively)[58]. The subsequent 9th Basic Electricity Plan finalised in December 2020 aimed to increase the share of renewable energy's installed capacity to 40 % by 2034, from 15.1 % in 2020[59]. In October 2021, South Korea also updated its NDC commitments[60] and upgraded its renewable generation objective to 30.2 % of total electricity generation by 2030[61].

Measures to support this objective included financial and project support for the expansion of solar PV and wind energy capacity, as well as strengthened Renewable Portfolio Standards for suppliers and feed-in tariffs for small-scale producers[62]. In 2021, an amendment to renewable energy regulation officially introduced the Korean RE100 Initiative (K-RE100) to encourage Korean businesses and consumers to align with the global RE100 initiative towards carbon neutrality, with incentives from the Ministry of Environment.

Under the Moon administration, solar PV installations have grown significantly[63], while wind energy development has lagged, in particular offshore wind (see Section 2.2.3). As of August 2021, 43 offshore wind projects had received licenses and business permits, totalling approximately 9.6 GW in capacity[64]. However, offshore wind projects faced challenges that remain to this day, such as permitting delays, grid connection issues, and local opposition.

By 2022, renewables had increased to 7.4 % of electricity generation[65], more than doubling from 2017 data. Yet this fell short of the initially set interim target (10.5 % by 2022[66]) and of the trajectory to achieve 20 % by 2030. In 2022, South Korea counted a total capacity of more than 30 GW[67] of renewable energy[68], showing progress since the Moon administration's plan but falling short of its 2030 goals. Beyond implementation and uptake challenges, a political shift with pro-nuclear presidential successor Yoon Suk-yeol has impacted the long-term implementation of Moon's renewables policies.

1.2.3. The Korean (Green) New Deal

In 2020, the Moon administration's nuclear phase-out and pro-renewable energy policies were integrated into broader policy visions: the Korean Green New Deal (KGND)[69] strategy announced in July 2020 as part of the larger Korean New Deal, which was born of the economic shocks of the COVID-19 pandemic and concerns over slowing growth (see Annex C). The Korean New Deal contained three central components to create jobs and bring back growth: the Digital New Deal, the Green New Deal, and the Human New Deal. The Digital New Deal aimed to 'promote digital innovation and dynamics in the economy' and the Human New Deal sought to create a 'stronger safety net' and a 'basis for a people-centred inclusive country'.

The KGND was a highly significant development in climate policy in South Korea. It was also a response to international trends in green policies, especially the EU's European Green Deal and discussions in the US surrounding a green new deal proposal, both in 2019. Joining this momentum, the KGND hoped to address not only climate change, but also social inequality and poverty.[70] The deal's ambition won the support of Ban Ki-moon, the former UN Secretary General, current GGGI Chair and 2019-21 Chair of Korea's National Council on Climate and Air Quality[71].

Planning to invest KRW 114.1 trillion (around USD 94 billion under 2020 exchange rates) from the treasury by 2025 to create 1 901 000 new jobs, the Green New Deal was the largest financial investment of all the Korean New Deal components. The Green New Deal plan included an initial investment of KRW 73.4 trillion (around USD 60.4 billion), an amount comparable to the combined budget of the Digital New Deal (KRW 58.2 trillion) and Human New Deal (KRW 28.4 trillion). The plan projected 659 000 jobs to stem from green investment.

After a year of implementation, the Moon government introduced the **Korean New Deal 2.0** in July 2021[72] to address limitations and failures of the existing framework of the KGND. The Green New Deal 2.0 added 'a carbon reduction programme for industries and a new impact calculation method in line with new international climate regimes', implicitly referring to the Carbon Border Adjustment Mechanism (CBAM), which was then under development in the EU (discussed in Section 3.3.4). Additionally, many of the ongoing projects were expanded, with notable accelerations of the existing hydrogen and renewable energy initiatives. To enable this expansion, the Green New Deal 2.0 allocated an additional KRW 18.3 trillion (around USD 15.92 billion under 2021 exchange rates), an increase of nearly 40 % from the existing budget[73].

Overall, a 2022 report by Agora Energiewende rated the Korean New Deal and Green New Deal 2.0 as 'excellent' as a policy priority with 'good' financial endowment and legal competence. All the same, challenges to their continuation emerged following Korea's 2022 presidential elections and political shift; the same report found the KGND's priority to be 'poor' under the Yoon administration when it began in 2022[74] – jeopardising the strategy's effectiveness and direction.

1.2.4. Carbon neutrality and sustainable development

In 2020, the Moon administration launched another decisive policy vision: the 2050 Carbon Neutral Strategy of the Republic of Korea towards a sustainable and green society [75,]. Then, the Framework Act on Carbon Neutrality and Green Growth to Respond to the Climate Crisis, known as the **Carbon Neutrality Act,** was passed in 2021. The Carbon Neutrality Act repealed and replaced the 2010 Framework Act on Low-Carbon Green Growth adopted under Lee Myung-bak's conservative administration (see Section 1.1.3).

The Act legally defined **carbon neutrality**, a term equivalent to climate neutrality or 'net-zero' in the EU, as 'a state where greenhouse gas emissions emitted, released, or leaked out into the atmosphere become net-zero as they are offset by greenhouse gas absorption elsewhere'. It also provided a definition of a 'carbon neutral society' as 'a society in which people lower or eliminate dependence on fossil fuels and lay the foundation for finance, technology, system, etc. for adaptation to climate crisis and just transition to smoothly achieve carbon neutrality and prevent and minimize damage and adverse effects that may arise in the process'[76].

The Carbon Neutrality Act by its name commits South Korea to carbon neutrality by 2050. It also includes a number of equally legally binding interim 2030 targets, including sectoral targets, enforced through carbon budgeting for the first time. Further, the Carbon Neutrality Act enacted novel mechanisms to enable the transition, including climate impact assessments of major national plans and projects, and a regular monitoring regime for GHG emissions[77].

Throughout 2021, the Moon government launched a number of actions to lay the groundwork for carbon neutrality, from waste management to transportation, job creation and technological innovation. Energy efficiency and consumption reduction efforts were complemented by the new, more stringent rules for the Phase 3 (2021-25) of the K-ETS[78] (discussed in Section 2.3).

In 2021, in line with the Carbon Neutrality Act, South Korea submitted an **updated Nationally Determined Contribution** to the UNFCCC. The set target of a 40 % GHG reduction compared with 2018 levels by 2030 was markedly more ambitious than the previous NDC commitments in late 2020. Nevertheless, the 2021 NDC submission was deemed rather limited[79, 80]. In addition, the fact that the Carbon Neutrality Act did not provide binding intermediate emission reduction targets for the 2031-49 period would later result in a ruling by the country's Constitutional Court of Korea that the law violates the climate rights of future generations (Court ruling of 29 August 2024)[81].

Near the end of Moon administration (2017-22), the government also revived the sustainable development narrative, promoted during Roh Moo-hyun's social-liberal presidency through the Sustainable Development Act[82] of 2007. Given lower priority throughout successive conservative presidencies, this narrative was revitalised by the Moon administration, aiming to coexist with the green growth rhetoric popular with the private sector. The **Framework Act on Sustainable Development**[83], the SDA's successor, was introduced only in January 2022, near the end of Moon's presidential mandate, to modernise and institutionalise South Korea's approach to sustainability. More comprehensive than the previous SDA, it also explicitly aligned South Korean policies with its international commitments. The 2022 Act referred not only to environmental sustainability, but also economic resilience and social inclusion.

1.3. REFRAMING CARBON NEUTRALITY UNDER THE YOON ADMINISTRATION (2022-25)

Yoon Suk-yeol, a former prosecutor from the conservative PPP, was elected president in May 2022 in a very close race against Democratic Party candidate Lee Jae-myung[84]. In terms of climate governance, Yoon's tenure exemplified how domestic political shifts reshape policy narratives, instruments, and priorities.

While maintaining Moon's legally binding 2050 carbon neutrality target, the Yoon government altered the rules of decarbonisation in Korea by promoting a 'realisable' or 'realistic' carbon neutrality strategy, advocating for what it presented as a technologically and economically grounded approach – and portraying the previous government's policies as unrealistic and ideologically motivated. Renewables lost momentum, with downgraded targets, reduced budgetary support, and delays in implementation. In contrast, nuclear energy was revived as a core solution for decarbonisation and industrial

competitiveness. The Korean Green New Deal disappeared from national planning and budgets, though some of its projects remained under development (see Annex C).

1.3.1. From renewables back to nuclear energy

Throughout his campaign, Yoon criticised the renewable energy policies of the DPK as unrealistic, vowed to reverse Moon's nuclear exit plans and to ease national carbon neutrality targets. Although climate policy was not a political focus in the presidential race, the nuclear phase-out was hotly debated[85], remaining a sensitive issue in domestic politics. When in office, Yoon ushered major climate and energy policy changes, illustrating the impact of political oscillation on Korea's green trajectory.

The 10th Basic Plan for Electricity Supply and Demand, released in January 2023, **lowered the 2030 renewable energy target** share in electricity generation from the previous 30.2 % linked to South Korea's 2021 NDC commitment, down to 21.6 % (and 30.6 % by 2036). The budget for renewables support was also cut[86]. This downward revision was interpreted by some as a missed opportunity for renewable energy transition and as prolonging reliance on fossil fuels[87]. The 10th Basic Plan marked the first time that hydrogen and ammonia co-firing were explicitly included as national electricity sources, with targets set at 2.1 % by 2030 and 7.1 % by 2036[88].

Meanwhile, **nuclear power targets were raised** from the previous 23.9 % (2021) to 32.4 % by 2030 and 34.6 % by 2036, reversing the phase-out policy adopted by the Moon government in 2017. This U-turn included the resuming of previously paused reactor construction (Shin Hanul Units 3 and 4) and the positioning of nuclear technology, such as small modular reactors, as a strategic export industry. This policy shift was well-received by economic players such as *chaebols* in major industries, the nuclear industry itself and some of the public, framed as a pragmatic move to ensure stable energy supply, predictable electricity costs and carbon neutrality.

However, energy policy experts in the country remained divided. Some acknowledged nuclear power as necessary for meeting short- to medium-term emission targets. At the same time, others warned of the opportunity cost in delaying the structural reforms needed to scale up renewables and feared the stalling of cleantech innovation[89]. Above all, public opinion on nuclear energy in the country remained ambivalent. Periodic polls have shown that Koreans have long-term concerns about the safety of nuclear power, risks of accident and nuclear waste disposal[90]. While the country improves its global competitiveness in nuclear technology, a lack of experience with extending the operational life of reactors[91] and social resistance to the construction of new sites have complicated this ambition.

1.3.2. Realisable carbon neutrality

While the Yoon government maintained the commitment to carbon neutrality by 2050, based on Moon's legally binding 2021 Carbon Neutrality Act, it rebranded the narrative and strategy as 'realisable' and 'realistic'. This reframing emphasised achieving South Korea's climate goals through a pragmatic and economically and technologically sound approach. In doing so, the Yoon administration distanced itself from the policies of the previous liberal government, portraying them as unrealistic and ideologically driven. In a nutshell, this approach was described in Yoon's address to the UN General Assembly in September 2023: 'Korea will not only harness renewable energy but also extensively employ high-efficiency carbon-free energy (CFE), such as nuclear power and hydrogen, as a realistic measure to hasten our pursuit of carbon neutrality. We also plan to share these energy sources with countries vulnerable to climate change, ensuring they too can benefit'[92].

In July 2022, the Yoon administration unveiled its National Agenda, which included a detailed plan to pursue 'realisable' and 'science-based' climate and environmental policies. It included the auctioning of allowances under the K-ETS, updating the Korean green taxonomy to include nuclear energy, drawing inspiration from the EU's taxonomy (see Section 3.1.2), and implementing a wide array of environmental measures from air quality to chemical regulations[93].

While South Korea's overall 2030 emissions reduction target established by the 2021 Carbon Neutrality Act remained unchanged, the plans to reach them changed with political leadership and momentum (see Section 2.2.1 and Box 3). Notably, the industrial sector's reduction target was lowered from 14.5 % to 11.4 %[94], a move that drew criticism domestically and from international observers, including in the EU[95]. The Yoon administration justified this adjustment by citing vulnerabilities in critical raw materials supply chains, essential for renewables, and technological constraints in emissions reduction in hard-to-abate energy-intensive industries (see Section 2.2.3). While framed as a pragmatic adjustment to safeguard national competitiveness, this revision drew further criticism, especially from environmental advocates, as undermining climate ambition and reducing incentives for major industrial emitters to innovate[96].

1.3.3. What has been left of the Korean Green New Deal?

Under the Yoon administration, **the Korean Green New Deal was no longer central to the climate policy narrative**. It was absent from the new Yoon government's economic plan, eliminating it from the 2023 Korean budget. While this elimination was part of a broader spending cut in the name of fiscal discipline and conservatism[97], ending pandemic-era stimulus, it also reflected a clear departure from the Moon administration's priorities. Most of the policies introduced under the KGND were also scrapped. For example, Yoon's

Ministry of Economy and Finance eliminated the Green New Deal's infrastructure tax benefits in 2022, cancelling a major funding mechanism for these projects[98]. The focus went instead to Yoon's July 2022 National Agenda and its 120 policy items. Green energy projects shifted away from Moon's large-scale renewables expansion, instead favouring nuclear energy and carbon-free energy sources.

Yet certain Green New Deal projects continued to be implemented, albeit with decreased momentum and visibility[99] (see Annex C). The green remodelling of buildings project – to improve the energy efficiency and environmental performance of buildings – continued under the Yoon administration[100], focusing on ageing public infrastructure, with mandatory retrofitting planned from 2025[101]. In the transport sector, the Yoon administration preserved and expanded electric and hydrogen mobility targets. Electric vehicle (EV) adoption exceeded initial goals by 2024[102] and hydrogen innovation, including nuclear-based hydrogen and hydrogen city pilots, became a major pillar of Yoon's green technology ambitions[103]. The Yoon government committed to the continuous implementation of 'smart and green industrial complexes' (SGICs), though this was not prioritised as of 2023[104]. In 2024, the Ministry of Trade, Industry and Energy planned to support 18 designated SGICs with the digital and low-carbon emission transition[105, 106]. The twin transition aspects of SGICs remain intertwined as of 2025[107].

1.4. THE FUTURE OF GREEN POLICIES AMID POLITICAL UNCERTAINTY (2025)

On 3 December 2024, President Yoon of the conservative PPP declared martial law, accusing the Democratic Party-majority National Assembly of 'anti-state activities' for opposing his policy agenda. The move sent shockwaves both domestically and internationally and threw South Korea into an ongoing crisis[108]. It was met with immediate backlash[109] from the National Assembly, leading to his impeachment on 14 December 2024 for abuse of power[110]. On 4 April 2025, the Constitutional Court upheld Yoon's impeachment[111], citing serious constitutional violations. While, prior to the crisis, Yoon's successor was expected to be chosen in 2027, the impeachment triggered a legally-required early election, its date set to 3 June 2025[112].

Whereas climate policy has not been central to the ongoing presidential electoral race, certain observations can still be made – particularly on energy. Following the last two presidential elections, PPP/DPK political fluctuations proved to cause strong energy policy redirections (see Box 1). Should the poll-leading candidate Lee Jae-myung of the DPK win, one might expect that national policy directions would change again. However, despite this legacy of political alternance, the DPK's Lee Jae-myung is contending with 2025 political realities.

In April 2025, Lee Jae-myung advocated for a balanced energy mix including nuclear and liquified natural gas (LNG), which is a break from DPK president Moon's defining stance

on the need for a nuclear phase-out. This may have come as a disappointment to pro-environmental segments of the DPK electorate, but there is a rationale: this political reversal can be linked partially to the growing energy needs of AI development and South Korea's nuclear technology exports. By focusing on economic pragmatism, stating that 'energy is reality'[113], Lee's campaign is borrowing from the conservative PPP's playbook. In line with DPK orientation, Lee is nevertheless advocating for reducing LNG use, phasing out coal by 2040, and renewable energy expansion[114].

Meanwhile, **PPP candidate Kim Moon-soo**, a staunch supporter of Yoon throughout the crisis, has pledged further nuclear expansion with the construction of six large nuclear power plants, and greater R&D investment and international cooperation[115]. In parallel to the campaign, Korean[116], European[117] and international[118] media are closely following the latest developments regarding a tender won by Korea Hydro & Nuclear Power, a subsidiary of KEPCO, to construct two nuclear reactors in the Czech Republic.

As the DPK will continue to hold the majority in the 22nd National Assembly (elected in April 2024) at the start of the next presidential term and until the next legislative elections, it will most likely have an impact on National Assembly debates on carbon neutrality policies. The 2024 DPK's policy manifesto[119] had included a proposed 'Carbon Neutrality Industry Promotion Act', later introduced as a bill in the National Assembly to support 'carbon neutral-industries' – a term defined in the 2021 Carbon Neutrality Act. The three targeted industries were electric vehicles, renewable energy and green hydrogen. While it has not been passed into law, the bill has been compared with the Inflation Reduction Act in the US and the Net-Zero Industry Act in the EU in its ambition to equip domestic industries for the global cleantech race[120]. Towards the end of Joe Biden's presidential term (2021-25), the DPK's plan was considered a pathway for stronger global collaboration on NDCs and on clean technologies[121]. What remains to be seen is whether there would be legislative momentum for such a bill, including in the absence of aligned leadership in Washington.

2. From a carbon-intensive export-oriented economy to green growth and innovation

South Korea's rapid rise as an industrial and high-tech powerhouse has been driven by decades of export-led growth, rooted in energy-intensive manufacturing and a heavy reliance on fossil fuels. This model led to a sharp increase in emissions, which peaked only in 2018. Increasing domestic and international pressure has since prompted a shift towards a policy agenda that is more sustainability-focused, culminating in a 2050 carbon neutrality pledge and a series of green growth-oriented strategies during the 2010s. Yet, structural challenges remain that anchor Korea's economy in high-emission sectors, powered by a fossil fuel-heavy electricity mix and industrial processes. There is also the rising use of fluorinated gases (F-gases) in the cornerstones of Korea's global competitiveness – the semiconductor and high-tech industries.

This section explores the contours of South Korea's transition from a carbon-intensive industrial model to a more sustainable, innovation-driven economy. It gives a snapshot of progress in the power and industrial sectors, the role of clean technologies, and the evolution of market-based mechanisms. While emissions have begun to decline, the transformation required to sustain this trend and meet the 2050 carbon-neutrality goals is only in its infancy. A critical debate is emerging domestically over post-2030 ambitions, especially following Constitutional Court rulings that have questioned the adequacy and constitutionality of current pathways.

Technological innovation is central to Korea's *current* decarbonisation strategy. With limited space for onshore renewables and hydro, offshore wind is expected to play a key role in decarbonising the fossil-dominated power mix, especially if nuclear energy expansion is reversed (again) by the next government. Meanwhile, the current strategy is increasingly betting on hydrogen and carbon capture, utilisation, and storage (CCUS) to address decarbonisation in both hard-to-abate sectors and power generation. Yet questions about their feasibility, maturity, and commercial viability remain, as do concerns that over-reliance on these technologies may delay systemic reform and near-term emissions cuts.

At the policy level, South Korea's K-ETS remains a key market-based instrument and somehow a blueprint in the region. Still, doubts persist about its stringency and impact, particularly given political sensitivities around carbon costs in power generation and the competitiveness of export-oriented industries. Ultimately, industrial decarbonisation will likely require stronger demand-side policies and broader structural changes to align Korea's economic model with its climate ambitions.

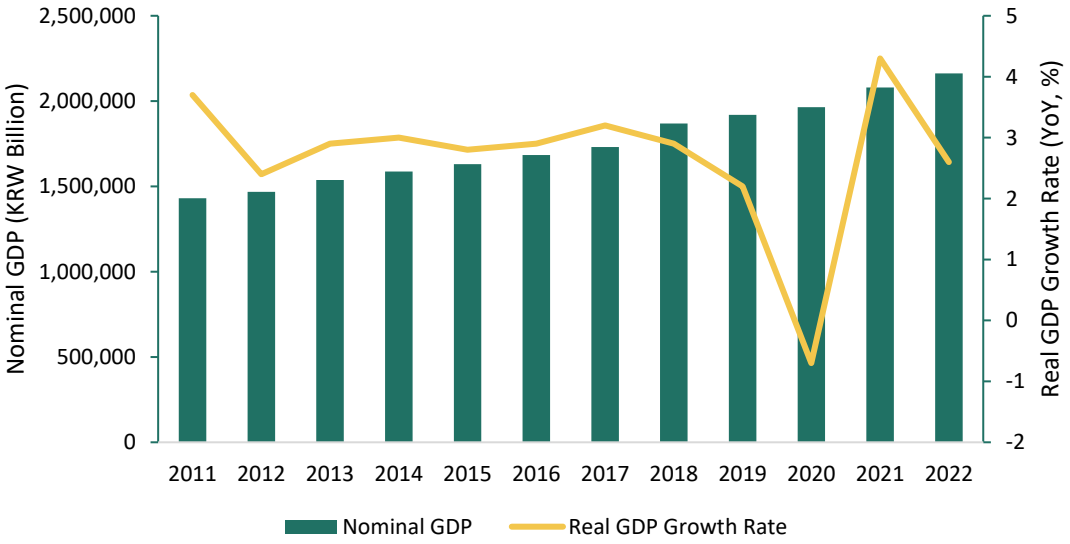
2.1. EMISSIONS AND ECONOMIC GROWTH IN A RESOURCE-POOR SETUP

South Korea's rapid industrialisation, driven by an export-oriented growth model centred on manufacturing, has delivered remarkable economic results but also brought environmental challenges. Despite limited domestic natural resources, the country has sustained high levels of industrial output through heavy reliance on imported fossil fuels, increasingly making emissions reduction a domestic concern. Carbon intensity has shown steady improvement but remained higher than in most other OECD economies. The past few years have marked a potential turning point, however, with early signs of absolute decoupling between emissions and economic growth. Yet, the continuation of this trend is far from guaranteed and will hinge critically on consistent, long-term policy support – an outcome that must be framed independently from South Korea's track record of shifting energy and climate priorities due to political alternance.

2.1.1. Export-oriented manufacturing as South Korea's path to growth

In 1953, the year the Korean War ended and left the Korean Peninsula divided, South Korea was one of the poorest countries in the world. More than 70 years later, the country is ranked among the world's 15 largest economies[122]. This rapid economic turnaround propelled South Korea into the '30-50 club' in 2017, becoming the seventh country to achieve both a 'per capital gross national income (GNI) surpassing USD 30,000 and a population of over 50 million'[123]. By the end of the 1990s, South Korea had joined the OECD (1996) and had earned its place among the *Four Asian Tigers*, alongside Hong Kong, Singapore, and Taiwan. Although South Korea's growth has slowed considerably over recent decades, falling from 6.9 % in the 1990s to 4.4 % in the 2000s and to 2.9 % in the 2010s[124], its economy remains a hallmark of the East Asian development model (Figure 1).

Figure 1: Nominal gross domestic product and real economic growth of South Korea, 2011-22



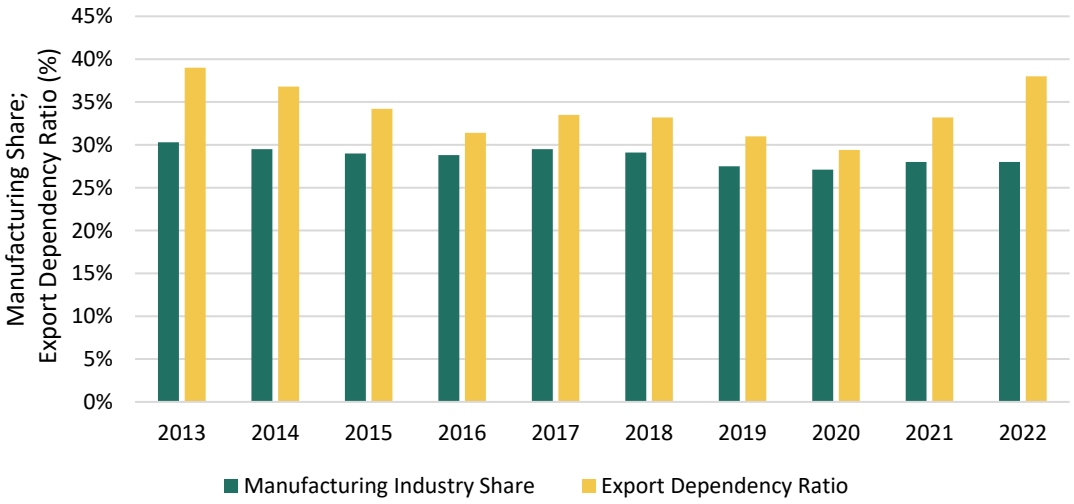
Source: Government of the Republic of Korea (2025).

South Korea's rapid economic development from the 1960s through the 1990s, often referred to as the *Miracle on the Han River*, was driven by an export-oriented growth strategy, heavily reliant on manufacturing and trade. This strategy brought with it **a high export dependency ratio** – i.e. the share of exports of goods and services as a percentage of GDP – which quickly trespassed 30 % and peaked at over 50 % in 2012[125]. Although this ratio has declined over the past decade, it has rebounded since the pandemic, returning to 38 % – similar to levels a decade ago (Figure 2). While export-oriented industrialisation had obviously benefited country's economic growth, it had also made Korea vulnerable to external global shocks, including the 1997 Asian financial crisis and the 2008-09 global financial crisis, as well as the trade tariff war launched by the second Trump administration[126].

The core components of South Korea's growth strategy have combined strong state-led industrial policies with the leadership of *chaebol* conglomerates, which are deeply nested in the political canvas of South Korea (see Section 1 and Box 1) and which were in the driving seat for industrial expansion. Alongside this has been major investment in Korea's strategic industries, such as steel, shipbuilding, electronics, and automobiles. The **manufacturing sector** remains central to the national economy, accounting for 28 % of GDP since the pandemic (Figure 2) – one of the highest shares among OECD countries in recent years, surpassing Japan, Germany, France, the UK and the US[127]. While the share of manufacturing production has fluctuated over the past decades, it increased after the pandemic, as part of the global post-pandemic rebound and due to rising domestic and

global demand in sectors such as semiconductors, automobiles, and petrochemicals – a few of the core export industries in South Korea.

Figure 2: Manufacturing industry share and export dependency ratio of South Korea, 2013-22



Source: Government of the Republic of Korea (2025).

Note: The dependency ratio equals the ratio of exports to GDP.

Since the 1970s, South Korea has rapidly transformed its industrial structure, shifting from a primary industry-centred economy to one focused on secondary and tertiary industries. Through this rapid industrialisation, South Korea has transitioned from light manufacturing (e.g. textiles) to heavy industries, including shipbuilding, steel, automobiles, and petrochemicals, and eventually into the high-tech sectors of semiconductors and electronics. By 2022, the top five sectors in South Korea's manufacturing production were electronics (16.2 % of total annual manufacturing production value), with growth largely driven by rising demand for semiconductors; the automotive industry (12.1 %); the chemical industry (10.5 %); primary metal manufacturing (9.8 %); and coke, briquette and petroleum refining products (9.7 %). Together, these sectors accounted for 58.4 % of total manufacturing production in 2022[128].

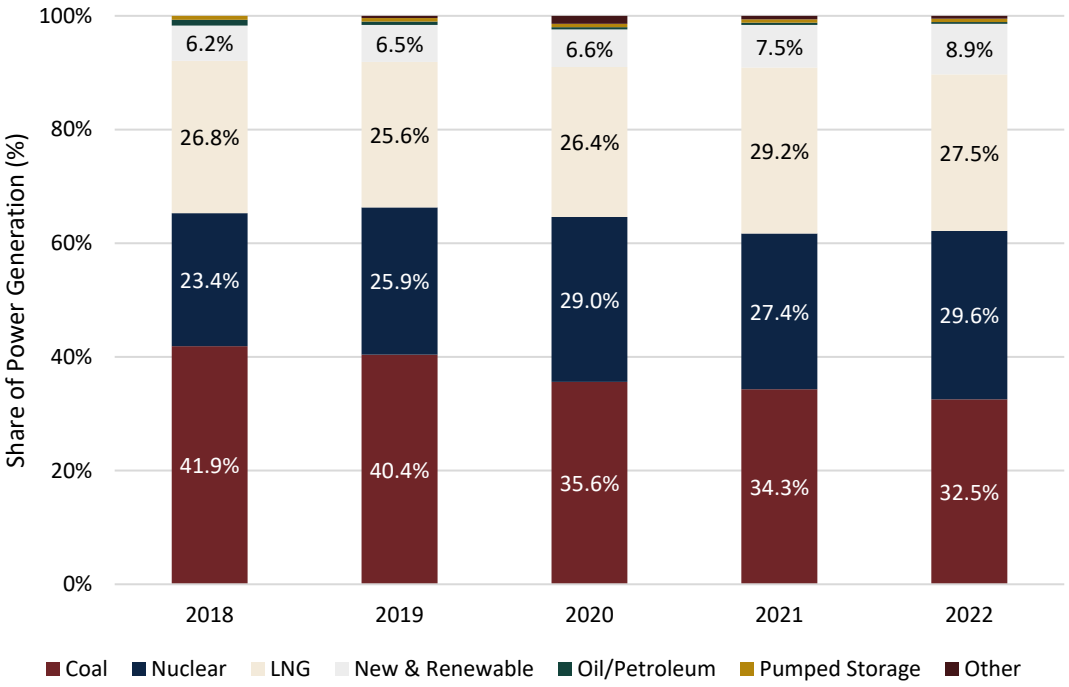
Unsurprisingly, this strong emphasis on manufacturing has driven **substantial energy demand, for both fuel combustion and industrial processes**. In recent years, this demand has been further boosted by rising energy use in transportation, including the growth of electric vehicles (EVs), increasing residential needs (air conditioning and heating), and – more recently – rising energy needs to support the development of data centres and AI-related technologies.

From 1990, total energy consumption of the country grew from slightly below 100 to almost 300 million tonnes of oil equivalent (Mtoe) by the end of the 2010s. To accommodate this consistently rising energy demand, South Korea has relied heavily on imported fossil fuels, with coal (23.9 %), oil (36.5 %), natural gas (18.7 %) (altogether 84.6 % of net energy imports) in their total energy supply in 2023[129]. The rest came from homegrown nuclear energy (17.0 %) and minor energy production volumes from hydro, waste, biofuels and renewables.

While coal consumption has been on a gradual decline since the late 2010s, in 2023, heat and power generation still accounted for around two thirds of coal consumption, with the remainder used in industry and distributed among other sectors. Throughout the 1990s-2000s, natural gas use showed steady growth in Korea's total energy consumption, although stabilising since 2010s and slowing down in recent years. In 2023, over half of the natural gas was used in power generation, about a quarter in residential and commercial buildings, and then an even smaller share in the industrial sector. More than a half of oil is used for non-energy purposes, mainly in production of petrochemicals – one of the core Korean industries. The rest is split between the transportation sector (around a third) and industrial sector.

Although electrification has shown modest growth since the 2010s, reaching 25.7 % of total energy consumption, there is room for further improvement, including increased electrification of industry, greater sector coupling and demand-side responses like increasing use of EVs. Yet, a growing rate of electrification goes hand in hand with the pressing need of decarbonising the electricity mix in terms of emissions reduction. The electricity mix in Korea is heavily dependent on fossil fuels such as coal and LNG – 32.5 and 27.5 % respectively in 2022) (Figure 3). Nuclear energy (29.6 %) has been gradually increasing over time, although subject to political swings in policy support. Renewables are also gaining traction, especially after the introduction of support measures throughout the 2010s, but their share remained at around 10.6 % in 2024[130]. The ratio of nuclear to renewable energy remains a subject of ongoing political debate in South Korea, with policy direction often influenced by the political orientation of the sitting president and their administration.

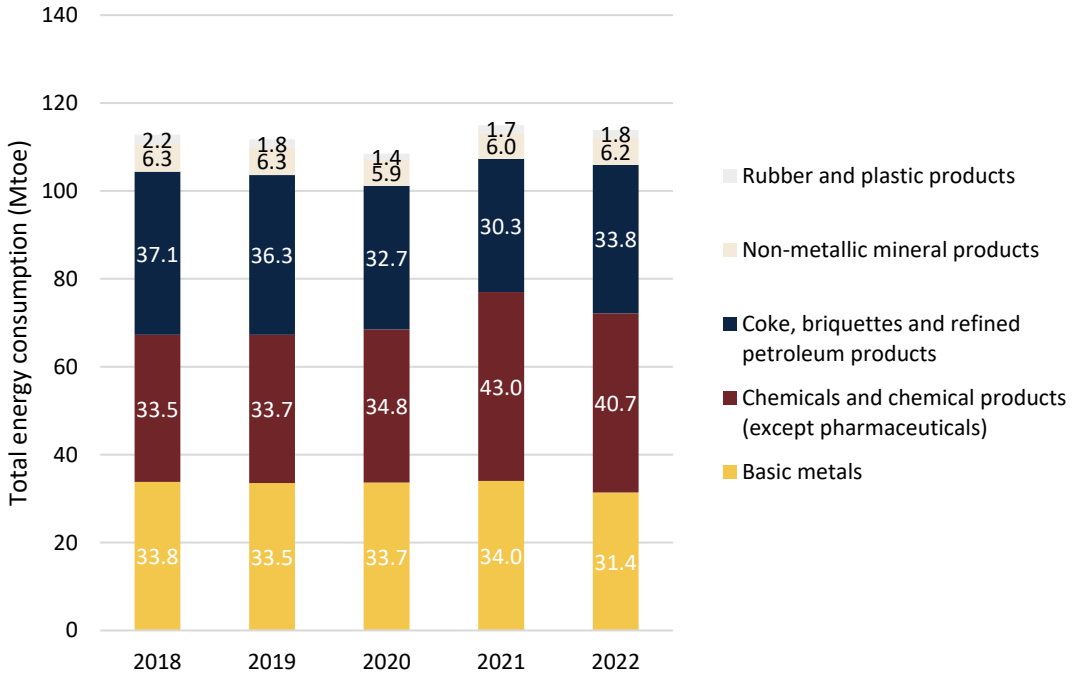
Figure 3: Share of power generation by source in South Korea, 2018-22



Source: Government of the Republic of Korea (2025).

By 2022, **industry accounted for 26.3 % of total final energy consumption**[131], dominated by three sectors: chemicals (30.5 % of industrial energy use), followed by coke, briquette and petroleum-refining products (25.2 %), and primary metal manufacturing (23.5 %)[132]. Industrial energy consumption in Korea grew steadily from 2010 to 2017[133], primarily driven by petroleum and coal[134]. These fuels are mainly used in the form of naphtha and cokes for steel and petrochemical production. Other sources like gas and electricity from (non-) renewable sources play an increasing but comparably smaller role. Since 2018, total energy consumption in energy-intensive industries has stagnated between 108 and 115 Mtoe, amounting to 114 Mtoe in 2022 (Figure 4). While energy consumption for chemicals and chemical products increased during that period, these changes were largely offset by reductions in other sectors.

Figure 4: Total energy consumption of selected energy-intensive industries in South Korea, 2018-22



Source: Own elaboration based on Government of the Republic of Korea (2025).

Note: Rounding errors may occur.

Industries remain the main offtakers of electricity in South Korea, accounting for over 50 % of total consumption in 2022, although the increase in EV use and data centres also drives commercial use of electricity[135] (Table 1).

Table 1: Electricity consumption in South Korea, 2013-22, TWh

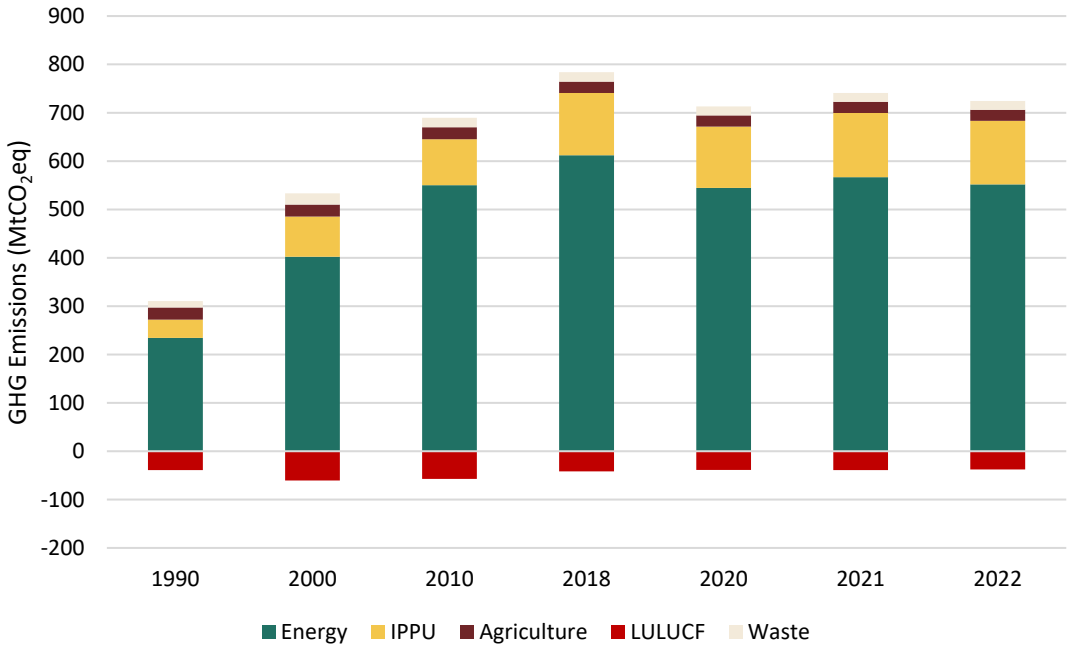
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total	474.8	477.6	483.6	497.1	507.8	526.2	520.6	509.3	533.5	547.9
Residential	64	62.7	63.8	66.2	66.5	70.7	70.5	74.1	77.6	78.6
Commercial	154	150.3	154.2	160.9	164.6	174.6	172.8	168.1	173.2	181.4
Industrial	256.8	264.6	265.6	270	276.7	280.9	277.3	267.1	282.7	287.9

Source: Government of the Republic of Korea (2025).

2.1.2. South Korea's carbon intensity improvements: A trend towards decoupling emissions and growth?

South Korea's fast-paced industrialisation, anchored in an export-oriented growth model and pursued in a resource-poor context, was supported primarily by imported fossil fuels. This structural setup contributed to a rapid rise in the country's GHG emissions, which increased steadily until peaking at 783.9 $MtCO_2eq$ in 2018[136]. Since then a gradual decline has been observed, aside from a brief rebound effect of post-Covid recovery (Figure 5). In 2022, emissions decreased to 724.3 $MtCO_2eq$ – still an increase of around 413.7 $MtCO_2eq$, or 133.2 % from 1990 levels to 2022, but a 7.6 % reduction since the 2018 peak.

Figure 5: GHG emissions by sector in South Korea, 1990-2022



Source: Government of the Republic of Korea (2025).

Although CO_2 remains the dominant greenhouse gas in South Korea's emission profile, F-gases have seen a sharp rise in recent years, driven largely by their use in air conditioning systems and in the electronics manufacturing sector, which has become one of Korea's flagship export industries (Box 2).

Box 2. GHG emissions per gas

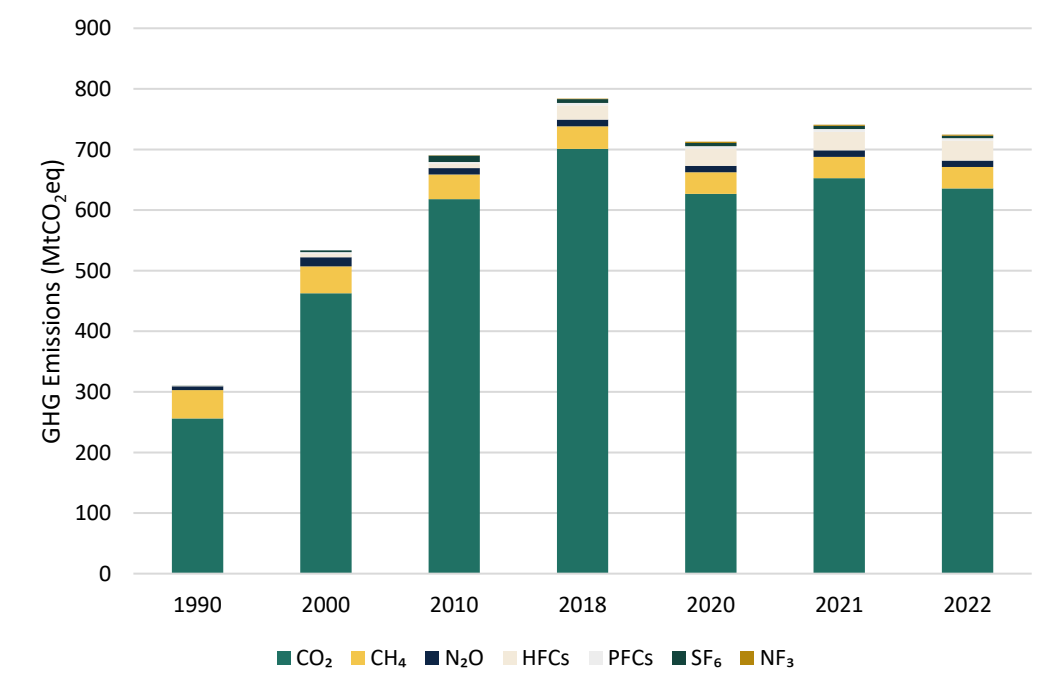
Almost 90 % of total GHG emissions in 2022 were CO_2 (Figure 6), with the largest part originating from the energy sector (85.5 % of CO_2 emissions) and Industrial Processes and Product Use (IPPU) (13.9 % of CO_2 emissions) [137].

F-gases represented the second-largest source, making up around 6 % of total emissions, all of which stemmed from IPPU. The growing role of F-gases including Hydrofluorocarbons (HFCs) used in cooling and Perfluorocarbons (PFCs) in semiconductor production, reflects Korea's shift to high-tech industries and the replacement of ozone-depleting substances in products like air conditioners.

Methane (CH_4) ranked third at 4.9 % of total GHG emissions in 2022, with the largest share of methane emissions in Korea originating from the agriculture sector (49.4 %) and waste sector (35.7 %), and energy sector and IPPU accounting for the remaining 14.1 % and 0.7 %. Related emissions decreased by around a fourth from 1990, driven by a decline in coal production and a reduction in rice cultivation areas and landfilling of waste.

The remaining 1.5 % of total GHG emissions are N_2O (nitrous oxide). N_2O emissions grew steadily until the mid-2000s before decreasing significantly due to N_2O abatement measures, but they have still increased by about 70 % compared with 1990.

Figure 6: GHG emissions by type of gas in South Korea, 1990-2022

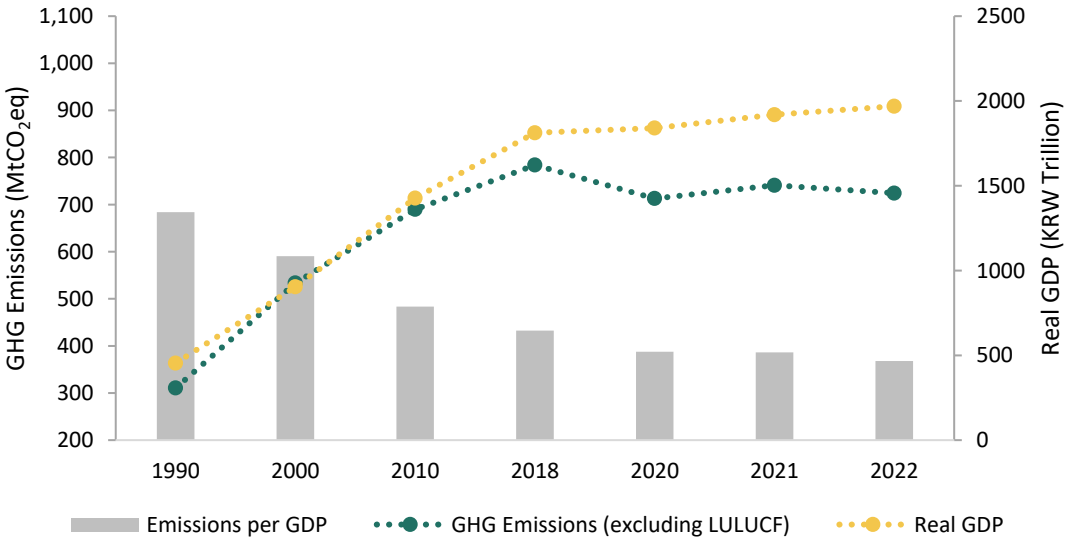


Source: Government of the Republic of Korea (2025).

With this emissions profile, South Korea continues to rank among the world's top 15 emitting countries[138], and for a long time has been the OECD country with the fastest-growing carbon emissions[139]. Yet, until the mid-2010s, emissions growth in Korea was almost linearly correlated with real GDP growth (Figure 7). Since then emissions per unit of GDP have been falling steadily. In 2023, they were 47.7 % lower than in 1990, a trend shared with other high-income countries. Still, South Korea's carbon intensity (0.23 $kgCO_2$/2015 USD) adjusted for differences in the cost of living between countries, remains higher than that of OECD peers such as Singapore (0.08), Japan (0.17) or France (0.09)[140].

During the mid-2010s, a decoupling trend seemed to emerge, albeit somewhat distorted by a rebound effect following the COVID-19 pandemic. Even though this trend is still very recent, the Korean government has claimed the beginning of absolute decoupling as of 2021, as reflected in its First Biennial Transparency Report (BTR1)[141]. Whether this trend will be sustained will largely depend on the new policies adopted from 2021 onwards to drive emissions reduction in line with Korea's 2030 targets and beyond – as well as the overall political choices that will be made by Korea's new government after the June 2025 elections (see Section 1.4).

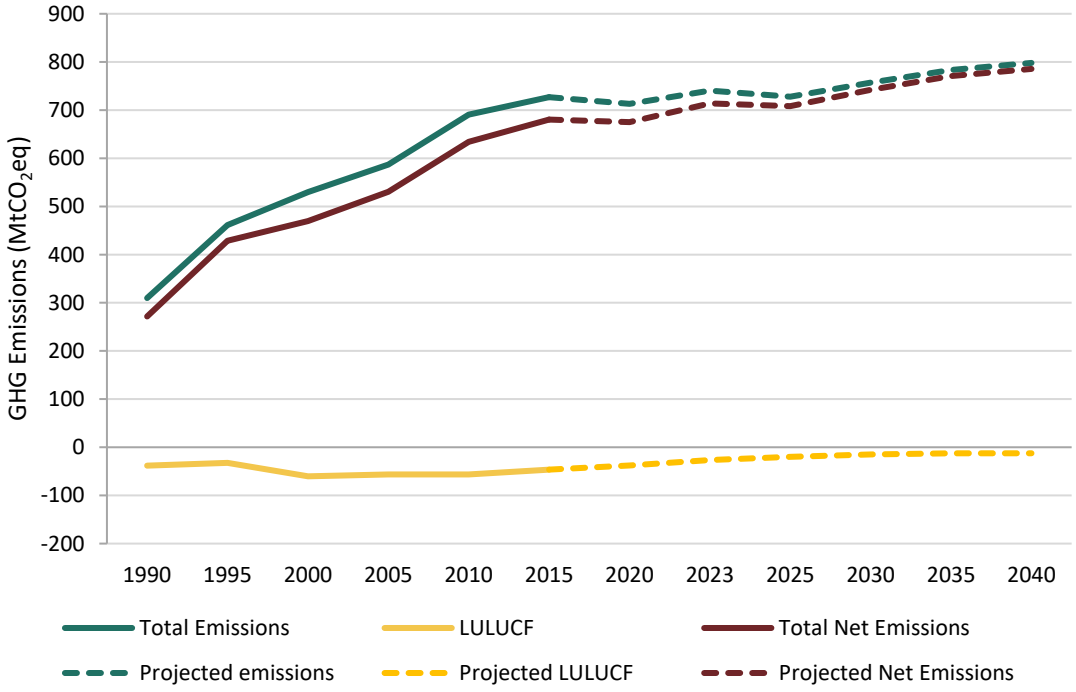
Figure 7: Historic GHG emissions per real GDP of South Korea, 1990-2022



Source: Own elaboration based on Government of the Republic of Korea (2025).

The BTR1 provides projections of future emissions under the With Measures Scenario. Taking into account the effects of climate and energy policies implemented up to 2021, the With Measures Scenario has projected the growth of total GHG emissions to 798 $MtCO_2eq$ by 2040 (Figure 8). Assessments evaluating the impact of policies introduced after 2021 have yet to be delivered.

Figure 8: Historic GHG emissions and projections for South Korea under the With Measures Scenarios, 1990-2040



Source: Government of the Republic of Korea (2025).

2.2. CARBON NEUTRALITY THROUGH GREEN GROWTH AND TECHNOLOGICAL INNOVATION

South Korea's decades-long reliance on an export-driven growth model, particularly in carbon-intensive sectors, has begun to shift in response to both global and domestic pressures. Since the 2010s, a slowdown in global trade has coincided with the growing attention to climate change and revitalised international climate commitments, particularly following the signature of the Paris Agreement in 2015. These external challenges have intersected with internal dynamics in South Korea, including an ageing population, democratic consolidation, and increasing civil society engagement on environmental issues (see Section 1). Formally introduced in 2008 under President Lee Myung-bak's Low Carbon, Green Growth vision, the concept of green growth has since then gradually assumed a bigger role in Korea's economic and innovation policy. With new frictions in Korea's economic model, including tightening carbon regulations in key markets like the EU, green innovation is increasingly shaping the country's search for a future economic model.

2.2.1. Emissions reduction pathways by 2030 and beyond

Korea's green policies have shown attempts to reconcile climate and environmental policies with Korea's industrial priorities, often shaped and altered by domestic power constellations. In this complex domestic environment, a gradual strengthening of the country's climate commitments has been evident over the past decade, with a notable leap forward during the Moon administration (2017-22), which pursued a more proactive, pro-climate agenda.

While the path of Korea's climate ambition (see Box 3) fits logically with Korea's economic structure, it has also faced major criticism, especially from environmental NGOs, for being insufficiently ambitious and carrying high transformation risks. It is worth noting, however, that South Korea is not formally listed among developed countries under the UNFCCC and is only 'encouraged to move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances', under the Paris Agreement[142].

However, the appetite for more ambitious and streamlined pathways, independent of frictions arising from political fluctuations (see Box 1), received support at the highest level in Korea. In August 2024, a landmark case of the Constitutional Court, brought before the body by a coalition of young climate activists, ruled that parts of the Carbon Neutrality Act are unconstitutional and violate the rights of future generations for not including binding GHG emission targets for the 2031-49 period. The ruling requires the Carbon Neutrality Act to be amended accordingly by February 2026, based on scientific facts, international standards and Korea's proportional climate burden on a global scale, regardless of the party or president in power by then. The case has been a landmark in South Korea for having placed future generations – not green growth or calculations towards carbon neutrality mired in technicalities – at the forefront of the climate debate[143].

In February 2025, the acting government promised a long-term carbon neutrality plan with binding commitments to 2050[144, 145]. The updated targets, as well as those to be submitted as an updated NDC ahead of COP30 (to take place in November 2025 in Brazil), will likely hinge on domestic politics, particularly on the outcome of upcoming elections in June 2025, which can significantly affect the country's climate ambitions (Section 1.3).

Currently, the targets adjusted back in 2023 under the Yoon government, are built on a combination of coal decommissioning, nuclear power expansion, conservative targets for renewables deployment, and major mid-term bets on hydrogen, ammonia, and carbon capture technologies – alongside intensification of international cooperation for achieving domestic reductions (further discussed in Section 2.2). International cooperation is set to play a significant role, particularly through expanded funding for overseas emissions

reduction projects and participation in internationally transferred mitigation outcomes (ITMOs). While this approach has found detractors among environmental advocates and segments of civil society, it nonetheless aligns with Korea's carbon-intensive, export-oriented industrial model.

Box 3. Evolution of Nationally Determined Contributions in South Korea

South Korea's first national GHG reduction target of a 30 % reduction compared with a business as usual (BAU) scenario by 2020 was first announced in 2009 and adopted in 2014 as part of negotiations for what later became the Paris Agreement. It was followed by the intended nationally determined contribution (INDC) in 2015 of a 37 % reduction from BAU levels by 2030.

During this period, South Korea undertook a significant reorganisation of its domestic climate governance framework, establishing a pan-governmental response mechanism, coordinated at a higher political level by the Prime Minister and the Deputy Prime Minister for Economic Affairs[146]. As a result of this cross-ministerial coordination, Korea adopted the First Basic Plan for Coping with Climate Change in December 2016. In parallel, the Basic Roadmap to Achieve the National GHG Reduction Target for 2030 was developed, setting out detailed pathways to achieve the submitted INDC. Initially, the plan envisaged that 25.7 % of reductions would be achieved domestically, with the remaining 11.3 % to be met through international mechanisms, including carbon removals. However, the Roadmap was revised in July 2018 to strengthen domestic action: the domestic reduction contribution was raised to 32.5 %, while the role of international carbon removals was reduced to 4.5 %.

In December 2020, Korea adjusted its target again as part of its update to the NDC for 2030. This update introduced two major changes.

i) It shifted the baseline from a 2030 BAU projection to an absolute 2017 emissions level, recognising the limitations of the BAU approach.

ii) It revised the reduction target to a 24.4 % cut from 2017 levels by 2030. Alongside this, the government also submitted its Long-term Low GHG Emission Development Strategy.

In August 2021, the Carbon Neutrality Act made South Korea the 14th country in the world to legislate a 2050 carbon neutrality commitment. As a result, in October 2021, Korea updated its 2030 target to a 40 % reduction from 2018 levels (727.6 $MtCO_2eq$) and officially submitted it in December 2021. Notably, while the baseline year (2018) was set using total emissions, the target was expressed in terms of net emissions (including removals, such as through natural carbon sinks).

The Carbon Neutrality Framework Plan under the Carbon Neutrality Act set out various policy measures to achieve these targets. In addition to domestic reduction measures, the plan also considered expanding public-private partnerships and exploring options for using

ITMOs under Article 6 of the Paris Agreement, whose final elements were operationalised at COP29 in Baku in November 2024.

The October 2021 targets were further adjusted in April 2023 through the First National Basic Plan for Carbon Neutrality and Green Growth[147]. While keeping the 40 % overall reduction target, sector-specific adjustments were made, including less ambitious targets for industries, and increased hydrogen production – compensated by the enhanced use of international carbon credits and carbon capture technologies[148].

As of 2022, approximately 8.4 % of the targeted net emissions reduction (compared with 2018 levels) have been achieved[149].

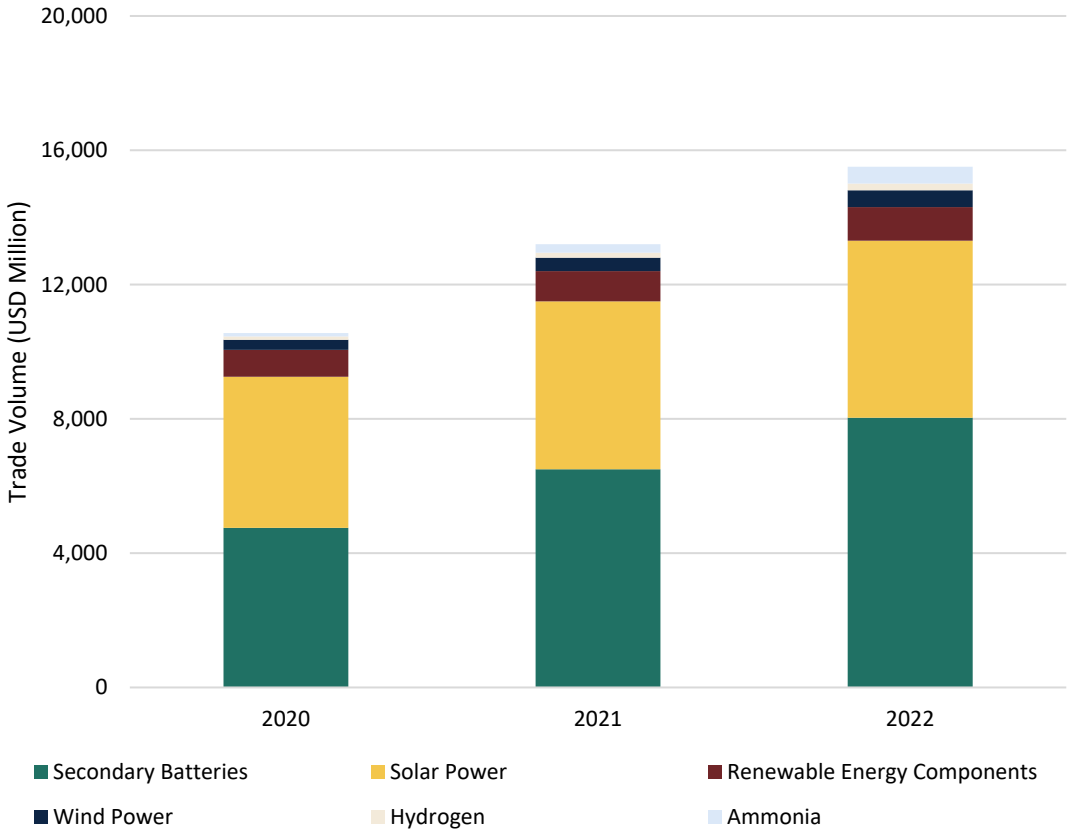
2.2.2. Cleantech manufacturing and an environment for innovation

South Korea, like the EU and many other industrialised countries, faces a dual challenge: reducing direct process emissions while decarbonising the national energy mix – all without undermining industrial competitiveness. To tackle this, South Korea is placing a strong bet on technological innovation – a policy rooted in the concept of powering economic growth through innovation.

This ambition is reflected in the significant progress of South Korea's cleantech industry (Figure 9). Notable success stories of South Korean cleantech include (secondary) batteries (Box 4) and solar power, which have managed to acquire a competitive edge in global markets and to resist the expansion of made-in-China products. The sectors have shown steady growth, with the trade volume of secondary batteries rising from USD 4.8 billion to 8 billion between 2020 and 2022 – a 1.7-fold increase. The solar power industry also grew steadily, reaching USD 5.3 billion in 2022.

In its Fifth National Communication and BTR1, Korea identifies the essential technologies for driving this transition. The list is fairly extensive and includes some of the usual suspects, such as hydrogen, CCUS, and offshore wind for lower winds.

Figure 9: Trade volume of selected low-carbon industries in South Korea, 2020-22



Source: Government of the Republic of Korea (2025).

Box 4. Batteries as a Korean success innovation story

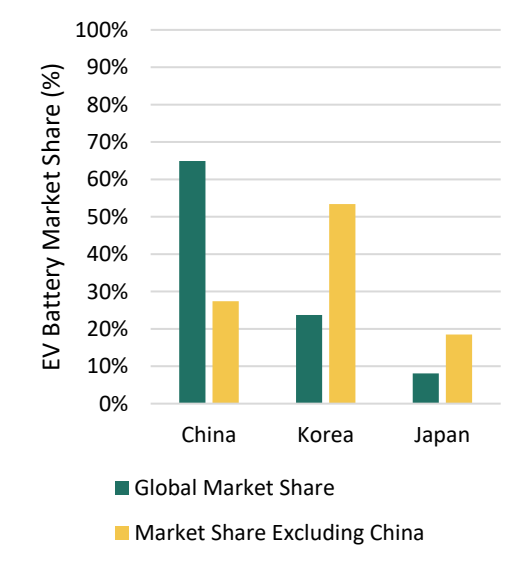
Batteries are truly a Korean success innovation story, with three South Korean companies (LG Energy Solution, Samsung SDI, and SK On) among the top 10 battery producers ranked by sales volume in the world. Korean companies control approximately 23.7 % of the global market for EV batteries (Figure 10). When excluding Chinese markets, this share increases to over 50 % (Figure 11). Their leading position spans across different battery segments (from mobile and electronic devices to EVs and energy storage), as Korean producers have secured substantial market shares for small over medium- to large-sized lithium ion batteries.

At this stage, the core focus of the Korean battery industry for the next decade will be market development for second-use batteries, especially with application for energy storage, stimulated by a need to balance the grid with an increasing share of renewables.

A core challenge for the battery industry is supply chain dependencies of critical minerals – or critical raw materials in EU terms – dominated by only a handful of players, particularly China, which Korea is trying to mitigate through the establishment of public-private partnerships for joint procurement of raw materials. Also, reducing material demand in a

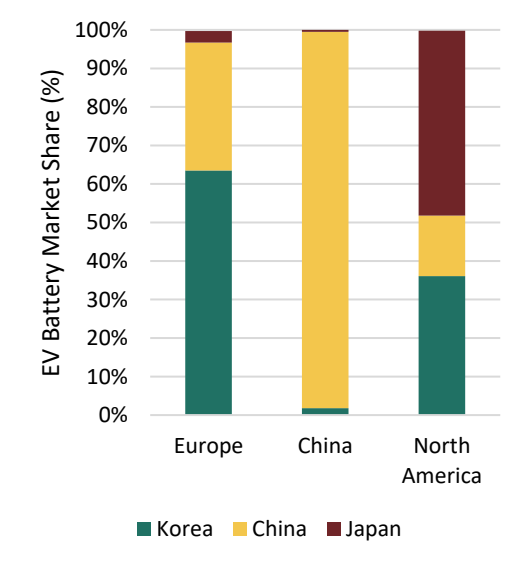
currently insufficient 'material ecosystem' in Korea could be done to some extent by raising domestic recycling rates.

Figure 10: Global market share of the EV battery market by country, 2022



Source: InvestKorea (2025).

Figure 11: Market share of key EV battery players in selected regions, 2022



Source: InvestKorea (2025).

South Korea has long prioritised R&D as a cornerstone of its innovation-driven economy, with large private investment[150] and generous R&D tax incentives – especially for large firms – playing a key role. However, recent budget cuts have introduced uncertainty and raised concerns about the country's ability to maintain its leadership in cutting-edge technologies. In response, the government announced plans to increase the R&D budget in 2025[151], signalling a potential reversal of previous reductions. Nonetheless, the final allocation remains uncertain and is likely to depend on the outcome of the June 2025 elections.

While acknowledging success in certain cleantech sectors as discussed above, South Korea's **approach to the cleantech transition still remains fragmented**. Findings from stakeholder consultations and expert discussions indicate that risks and opportunities in cleantech innovation are rarely addressed in an integrated manner.

This can in large part be explained by Korean domestic business structures, with the *chaebol* conglomerates being prime actors in technological innovation but not necessarily focused on clean technologies as their core business model. Many of them are major

emitters in their core businesses and show a certain reluctance towards more stringent carbon pricing. This results in a low level of ambition and inertia in moving away from established, emission-intensive technologies and complementing carbon pricing with mechanisms that could create markets for clean technologies or enable the emergence of new business models.

SMEs, which could act as drivers of cleantech innovation, face even greater structural barriers in South Korea. Unlike startups in ecosystems like Silicon Valley in the US, Korean cleantech SMEs are often structurally dependent on large conglomerates for access to supply chains and markets. Although government support exists, it is typically short-term and project-specific. The Ministry for SMEs and Startups, established in 2017 by Moon Jae-in, has implemented instrumental initiatives to support SMEs, but challenges remain in ensuring that these initiatives provide long-term strategic support that addresses the systemic issues faced by SMEs in the cleantech sector and foster ecosystem growth[152].

While some government agencies provide support for technology development, these efforts rarely extend to building broader innovation systems. Crucially, there is limited collaboration between academia and industry[153], and a lack of integration of the social science perspectives[154] necessary for effective transition governance. Without these elements, the country continues to fall short of establishing a cohesive ecosystem that connects SMEs, large firms, research institutions, and public policy. As a result, South Korea lacks an integrated system for developing low-carbon technologies.

2.2.3. Decarbonising the power sector and industry

Considering the carbon-intensive energy mix and heavy presence of energy-intensive industries in Korea's economy, it is not surprising that emissions from energy combustion in power and industry and industrial processes in energy-intensive industries have consistently accounted for about three quarters of total GHG emissions (Table 2).

Table 2: GHG emissions from the Korean energy sector and selected industrial sectors, 1990-2022

Sector	GHG Emissions ($MtCO_2eq$)							Growth Rate (%)	
	1990	2000	2010	2018	2020	2021	2022	2022/ 1990	2022/ 2018
1.A.1. Energy Industries	42.0	136.3	254.6	300.0	248.2	260.0	257.5	513.1%	-14.2%
1.A.2. Manufacturing Industries and Construction	72.2	115.4	142.8	153.5	144.9	152.9	141.0	95.3%	-8.1%
2.A. Mineral Industry	16.4	26.1	28.3	30.5	28.0	29.0	28.4	73.2%	-6.9%
2.B. Chemical Industry	8.9	33.5	25.1	31.4	29.1	32.8	31.8	257.3%	1.3%
2.C. Metal Industry	13.1	18.5	20.5	31.7	29.3	28.2	28.0	113.7%	-11.7%
% of Total GHG Emissions (excl. LULUCF)	49.1%	61.8%	68.3%	69.8%	67.3%	67.9%	67.2%		

Source: Own elaboration based on Government of the Republic of Korea (2025).

Note: Rounding errors may occur.

The power sector

Since 2018, a modest decline in emissions from the power sector has been observed, reaching 257.5 ($MtCO_2eq$) in 2022[155]. This trend can be attributed to several factors, including the gradual phase-out of the most polluting coal-fired power plants, improvements in industrial energy efficiency, increased reliance on nuclear energy, and a growing share of solar PV and other renewables. The inclusion of the power sector in the K-ETS, along with the transition towards gradual auction-based allowance allocations (see Section 2.3), may also have contributed to emissions reductions. However, carbon pricing in the electricity sector remains a politically sensitive issue in South Korea, limiting the pace and scope of decarbonisation measures.

Decarbonisation of the power sector is shaped around a gradual coal phase-out – in the short term with gradual closure of old and inefficient coal-fired power plants, and its substitution by imported natural gas (although domestic drilling is currently being explored[156]), and co-firing (coal burnt blended with ammonia, gas – with hydrogen). Alongside politicised debates about nuclear and renewables that were reflected in the recent targets, this debate will most likely continue again with the new government. The

feasibility of scaling renewables would increasingly bet on large-scale offshore wind deployment – an industry still in development in Korea (see Box 5).

Box 5. Offshore wind in South Korea

Like solar, wind energy deployment in South Korea faces significant geographical constraints. With over 70 % of the country covered by mountains and most flat land already used for agriculture or urban development, available space for onshore wind is minimal. As a result, offshore wind is increasingly recognised as essential to meeting, and eventually raising, the country's renewables targets[157].

By 2019, South Korea's offshore wind portfolio included a handful of small bottom-fixed wind farms and demonstration turbines, often backed by foreign investment. These early projects were designed to showcase feasibility and attract long-term investment from both domestic and international developers[158]. The Korean Green New Deal embraced offshore wind as a strategic priority, setting a target of 12 GW by 2030 – an ambitious, if not to say more, leap from just 124.5 MW installed in 2022[159]. In 2024, this target was further increased to 14.3 GW[160].

However, progress has obviously lagged. In August 2024, a study[161] to support the EU Climate Dialogues highlighted the gap between South Korea's 2030 objective for 14.3 GW offshore wind installed capacity and 142.1 MW installed capacity in late 2023.

Geographical and technical challenges also affect offshore wind deployment in Korea. Water depth and complex seabed geology limit suitable areas for bottom-fixed turbines, while wind generation shows strong seasonal variation, with significantly lower output in summer[162]. According to Aurora[163], load factors range from 27-32 % for fixed offshore and 35-40 % for floating offshore, with the east coast and Honam region seeing better load factors than the west coast.

These relatively modest wind speeds, especially in near-shore zones, make the business case for offshore wind less compelling – compared with high winds in northern Europe, which pioneered offshore wind industry. While floating offshore turbines can access stronger winds farther from shore, deploying them in generally lower wind conditions remains in the earlier phases. If commercialised successfully, floating wind technology tailored to lower wind areas could prove decisive in decarbonising Korea's power sector.

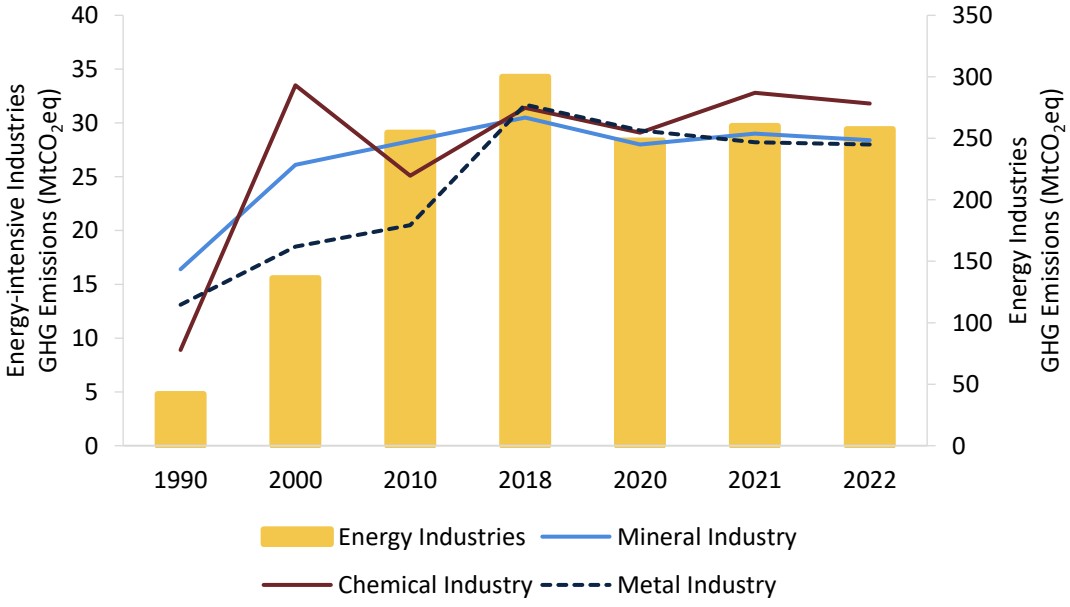
Offshore wind development in Korea has also faced regulatory and infrastructure-related hurdles. The permitting process remains complex, involving numerous agencies and lacking coordination, while the regulatory framework often fails to account for the specific technical needs of offshore wind. Grid infrastructure remains inadequate and costly to upgrade, with developers facing significant uncertainty around securing grid connection from the KEPCO, the sole transmission and distribution operator[164]. In addition, the domestic supply chain for key components is underdeveloped, and there is limited government risk-sharing, further dampening investor confidence[165]. Stakeholder engagement also requires improvement to avoid project delays and local opposition.

Since then, a major legislative step has been taken: the South Korean National Assembly passed the Special Act on the Promotion of Offshore Wind Power Development and Distribution, or Offshore Wind Promotion Act in February 2025[166], which aims to streamline regulatory frameworks and speed up development in a streamlined manner.

Industrial decarbonisation

In addition to the power sector, energy-intensive industries are a major contributor to national GHG emissions, with mineral, chemical and metal producers among the largest emitters. In 2022, they accounted for around 67.2 % (88.2 $MtCO_2eq$) of direct emissions from Industrial Processes and Product Use, which in turn made up 12.2 % of Korea's total emissions[167] (Figure 12). In addition to direct emissions, energy-intensive industries are the largest consumers of energy in Korea, responsible for 26.3 % of total final energy consumption in 2022[168] (see Section 2.1).

Figure 12: GHG emissions of selected energy-intensive industries in South Korea, 1990-22



Source: Own elaboration based on Government of the Republic of Korea (2025).

Industrial emissions from key sectors, including steel, cement, petrochemicals and oil refining are currently expected to decrease by around 80 % by 2050 from the 2018 baseline in line with the 2050 Carbon Neutral Strategy[169]. The 2030 interim target initially aimed for a 14.5 % reduction but was revised down to 11.4 % in 2023[170] – a move by the Yoon government that is increasingly debated domestically.

The problem of indirect emissions in industry is closely tied to the reliance of South Korea's power mix on fossil fuels. This reliance risks undermining the climate benefits of electrification of industry unless paired with a rapid clean energy transition[171].

Options to reduce emissions or completely decarbonise industrial processes in hard-to-abate industries vary from sector to sector, with a range of technological options all at different stages of R&D&I and economics. Below, three boxes provide a brief overview of the challenges faced by the steel, cement and petrochemicals sectors in South Korea.

Box 6. Steel sector in South Korea

The steel sector plays a key role in South Korea from both an economic and climate perspective, as the country is the world's 3rd largest exporter of steel[172]. The sector accounts for around 38 % of industrial emissions[173]. Steel production in South Korea is particularly carbon-intensive, with emissions averaging around 1 640 $KgCO_2$ per tonne of steel – around 125 $KgCO_2$ *above* the world average[174]. The high carbon intensity stems from a strong reliance of the sector on carbon-intensive production methods, such as coal-based blast furnace-basic oxygen furnace[175].

Under current policies, emissions from South Korea's steel industry are expected to peak around 2030 and decrease to roughly 90 $MtCO_2eq$ by 2050 compared with around 105 $MtCO_2eq$ in 2017[176], thus falling short of required reductions to align with net-zero emission scenarios by 2050[177].

Decarbonisation pathways for the steel sector may include a combination of technologies:

i) increasing deployment of electric arc furnaces using direct reduced iron from hydrogen-based processes (DRI-EAF-H_2),

ii) combining DRI-EAF processes with carbon capture and storage (DRI-EAF-CCS),

iii) scaling up the use of scrap steel in electric arc furnace production processes (EAF-scrap)[178].

According to some scenarios, increasing the use of hydrogen and renewable energy in steel production, supported by targeted policy incentives, could enable emissions to decrease to below 10 $MtCO_2eq$ [179].

The Korea Iron and Steel Association, representing leading producers such as POSCO and Hyundai Steel[180], has committed to the decarbonisation of the steel sector and South Korea's 2050 carbon-neutrality target[181]. South Korea's leading steelmakers are investing in electric arc furnaces to produce low-carbon steel[182]. However, challenging market conditions surrounding overcapacity on the global steel market and trade tensions with the US increase uncertainty around these investments[183].

Internationally, South Korea is falling behind in the deployment of low-carbon steelmaking technologies. For instance, Sweden and the US aim to have their first hydrogen-based steel

plants operational by 2026, whereas South Korean plans do not anticipate deployment before the mid-2030s[184].

In February 2023, the Ministry of Trade, Industry, and Energy released the Steel Industry Development Strategy for Transition to Low-Carbon Steel Production[185]. Financial support focuses heavily on R&D for retrofitting existing facilities. While the plan includes funding for hydrogen-based production, most resources aim to make conventional methods cleaner, for example through increasing the use of scrap and/or low-carbon fuels.

Box 7. Petrochemicals in South Korea

In 2022, the petrochemical sector made up 21 % of Korea's industrial emissions, amounting to 51.9 $MtCO_2eq$. Sectoral direct and indirect emissions have increased by 25 % since 2020[186], largely as a result of production due to rising global demand. As of 2020, direct emissions represented the largest share with 68 %, while indirect emissions made up around 31 % of total GHG emissions in the petrochemical sector[187]. Current estimates suggest petrochemical emissions could continue to grow from 51.9 $MtCO_2eq$ in 2023 to 54.8 $MtCO_2eq$ by 2030[188].

Opportunities for reducing direct emissions from petrochemical production can broadly be divided into two categories:

i) feedstock-related strategies, such as increasing the use of low-carbon materials,

ii) process decarbonisation through low-carbon fuels and the innovative technologies, including electrochemistry[189].

While progress has been more advanced in the feedstock category, all strategies remain at the R&D stage in South Korea. Full commercialisation of most technologies is expected only from 2030 onwards[190].

Opportunities for process decarbonisation in the petrochemical sector also include CCUS. Still, Korea ranks 8th globally in CCUS innovation and lags behind in commercial deployment. Unlike the US and Europe, and despite investment, South Korea has not yet commercialised CCUS technologies, arguably due to uncertainty around techno-economic viability[191].

Although leading chemical companies like LG Chem are pursuing different measures to decrease direct emissions, including enhancing the use of low-carbon fuels and materials and alternative production processes, these efforts are deemed insufficient by some observers[192].

Box 8. Cement sector in South Korea

The cement sector is Korea's third-largest industrial emitter, producing 34.1 $MtCO_2eq$ in 2018[193]. Sectoral emissions are predominantly due to carbon content and processing of key input materials of cement, such as clinkers[194]. In 2018, the carbon intensity of Korean cement was at around 830 $KgCO_2$ per tonne of Portland cement[195]. By 2023, the carbon intensity decreased to around 770 $KgCO_2$ per tonne – slightly above the European average of approximately 750 $KgCO_2$[196]. For comparison, the production of one tonne of concrete emits around 190 $KgCO_2$ in Korea[197].

Potential pathways to reduce emissions in the petrochemical sector include:

- expanding the use of supplementary cementitious materials, such as calcined clays and limestone powders,
- capturing carbon, also directly into cement and concrete products through CCU technologies,
- increasing the use of alternative fuels, particularly plastic waste and biomass[198].

A major challenge for Korea's cement sector is finding low-carbon alternatives to limestone, a key input. Promising substitutes exist but remain underdeveloped domestically, and the lack of industry-wide standards limits their adoption. Moreover, reducing fuel consumption, responsible for around a third of cement manufacturing emissions, remains difficult as less carbon-intensive alternatives are still in early development stages[199].

2.2.4. Mid-term technological innovation across sectors

In the mid-term, Korea's emissions reduction strategy assumes that hydrogen and carbon capture and storage (CCS) will do major heavy lifting.

The hydrogen economy

In its current climate strategy, Korea has placed a strong bet on various hydrogen-based technologies, arranged under the umbrella of the hydrogen economy, with the country aiming become a **'hub for a sustainable hydrogen economy'**[200]. This ambition was outlined in the 2019 Hydrogen Economy Roadmap[201], and has been further detailed in the 2021 First Master Plan for the Implementation of the Hydrogen Economy[202], setting out concrete milestones from 2020 through to 2050 (see Box 9).

In Moon Jae-in's 2020 Green New Deal, hydrogen was positioned as a strategic future industry. This was largely continued by the Yoon administration (2022-25), which was particularly interested in hydrogen technologies and uses, supporting 'blue, green and pink' (nuclear-based) hydrogen production. Yoon's hydrogen push was also demonstrated by investment in hydrogen R&D and the continuation of hydrogen cities, with five such

cities planned by 2025. Ansan became the country's first hydrogen demonstration city in October 2024[203].

In terms of its end use, hydrogen and ammonia are central to Korea's decarbonisation plans, particularly in industrial sectors and power generation. Blending ammonia with coal is seen as a way to cut emissions while extending the life of existing coal plants.

Since the introduction of the 2019 Roadmap, Korea has built a green hydrogen plant in Ulsan with a daily production capacity of 30 tonnes, and a smaller facility in Samcheok, complemented by pilot programmes for hydrogen-powered public transport in several cities[204]. To further develop the hydrogen economy, Korea's private sector is investing heavily in technology sharing and novel projects[205]. Notable projects include international technology partnerships with foreign companies[206] and large-scale investment to build hydrogen production, transportation and storage technologies, for example by companies such as SK Group, Hyundai, and POSCO[207].

From a policy perspective, Korea is leveraging instruments such as contracts for difference to accelerate its hydrogen transition. These auctions guarantee a fixed price for hydrogen-based electricity[208] for the winning bidder. Under this system, the government plans to purchase up to 6 500 GWh of electricity annually through 15-year contracts, starting in 2028[209]. The first auction was launched in May 2024[210]. The only winning bid, announced in December 2024, is Korea Southern Power (KOSPO)'s Samcheok coal-fired power plant site, set to deploy ammonia co-firing.

Public investment also plays a role in developing the hydrogen economy. In 2021, the Korean government spent USD 702 million on hydrogen projects, with an additional USD 2.3 billion dedicated to establishing a market for hydrogen-powered vehicles[211]. In 2025, Korea announced the launch of a USD 34 billion fund for loans and investment programmes in strategic technologies, including hydrogen, which will be provided through the Korean Development Bank from 2025 to 2030[212].

These investments are supported by ongoing regulatory reform. The Ministry of Trade, Industry, and Energy is convening public-private working groups[213] to adapt Korea's legal and regulatory framework, including reforms, across the hydrogen value chain, spanning production, distribution, and utilisation[214].

However, sectoral developments have emphasised grey and blue hydrogen, at the expense of green hydrogen – which occupies a limited position in South Korea's plans. This can be largely explained by the low renewables share in South Korea's electricity mix and arguably by the limited technological and geographical conditions for large-scale renewable expansion beyond offshore wind, which is still at a nascent stage.

International agreements and supply chain improvements are therefore considered essential to forging ahead with the hydrogen transition[215]. In partnership with Japan, Korea is advancing a hydrogen strategy dominated by blue hydrogen, with plans to import hydrogen and ammonia from fossil-fuel-rich countries like those in the Middle East.

Box 9. The First Master Plan for implementing the Hydrogen Economy (2021)

The First Master Plan for implementing the Hydrogen Economy sets key milestones to significantly expand the production and use of hydrogen as well as complementary infrastructure in South Korea by 2050[216].

By 2030, hydrogen demand is expected to reach 3.9 million tonnes, with around 90 % allocated to power generation. This demand is expected to be met with approximately 50 % of imports and the rest coming from domestic grey and blue hydrogen production. Infrastructure plans include the deployment of hydrogen vehicles (both passenger and commercial) and the rollout of a nationwide hydrogen charging network [217].

By 2050, hydrogen demand is projected to surge to 27.9 million tonnes – a seven-fold increase from 2030 levels. Power generation is estimated to account for nearly half of total hydrogen consumption, followed by industrial applications (38 %) and transport (8 %). Domestic supply is expected to cover about 18 % of demand through green and blue hydrogen production, with the vast majority (around 82 %) of hydrogen continuing to be sourced from abroad. To support this scale-up, Korea aims to further develop its hydrogen infrastructure though a domestic pipeline network, and a large number of overseas supply chains. The plan also includes ambitious goals for emerging applications, such as hydrogen-powered ships and aircraft[218].

Carbon capture, utilisation and storage

Carbon capture and storage (CCS) is another technology that South Korea currently considers an important tool to achieve carbon neutrality by 2050[219]. Capture technologies can be applied to the decarbonisation of hard-to-abate sectors and waste incineration and can facilitate the transition from coal to gas-fired generation with CCS[220, 221]. In the medium term, CCS is also seen as an enabler for Korea's hydrogen economy, by capturing emissions during hydrogen production from natural gas.

CCS remains a solution yet to be deployed at the needed scale for storage and capturing CO_2, and only in R&D and early demonstration stages for capturing in industrial emissions. Another critical observation rests on the argument that over-reliance on CCS may delay real systemic transformation as well as simply export emissions outside Korea as stored CO_2.

In April 2023, the government updated its 2030 CCUS target in the 1st National Basic Plan for Carbon Neutrality and Green Growth[222], increasing it from 10.3 $MtCO_2$ to 11.2 MtCO[223].

The regulatory framework for CCUS was outlined in January 2024 by the Carbon Dioxide Capture, Usage and Storage Act. This legislative framework addresses previous regulatory fragmentation by establishing permitting procedures, monitoring responsibilities, and introducing certification for capture processes and CCUS products, as well as support for international collaboration. Although the Act offers financial incentives to foster CCUS deployment[224], the high cost of retrofitting industrial facilities for CCS remains a barrier[225].

Yet, private sector initiatives are emerging. In January 2024, K-water, BKT, and Capture6 signed a Memorandum of Understanding to develop a pilot facility integrating direct air capture and CCS into desalination processes near the Daesan Industrial Complex, a major petrochemical hub[226].

One of the largest CO_2 storage projects involves Hyundai Heavy Industries and Korea National Oil Corporation, which plans to store 1.2 $MtCO_2$ per year in the depleted Donghae-1 offshore gas field starting in 2028[227]. South Korea nonetheless faces geographical constraints for large-scale geological CO_2 storage. To address this, companies are exploring CO_2 export options, with initial agreements signed with partners in Malaysia and Australia[228].

Meanwhile, policy attention on R&D seems to shift towards carbon capture and utilisation (CCU) technologies. Since 2017, R&D investment in CO_2 utilisation has outpaced that in CO_2 transport and storage, driven by interest in chemical and biological conversion[229]. The Technological Innovation Roadmap for CCU[230], announced in 2021, sets goals to commercialise CCU products by 2030 and achieve price competitiveness by 2040. Five pilot CCU projects across major industrial sites are scheduled to launch in 2026[231].

2.3. Carbon pricing as a long-term investment signal for the low-carbon transition

South Korea launched its own ETS (K-ETS) in 2015 as one of the earliest carbon markets in the Asia-Pacific region. Set to enter its fourth phase in 2026, K-ETS faces complex technical challenges and political sensitivities, increasingly shaped by the interplay between electricity market reforms and market-based climate mitigation strategies.

Persistently low K-ETS prices have limited the policy's impact, largely due to an oversupply of allowances and political reluctance to allow the full pass-through of carbon prices. This has helped protect industrial competitiveness but come at expense of the system's effectiveness. To increase its environmental effectiveness, the K-ETS will require more ambitious cap levels and greater stringency, an effort that will inevitably place the interests of the power sector and major industries at the centre of political negotiations.

Meanwhile, external developments are also shaping Korea's carbon pricing debate and with it potentially the future of the K-ETS. The EU's CBAM, for instance, adds a new layer of complexity by pushing for greater alignment between Korea's domestic reforms and global climate policy – and has become a contested issue in national politics and relations with the EU (see Section 3.3.4). The impact of CBAM remains to be seen, with uncertainty and concern surrounding its implementation and arguably contributing to hesitation and ambiguity in South Korea's deliberations on its domestic carbon pricing policy.

2.3.1. Korea's ETS: Increasing environmental integrity

The K-ETS was established under the Framework Act on Low Carbon, Green Growth (2010) and was based on the Target Management System, which 'still applies to smaller entities not covered by the K-ETS'[232]. In 2025, the K-ETS is approaching the end of its third phase (2021-25) (Box 10). The system currently covers entities with at least 125 000 tonnes of annual GHG emissions or with installations emitting at least 25 000 tonnes of CO_2eq per year, representing around 74 % of the country's total GHG emissions and over 800 companies[233].

To ensure compliance, K-ETS has a system for monitoring and verifying emissions which requires companies to submit a yearly report that is verified by an accredited third party. Once the report is approved, participants must surrender allowances to cover their reported emissions for the year[234].

Emission allowances are freely allocated and/or can be purchased through public auctions. In the current stage, only 10 % of allowances are allotted through auctioning and the price signal has remained chronically weak, raising overall concerns about the environmental effectiveness of the carbon pricing instrument. Covered entities are allowed to participate, to some extent, in banking and borrowing schemes in which they

can save unused allowances from previous years for future years or use allowances from future periods to cover responsibility in the current period[235].

To address potential price volatility, there are stability mechanisms that can influence the amount of tradable emission allowances in the market to stabilise the price if pre-determined conditions are met[236].

Government revenues from auctioning emission allowances are channelled into the Climate Response Fund[237], which finances 'emissions mitigation infrastructure, low-carbon innovation, and technology development for small- and mid-sized companies covered by the K-ETS'[238]. Since the K-ETS was established in 2015, roughly USD 1 billion (KRW 1.4 trillion) has been generated through auctions. In 2024, the revenue was around USD 136.4 million (KRW 185.9 billion)[239]. To put this into perspective, the EU ETS generated around USD 37 billion (EUR 33 billion) in auction revenue in 2023 alone[240]. While a direct comparison is not entirely appropriate, given that the EU's GDP is roughly 11 times larger than Korea's[241], the scale of the difference is still notable as EU ETS revenues were over 270 times[242] higher than those of Korea in 2024.

Reflecting on the K-ETS design highlights one of the reasons for this difference: only a small share of allowances are allotted through auctioning, with the majority being freely allocated with a generously allocated cap. This leads to a chronically weak market price and low liquidity, which limits auction revenues and raises doubts about the effectiveness of the K-ETS.

Box 10. K-ETS development (2015-to date)

The development of K-ETS is structured in phases, each intended to become progressively stricter and expand sectoral coverage.

Phase 1 (2015-17) aimed to build operational capacity and ensure a smooth rollout. It involved 100 % of emission allowances being allocated for free to market participants. The amount of allowances was calculated based on average historic emissions of the baseline year, and for three selected industries – oil refining, aviation, and grey clinker cement production – on the basis of a benchmarking approach[243].

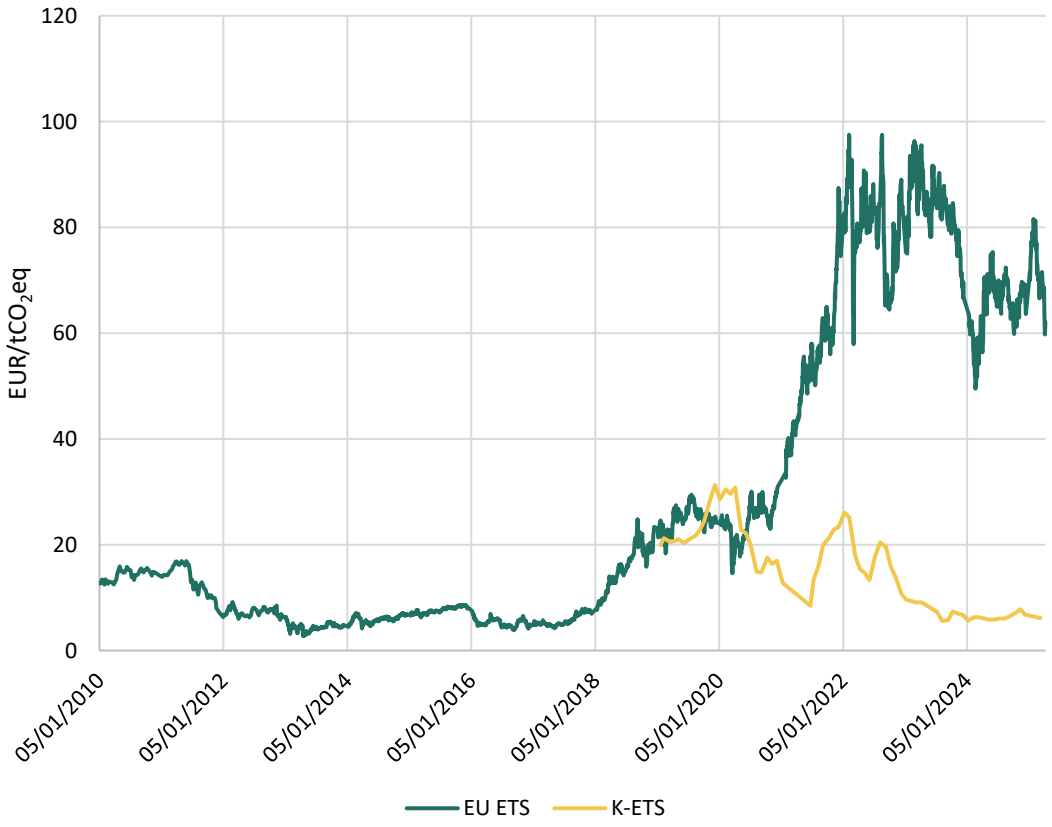
Phase 2 (2018-20) introduced auctioning as a means of allocating emissions, yet with only 3 % of total allocations being auctioned, and 97 % being allocated freely. Free allocation remained at 100 % for emission-intensive and trade-exposed sectors to protect their international competitiveness. Auctioned allowances were subject to a price floor and quantitative limits on the emission allowances that bidders could acquire in one auction. The benchmarking approach was extended to multiple new sectors, including power generation, industrial complexes, petrochemicals, and waste.

Phase 3 (2021-25) was officially approved in September 2020 and aims for an emissions reduction of 4 % relative to the phase 2[244]. The coverage of firms was expanded to around 74 % of South Korea's emissions[245]. Due to the increase in covered entities, total average annual allowances entering the system increased despite a reduction in emissions covered by the ETS during 2021-25'. The share of auctioned allowances increased to 10 %, covering 41 out of the 69 ETS-covered industries[246].

Phase 4 of the K-ETS will cover the period from 2026 to 2030. Preparation is underway, with more details to be announced in June 2025[247].

The weak and volatile price signal is arguably one of the most significant challenges of the K-ETS from a clean transition perspective. Prices peaked at around EUR 30 per tonne of CO_2eq between 2019 and 2022, dropped to approximately EUR 8 in 2021, before rebounding to EUR 20-26 in 2022. However, since then a gradual decline has been visible, with current prices plateauing around EUR 6-7 per tonne, which is substantially lower than the EU ETS price of EUR 60-80 (See Figure 13).

Figure 13: Prices for emission allowances under the EU ETS and K-ETS, 2010-25



Source: Own calculation based on ICAP (2025).

Reasons for the low price can be traced back to several factors, including an oversupply of (free) allowances[248] and volatile trading dynamics. Over the past decade, several reforms have been introduced which impact the market dynamics of the K-ETS, including the market stability mechanism and third-party participation (e.g. pension funds) to facilitate demand and liquidity. There has been a gradual shift to more stringent allocation rules, such as the increasing adoption of benchmarking, which allocates allowances based on the performance of the most efficient installations rather than historical emissions levels[249]. Beyond this, to increase liquidity, entities subject to the K-ETS have also been allowed to participate in 'banking and borrowing' schemes[250].

While these reforms have improved the system's architecture, they have not delivered a robust price signal yet. Looking ahead, one critical milestone will be the setting of the 2026-30 cap, to be announced by the Ministry of Energy in June 2025. This decision will be vital in setting the tone and ambition for the next phase of Korea's ETS. Considerations of more closely aligning the K-ETS with South Korea's long-term commitment of reaching climate neutrality by 2050 also include deliberations on more ambitious reduction rates for the allowances cap during Phase 4, e.g. being already tied to an enhanced NDC beyond 2030[251].

The arguments in favour of a more stringent allowances cap – and thus, stronger price signals – are well known. In many cases, measures to shift carbon costs onto producers are among the only effective ways to drive them to invest in clean technology.

Reducing the number of free allocations would also increase government revenue from auctioning. This, in turn, would increase the relevance of channelling these funds effectively through a transparent, well-functioning fund that supports the development and deployment of clean technologies as well as a more just transition. A way forward could be to ensure that revenues flow back to the covered sectors in a strategic way, as support for innovation, R&D, and long-term decarbonisation.

While ways to increase the environmental effectiveness of the K-ETS are crystal clear, they must be balanced with domestic social and political realities[252]. A higher carbon price, especially if perceived as externally imposed or required for export competitiveness, as in the case of CBAM, could exacerbate political tensions and severely affect public support for carbon pricing in Korea.

This is particularly sensitive when it affects electricity prices in South Korea. A critical issue is managing the political fallout from potentially higher electricity costs due to more stringent carbon pricing. Korea remains heavily dependent on energy imports. Following Russia's invasion of Ukraine, global LNG prices surged, placing immense financial pressure on Korea's state utility, due to fixed end consumer prices and rising input costs. The ETS adds another layer of cost for electricity producers. In 2023, compliance costs for the

utility were estimated at EUR 200 million[253]. However, rather than passing this cost on to consumers, it has largely been absorbed into the deficit of state-owned companies. While the government has introduced gradual price adjustments, they still do not fully reflect the carbon costs imposed through the K-ETS.

The latest 11th Basic Plan for Electricity[254] suggests an intention to liberalise the electricity market further, but concrete implementation remains to be seen. In the long run, sustainable carbon pricing requires that costs be passed through to consumers – something that is politically difficult but essential for real market transformation.

2.3.2. K-ETS as an example of good practice in the region: External perceptions of effectiveness

Despite some shortcomings of the K-ETS discussed above, the feedback on the system gathered through policy dialogue with Korea's neighbours is often positive and shared by a wide range of stakeholders from civil society, government agencies and international partners.

Even so, this positive perception of the K-ETS should take its performance with a grain of salt. So far, the K-ETS has not delivered the emissions reduction or the pricing signals needed for an effective carbon market. Adopting the K-ETS simply as a blueprint without fully understanding its design and inherent shortcomings could result in limited environmental effectiveness of the policy instrument. That is, unless it is an intentional decision by the legislature.

On a positive side, one area where the K-ETS *has* made progress is in monitoring, reporting and verification (MRV). The establishment of a functioning MRV framework has improved transparency on emissions and accountability. So even though the cap-setting process and price signal are not where they need to be to effectively drive decarbonisation, the K-ETS has at least helped establish a shared reference point for measuring emissions more consistently.

2.3.3. Beyond carbon pricing: Creating a business case for low-carbon goods

Carbon pricing is widely recognised as a key market-based instrument that, by establishing a price signal for emissions, incentivises the shift from emission-intensive production to cleaner alternatives. In principle, carbon pricing can help close the cost gap between conventional and low-carbon production. This gap is particularly relevant in the early stages when new technologies face higher production costs due to significant upfront investment.

That notwithstanding, carbon pricing does not resolve the issue of higher costs for low-carbon goods being passed through to consumers. If the 'green premium' – the cost gap between conventional goods and low-carbon goods – is passed onto consumers, the higher prices may reduce demand and weaken the business case for low-carbon goods. Over time, economies of scale are expected to reduce these costs, but demand uncertainties in the early stages of the market can deter investment in clean technologies.

In this context, market-based instruments like an ETS can be complemented by supply-side measures, such as subsidies or carbon contracts for difference, to reduce costs and risks associated with the deployment of low-carbon technologies.

'Lead markets' are a (complementary) demand-side framework to create a clear business case for low-carbon goods. These involve sectors that are better able to absorb the 'green premium', such as the automotive and building sectors, where the impact of additional costs for low-carbon materials on final prices is relatively small. In Europe, linking public procurement to carbon intensity standards and (voluntary) labels are considered to create lead markets and stimulate the uptake of clean technologies – as the core of the Clean Industrial Deal policies.

The effectiveness of lead markets still depends on having clear and robust definitions of what qualifies as 'low carbon'. While various private initiatives aim to define low-carbon goods, such as green steel[255], no internationally harmonised standards exist (see Box 11). This fragmented landscape hampers the creation of a global market for low-carbon goods.

South Korea has a long history of using **voluntary environmental labelling** to promote the uptake of ecofriendly products[256]. The Eco-Label Certification System was launched in 1992 and complemented by a Carbon Footprint Label in 2009[257]. As of December 2024, the Eco-Label Certification System covered eight product areas, including industrial and household items, spanning 155 product categories. Companies can apply for certification of different label criteria, such as 'improved resource circulation' or 'energy conservation'[258]. Under the Carbon Footprint Label, products meeting specific thresholds or achieving defined reductions can qualify for 'low carbon product certificates'[259]. South

Korea is also a member of the Global Ecolabelling Network[260] and has signed mutual recognition agreements with international partners, including the EU, to facilitate compliance with foreign standards like the EU's Battery and Ecodesign regulations[261].

As with labelling schemes, the use of **public procurement** to promote ecofriendly products is well established South Korea. In 2005, Korea introduced the Act on Promotion of Purchase of Green Products, which set mandatory public procurement quotas for eco-labelled products. Complementing the quotas, 'Minimum Green Standards' were defined for selected product categories in 2010. These include requirements for energy efficiency, standby power reduction, the reduction of hazardous substances, recyclability, and other environmental parameters[262].

Box 11. Lead markets for low-carbon steel

There is a modest but increasing appetite for low-carbon steel, influenced by the decarbonisation targets of major downstream sectors and by regulatory measures across different jurisdictions[263]. As one of the world's largest steel producers with a significant share of industrial emissions, low-carbon steel is both environmentally and economically an opportunity for South Korea. Yet currently around 64 % of national steel capacity still relies on coal-based production, and without targeted policy, low-carbon steel is projected to account for less than 2 % of production by 2030 in Korea[264].

Relocating steel production to countries with abundant renewables (friendshoring in EU jargon) could improve access to low-carbon feedstock like green hydrogen and thereby reduce production costs for low-carbon steel. Such moves, however, raise security concerns about domestic retention of this strategic industry. South Korea, still technically at war with North Korea, views domestic steel production as a strategic asset, making offshoring decisions also a question of national security.

In turn, in resource-poor setups, domestic production of low-carbon steel also poses challenges related to cost pressures, market access and competitiveness. The impact of the 'green premium' on the prices of low-carbon steel produced in South Korea looms large. A recent study[265] highlights the risk of a competitiveness gap for Korean low-carbon steel on global markets.

If low-carbon steel production in South Korea is seen as a strategic sector for the future, this increases the importance of building up strong **domestic demand to create lead markets for low-carbon steel** – to incentivise investment in low-carbon production and enable cost reduction through economies of scale.

Domestic steel consumption in Korea is primarily driven by the construction sector (35 %), the automotive sector (26 %) and shipbuilding (18 %)[266]. According to Hasanbeigi et al. (2024)[267], these sectors present varying levels of suitability as lead markets for low-carbon steel in Korea. **The automotive sector** shows the most promise, with only a minor impact on final vehicle costs, followed by construction and shipbuilding.

South Korea already has several key policy pillars in place that could support lead markets for low-carbon steel – including plans for gradually more stringent carbon pricing[268], public procurement and labelling schemes. Steering the latter towards key lead markets like automotive and construction could strengthen domestic demand for low-carbon steel.

Despite having industry-level climate targets, Korea lacks specific goals, such as for the steel sector. Clearer targets could increase investment certainty in low-carbon steel production but come with associated sensitivity with respect to the economic burden on industry.

3. Key pathways to deepen EU-Korea cooperation on the green transition

In a world where climate ambition is increasingly fragmented, and where trade tensions and economic uncertainty are on the rise, key questions emerge for strengthening EU-Korea cooperation. Despite certain friction points, such as CBAM, this report explores ways for the shared pursuit of economic and industrial resilience in the clean transition to become a unifying pillar for the two partners. Different pathways towards climate ambitions and differences in approaches to decarbonising the energy sector and heavy industries will undoubtedly play a role. Nonetheless, there is certainly room for intensifying joint effort: a dual focus on industrial competitiveness and economic security can drive, rather than hinder, deeper EU-South Korea cooperation on the green transition.

3.1. A green partnership

EU-Korea relations upgraded to a Strategic Partnership in 2010, and are grounded on three legal agreements for political, trade and security cooperation[269]. Since then, the relationship has deepened and expanded, with strengthened cooperation in key policy domains. These range from digital technology to health, education, transport, security, research and innovation, climate, energy and the environment. The latter have become a defining area of bilateral engagement over time, intertwined with other policy issues. **The EU-Korea Free Trade Agreement** (FTA), in force since 2011, was the EU's first 'new generation' FTA and its first agreement of this kind in the Asia-Pacific region, serving as a blueprint for subsequent agreements with other nations. It goes beyond traditional FTAs by including provisions on labour and sustainability and incorporating a dedicated dispute settlement mechanism[270]. Dialogue on trade and sustainable development (TSD) is conducted within the EU-Korea TSD Committee[271] and serves as a platform to discuss a wide range of issues, from climate ambition to decarbonisation of maritime transport and renewable energy.

In 2018, the EU and South Korea established **Working Group on Energy, Environment and Climate**, with delegates from the EU's European External Action Service and South Korea's Climate Change, Energy, Environmental and Scientific Affairs Bureau of the Ministry of Foreign Affairs. This working group has arguably become a dedicated exchange platform and main 'steering instrument' for energy policies, climate change strategies and environmental issues[272]. The sixth meeting[273] of the working group took place on 10 October 2024 in Seoul, just weeks before the 2024-25 impeachment crisis in Korea. Its discussions focused on domestic policy developments, the security of global energy supply, with an exchange of views on 2030 NDC implementation, COP28 outcomes and COP29 objectives, and environmental issues from biodiversity to air pollution and hazardous chemicals. The next day, the Delegation of the European Union to the Republic

of Korea hosted a high-level seminar on NDCs[274] under the EU-Korea Green Partnership Programme. At COP29 in Baku in November 2024, the EU reiterated that it sees South Korea as a key partner in steering global climate ambitions, including through financial means[275].

The **EU-Korea Green Partnership**[276] was launched in 2023, providing a broad framework for cooperation on all aspects of the green transition. This encompasses but is not limited to collaborative effort on climate action, a clean and fair energy transition (including renewables), protection of the environment and biodiversity, clean industrial innovation and the circular economy. It further covers business, finance, research and innovation aspects. The partnership envisages joint promotion of shared priorities through cooperation with third countries and engagement on multilateral platforms[277]. The Green Partnership was established through a Memorandum of Understanding and reflects a political commitment characterised by 'light governance' and mutual goodwill. Its primary goal is to foster closer ties through dedicated dialogue, meetings, study tours and awareness-raising activities on both sides. It has multiple planned activities for 2025, reflecting the large scope of the Green Partnership and stakeholders from the public, private and civil society sectors. Themes for energy and industrial cooperation will include green shipping corridors for automotive logistics as part of the decarbonisation of maritime transport and offshore wind power[278].

The programme of the EU-Korea Green Partnership is funded through the European Commission's regional Multiannual Indicative Programme for Asia and the Pacific (2021-27)[279]. The programme is meant to strengthen the green diplomatic reach of the EU and Member States in Korea, support Korea's own transition and enhance industrial cooperation with an emphasis on the circular economy. It also fosters cooperation on green smart city innovation, pollution, biodiversity and sustainable production, trade and consumption[280]. The programme's counterparts in the Korean government include the Ministry of Environment, but also the Ministry of Trade, Industry and Energy; Ministry of Land, Infrastructure and Transport; Ministry of Foreign Affairs; Ministry of Oceans and Fisheries; and the Korea Forest Service.

Industrial decarbonisation and the clean energy transition have progressively come into focus for the strategic partners. Alongside the Green Partnership, the EU and South Korea held their first bilateral **Supply Chains and Industrial Policy Dialogue** in December 2023, to address matters of economic security, supply chain resilience, and industrial decarbonisation[281]. The dialogue explored regulatory alignment in sectors like hydrogen, critical raw materials, wind power, semiconductors, and the automotive industry. Further collaboration was also considered, which could cover joint monitoring tools, standards harmonisation, and discussions around hydrogen certification.

Progress in negotiations on research and innovation resulted in South Korea joining **Horizon Europe**, the EU's flagship research and innovation programme, as an associated country from January 2025 (Section 3.3.2). This will allow Korean researchers and organisations to participate in Horizon Europe's funding and collaborative projects from 2025 onwards[282]. This participation includes access to Pillar II of the programme on addressing global challenges such as the climate, energy, digital economy, and health, with a budget of EUR 53.5 billion[283]. Overall, deeper cooperation on R&D matters related to industrial decarbonisation and the clean energy transition will be made possible through Horizon Europe cooperation.

The November 2024 **EU-Korea Security and Defence Partnership** helps to frame the green industrial transition as a common security imperative, stimulated by innovation. EU diplomacy in Seoul recently highlighted the broader EU-Korea strategic relationship in the Indo-Pacific region and its current triple focus on green, digital and security aspects. In an interview, the EU ambassador to the Republic of Korea also emphasised that increasing renewables in Korea's energy mix was in the country's best interest, including from a security point of view[284].

In addition to EU-Korea relations, South Korea has several well-established **bilateral partnerships with EU Member States** on specific clean transition topics. For example, the South Korea-Denmark Green Growth Alliance[285], which was set up in 2011, has more recently focused on offshore wind projects and green hydrogen. The Korean-German Energy Partnership[286], in place since 2019, has annual Korean-German Energy Days and has lately taken a similar interest in hydrogen technology[287]. A long-running Korea-France Joint Coordinating Committee on Nuclear Energy was set up in 1982 and met for the 25th time in November 2022[288] to underline sectoral opportunities – as former Korean president Yoon Suk-yeol was kickstarting a nuclear revival. In 2018, during the presidency of his nuclear-averse predecessor Moon Jae-in, the two countries reached an agreement to cooperate on technological safety and the decommissioning of nuclear reactors[289].

3.2. BETWEEN PARTNERSHIP AND REGULATORY INFLUENCE: A 'BRUSSELS EFFECT' IN KOREA?

Among the EU's close global partners, South Korea provides prime examples of EU regulations making an impact outside its borders. This influence is akin to the 'Brussels effect'[290], according to which non-EU partners adapt to EU regulations because it is more economically, legally and technically beneficial. That is not only in order to retain access to a sizable EU market, but also, in many cases, because it equates to aligning with the world's most stringent standards and regulations, uniformly across global markets.

To understand the potential impact of EU regulations in Korea, data privacy laws provide a useful case study. In 2020, South Korea amended its Personal Information Protection

Act[291] to align with the EU's General Data Protection Regulation (GDPR) and therefore facilitate bilateral data flows[292], deepening an already successful trade relationship. This alignment, which led to an 'adequacy decision'[293] from the EU, implies some level of political endorsement of the EU's digital values in South Korea. This translated into harmonised measures, such as free and informed consent and independent oversight[294]. It paved the way for the launch of the EU-Korea Digital Partnership in June 2023 which, while primarily targeting shared economic security objectives, emphasised the partners' like-mindedness in pursuing a 'sustainable, human-centric digital transformation'[295].

In the climate and energy sectors, tracing the Brussels effect in Korea is complex and multidimensional. Beneath joint leadership on the international stage on a variety of issues and strong trade ties, there is also Korea's hyper-awareness of the EU's ever-evolving regulatory frameworks, ranging from corporate governance to the EU taxonomy for sustainable activities, energy market regulations and carbon pricing. Since the launch of the European Green Deal in 2019, South Korean institutions and media have kept a close watch on related regulatory developments. The EU's Green Deal approach, which channels investment into structural changes towards reaching net-zero by 2050, clearly resonated with then-President Moon Jae-in (2017-22), who launched the Korean New Deal[296]. The latter included a large green component in 2020 – a pioneering move in the region[297] – although it proved vulnerable to a domestic political shift[298].

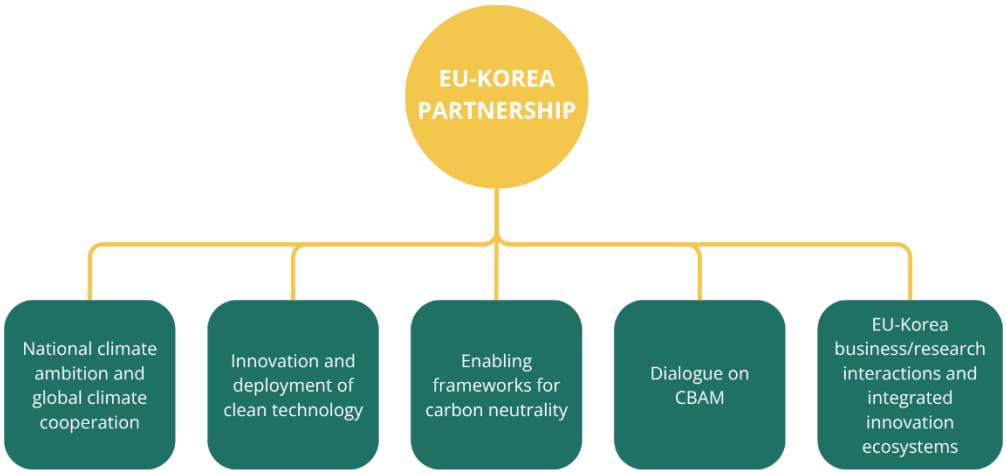
The intensity of South Korean media and political response to EU regulations is above all driven by the impact of EU regulations on domestic industries. South Korea remains a highly open, tech-heavy and export-driven economy: awareness and compliance with regulations in one of its main markets is a critical lever for competitiveness. South Korea was actively awaiting the EU's decision on a sustainable taxonomy to approve its own sustainability criteria. When the EU Taxonomy Complementary Climate Delegated Act[299] was adopted in 2022, its inclusion of nuclear energy and natural gas as transitional sources to accelerate decarbonisation had an outsized impact in Korea. While politically contentious in the EU, the Act was interpreted as legitimisation of nuclear energy in Korea and justified the expansion of opportunities for the domestic nuclear energy industry[300].

Yet despite these positive responses, a diplomatic thorn remains in EU regulatory impact on South Korea: the EU CBAM (see Section 3.3.4). While CBAM remains a difficult sell to the EU's international partners in general[301], its contrast with an otherwise excellent EU-Korea partnership makes it a weak link in bilateral relations.

3.3. STRATEGIC ENTRY POINTS FOR MORE EU-KOREA COOPERATION: LOW-HANGING FRUIT WITH A HIGH IMPACT

This section presents initial ideas and preliminary suggestions for advancing EU-Korea dialogue, informed by the preceding analysis and stakeholder discussions. The ideas are structured around five pillars to support an effective green policy dialogue, as illustrated below.

Key themes for future EU-Korea dialogue



3.3.1. Strengthening national climate ambitions and global climate cooperation

The EU and South Korea share the common goal of achieving climate (or, as framed in South Korea, carbon) neutrality by 2050, with interim targets for 2030 in place. In the EU, debate is intensifying around setting a 2040 target and preparing an updated NDC for 2035, to be presented at COP30 in November 2025. Future decarbonisation pathways are still being debated in terms of the appropriate level of ambition. The elephant in the room is the potential use of international carbon credits to meet climate targets. If the latter are pursued, this would imply a significant shift away from the EU's focus on domestic emission reductions.

Somewhat similarly, South Korea will submit a belated NDC update in September 2025, with progress largely dependent on the outcome of the June 2025 elections and the subsequent course of national climate policies. As both sides move forward, ongoing bilateral dialogue could be deepened, particularly on the use of carbon credits in achieving climate targets.

Rising uncertainty in global climate governance, notably linked to the upcoming withdrawal of the US from the Paris Agreement[302] for the second time, also raises critical questions about how to sustain global ambition. In this context, advancing climate finance mechanisms to stimulate cleantech adoption globally becomes even more urgent. Exploring new models for climate financing, including greater private sector engagement, could support broader green transition goals.

Looking ahead, cooperation on climate financing could become a key pillar of the EU-Korea Green Partnership. The EU and South Korea have both shown interest in engaging private actors through green bonds. Meanwhile, the Green Climate Fund, headquartered in South Korea, scaled up its private sector strategy[303] in May 2022 to catalyse private climate finance in a country-driven manner. In 2024, the Green Climate Fund approved a project led by the Korea Development Bank to promote the creation of a 'Climate Technopreneurship Fund'[304]. It provides entrepreneurs in five Southeast Asian countries with Korean technical assistance for research, development and business activities.

3.3.2. Innovation and deployment of clean technologies

R&D&I cooperation: Horizon Europe

R&D&I cooperation between the EU and South Korea will be greatly facilitated through the association with Horizon Europe from 2025 onwards. The Horizon Europe association should come with hard-earned regulatory and funding compatibility, administrative support, an increase in mutual awareness and visibility, and the related establishment of networking and matchmaking opportunities. These are not givens and will require initiative from both sides. In addition, it will be telling to observe how and to what extent the Korean and EU R&D agendas will align on a mix of technological, social and environmental concerns through Horizon Europe cooperation.

Several factors stand in the way of further R&D&I cooperation. One of the main stumbling blocks is the complexity of Horizon Europe itself. Korean researchers often find the programme difficult to navigate due to the heavy burden of documentation and administration. Moreover, language barriers, differences in funding systems and lack of established networks have been cited[305]. Thus, there is a strong need for more outreach, capacity building, and user-friendly communication. The EU is working closely with South Korea's National Research Foundation to help simplify access and better connect Korean researchers with European partners, mainly through the activities of the Korea-Europe Research Centre[306], which also includes support for National Contact Point activities.

Despite the challenges, there is clear potential for stronger engagement. Among the top-10 Horizon Europe projects involving South Korea, by budget and before full association, nearly half dealt with climate, energy, or environmental issues, including major projects

on liquid hydrogen and pollution reduction in transport[307]. These examples show that where the match is made, the results can be highly significant.

Looking ahead, the Green Partnership could serve as a catalyst to increase the share of cleantech and industry decarbonisation topics within EU-Korea R&D&I cooperation. South Korea's strong capabilities in advanced technologies, including AI, clean energy, batteries and hydrogen, position it as a key partner for cluster-specific programmes under Horizon Europe. In Europe, the perception of South Korea as a tech leader and the growing link between the green and digital transitions in both economies create strong foundations for expanding collaborative research at the intersection of climate, energy security, and technology innovation.

Advancing the twin digital & energy transition

The twin digital and green transition also remains an underexplored opportunity and is emerging as a critical area of interest for EU-Korea cooperation. Recent discussions, including a series of EU Climate Dialogues hosted by the EU Delegation in Seoul throughout 2024[308], in cooperation with the European Chamber of Commerce in Korea and consulting firm Asian Insiders, have highlighted keen interest in topics such as smart grids and grid decentralisation.

While the twin transition has not yet been fully addressed in existing cooperation programmes, there is growing momentum to prioritise it. Future initiatives could include industry-focused seminars and exchanges of best practice, particularly on smart grid technologies, digital solutions for energy management, and decentralised energy systems. Strengthening the digital-energy nexus could play a key role in unlocking renewable energy potential and accelerating the broader green transition.

Offshore wind: (Floating) wind technologies in lower wind areas

There is now an even bigger window of opportunity for the EU and Korea to cooperate on offshore wind. The EU and notably Member States such as Denmark and Germany have accumulated experience in constructing bottom-fixed turbines. Among others, Denmark and South Korea signed an offshore wind cooperation agreement back in 2018[309], and an energy partnership between Port Esbjerg and the Port of Ulsan was formed in 2024[310].

The EU also retains substantial expertise and technological capabilities in floating offshore wind that may hold significant interest from South Korea with substantial lower wind areas. It may be advisable to further explore collaborations on (floating) wind technology for lower wind conditions, through both new and existing cooperation channels to facilitate knowledge exchange and joint development efforts.

Carbon capture, storage and utilisation technologies

The EU and South Korea face common challenges in decarbonising industrial processes where electrification or alternative feedstocks remain technologically or economically unviable.

In Europe, industrial carbon management has returned to the policy agenda, particularly in terms of addressing hard-to-abate sectors[311]. In South Korea, there is a major strategic focus on CCUS, albeit extending beyond industrial decarbonisation and mainly concentrating on carbon capture in power generation and hydrogen production. Regulatory frameworks in South Korea and the EU are being developed to enable a business case for CCUS but costs and uncertain decarbonisation pathways continue to be barriers for large-scale deployment.

With flagship capture projects, industrial clusters, and one of the first operational CO_2 storage sites in Europe, a structured EU-Korea dialogue on CCUS technologies, regulatory frameworks, and storage infrastructure could be highly beneficial. Enhanced cooperation through R&D&I initiatives, including under Horizon Europe, offers a concrete way forward for joint innovation in this field.

3.3.3. Enabling (regulatory) frameworks for carbon neutrality

EU-Korea dialogue on carbon pricing

Carbon pricing remains a well-established climate policy instrument in both the EU and South Korea. Each has implemented a domestic ETS to incentivise decarbonisation across a number of sectors (for the discussion on K-ETS, see Section 2.3). There are clear indications that EU policies and norms have served as a source of technical inspiration for aspects of Korean energy and climate policy. While the K-ETS launched in 2015 was tailored to the country's political economy, the EU's ETS served as a case study and partial blueprint for Korean policymakers[312].

Yet, the level of ambition and the environmental effectiveness of these systems are and will remain politically sensitive domestic issues. K-ETS is set to enter its Phase IV, while during the previous political cycle, the EU ETS underwent profound reform, which included a more stringent and ambitious allowances cap reduction[313]. For both parties, ETS design – and especially the allowance allocation and allowance caps – is a focal point of domestic political debate, inevitably influenced by broader economic and industrial policy priorities[314].

Looking externally, a shared challenge for the EU and Korea is how to maintain a level playing field in a global context marked by uneven climate ambition. Currently, around 110 carbon pricing instruments are in use worldwide, ranging from emissions trading

systems to carbon taxes[315]. Yet, there remains limited interoperability and significant variation in ambition across jurisdictions.

Central issues for collaboration in this area are MRV mechanisms, including underlying methodologies, as well as differences in carbon pricing levels. Such discrepancies between the EU and South Korea have been made evident by the introduction of CBAM. While CBAM remains the most visible – and contested – issue in current EU-Korea discussions, there is scope for broader cooperation in carbon pricing.

Within the European Commission, a dedicated Task Force for International Carbon Pricing and Markets Diplomacy[316], announced in February 2024, is working to explore how the EU can support capacity building and technical collaboration on carbon pricing and standard alignment with partner countries like South Korea. For its part, South Korea is engaging directly with its industries to build capacity and explore options for strengthening its ETS to stimulate domestic investment in low-carbon products – and, apparently, to reduce trade frictions with the EU in terms of CBAM applications[317].

Dialogue on how to transform carbon pricing from the perception of a cost risk to an enabler of new cleantech business models and future competitiveness could provide a positive and forward-looking agenda for cooperation. Examples could include dedicated exchanges on strengthening carbon price signals and channelling ETS revenues more effectively towards financing decarbonisation in strategic sectors, while ensuring a just transition by mitigating the impact of carbon costs on vulnerable groups. The experience of the EU Innovation Fund and a newly created Social Climate Fund are among potential topics for knowledge sharing.

Industrial decarbonisation: Lead markets and low carbon standards

Building a clear business case for specific low-carbon goods – and by extension, clean energy – is essential for incentivising investment in clean technologies across key emitting industries and energy systems. In light of the EU and Korea's shared challenge in this context, structured dialogue on developing lead markets for low-carbon goods could be another area for deepening bilateral collaboration.

Both partners have experience with instruments like public procurement and labelling schemes to steer consumption towards more sustainable products. These tools can be further leveraged to build lead markets for low-carbon goods – an area that is now high on the EU's agenda.

A hindrance to scaling global markets for less carbon-intensive goods is the lack of internationally harmonised definitions of what is 'low carbon'. While both Korea and the EU are advancing domestic labelling systems and procurement guidelines for low-carbon

products, cross-border alignment could be enhanced. As South Korea has already signed mutual recognition agreements for domestic labels with the EU[318], this could build the foundation for deepening bilateral dialogue on low-carbon definitions and standards – particularly in areas like carbon intensity benchmarks and labelling methodologies. Joint efforts to develop interoperable standards and definitions would help to create a broader market for low-carbon goods and reduce trade friction. These efforts could also contribute to emerging global initiatives for internationally harmonised definitions.

Exchanging good practices in energy market policies

Further lesson sharing on energy system transformations, particularly in resource-constrained environments, could open new avenues for EU-Korea dialogue. Europe has provided something of a blueprint of liberalised energy markets; it has also progressed in terms of a rapid uptake of renewables in the electricity system and faced associated needs for flexibility resources. Sharing European experience and expertise in terms of the effects, costs and barriers involved in integrating renewables into the energy system would be beneficial for Korea, where debates about increasing the share of renewables is a hot political topic. Comparing experience could further contribute to the ongoing debate about nuclear energy in Korea, especially in the context of Korea's isolated energy market[319].

These discussions could also cover grid modernisation, which will likely present a challenge for both partners in the coming years. Grid centralisation remains a major structural bottleneck in South Korea, posing a significant obstacle to the wider deployment of renewable energy[320]. Modernisation and expanding the grid are among the core priorities in the EU for the near future. This could also help better shape visions in Korea about the future trajectories of market liberalisation, if any.

Consumer behaviour and willingness to pay could be another option for enhancing the exchange of good practices. This is a long-standing issue in South Korea, where consumer behaviour and expectations differ somewhat from Europe; for instance, European consumers may be more willing to pay a premium for greener electricity[321,322].

3.3.4. Finding a path out of the woods: EU-Korea dialogue on CBAM

As one of the top exporters of CBAM-covered goods to the EU, primarily aluminium and steel, South Korea faces considerable exposure to this instrument[323]. Estimates suggest that CBAM could reduce Korean exports of these products to the EU by over 20 %, prompting fears of trade disruptions and increased costs for domestic producers in South Korea[324].

The key issues dominating the debate are mainly related to the reporting and verification procedures[325] and the carbon price gap between the EU and K-ETS, as well as the recognition of K-ETS under CBAM[326].

Korean policymakers and industries have expressed significant concerns over the compliance costs and impact on the competitiveness of Korean industries[327]. From its announcement, the EU CBAM was slammed as a potential 'trade barrier in disguise' by the then-Vice Minister of Trade, Industry and Energy[328]. On the side of industries and large *chaebol* conglomerates, critics argued that the transitional administrative burden seemed to fall, unfairly and punitively, on non-EU rather than EU producers[329]. The Korean steel industry has been particularly vocal at the consultation and lobby levels[330].

To coordinate its CBAM response, the Korean government launched stakeholder consultations on ETS reform in 2022[331] and offered consulting support to affected companies in 2025[332]. In February 2025, South Korea announced the establishment of a dedicated entity under the Ministry of Environment which will be tasked with facilitating cooperation on climate-related international regulations, such as CBAM[333]. There are also plans to join forces with Japan in this endeavour[334].

While CBAM has a clear logic in terms of protecting the EU's climate ambitions, South Korea's export-driven structure and industrial fabric is particularly vulnerable to encompassing mechanisms such as CBAM[335]. South Korea's green growth model, which is centred on cleantech investment and leadership, has made headway in the transition but has not prioritised deeper corporate reform towards carbon neutrality[336] – a dynamic that has fuelled debate on greenwashing[337]. Notably, South Korea has been a high-income economy since 1995[338]. It stopped declaring itself as a developing country in the context of WTO negotiations in 2019[339]; its emerging status solely remains for its financial and capital markets[340], as well as for implementation of the Paris Agreement.

At the same time, responses to CBAM have inevitably raised broader questions about fairness, climate justice and diplomacy: is it just for the EU, whose historical emissions are far higher than South Korea's, to impose additional burdens on nations that are still in the process of decarbonising their industries?

CBAM implementation must be mindful of the domestic constraints and equity concerns in non-EU countries, perhaps even more so for strategic partners like South Korea. **This is a conversation that is increasingly urgent, and one that both the EU and South Korea will need to address moving forward.** Currently, South Korea is joining forces with neighbouring Japan, whose industries are facing similar challenges, to tackle the EU's CBAM amid broader cooperation on industrial environmental policies[341].

At this stage, the EU may benefit from taking the initiative to enhance dialogue in order to avoid further antagonising Korean and Japanese industries. **A trilateral EU-South Korea-Japan joint task force** could be considered, representing a strategic investment in trust-building and good-faith diplomacy from the EU. In the setup of a hypothetical trilateral task force on CBAM, there is a risk of the EU finding itself in an uneasy position among two strong economic partners, Japan and South Korea, with lingering reservations on CBAM. However, this would not aim to be a negotiation per se, and innovative diplomatic mechanisms may be essential to support CBAM acceptance and implementation, which is increasingly more difficult. Some inspiration could be taken from the EU's Joint Task Force with Indonesia and Malaysia to support implementation of the EU Deforestation Regulation[342] in the context of their palm oil industries and other agroforestry commodity sectors.

In addition to these high-level efforts, the integration of EU perspectives – from academic experts and think tank circles, for example – in Korean discussions on climate change policy could promote deeper understanding of the EU in the domestic policy debate in Korea. In the long run, expert mobility could foster more coordinated policy approaches to the green transition and smooth potentially contested policy choices of the partners.

Box 12. CBAM

In 2023, the EU introduced the CBAM[343], applying to 'certain goods and selected precursors whose production is carbon intensive and at most significant risk of carbon leakage: cement, iron and steel, aluminium, fertilisers, electricity and hydrogen'[344]. The mechanism commits importers in the EU to purchase CBAM certificates in the amount of embedded emissions in their imported goods. The price of a 'CBAM certificate' mirrors the price of emission allowances at EU ETS auctions and is expressed in EUR/tonne of CO_2 emitted[345].

It is planned that CBAM will enter its full implementation phase ('definitive phase') in 2026, preceded by a 'transitional phase' from 2023 to 2025, serving as a pilot to introduce the mechanism and give affected entities time to prepare.

In 2025, as part of omnibus simplification proposals, the European Commission proposed several measures to modify CBAM. The proposed changes would (i) exclude 'small importers' and 'small occasional importations' from CBAM obligations, (ii) adjust reporting requirements aimed at 'simplifying the authorisation of declarants, the calculation of emissions, reporting requirements and compliance with the financial liability', and (ii) work towards 'strengthening anti-abuse provisions and developing a joint anti-circumvention strategy'[346].

In addition, the European Commission will conduct a scheduled review in 2025 of the CBAM legislation. Among the topics are how much the scope of CBAM will be enlarged to downstream sectors and/or indirect emissions and potential measures to tackle possible

circumvention risks and address the problem of carbon leakage of goods exported to third countries. The proposal for amending CBAM legislation is scheduled for Q1 2026[347].

3.3.5. Facilitating EU-Korea business and research interaction and creating integrated ecosystems for innovation

Finally, building more integrated innovation ecosystems and facilitating cross-border interactions of cleantech businesses is a cross-cutting area for deeper EU-South Korea cooperation on clean industry. While Korean businesses are leaders in various technologies crucial for the clean transition, such as batteries, the innovation landscape in South Korea remains fragmented and largely driven by large conglomerates. The EU has gained experience in building innovation frameworks that combine risk-sharing mechanisms, SME support and mission-oriented funding[348]. This creates potential for mutual learning and joint initiatives.

Cooperation could take shape at both the policy and business levels through joint initiatives to build more integrated innovation systems. This could take place through direct collaboration and knowledge exchanges between Korean and European cleantech businesses, as occurs through the activities of the EU-Korea Green Partnership Programme.

Trust-building and direct engagement are important for fostering interactions between businesses. Cultural differences and language barriers often remain major blocks to private sector collaboration. Expanding networking programmes to facilitate interactions through face-to-face visits and the offer of advisory services are crucial. Programmes like these already exist, at the initiative of the EU (through the Green Partnership Programme) and its Member States (e.g. the Innovation Centre Denmark[349]), but they could be augmented. In particular, the inclusion of academic and policy researchers focusing on relevant areas should be promoted alongside existing activities for business matchmaking, as a vector for the better integration of social sciences into a shared space for innovation and improved mutual understanding.

CONCLUSIONS: TAKING THE EU-KOREA PARTNERSHIP TO THE NEXT LEVEL

This CEPS In-Depth Analysis report has explored opportunities for enhanced collaboration between the EU and South Korea across a broad spectrum of green transition issues, from global climate to cleantech cooperation and regulatory discussions on low-carbon standards. Increasingly, these issues are being addressed through the lens of the EU-Korea Green Partnership – a political framework built on shared interests and sustained political will. As the EU-Korea Strategic Partnership deepens in response to turbulent geopolitical times, and the Green Partnership enters its third year, there is a real opportunity to translate strategic clean industrial cooperation into concrete initiatives. This report lays the groundwork, while recognising that there is still much more to explore.

Primarily aimed at an EU policy audience, the report has provided an analytical overview of South Korea's transition towards a low-carbon, clean technology-driven growth model. It has retraced key political and policy developments, profiled the evolution of South Korea's emissions and export-oriented economy, and offered a snapshot of policy instruments supporting cleantech deployment. Looking ahead, it also examines Korea's carbon neutrality pathways, highlighting obstacles and likely strategic shifts under new presidential leadership that is expected from mid-2025.

The underlying assumption is that while South Korea's economic achievements and global soft power are well known, greater awareness of its political economy and policy architecture could further enrich EU-Korea cooperation. By zooming in and then out from Korea's net-zero trajectory, this report offers a foundation for a much deeper understanding that remains relevant well beyond short-term political cycles.

In the context of global geopolitical shifts and the EU's evolving climate, industrial and competitiveness strategies, this study has identified avenues for EU-Korea collaboration ranging from industrial and energy system decarbonisation to joint efforts in advancing global climate ambition. This scoping exercise has synthesised the latest research and insights from dialogues with South Korean and European stakeholders, offering a well-informed starting point for deeper policy alignment and cooperation.

Alas, these are only the initial steps. Each of the areas highlighted warrants further dialogue, research and stakeholder engagement. By weaving together different perspectives, this report serves as an entry point for future collaboration. It speaks to a broad community of EU-Korea policy, diplomatic, research and business actors working across climate, energy, industry, economy, environment, R&D and innovation.

ANNEXES

ANNEX A. ELECTED PRESIDENTS OF THE SIXTH REPUBLIC

President	Years in office	Political affiliation
Roh Tae-woo	1988-93	Conservative
Kim Young-sam	1993-98	Conservative
Kim Dae-jung	1998-03	Liberal
Roh Moo-hyun	2003-04, 2004-08	Liberal
Lee Myung-Bak	2008-13	Conservative
Park Geun-hye	2013-17	Conservative
Moon Jae-in	2017-22	Liberal
Yoon Suk-yeol	2022-25	Conservative

ANNEX B. SOUTH KOREA'S LEGAL, LEGISLATIVE AND JUDICIAL SYSTEM

The **national legislative authority** in South Korea is a unicameral **National Assembly** of 300 members, elected for a renewable four-year mandate, from constituencies and through proportional representation. The National Assembly, which deliberates and passes legislation, has 17 standing policy committees, including a Foreign Affairs and Unification Committee and a Trade, Industry, Energy, SMEs and Startups Committee. The 22nd National Assembly began in May 2024 after the legislative elections[350]. Unlike in other presidential systems, the National Assembly cannot be dissolved by the president. The next legislative elections are provisionally scheduled to take place in April 2028.

South Korea's **legal system** is based on the civil law system like many European countries, taking the form of legal codes and systems. Yet, it is similar to the common law (or case law, or judicial precedent) system of the US on certain aspects, such as **constitutional due process.** The **Constitution of the Republic of Korea**[351], founded in 1948 and amended in 1987 following the country's democratisation, is the paramount law in South Korea. **The 1987 amendment** notably includes **a five-year single-term limit for the president** to prevent the return of military dictatorship (Art. 67). Constitutional provisions also make the president a very powerful figure, who is both **head of state and chief executive** (Art. 66), as well as **commander-in-chief of the armed forces** (Art 74). The president can bypass the National Assembly in the event of extreme emergency (Art. 76.) The **National Assembly**, with its members elected every four years with no term limit, legislates (though the president may veto a bill), controls the budget (Art. 54) and can impeach the president with a two-thirds majority (Art. 65).

Other legally binding categories include acts to realise the constitutional notions – such as framework acts and cascading levels of subordinate acts, and administrative legislation to implement the acts, including presidential decrees, ordinances of the prime minister, ordinances

of ministries, etc. **Framework acts**, like the name suggests, lay down a policy strategy: overarching principles, goals and guidelines for a given policy area such as environmental and sustainability policies, while often covering multiple sectors. They are legally binding, mandate compliance, and are the basis from which subordinate acts are introduced to cover specific policy aspects with detailed provisions[352].

South Korea's national **judicial system** includes the **Constitutional Court**, the highest court on constitutionality matters, and the **Supreme Court**, the highest court for all matters outside the Constitutional Court's jurisdiction. The respective chief justice and president of these courts are the heads of the country's judiciary branch. There are also six high courts, many district-level courts, as well as specialised courts.

Due to the importance of constitutional interpretation in the country, **the Constitutional Court is sometimes perceived as the fourth and highest branch of government.** Its nine justices are selected by the other three branches. A vote of six or more justices is required to declare a law or policy unconstitutional[353].

ANNEX C. PROJECTS UNDER KOREA'S GREEN NEW DEAL (2020-25)

The **Korean Green New Deal**[354] was divided into three focus areas, namely:

- **the green transition of industries**
- **low-carbon and decentralised energy**
- **innovation in the green industry**.

The broader **Korean New Deal** contained **ten key projects**, five of which were explicitly tied to the Korean Green New Deal.

(1) The 'green remodelling' project sought to improve energy efficiency through solar power installations and using ecofriendly insulation materials in public buildings, encouraging private buildings to do the same. The plan was to install solar power for 225 000 public housing units and undergo energy reductions through solar power and more energy efficient lighting at 1 148 cultural centres. Under the Yoon administration, the green remodelling of public building continued[355], with a focus on ageing public buildings and progressively making their remodelling mandatory as of 2025[356].

(2) The 'green energy' project aimed to increase renewables from 12.7 GW in 2020 to 42.7 GW by 2025. The government planned to support 200 000 households and private businesses in installing renewable power infrastructure, deploy a resident participatory benefit-sharing project, expand support for rural and industrial renewable energy, and conduct a feasibility study of wind power on the Korean Peninsula. The Yoon administration (2022-25) famously reversed Moon's ambitious renewables targets (see Section 1.3).

(3) The 'ecofriendly mobility of the future' component supported an increase from 90 100 to 1.13 million electric vehicles by 2025, as well as the installation of 15 000 quick chargers and 30 000 slow chargers. The plan also included supplies of 200 000 hydrogen vehicles, including passenger

buses and cargo trucks, and 450 hydrogen charging stations. By 2024, there were 1.37 million EVs on Korean roads, surpassing the original target, as well as 240 000 EV charging stations[357]. This element of Moon Jae-in's New Deal was not discarded by the Yoon administration, which was particularly interested in hydrogen technologies and uses (see Section 2.2.3).

(4) The 'green and smart schools' initiative planned to retrofit more than 2 890 Korean school buildings with solar panels and ecofriendly insulation. It is difficult to establish the development or progress of this project and it was not an ongoing policy during Yoon's 2022-25 term.

(5) The 'smart and green industrial complexes' (SGIC) strategy planned to 'convert industrial complexes into smart and ecofriendly manufacturing spaces with digital-based high productivity (smart), high energy efficiency, and low pollution'[358]. The plan included three simulation sites to test clean manufacturing, 100 smart and pollution-reducing facilities, 1 750 retrofitted and new clean factories, and the installation of 9 000 fine dust reduction mechanisms in small factories and workshops.

Yoon Suk-yeol's government pledged to continue the SGIC initiative, fitting into a broad industrial strategy to digitalise outdated industrial complexes and invest in green technology and infrastructure. Implementation was difficult to track as of 2023, with policy improvements recommended by economic experts to boost the strategy[359]. In 2024, new SGICs were designated and the momentum for the SGIC twin digital and green transition continues as of 2025.

NOTES

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