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# BOK ISSUE NOTE

## Facilitating the Green Transition through the Stock Market: Feasibility Study on Introducing a Korean Climate Benchmark Index

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1. Green finance in Korea has evolved primarily around green lending and guarantees provided by banks and policy financial institutions, along with green bond issuance in the bond market. In contrast, **the stock market has played only a limited role**. This is **primarily** attributable to the fact that, unlike the bond and loan markets where green finance systems and infrastructure are relatively well established, the stock market **lacks adequate climate disclosure and performance assessment frameworks, resulting in an unfavorable environment for promoting green finance**.

2. In contrast, the European Union introduced the EU Climate Benchmarks\* framework in 2019 to provide investors with standardized criteria for evaluating the climate performance of green investments. Against this backdrop, this paper **reviews the EU Climate Benchmark system and assesses its applicability to the Korean market as part of efforts to promote green finance through the stock market**.

\* A climate benchmark indicates reference, such as an index or rating, that is used to compare and evaluate climate-related investment performance. The EU has stipulated quantitative indicators and standardized index composition requirements to enhance transparency and comparability.

3. **The EU has established minimum requirements for two categories of climate benchmarks—EU PAB and EU CTB\*—which aim for emission reductions consistent with the Paris Agreement. Only indexes that meet these criteria may be labelled as an EU PAB or EU CTB.** Previously, various privately developed climate indexes were used to evaluate the climate performance\*\* of investment portfolios. However, many of these were marketed as “climate” indexes despite the lack of standardized criteria and discrepancies in their performance objectives and indicators, causing confusion among investors. To address this, the EU standardized detailed requirements for

benchmark composition, including (1) decarbonization, (2) exclusion criteria, and (3) sector composition.

\* PAB: Paris-Aligned Benchmark, CTB: Climate Transition Benchmark

\*\* Key indicators include carbon reduction rates, decarbonization pathways, the share of high-emission companies, investment-excluded companies, and the share of renewable energy firms.

**4. PAB and CTB indexes can serve as effective tools to enhance the reliability and transparency of financial products, enable investors to invest responsibly, strengthen corporate incentives for voluntary carbon reduction, and provide policymakers with instruments to advance carbon neutrality.** As a result, in Europe, financial products referencing PABs and CTBs benefit from reduced disclosure requirements under the Sustainable Finance Disclosure Regulation (SFDR) and are recognized as eligible instruments for transition finance.

5. Since the implementation of the system, **the market for PAB and CTB index products has rapidly emerged. Major global index providers such as MSCI and S&P, along with leading asset managers including BlackRock and Amundi, have successively launched indexes incorporating the EU benchmark requirements alongside funds that track them.** In the global financial market, the total assets of funds tracking PAB and CTB indexes have grown substantially since 2021, reaching USD 155.9 billion as of the end of June 2025 (EPFR).

6. To evaluate the applicability of the EU Climate Benchmarks to Korea, **this study simulated indexes for Korea (hereafter referred to as K-PAB and K-CTB) that reflect the EU requirements. The results show that both indexes closely tracked\* the performance of the parent index (KOSPI) while maintaining substantially lower carbon intensity\*\*.** In addition, compared to the parent index, the share of investment (or the constituent weight) allocated to low-carbon companies has expanded, indicating a shift of capital from high-carbon to low-carbon firms. By industry, carbon intensity improved notably in manufacturing and the science and technology sector, which demonstrates a significant mitigation of transition risk.

\* Excess cumulative return relative to KOSPI (%p, Oct. 2015–May 2025): K-PAB 5.6, K-CTB 4.6

\*\* Weighted average carbon intensity by index (tons/KRW billion, 2024): KOSPI 217.0, K-PAB 92.4, K-CTB 129.4

**7. The introduction and utilization of the K-PAB and K-CTB indexes is currently constrained by the limited availability of domestic climate data and weak demand for low-carbon investments.** While it is necessary to develop indexes that comply with EU requirements, Korea faces a shortage of granular climate-related data, such as corporate greenhouse gas emissions (Scopes 1, 2, and 3) and fossil-fuel-derived revenue. Moreover, despite the launch of several low-carbon funds, demand from both institutional and retail investors remains subdued, suggesting that the applicability of

these indexes and the growth of related markets may be limited at this stage.

8. Nevertheless, **the K-PAB and K-CTB indexes are expected to enhance the quality and transparency of domestic climate finance and strengthen Korea’s global competitiveness by presenting quantitative low-carbon investment standards consistent with the Paris Agreement and adopting internationally recognized benchmarks.** In particular, greenhouse gas reduction efforts and the disclosure of credible climate information are likely to attract global capital inflows and positively impact corporate value across the stock market. As demonstrated in the European case, such indexes can also serve as practical tools for designing and implementing diverse green finance frameworks and infrastructures in the stock market.

9. **As such, the K-PAB and K-CTB indexes can be further refined and the related markets can be developed smoothly when supported by the following conditions: the expansion of reliable climate data to improve index transparency and credibility; the implementation of effective government climate policies; and the strengthening of demand through increased low-carbon investment by institutional investors.** In particular, the introduction of a domestic climate disclosure framework will be a prerequisite for enhancing index usability. Furthermore, realistic carbon pricing, policy funding-based support for climate finance, and the establishment of decarbonization plans by long-term institutional investors such as pension funds and the expansion of low-carbon investment are likely to serve as key catalysts for stimulating private-sector participation.

10. Lastly, **relevant domestic institutions should be encouraged to cooperate in developing and operating climate benchmarks tailored to Korea’s circumstances.** While referencing EU requirements, it is also necessary to establish standards that adequately reflect Korea’s industrial structure, characterized by a high concentration of high-carbon companies, as well as transition conditions in Korea. Europe has recently proposed the introduction of a new type of benchmark—Investing for Transition Benchmarks (ITBs)—which aims to encourage corporate transition efforts. This will benefit from a phased approach, beginning with pilot indexes based on available data that are refined through the improvements and limitations identified during the process.

■ Disclaimer: The views expressed herein are those of the authors, and do not necessarily reflect the official views of the Bank of Korea. When reporting or citing this paper, the authors’ names should be always explicitly stated.

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## I. Background of the Study

**1. Under the aim to promote the transition to a low-carbon economy, Korea’s efforts toward green finance have primarily developed around green loans and guarantees provided by banks and policy financial institutions, as well as green bond issuance in the bond market, while the equity market’s role has remained relatively limited.**<sup>1</sup> The growth of the markets for green loans and green bonds has largely been supported by the establishment of international standards<sup>2</sup> and by subsequent government initiatives, including the Green Taxonomy (2021), Green Bond Guidelines (2022), and Green Loan Management Guidelines (2024), which expanded related systems and infrastructure.<sup>3</sup> However, the equity market lacks such infrastructure<sup>4</sup> to support climate-related information required for green investment and performance evaluation frameworks, indicating inadequate conditions for revitalizing green finance.

**2. In contrast, Europe introduced the EU Climate Benchmarks<sup>5</sup> framework in 2019, followed by its implementing rules in 2020, to provide investors with standardized criteria for assessing the climate performance of green investments.** The EU Climate Benchmarks serve as quantitative tools for comparing and evaluating the carbon reduction performance and objectives of climate-related financial products and are now widely in use across international financial markets. Against this backdrop, this paper reviews the EU Climate Benchmarks framework and explores its applicability to Korea as part of efforts to promote green finance through the domestic equity market.

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<sup>1</sup> The domestic ESG fund market has grown rapidly since the 2020s, supported by the global spread of the Principles for Responsible Investment (PRI) and strengthened ESG investment trends. However, low-carbon funds focusing on climate change response have been slow to expand due to limited participation from institutional and retail investors. (See <Box 1> “Current Status and Limitations of the Domestic ESG Fund Market.”)

<sup>2</sup> The International Capital Market Association (ICMA) presented the Green Bond Principles (GBP) in 2014, and the Loan Market Association (LMA) introduced the Green Loan Principles (GLP) in 2018, which have since become global standards for defining the eligibility and processes of green bonds and green loans.

<sup>3</sup> Building upon these international standards, the Korean government introduced the Green Taxonomy (K-Taxonomy) in 2021, revised the Green Bond Guidelines (2020) in 2022, and established the Green Loan Management Guidelines (2024), thereby clarifying the definitions of green bonds and green loans. Furthermore, various institutional support systems have been established, including the K-Taxonomy Support System (Ministry of Climate, Energy and Environment), KTSS (a K-Taxonomy application support system; Financial Supervisory Service), and KTAS (a K-Taxonomy compliance assessment support system; Korea Technology Finance Corporation).

<sup>4</sup> In line with the introduction of domestic climate disclosure, the Korea Sustainability Standards Board (KSSB) announced a draft sustainability disclosure standard in April 2024 and gathered stakeholder feedback. The Board plans to finalize and announce the scope, coverage, and implementation timeline in the near future.

<sup>5</sup> Established by the European Commission as minimum requirements aligned with the target of the Paris Agreement’s 1.5°C scenario, the EU Climate Benchmarks serve as reference standards for low-carbon investment and are primarily utilized by index providers and asset managers in designing index products that incorporate decarbonization trajectories within their investment portfolios.

## II. Case Study on the EU Climate Benchmarks

3. This chapter examines the structure, usefulness, and current utilization of the EU Climate Benchmarks. It first reviews the background and policy implications of the introduction of the framework, outlining its detailed requirements and characteristics. It subsequently examines the utility of the EU Climate Benchmarks and assesses their practical impact in the market by analyzing the scale and performance of linked financial products.

### (1) Introduction

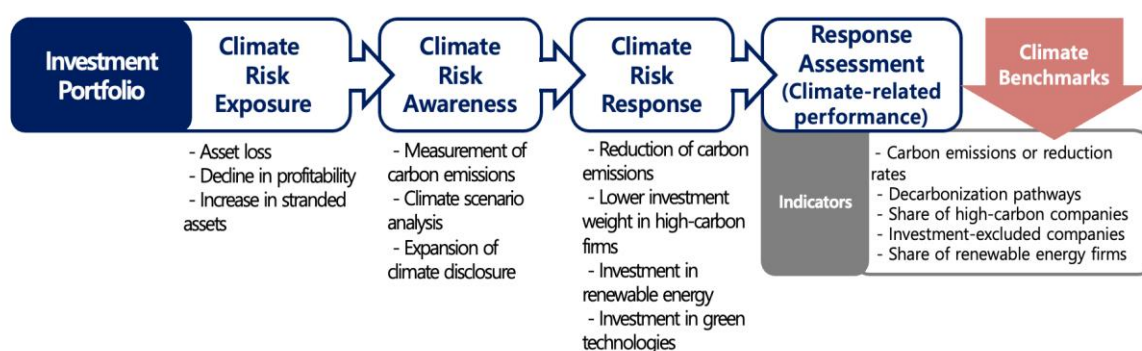
4. A climate benchmark refers to a standard based on which investors can compare and evaluate the level of climate change response, or climate-related performance, of financial products or investment portfolios. Key indicators used to assess such performance include carbon emissions, carbon reduction rates, decarbonization pathways, the share of high-carbon companies, investment-excluded companies, and the share of renewable energy firms. Since the establishment of the Paris Agreement, the growing recognition that climate change directly affects investment risks and returns has increased the need for investors to incorporate climate-related factors into their asset management and investment decisions, thereby expanding the use of climate benchmarks.

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Investors use climate benchmarks to assess the level of climate risk management in their investment portfolios

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<Figure 1> Climate Risk Management Framework for Investment Portfolios



5. Climate benchmarks consist of various indicators, including indexes, ratings, policy allocations, and scenario pathways, with climate indexes<sup>6</sup> being the most representative.

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<sup>6</sup> According to MSCI, its climate indexes are designed to enable institutional investors to integrate climate-related factors into their investment decision-making processes. These indexes assist investors in benchmarking, measuring and managing climate risk exposure, and identifying new investment opportunities.

Climate indexes are preferred for their high accessibility as investors are familiar with index-based investment products, and because they allow for portfolios consisting of companies with an active posture toward climate action, whose decarbonized performance can be more easily quantified.

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### Climate Index: The most representative form of climate benchmarks

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<Table 1> Types of Climate Benchmarks

Type	Composition Methodology
▪ Climate index	Measures the climate risk exposure and carbon reduction performance of investment products and incorporate them in constituent weights
▪ Rating	Scores the climate risk exposure and carbon reduction performance of investment products (e.g. A–F)
▪ Policy allocation	Adjusts asset allocation based on the level of climate change response by investee firms and industries
▪ Scenario pathway	Tracks decarbonization trajectories and monitors compliance to evaluate climate risks

Source: Authors' compilation.

**6. Following the Paris Agreement, many indexes released in Europe have been labeled with the term “climate.” However, the proliferation of such indexes without clear and consistent standards led to investor confusion and concerns about greenwashing.** While investors used these indexes as benchmarks to assess the climate performance of financial products and investment portfolios, they were often promoted as climate indexes without clear classification systems or standards, or were revealed to face limitations such as incongruity between the carbon reduction targets and measurement indicators, which were non-standardized. In particular, some indexes included coal-related companies or showed limited progress in achieving actual emission reductions, further fueling the greenwashing concerns.

**7. To enhance the transparency and comparability of climate-related financial products, protect investors, and promote the development of low-carbon capital markets, the European Commission introduced the EU Climate Benchmark Regulation in 2019.** This regulation legally defines the minimum requirements for climate benchmarks that aim to achieve carbon reduction objectives<sup>7</sup> in line with the Paris Agreement by standardizing the pace of decarbonization, exclusion criteria, and carbon measurement indicators. Through this framework, the EU ensured higher levels of transparency and credibility than privately developed climate benchmarks. Furthermore, only

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MSCI's proprietary climate indexes include the Climate Action Indexes, Climate Paris Aligned Indexes, Climate Change Indexes, Low Carbon Indexes, Global Environment Indexes, and Global Fossil Fuels Exclusion Indexes (MSCI website).

<sup>7</sup> The reliability and comparability of the EU Climate Benchmarks are ensured by setting decarbonization pathways based on the scientifically validated 1.5°C scenario.

indexes that meet these requirements are granted the official labels of “EU PAB” and “EU CTB,”<sup>8</sup> thereby guaranteeing the credibility and quality of EU-recognized climate benchmarks. (Regulation (EU) 2019/2089; Commission Delegated Regulation (EU) 2020/1818)

**EU Climate Benchmarks pursue Paris Agreement-aligned carbon reduction and apply standardized requirements**

**<Table 2> Comparison between Private and EU Climate Benchmarks**

	<b>Private Climate Benchmarks</b>	<b>EU Climate Benchmarks</b>
Establishing Entity	Privately designed	EU (regulation-based)
Objective	Climate change response <sup>1)</sup> , decarbonization <sup>2)</sup> , etc.	Achieving the Paris Agreement’s 1.5°C target <sup>3)</sup>
Requirement	Autonomous setting of reduction targets, exclusion criteria, carbon indicators, etc. (non-standardized)	Strict requirements for reduction targets, exclusion criteria, and carbon indicators (standardized)
Type	Various (no clear classification)	Two types (PAB and CTB)
Disclosure	Mostly autonomous and non-standardized	Standardized (legally mandated)
Form	Indexes, ratings, policy allocations, etc.	Indexes (labelled as “PAB” or “CTB”)

Notes: 1) Share of investment in renewable energy, exclusion of fossil fuels, etc.

2) Unclear criteria and definitions, even if aiming for decarbonization.

3) Carbon reduction pathway consistent with the scientifically validated 1.5°C scenario.

Source: Authors’ compilation.

**8. The EU Climate Benchmarks are divided into two categories: the EU PAB and the EU CTB.**

The two benchmarks differ according to the pace of decarbonization and the strength of exclusion applied to constituent assets (such as corporate bonds and equities), with the PAB subject to stricter requirements. While the PAB calls for strong carbon reduction and fossil fuel exclusion consistent with the objectives of the Paris Agreement, the CTB applies relatively moderate requirements and is designed for investment strategies pursuing a gradual transition toward decarbonization.

**■ Decarbonization requirements<sup>9</sup>:**

<sup>8</sup> Examples of indexes developed in line with EU requirements and those independently designed by private institutions are as follows:

<Indexes Reflecting EU Requirements>

- S&P Eurozone 50 Paris-Aligned Climate Select Index
- MSCI Europe Climate Change CTB Select Index
- FTSE Developed Climate Transition(CTB) Index

<Private Climate Indexes>

- (International) S&P Global 1200 Fossil Fuel Free Index
- (International) FTSE Developed ex-Fossil Fuels Index Series
- (Domestic) KRX Climate Change Solutions Index

<sup>9</sup> Index providers may increase the constituent weight of companies that (1) consistently and accurately disclose Scope 1, 2, and 3 greenhouse gas emissions, or (2) achieve an average annual reduction of at least 7 percent in carbon intensity or absolute emissions for three consecutive years. (Delegated Regulation (EU) 2020/1818)

Under both the PAB and CTB, the average carbon intensity of constituent assets must (1) be at least 50 percent (PAB) and 30 percent (CTB) lower than that of the parent index or investable universe<sup>10</sup> (“initial requirement”); and (2) further decrease by at least 7 percent per year in alignment with the Paris Agreement pathway (“pathway requirement”). In this context, carbon intensity is calculated as the greenhouse gas emissions (Scope 1, 2, and 3)<sup>11</sup> relative to the enterprise value including cash (EVIC).

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### Stricter decarbonization requirements applied to the EU PAB

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<Table 3> Decarbonization Requirements and Carbon Intensity Composition of PAB and CTB

	PAB	CTB
▪ Reduction Rate Relative to the Parent Index	(Initial requirement) 50% or more	(Initial requirement) 30% or more
▪ Year-on-Year Reduction Rate	(Pathway requirement) 7% or more	
▪ Carbon Intensity Composition	<ul style="list-style-type: none"> <li>• Carbon emissions: Include Scope 1, 2, and 3 emissions, with phased application of Scope 3 by industry<sup>1)</sup></li> <li>• EVIC: Market capitalization + total debt + book value of minority interests (including cash)               <ul style="list-style-type: none"> <li>- When the average EVIC of benchmark constituents changes during the fiscal year, each constituent’s EVIC is adjusted using the enterprise value inflation coefficient<sup>2)</sup></li> </ul> </li> </ul>	

Notes: 1) Applied to energy and mining sectors (Dec. 23, 2020); added transportation, construction, building materials, and other sectors (Dec. 23, 2020); and applied to all sectors (Dec. 23, 2024).

2) Average EVIC at fiscal year-end ÷ average EVIC at previous fiscal year-end.

Source: Commission Delegated Regulation (EU) 2020/1818.

### ■ Exclusion requirements:

Constituent assets of the PAB and CTB exclude companies that are inconsistent with sustainability principles—such as arms manufacturers or tobacco companies, or those causing significant harm to the environmental objectives defined under the EU Taxonomy (“minimum exclusion criteria”)<sup>12</sup>—

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<sup>10</sup> Refers to the entire set of assets taken into account in determining the constituents of the PAB and CTB.

<sup>11</sup> Scope 1 refers to direct GHG emissions from sources owned or controlled by a company (e.g., fuel combustion); Scope 2 refers to indirect emissions from the generation of purchased electricity, heat, or other forms of energy; and Scope 3 includes all other indirect emissions occurring across the company’s value chain, such as from supply chains, logistics, business travel, investments, and lending activities.

<sup>12</sup> The EU Taxonomy defines six environmental objectives: (1) climate change mitigation, (2) climate change adaptation, (3) sustainable use and protection of water and marine resources, (4) transition to a circular economy, (5) pollution prevention and control, and (6) protection and restoration of biodiversity and ecosystems. It applies the “do no significant harm (DNSH)” principle, under which an economic activity must make a substantial contribution to at least one of these objectives without causing significant harm to any

and fossil fuel-related companies (“activity-based exclusion criteria”). The minimum exclusion criteria apply to both the PAB and CTB, while the activity-based exclusion criteria apply only to the PAB.

### Stricter exclusion criteria applied to the EU PAB

<Table 4> Exclusion Requirements for PAB and CTB

	PAB	CTB
Minimum Exclusion Criteria	<ul style="list-style-type: none"> <li>· Companies involved in controversial arms-related activities</li> <li>· Companies engaged in tobacco cultivation or production</li> <li>· Companies violating the UN Global Compact (UNGC) principles or the OECD Guidelines for Multinational Enterprises</li> <li>· Companies causing significant harm to the environmental objectives under the EU Taxonomy</li> </ul>	
Activity-based Exclusion Criteria	<ul style="list-style-type: none"> <li>· Companies deriving <math>\geq 1\%</math> of revenue from coal or lignite</li> <li>· Companies deriving <math>\geq 10\%</math> of revenue from oil</li> <li>· Companies deriving <math>\geq 50\%</math> of revenue from gas fuel</li> <li>· Companies deriving <math>\geq 50\%</math> of power generation revenue with carbon intensity above 100 gCO<sub>2e</sub>/kWh</li> </ul>	Not applicable

Source: Commission Delegated Regulation (EU) 2020/1818.

### ■ Sector composition requirements:

For equity-based PAB and CTB benchmarks, the investment weight of the nine sectors with high climate impact<sup>13</sup> must be maintained at a level equal to or higher than that of the parent index (or investable universe). This requirement prevents index providers from focusing only on low-carbon industries with the express goal of meeting decarbonization targets and ensures that the benchmarks remain representative of the real economy.<sup>14</sup>

### EU PAB and CTB maintain the share of nine high-carbon sectors to reflect the real economy and encourage low-carbon transition

<Table 5> Sector Composition Requirements for PAB and CTB

PAB and CTB
<ul style="list-style-type: none"> <li>· For equity-based benchmarks, the investment weight in the nine high climate-impact sectors<sup>1)</sup> (based on the EU industrial classification system) must be maintained at a level equal to or</li> </ul>

of the others.

<sup>13</sup> Under the EU industrial classification system (NACE; Nomenclature of Economic Activities), the nine sectors include agriculture, forestry and fishing; mining; manufacturing; electricity and gas; water supply and wastewater management; construction; transportation and storage; wholesale and retail trade; and real estate.

<sup>14</sup> The purpose of this requirement is to encourage investors to allocate capital and exercise shareholder rights in high climate-impact sectors to promote their low-carbon transition.

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higher than that of the parent index (or investable universe).

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Note: 1) Agriculture, forestry and fishing; mining; manufacturing; electricity and gas; water supply and wastewater management; construction; transportation and storage; wholesale and retail trade; and real estate (based on Nomenclature of Economic Activities).

Source: Commission Delegated Regulation (EU) 2020/1818.

## (2) Usefulness

**9. The EU PAB and CTB were designed to develop index products equipped with quantitative indicators and standardized requirements based on decarbonization trajectories in alignment with the Paris Agreement.** Compared with general climate benchmarks, PAB- and CTB-based index products provide greater transparency and comparability and serve as effective tools for investors to manage climate risks. This section examines the utility of the EU Climate Benchmarks from the perspective of various economic actors, where “PAB and CTB indexes” refer to indexes meeting the EU requirements for PAB and CTB, while “PAB and CTB index products” refer to financial products, such as funds, that track these indexes.

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### EU PAB and CTB indexes exhibit higher transparency and credibility through quantitative indicators and standardized requirements

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<Table 6> PAB and CTB Indexes and Conventional Climate Indexes

Category	PAB and CTB Indexes	Conventional Indexes
Quantification Level	Based on quantitative indicators	Varies by index; mostly non-quantitative
Comparability	Standardized and comparable	Varies by ESG framework
Climate Risk Response	Pathway-based; manageable	Varies across products
Greenwashing Risk	Clear criteria; low risk	Unclear criteria; potential legal and reputational risks

Source: Authors' compilation.

**10. Asset managers<sup>15</sup> and index providers can enhance the credibility of related financial products and secure differentiated competitiveness by developing PAB and CTB indexes and utilizing them for their fund operations.** For financial institutions, PAB and CTB index products offer clearly defined climate-related information—such as decarbonization levels and exclusion criteria—thereby reducing legal and reputational risks<sup>16</sup> associated with greenwashing. In addition,

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<sup>15</sup> Asset managers, who manage funds entrusted by both individual and institutional investors, can be regarded as a type of institutional investor. However, unlike pension funds or insurance companies that invest their own capital, they design fund products and act as fiduciaries on behalf of clients. Accordingly, they are classified separately from general investors when evaluating the effectiveness of the benchmarks.

<sup>16</sup> In September 2024, the Federal Court of Australia fined Vanguard AUD 12.9 million for misleading investors after finding that 74 percent of its ESG funds had not been reviewed in accordance with disclosure

asset managers can formulate investment strategies and evaluate performance based on the quantitative indicators of PAB and CTB indexes, which can also be effectively used for fund disclosure and marketing. Since the EU Climate Benchmarks specify only the minimum requirements for index composition, index providers can develop differentiated indexes by applying their own models and utilizing diverse climate data.<sup>17</sup>

**11. From the perspective of investors, PAB and CTB index products are useful tools for implementing the Principles for Responsible Investment (PRI)<sup>18</sup>, complying with climate-related disclosure requirements, and managing climate risks.** Since the EU Climate Benchmarks provide standardized composition requirements in addition to quantitative targets and performance indicators for carbon reduction, investing in these products helps investors fulfill their responsible investment commitments. In addition, the disclosure burden can be reduced in the process of disclosing climate-related information in accordance with international standards, as investors are not required to provide separate explanations of investment products or measure climate-related performance. In terms of climate risk management, these index-linked products face lower exposure to high-carbon industries and firms with insufficient transition efforts, thereby helping mitigate potential investment losses arising from transition risks.<sup>19</sup> For instance, during the 2020–2021 period of rising EU carbon allowance prices, the return of the EU PAB index exceeded that of its parent index, mainly due to the weaker<sup>20</sup> performance of carbon-intensive companies.<sup>21</sup>

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**Enhancing the credibility of financial products and supporting responsible investment**

**Mitigating potential investment losses from transition risks**

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**<Figure 2> Incentives for Economic Actors to Use PAB and CTB Indexes**

**<Figure 3> Returns of PAB and Conventional Indexes**

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requirements. Similarly, in April 2025, German authorities imposed a EUR 25 million fine on DWS, a Deutsche Bank subsidiary, for greenwashing violations.

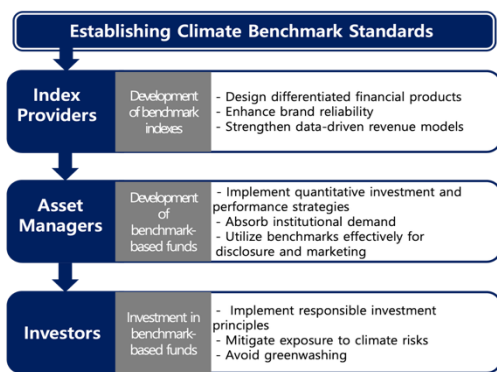
<sup>17</sup> The EU Climate Benchmarks specify only minimum criteria for key elements such as carbon reduction level, exclusion entities, and sectoral allocation, while granting index providers broad discretion in the detailed design composition. As such, index providers may incorporate various climate-related data—such as physical risk indicators—in addition to the carbon indicators prescribed by the regulation (including Scope 1–3 emissions and carbon intensity).

<sup>18</sup> The Principles for Responsible Investment (PRI), established in 2006 under the auspices of the United Nations, emphasize the integration of ESG and other non-financial factors into the investment decision-making process.

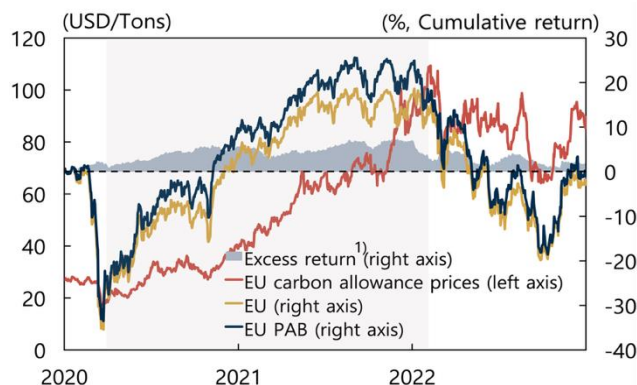
<sup>19</sup> Unlike physical risks, which refer to direct damages caused by extreme weather events such as floods and droughts, transition risks denote financial risks arising from policy, technological, and market changes during the transition to a low-carbon economy. Examples include increased costs due to carbon taxes and the decline in asset values of fossil-fuel-related facilities resulting from technological advances in renewable energy.

<sup>20</sup> According to relevant preceding research (Bolton et al., 2022), an increase in carbon prices tends to lower the stock prices of firms with insufficient emission allowances, while raising those of firms with surplus allowances.

<sup>21</sup> However, the rise in the PAB index’s returns during 2020–2021 appears to have been jointly influenced by the post-COVID-19 global liquidity expansion and the resulting rally in growth stocks.



Source: Authors' compilation.



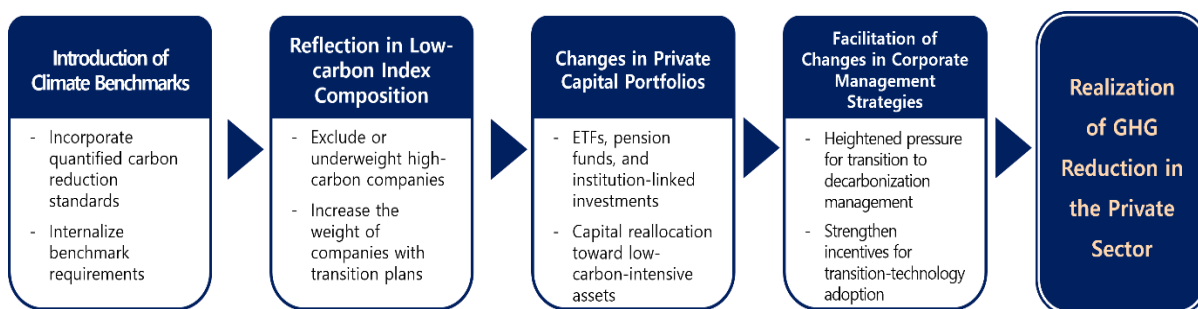
Note: 1) Excess return = EU PAB return – EU return.

Sources: Int'l Carbon Action Partnership, MSCI.

**12. The expansion of the PAB and CTB index product market is also expected to reinforce corporate incentives for decarbonization.** Companies with inadequate carbon emission management or climate disclosures may be excluded from the indexes or assigned lower weights, which would disadvantage them in terms of stock prices and funding conditions. On the other hand, firms that demonstrate strong efforts to reduce carbon emissions would benefit from increased investment demand. Such a signaling effect may encourage other companies to pursue voluntary transition efforts. Furthermore, as climate benchmark-based investment becomes a more widespread practice, climate risks could function as price signals in the capital market, accelerating a shift toward a structure where carbon efficiency is directly reflected in corporate value.

**Encouraging market participants to increase low-carbon investments is expected to strengthen corporate incentives for decarbonization**

<Figure 4> Carbon Emissions Reduction Mechanism through the Introduction of PAB and CTB Indexes



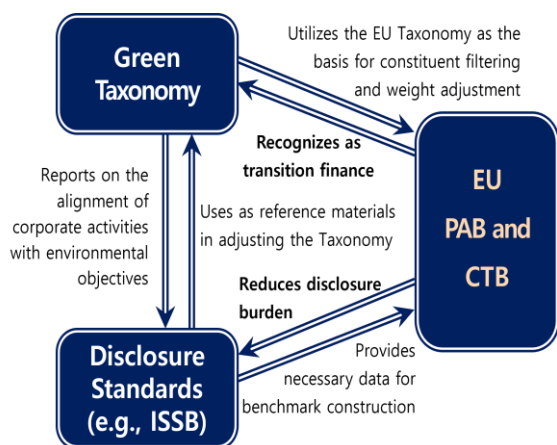
Source: Authors' compilation.

**13. From the policy authorities' perspective, PAB and CTB indexes can serve as tools to support the implementation of carbon neutrality in linkage with key green finance infrastructure such as the Green Taxonomy and climate disclosure frameworks.** Since these indexes clearly reflect companies' decarbonization efforts and performance, they can be construed as effective climate policy instruments based on capital markets. In fact, in terms of the PAB and CTB index products, the EU

eased<sup>22</sup> disclosure obligations related to the carbon reduction efforts stipulated under the Sustainable Finance Disclosure Regulation (SFDR), thereby alleviating the burden of disclosure for financial institutions and investors. Furthermore, the “Guidelines on funds’ names using ESG or sustainability-related terms,” released by the European Securities and Markets Authority (ESMA) in August 2024, partially incorporates the requirements of EU climate benchmarks and reinforces compatibility<sup>23</sup> across different frameworks. In particular, in June 2023, the EU expanded the congruity and scope of the overall framework by recognizing investments in PAB and CTB index products as transition finance. This measure sought to address the limitation of the EU Taxonomy where its activity-based focus rendered it difficult for companies’ voluntary carbon reduction pathways to be recognized as transition finance. Therefore, the EU Climate Benchmarks function as a supplementary instrument that enables capital markets to evaluate and support carbon reduction activities that are difficult to cover using the EU Taxonomy.

**EU PAB and CTB Indexes can be linked to green financial infrastructure**

<Figure 5> Green Financial infrastructure



Source: Authors’ compilation.

**Investments in PAB and CTB Indexes are recognized as transition finance**

<Table 7> Definition of Transition Finance<sup>1)</sup>

Definition of Transition Finance
<ul style="list-style-type: none"> <li>• Financing of investments in portfolios tracking EU PAB and CTB</li> <li>• Financing of investments in EU Taxonomy-aligned economic activities<sup>2)</sup></li> <li>• Financing of investments in undertakings or economic activities with a credible transition plan<sup>3)</sup></li> <li>• Financing of investments in undertakings or economic activities with credible science-based targets</li> </ul>

- Notes: 1) If any of the above criteria are met.  
 2) Transitional economic activities defined under the EU Taxonomy (including Taxonomy-eligible economic activities projected to align with the Taxonomy within five years).  
 3) A transition plan refers to an aspect of the undertaking’s overall strategy that lays out the entity’s targets and actions for its transition towards a climate-neutral economy.  
 Source: European Commission (2023).

<sup>22</sup> Article 9 of SFDR requires financial companies to disclose how financial products aimed at sustainable investment achieve their objectives and meet the criteria corresponding to said objectives. It also stipulates that, for financial products aimed at carbon reduction, firms should clarify the process through which continued effort is maintained throughout the process of achieving the objectives. In this context, since the PAB and CTB indexes are aligned with the Paris Agreement pathway, the European Supervisory Authorities (ESAs) presented its interpretation in 2023 that financial products that passively track these indexes satisfy the requirements of SFDR’s Article 9 without requiring additional proof of carbon reduction efforts.

<sup>23</sup> Some have concluded that since the PAB and CTB indexes largely meet the regulatory standards for ESG-related fund-naming, funds utilizing these indexes would face a significantly reduced burden to provide explanations for regulatory compliance (Harvard Law School Forum, 2024). See <BOX 6> “Current Status of ESG Fund Naming Regulations in the EU and the U.S.” for detailed information regarding naming regulations for ESG funds.

**EU PAB and CTB requirements are reflected in the guidelines on the use of the term “ESG” in funds’ names**

**<Table 8> Guidelines on ESG-related Fund-naming or Sustainability-related Terms Released by ESMA**

<b>Fund Name (Terms)</b>	<b>Investment Criteria</b>	<b>Sustainability Criteria</b>	<b>Exclusion Criteria</b>
<ul style="list-style-type: none"> <li>Funds using transition-, social- and governance-related terms</li> </ul>	At least 80% of fund assets must be managed for the achievement of environmental, social, governance, or sustainability objectives.	Not applicable	CTB
<ul style="list-style-type: none"> <li>Funds using environmental- or impact-related terms</li> </ul>			PAB
<ul style="list-style-type: none"> <li>Funds using sustainability-related terms</li> </ul>		At least 50% of fund assets must be invested in the SFDR-defined sustainable investment segment <sup>1)</sup>	

Note: 1) An investment in an economic activity that contributes to an environmental or social objective, provided that such investment does not significantly harm any of those objectives and that the investee companies follow good governance practices (SFDR Article 2(17)).

Source: ESMA.

**14. Overall, PAB and CTB indexes can enhance the credibility and transparency of financial products and support investors to fulfill their responsible investment commitments. Furthermore, they are expected to strengthen incentives for voluntary corporate carbon reduction and serve as an instrument for policy authorities to implement carbon neutrality.**

**PAB and CTB Indexes are useful tools for enhancing financial product credibility, promoting responsible investments, and facilitating carbon neutrality implementation**

**<Table 9> Evaluation of the Utility of PAB and CTB Indexes by Economic Actors**

<b>Economic Actor</b>	<b>Expected Effects</b>
<ul style="list-style-type: none"> <li>Asset managers and index providers</li> </ul>	Enhance the credibility and transparency of financial products and help develop differentiated products
<ul style="list-style-type: none"> <li>Investors</li> </ul>	Fulfill responsible investment commitments and utilize indexes for managing climate risks in asset holdings
<ul style="list-style-type: none"> <li>Corporations</li> </ul>	Strengthen incentives for voluntary corporate carbon reduction
<ul style="list-style-type: none"> <li>Policy authorities</li> </ul>	Utilize indexes as a tool for policy authorities to implement carbon neutrality

Source: Authors’ compilation.

### **(3) Current Status of Utilization**

**15. Since the introduction of the EU Climate Benchmark framework, the market for PAB and**

**CTB index products rapidly emerged. Major global index providers such as MSCI, S&P, and STOXX have constructed<sup>24</sup> a range of EU climate benchmark indexes that incorporate PAB and CTB requirements.** These indexes are used not only within EU countries but also in other financial markets as reference points for developing low-carbon investment strategies and designing climate-related financial products. Among them, the MSCI indexes are the most widely used.<sup>25</sup>

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**Major global index providers have developed various EU PAB and CTB Indexes**

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**<Table 10> Major PAB and CTB Indexes**

<b>Index Provider</b>	<b>Index Name</b>
MSCI	<ul style="list-style-type: none"> <li>▪ MSCI World Climate Paris-Aligned Index</li> <li>▪ MSCI Europe ESG Climate Transition Select (EU CTB) Index, etc.</li> </ul>
S&P Dow Jones	<ul style="list-style-type: none"> <li>▪ S&amp;P 500 Net Zero 2050 Paris-Aligned ESG Index</li> <li>▪ S&amp;P World Net Zero 2050 Climate Transition ESG Index, etc.</li> </ul>
STOXX	<ul style="list-style-type: none"> <li>▪ EURO STOXX Paris-Aligned Benchmark</li> <li>▪ STOXX Europe 600 Climate Transition Benchmark, etc.</li> </ul>
FTSE Russell	<ul style="list-style-type: none"> <li>▪ FTSE All-World Paris-Aligned (PAB) Index</li> <li>▪ FTSE Developed Climate Transition (CTB) Index, etc.</li> </ul>
Bloomberg	<ul style="list-style-type: none"> <li>▪ Bloomberg MSCI Global Corporate Paris-Aligned Index</li> <li>▪ Bloomberg MSCI Global Liquid Corporate Climate Transition ESG Bond Index, etc.</li> </ul>

Sources: Official website of each company.

**16. The PAB and CTB index product market has also grown rapidly as major global asset management firms such as BlackRock, Amundi, and UBS launched related products.<sup>26</sup>** The PAB and CTB index product market has steadily expanded, led by the EU and the United States, with net assets exceeding USD 150 billion as of the end of June 2025 (EPFR). In the early stage of index development, PAB index products led the market. However, in response to spreading concerns in recent years that the PAB’s exclusion criteria are excessively strict, fund inflows have shifted towards CTB index products (Financial Times, 2024). This growth was also driven by the implementation of the EU SFDR<sup>27</sup> in March 2021, which prompted some European asset managers to convert<sup>28</sup> their

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<sup>24</sup> Global index providers have developed PAB and CTB indexes to minimize divergence from their parent indexes. By keeping turnover as low as possible and managing tracking error, they allow investors to pursue low-carbon strategies without significant performance deviation.

<sup>25</sup> As of September 2023, among 127 equity funds tracking PAB and CTB indexes, over 90 were based on MSCI indexes (J.P. Morgan, 2024).

<sup>26</sup> For further details on general trends among global ESG funds, including the PAB and CTB index products, see <BOX 2> “Current Status of Global ESG Fund Market.”

<sup>27</sup> In March 2021, the EU introduced the SFDR that requires financial companies to disclose detailed and transparent sustainability-related information for all financial products offered to investors. This has significantly enhanced the credibility and transparency of ESG-related information for financial products. For more details, see <BOX 3> “EU Sustainable Finance Disclosure Regulation (SFDR).”

<sup>28</sup> Article 9 of the EU SFDR requires financial products whose primary objective is sustainable investment to disclose detailed relevant information on their investment objectives, methodologies, and performance measurement. Consequently, some European asset managers have utilized PAB and CTB indexes to help

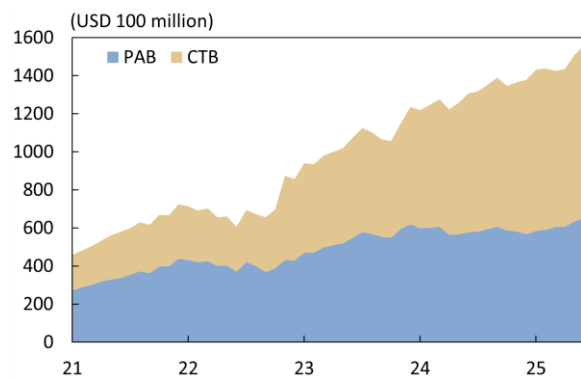
existing ESG funds into PAB and CTB index products. As of the end of June 2025, the total number of PAB and CTB index products worldwide stood at 218 (138 PAB, 80 CTB). Among them, funds investing in global companies accounted for the largest share and those targeting EU and U.S. companies also held a considerable share (EPFR).

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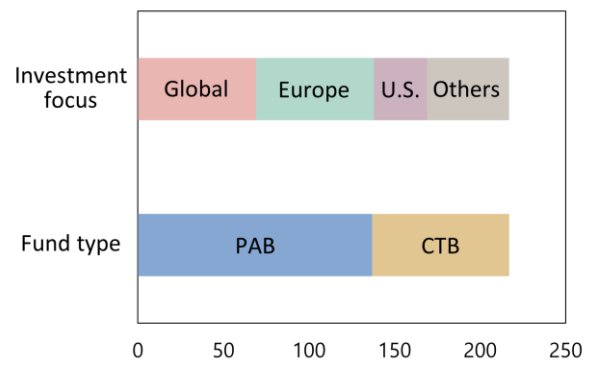
**Funds Tracking PAB and CTB Indexes Have Grown Rapidly**      **Various Types of PAB and CTB Tracking Funds Have Been Launched**

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<Figure 6> Global PAB and CTB Index-Tracking Fund Size<sup>1)</sup>      <Figure 7> Number<sup>1)</sup> of PAB and CTB Index-Tracking Equity Funds



Note: 1) Based on net assets.  
Source: EPFR.



Note: 1) As of end of June 2025.  
Source: EPFR.

**17. According to the performance results, PAB and CTB indexes generally showed returns similar to or slightly higher than those of the parent indexes (MSCI).** For instance, the cumulative return from January 2025 to May 2025 for the MSCI EU index family was 23.3 percent for the parent index, while PAB recorded 34.5 percent and CTB 33.7 percent. Also, for the MSCI USA index family, the return for the parent index was 82.9 percent, PAB 78.1 percent, and CTB 102.1 percent, indicating that the CTB index delivered relatively better performance. By period, although both the PAB and CTB indexes underperformed the parent index in 2022, but they delivered higher returns overall during other periods. This is due to the fact that the PAB and CTB indexes are constructed with a focus on low-carbon growth sectors such as IT and healthcare, while reducing the weight of high-carbon business sectors including fossil fuel energy (J.P. Morgan, 2024). This composition became a vulnerability for the PAB and CTB indexes during overall market downturns, as it coincided with the increased preference for fossil fuel energy companies following the Russia-Ukraine war and the heightened volatility arising from portfolios centered on growth stocks. Meanwhile, in terms of the number of constituent stocks, the CTB index maintained a similar number to its parent index, whereas the PAB

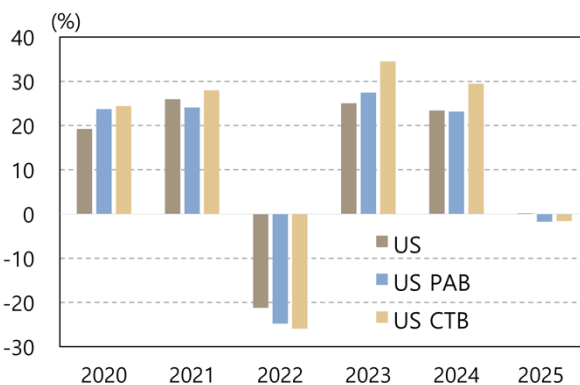
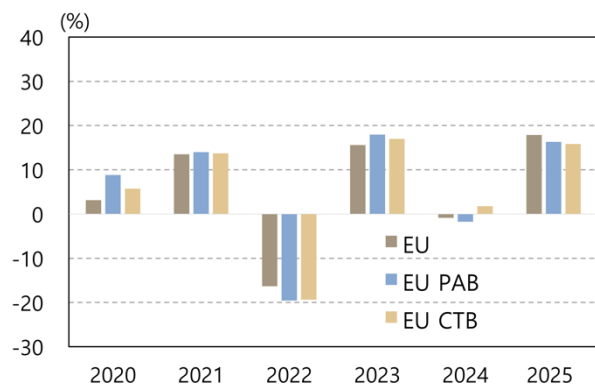
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ease their disclosure burden. For example, Amundi, Europe’s largest asset management company, switched the benchmarks of nine exchange-traded funds (ETFs), which previously tracked the MSCI SRI Filtered ex Fossil Fuels Indexes, into the MSCI SRI Filtered PAB Indexes in 2022. The company also changed the benchmarks of four additional ETFs that it managed separately to the MSCI ESG Broad Climate Transition Benchmark (CTB) Select Index.

index saw a relative decrease in its constituents due to its strict criteria such as excluding fossil fuel energy firms.

**PAB and CTB Indexes showed returns similar or slightly higher than those of their parent indexes (MSCI)**

**<Figure 8> MSCI EU PAB and CTB<sup>1)</sup> Index Returns<sup>2)</sup>      <Figure 9> MSCI US PAB and CTB<sup>1)</sup> Index Returns<sup>2)</sup>**



Notes: 1) EU (MSCI EU Index), EU PAB (MSCI EU Climate Paris Aligned Index), EU CTB (MSCI EU Climate Change Index).

Notes: 1) US (MSCI USA Index), US PAB (MSCI USA Climate Paris Aligned Index), US CTB (MSCI USA Climate Change Index).

2) Figures for 2025 cover January to May.

2) Figures for 2025 cover January to May.

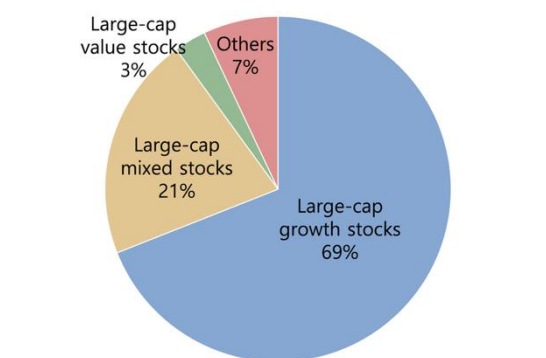
Sources: MSCI, Bloomberg.

Sources: MSCI, Bloomberg.

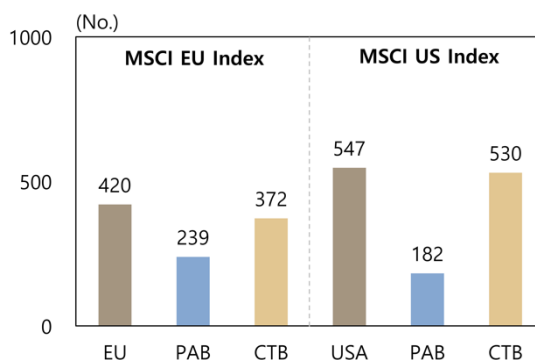
**PAB and CTB tracking funds are tilted towards large-cap growth stocks**

**The number of constituents between PAB and CTB Indexes differs significantly**

**<Figure 10> Composition of PAB and CTB Tracking Funds by Stock Type<sup>1)</sup>**



**<Figure 11> Number of Constituents<sup>1)</sup> in PAB and CTB Indexes**



Note: 1) Based on equity funds tracking PAB and CTB as of September 2023.

Note: 1) As of June 2025.

Source: J.P. Morgan (2024).

Source: MSCI.

**III. Feasibility Assessment for Domestic Adoption**

**18. This chapter examines the applicability of introducing climate benchmarks that incorporate PAB and CTB requirements into the domestic equity market based on the case of the EU.** Specifically, by simulating index constructions for KOSPI-listed companies that reflect these requirements, this study assesses the applicability of the framework. Furthermore, it explores the potential expected effects such benchmarks could bring to the domestic capital market and its participants, while also simultaneously identifying constraints that may hinder the adoption of the system.

**(1) Simulation results for domestic PAB and CTB indexes (tentatively named “K-PAB” and “K-CTB” indexes)**

**19. First, a simulation was conducted on domestic equity climate benchmark indexes (the K-PAB and K-CTB indexes) that incorporate the EU PAB and CTB requirements.** Using KOSPI-listed companies (821 firms as of end of May 2025) that disclose greenhouse gas emissions data, the K-PAB and K-CTB indexes were constructed by applying the decarbonization and sector composition requirements of the PAB and CTB, then minimizing tracking deviation from the parent index (KOSPI) via an optimization methodology.<sup>29</sup> However, exclusion criteria were omitted due to the insufficient availability of related data and given the limitations of available information, carbon intensity was based only on Scope 1 and 2 emissions.<sup>30</sup> Meanwhile, the sector composition requirement was also restricted to the manufacturing sector.

**Domestic climate benchmark indexes (K-PAB and K-CTB) were constructed by incorporating EU PAB and CTB requirements**

**<Table 11> K-PAB and K-CTB Construction Methodology**

	EU Standards	K-PAB and K-CTB	
Carbon Intensity	Carbon emissions relative to EVIC	Carbon emissions relative to EVIC <sup>1)</sup>	<ul style="list-style-type: none"> <li>Among 821 KOSPI-listed firms as of the end of May 2025, <b>807</b> companies with greenhouse gas emissions data (Scope 1 and 2) were included.</li> <li>After excluding stocks not suitable for the optimization process (assigned zero weight), the indexes consist of <b>450 firms for K-PAB</b> and <b>515 for K-CTB</b>.</li> </ul>
Carbon Emissions	Scope 1, 2, and 3	Scope 1 and 2	
Composition Requirements	Decarbonization Investment exclusion Sector composition	Decarbonization - Sector composition <sup>2)</sup>	

Notes 1) Based on Bloomberg data (Enterprise Value Including Cash and Scope 1 and 2 emissions information).

2) Applied only to the manufacturing sector (K-PAB and K-CTB investment weights must be maintained at or above the weight for KOSPI).

Source: Authors' compilation.

<sup>29</sup> For details of the optimization methodology, see <BOX 4> “Methodology for Simulating the K-PAB and K-CTB Indexes.”

<sup>30</sup> Bloomberg provides Scope 1, 2, and 3 emissions for Korean companies based on company disclosures, its own estimates, and third-party sources. However, full Scope 3 emissions information is not available for some industries including banking, limiting the analysis to Scope 1 and 2 emissions.

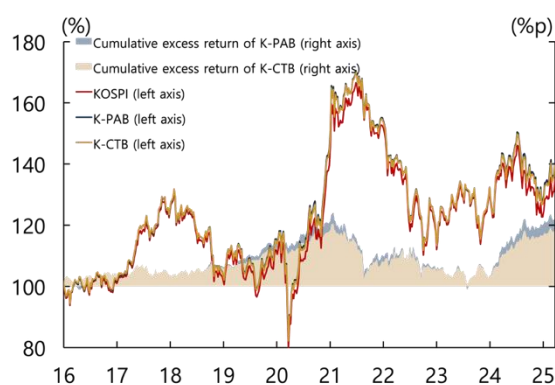
**20. According to the simulation, the K-PAB and K-CTB indexes stably tracked their parent index (KOSPI) while showing significantly lower carbon intensity.** During the period from October 2015 to March 2025,<sup>31</sup> the cumulative excess returns of the K-PAB and K-CTB indexes relative to the parent index were 5.6 and 4.6 percentage points, respectively. The standard deviation of the return differentials (benchmark return minus KOSPI return, on a weekly basis) was also low at 0.17 for the K-PAB and 0.14 for the K-CTB.

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**K-PAB and K-CTB Indexes stably track the parent index**

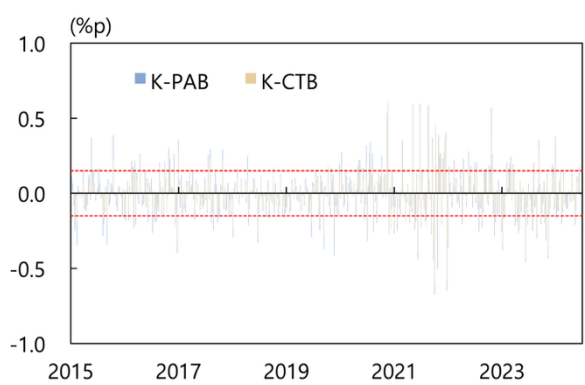
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**<Figure 12> Returns of K-PAB and K-CTB Indexes**



Source: Authors' calculations.

**<Figure13> Return Differentials <sup>1)2)</sup> between K-PAB, K-CTB, and the Parent Index**



Notes: 1) Weekly basis.

2) Dashed lines indicate the  $\pm 0.15$  range.

Source: Authors' calculations.

**21. The weighted average carbon intensity (WACI) of the K-PAB and K-CTB indexes stood at 92.4 and 129.4 respectively as of 2024, which were 57.4 and 40.5 percent lower than that of the parent index (217.0).** This reduction is largely attributed to the initial requirement (initial carbon intensity reduction of at least 50 percent for PAB and 30 percent for CTB relative to the parent index) than by the pathway requirement (annual carbon intensity reduction of at least 7 percent). In fact, since 2015, the annual reduction in carbon intensity for the KOSPI has averaged 5.4 percent,<sup>32</sup> showing a level not substantially different from those of the K-PAB and K-CTB indexes (with a target of at least 7 percent per year).

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**The WACI of the K-PAB and K-CTB Indexes is significantly lower than that of the parent index**

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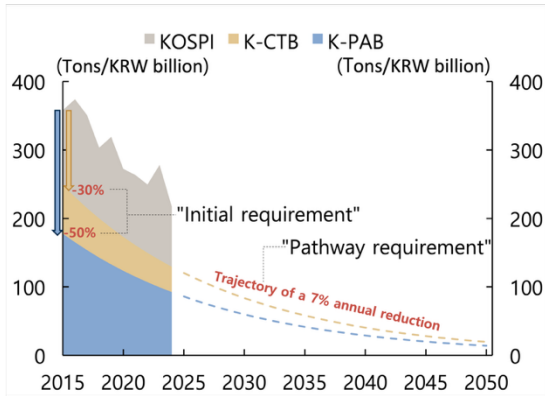
**<Figure 14> Carbon Reduction Trajectory<sup>1)</sup> by Index**

**<Table 12> WACI<sup>1)</sup> by Index**

(Tons/KRW billion, %)

<sup>31</sup> Bloomberg has provided estimated Scope 1, 2, and 3 emissions data for Korean companies since 2015.

<sup>32</sup> A company's carbon intensity is calculated by dividing its carbon emissions by enterprise value including cash (EVIC). Therefore, when the EVIC surges substantially, the decline in a company's carbon intensity may appear larger than the actual reduction in carbon emissions.



Note: 1) Dashed lines indicate the projected decarbonization pathway.

Source: Authors' compilation.

	2015(A)	2024(B)	B/A
▪ KOSPI	355.3	217.0	-38.9
	(1.00)	(1.00)	
▪ K-PAB	177.6	92.4	-48.0
	(0.50)	(0.43)	
▪ K-CTB	248.7	129.4	-48.0
	(0.70)	(0.60)	

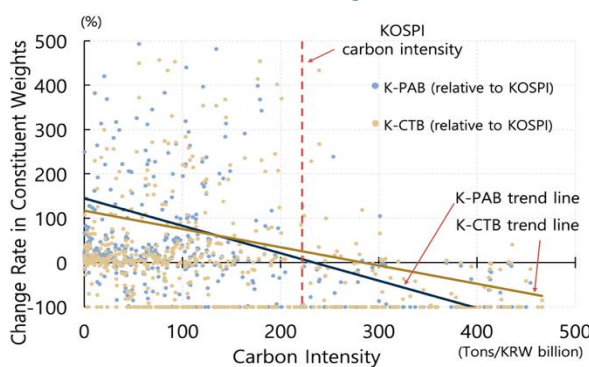
Note: 1) Figures in parentheses indicate ratios relative to the carbon intensity of the KOSPI.

Source: Authors' calculations.

**22. A capital reallocation effect from high-carbon to low-carbon firms was observed at the individual company level.** According to the simulated construction of the K-PAB and K-CTB indexes, companies with lower carbon intensity than the parent index generally gained higher weights in index composition while those with higher intensity saw their weights reduced.<sup>33</sup> The change in constituent weights relative to the KOSPI was larger for the K-PAB index than for the K-CTB index, but the margin of change remained limited due to the optimization methodology that minimizes deviation from the parent index. By carbon-intensity level, the weight of companies with lower intensity (below 100 tons per KRW 1 billion) increased slightly (69.7 percent for KOSPI, 76.6 percent for K-PAB, and 74.0 percent for K-CTB) whereas that of highly carbon-intensive firms (over 500 tons per KRW 1 billion) declined sharply (8.6 percent for KOSPI, 2.3 percent for K-PAB, and 4.1 percent for K-CTB).

**In general, the weight of high-carbon firms decreased while that of low-carbon firms increased, but the degree of change remained limited**

<Figure 15> Carbon Intensity and Change Rate in <Table 13> Margin of Change in Constituent Constituent Weights<sup>1)</sup> (as of 2024)



Note: 1) Rate of change in the constituent weights of the K-PAB and K-CTB relative to the KOSPI.

Source: Authors' compilation.

Weights (as of 2024)

Changes in Constituent Weights		K-PAB	K-CTB
Over	Below		
-1.00	-0.05	22	20
-0.05	0.05	732	766
0.05	1.00	52	21
1.00		0	0
Total		807	807

Source: Authors' calculations.

<sup>33</sup> However, during the optimization process to minimize deviation from the parent index (KOSPI), cases were observed where the weights of low- (high-) carbon intensity companies decreased (increased).

**Companies with higher carbon intensity recorded a substantial decline in their weight**

<Table 14> Constituent Weight by Carbon Intensity Level<sup>1)</sup> (as of 2024)

(Tons/KRW billion, %, %p, No.)

Carbon Intensity	KOSPI	K-PAB	K-CTB	Number of Constituents
0-10	23.3	24.9 (1.6)	24.0 (0.7)	63
10-50	19.8	22.6 (2.8)	21.4 (1.6)	126
50-100	26.6	29.1 (2.5)	28.6 (2.0)	139
100-500	21.6	20.9 (△0.7)	21.8 (0.2)	316
<b>500+</b>	<b>8.6</b>	<b>2.3 (△6.3)</b>	<b>4.1 (△4.5)</b>	<b>163</b>

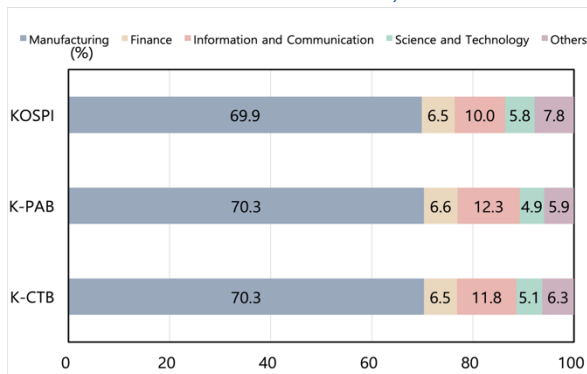
Note: 1) Figures in parentheses indicate changes in constituent weights relative to the KOSPI (%p).

Source: Authors' calculations.

**23. By sector, investments in high-carbon industries declined, and within those sectors, a reallocation occurred toward companies with relatively low-carbon intensity.** For instance, low-carbon industries including finance and information and communication recorded increases in their weights while high-carbon industries such as science and technology<sup>34</sup> saw declines. However, despite being a high-carbon industry, manufacturing showed a slight increase in weight (69.9 percent for KOSPI, 70.3 percent for K-PAB, and 70.3 percent for K-CTB) due to the sector composition criteria requiring that its share should not fall below that of the parent index. In terms of carbon intensity by sector, the manufacturing and science and technology sectors saw particularly substantial reductions, indicating that investments in K-PAB and K-CTB index products meaningfully reduce transition risk exposure in these sectors.

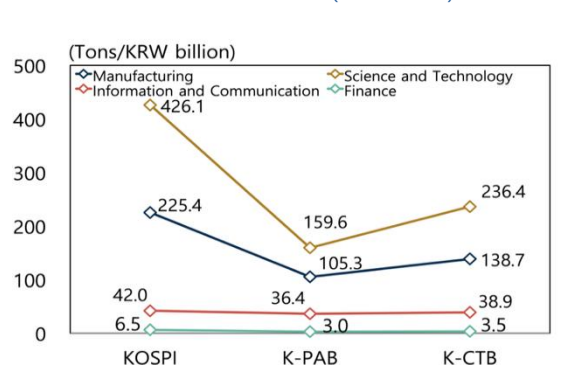
**Sector weight composition also showed a significant change depending on carbon intensity**

<Figure 16> Sector Weights by Index (as of 2024)



Source: Authors' calculations.

<Figure 17> Carbon Intensity<sup>1)</sup> by Sector across Indexes (as of 2024)



Note: 1) Based on the Weighted Average Carbon Intensity (WACI).

Source: Authors' calculations.

<sup>34</sup> The science and technology sector (professional, scientific and technological services; major category) includes several holding companies (company headquarters and management consulting services). Since holding companies disclose not only the greenhouse gas emissions from their business activities, but also the aggregated emissions of their subsidiaries, the overall carbon intensity of the science and technology sector tends to be relatively higher than that of other sectors.

**24. In summation, K-PAB and K-CTB indexes maintain financial performance comparable to that of the parent index while allowing for portfolio compositions that effectively reduce climate risks.** However, if the scope of greenhouse gas emissions is extended to include Scope 3 or if additional exclusion criteria are applied when constructing the index, results may differ significantly.<sup>35</sup> For example, since the finance sector generates considerably more Scope 3 emissions compared with Scope 1 and 2, incorporating the former into the index would sharply raise the sector’s carbon intensity and lead to notable changes in its index weight. Also, the addition of exclusion criteria could further differentiate returns and index composition constituent weights between the K-PAB and K-CTB indexes.

## (2) Expected effects of introduction

**25. The introduction of the PAB and CTB indexes into the domestic markets is expected to contribute to enhanced quality and transparency of climate financial products.** Although several types of climate indexes are currently being produced by the Korea Exchange and other institutions, these indexes do not clearly specify carbon reduction targets, nor do they provide quantitative measurements of climate performance. Low-carbon funds launched by asset managers highlight their response to climate change as a key investment strategy, yet most of them lack sufficient information on carbon emissions levels and reduction pathways.<sup>36</sup> Considering these limitations, the adoption of the PAB and CTB indexes in Korea could serve as a steppingstone to improve transparency and comparability in climate financial products. Moreover, amid the global trend toward stricter greenwashing regulations,<sup>37</sup> these indexes may also help strengthen the response capability of asset managers and institutional investors to address climate risks.

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### Korean climate indexes lack carbon reduction targets

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<Table 15> Climate Indexes Provided by the Korea Exchange

Name	Composition Criteria
KOSPI 200 Climate Change Index	Adjusts constituent weights based on low carbon transition (LCT) score <sup>1)</sup>
KRX 300 Climate Change Index	Adjusts constituent weights based on low-carbon transition (LCT) score <sup>1)</sup>

<sup>35</sup> For detailed simulation results including Scope 3 emissions data for KOSPI-listed companies provided by Bloomberg (Scope 3 data are not available for some sectors including banks), see <BOX 5> “K-PAB and K-CTB Simulation Results Including Scope 3 Emissions.”

<sup>36</sup> The majority of ESG funds, including domestic low carbon funds, construct their portfolios based on ESG scores or ratings provided by external assessment agencies and the level of disclosure regarding specific management standards and climate performance remains anemic. In particular, funds tracking domestic climate indexes also lack clear information on carbon reduction targets or levels, making it difficult to compare funds and limiting their effectiveness as tools for hedging climate risks.

<sup>37</sup> For example, under the Green Claim Directive (GCD) starting in September 2026, EU plans to impose fines up to 4 percent of annual turnover for greenwashing violations.

KRX Climate Change Solutions Index	Adjusts constituent weights based on low-carbon transition (LCT) and low-carbon patent score <sup>1)</sup>
S&P/KRX Carbon Efficient Capped Index	Adjusts constituent weights based on carbon intensity and excludes some companies with insufficient carbon disclosures

Note: 1) Based on MSCI data.

Source: Korea Exchange (KRX).

**26. The K-PAB and K-CTB indexes are expected to demonstrate greater utility when linked to domestic green financial infrastructures.** In Europe, the EU Climate Benchmarks are integrated with the EU Taxonomy, Sustainable Finance Disclosure Regulation (SFDR), and the Guidelines on funds' names using ESG, which allow them to enhance the transparency and credibility of climate finance while serving as a useful climate policy instrument. Given that the basis of green finance in Korea's domestic stock market remains relatively underdeveloped, the K-PAB and K-CTB can surpass being simple investment indicators to serve as tools for designing related systems, infrastructure, and standards.

**27. Introducing the K-PAB and K-CTB indexes to strengthen carbon reduction efforts and ensure the disclosure of reliable climate-related information can lead to greater global investment inflows and furthermore contribute to enhancing overall corporate value in the stock market.** Prior studies have shown that greenhouse gas reductions and reliable climate disclosure improve financing conditions for companies.<sup>38</sup> In particular, amid sluggish foreign investment in domestic climate financial products,<sup>39</sup> the K-PAB and K-CTB indexes, which reflect internationally verified standards, can help enhance the global connectivity and credibility of the domestic climate finance market.

### (3) Constraints

**28. However, there are several constraints in introducing and utilizing the K-PAB and K-CTB indexes. First, constructing an index that complies with the EU Benchmark requirements requires detailed climate data, including companies' carbon emissions and the share of revenue derived from fossil fuels, but such data remains insufficient.** For instance, MSCI (2024) found that only about one-third of the companies in the global investable universe met the eligibility criteria for the PAB, regionally comprising only 62 percent for Europe and 29 percent for emerging countries. Moreover, in Korea, the credibility of climate data remains low due to insufficient information on Scope 3 emissions and delays in the introduction of climate disclosure. Although

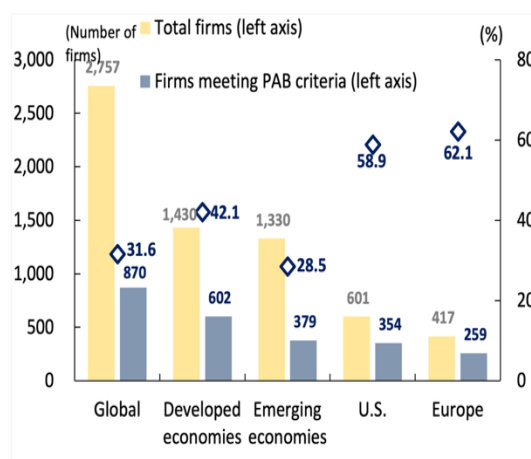
<sup>38</sup> According to prior research, companies emitting more greenhouse gases experienced higher cost of capital, showing a positive correlation (Seo & Hong, 2024), while firms with stronger climate-related performance (particularly, those disclosing environmental information in line with the TCFD recommendations) had a higher ratio of foreign ownership (Park & Kim, 2023).

<sup>39</sup> For example, in 2024, the share of foreign investors in funds tracking the KRX Climate Change Solution Index was only 0.14 percent on a buy basis and 0.03 percent on a sell basis (KRX Market Data System).

some large domestic companies have been included in the PAB and CTB indexes developed by global index providers such as MSCI, the overall level of climate-related information disclosure across Korean firms remains inadequate. In addition, many companies hope to postpone the implementation of mandatory climate disclosure (Korea Chamber of Commerce and Industry, 2024), suggesting that the lack of climate disclosure capacity may persist for a considerable duration. These data limitations constrain the number and transparency of the stocks eligible for inclusion in the PAB and CTB indexes, thereby hindering the diversity of index composition.

**Only a portion of global investment firms meet the PAB criteria**

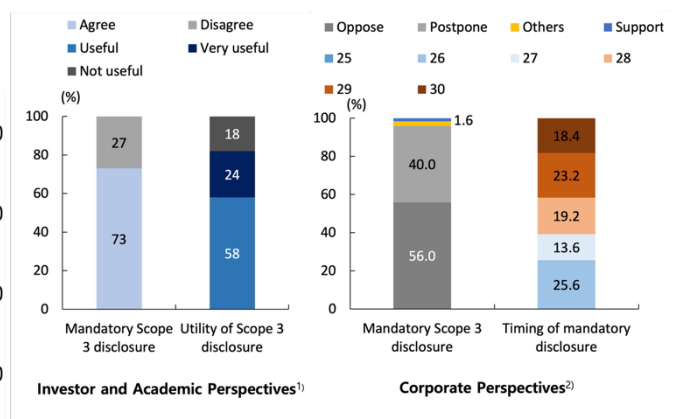
**<Figure 18> PAB-eligible Firms in the Global Investable Universe<sup>1)</sup>**



Note: 1) Based on MSCI selection criteria.  
Source: MSCI Sustainability Institute (2024).

**Opinions vary on the timing of domestic climate disclosure**

**<Figure 19> Positions on Mandatory Climate Disclosure**



Notes: 1) Based on a survey of 94 institutions, including asset management firms, securities companies, and academia.  
2) Based on 125 listed companies with assets of KRW 2 trillion or more.  
Sources: Korea Chamber of Commerce and Industry (2024), Sohn (2024).

**29. Another limiting factor for the development of PAB and CTB indexes is the insufficient domestic demand for low-carbon investment.** Despite the recent launch of low-carbon funds in Korea, their overall scale remains limited, reflecting the low level of interest from both institutional and retail investors. In the absence of a sufficiently robust demand base in the private sector, the practical impact of PAB and CTB indexes is expected to be limited, as their utilization would remain low and their contribution to promoting low-carbon investment would be constrained. In this regard, global investors have highlighted the need for proactive climate policies by the government to enhance market participants' awareness of climate change and stimulate investment.<sup>40</sup>

<sup>40</sup> For example, in October 2021, 23 global investors—including the Dutch pension fund All Pension Group (APG)—sent a joint letter to the Korean government, urging it to suspend new coal power plant projects and to fulfill its commitments under the Paris Agreement. In a similar vein, the CEO of the Asia Investor Group on Climate Change (AIGCC) stated in a November 2023 speech that improving Korea's climate policies

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## The domestic low-carbon fund market remains in its infancy

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<Table 16> Size of Domestic ESG Funds<sup>1)</sup> (as of May 2025)

	Number of Funds (Units)	Fund Size (KRW billion)
Low-carbon <sup>2)</sup>	12 (7.6%)	156 (1.3%)
Non-low-carbon ESG <sup>3)</sup>	146 (92.4%)	11,768 (98.7%)

Notes: 1) Based on net asset value.

2) Refers to funds whose names, investment objectives, or strategies explicitly include low-carbon-related terms such as climate, carbon, net zero, or transition.

3) Refers to funds whose names, investment objectives, or strategies include terms related to ESG (ESG, sustainability, environment, etc.), the environment (environmental, green, eco, etc.), or low carbon (climate, carbon, net zero, transition, etc.).

Source: Bloomberg.

## IV. Policy Implications

**30. The introduction of the K-PAB and K-CTB indexes could enhance the credibility and effectiveness of Korea's climate finance by establishing quantitative investment criteria in line with the Paris Agreement. In the long term, this would help steer capital flows toward low-carbon sectors,** while helping investors to develop investment strategies that balance financial performance with climate performance. Furthermore, the use of internationally recognized climate benchmark indexes is expected to expand global capital inflows and strengthen the competitiveness of domestic low-carbon financial products.

**31. To achieve this, it is essential to first establish the relevant institutional frameworks, including the prompt finalization of domestic climate disclosure standards and implementation timelines.** To ensure that the K-PAB and K-CTB indexes achieve international consistency and acceptance, it is particularly essential to secure reliable climate data. In particular, the phased introduction of mandatory disclosure for Scope 3 emissions is crucial to enhancing the effectiveness of the K-PAB and K-CTB indexes. Without incorporating Scope 3 emissions, companies could downplay reported emissions by transferring climate risks along their supply chains or outsourcing high-emission processes, which would distort their actual carbon reduction effect and increase the risk of greenwashing.

**32. The importance of government climate policy and long-term institutional investors is also significant.** The government should use policy instruments—such as aligning carbon allowance prices with reality<sup>41</sup>—to transmit climate risk as a price signal across the financial market and

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could attract billions of dollars in investment inflows.

<sup>41</sup> Currently, the carbon reduction burden for domestic industrial sectors is set at the relatively low target of a 11.4-percent reduction by 2030 compared to 2018. Moreover, with 90 percent of emission permits being allocated free of charge, the domestic carbon allowance price is significantly lower than those of major economies.

encourage investors to reflect it in their asset management decisions. In addition, the government can support the stimulation of private-sector demand by promoting climate finance through the use of policy funds. Long-term institutional investors, such as pension funds, face sufficient incentives to manage climate risks. Therefore, they should actively consider establishing phased decarbonization plans and expanding low-carbon investments with sufficient consideration for the long-term stability and profitability of their investment portfolios.

**33. It is also necessary to consider developing and operating a climate benchmark that reflects domestic conditions through cooperation among relevant institutions.** To this end, while referring to the EU PAB and CTB requirements, standards should be established in consideration of the structure of Korea’s industries, which have a high proportion of carbon-intensive sectors, and their conditions for transition. It would be desirable to adopt an approach that maintains consistency with international standards while granting favorable treatment to companies demonstrating strong transition efforts. Recently in Europe, the EU Platform on Sustainable Finance (an advisory body to the European Commission) proposed a new type of benchmark named Investing for Transition Benchmarks (ITBs),<sup>42</sup> which would apply more flexible carbon reduction requirements than the PAB and CTB while encouraging companies’ transition efforts. This demonstrates that it is possible to account for each country’s industrial structure and pace of transition without compromising international consistency. For instance, it is feasible to consider the inclusion of companies that show limited short-term carbon reduction outcomes but possess clear transition plans with expanding green investments. In this regard, it would be desirable to take a phased approach, first developing and operating a pilot index based on available data, then identifying and addressing any improvements or limitations revealed in the process.

**ITBs emphasize companies’ transition efforts (Green CapEx) as a key requirement**

<Table 17> Key Requirements of Climate Benchmarks

Benchmark	Decarbonization Requirements	Green CapEx Requirements
PAB and CTB	<ul style="list-style-type: none"> <li>Initial reduction in carbon intensity (50%/30%)</li> <li>Annual reduction in carbon intensity (7%)</li> </ul>	-
<b>ITBs</b>	<b>Annual reduction in carbon intensity <sup>1)</sup> (7%)</b>	<b>Annual increase in CapEx (5%<sup>2)</sup>)</b>

Notes: 1) Carbon intensity reduction rate compared to the parent index.  
 2) Benchmark setters may relax the trajectory requirement (annual 7 percent reduction) depending on the proportion of Green CapEx (at year-end) as follows: Adjusted reduction rate = 7% × (1 – proportion of Green CapEx).  
 \* Share of Green CapEx in total CapEx.  
 3) Based on EMEA advanced economies.  
 Source: EU Platform on Sustainable Finance

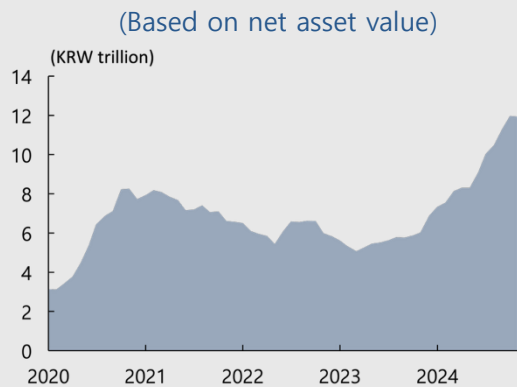
▪ Carbon allowance prices (as of June 1, 2025, World Bank): Korea (USD 6), EU (USD 70), global average (USD 31).  
<sup>42</sup> For more details on the transition benchmarks (ITBs; Investing for Transition Benchmarks), refer to <BOX 7> “Key Features of the EU Transition Benchmarks.”

## BOX 1 Current Status and Limitations of the Domestic ESG Fund Market

### 1. Current Status

Korea's ESG fund market has grown rapidly since the 2020s, driven by the spread of the Principles for Responsible Investment (PRI) and the global expansion of ESG investing (<Figure A1>). As of the end of May 2025, the total size of ESG funds (based on net assets) reached approximately KRW 12 trillion (158 funds), representing a fourfold increase compared with KRW 3.1 trillion in 2020 (hereafter based on Bloomberg data). A number of funds have also been launched with a specific focus on the environmental (E) dimension of ESG—30 funds with KRW 623 billion in assets as of the end of May 2025. In addition, some new low-carbon funds emphasize strategies to address climate change—12 funds with KRW 157 billion in assets as of the same date (<Table A1>).

<Figure A1> Size of Domestic ESG Funds<sup>1)</sup>



Note: 1) Based on funds that specify ESG elements in their names, investment objectives, or strategies.

Source: Bloomberg.

<Table A1> Types of Domestic ESG Funds<sup>1)</sup>  
(As of the end of May 2025)

(Number of funds, KRW billion)

Category	Number of Funds	Net Assets
ESG	158	11924
Environmental	30	623
Low-carbon	12	156

Notes: 1) Classification based on terms specified in the fund name, investment objectives, or strategies.

1. ESG: ESG, sustainability, environment, etc.

2. Environmental: environment, green, eco, etc.

3. Low-carbon: climate, carbon, net zero, transition, etc.

Source: Bloomberg.

### 2. Limitations

Despite their quantitative growth, domestic ESG funds are limited in their effectiveness as tools for managing investors' climate risks. Most ESG funds construct their portfolios based on ESG scores provided by external rating agencies (see "Major ESG Investment Strategies"), yet they offer little quantitative explanation regarding carbon reduction performance or targets. As a result, investors find it difficult to assess carbon reduction achievements and goals solely based on ESG scores. Furthermore, as ESG rating methodologies vary across rating agencies, even the same company may receive different scores. This inconsistency makes it difficult to compare

funds and weakens the linkage between ESG scores and actual corporate performance.

For these reasons, domestic ESG funds have been criticized for functioning as a superficial score-screening mechanism, rather than a genuine tool for hedging climate risks. In practice, some funds have invested in high-emission companies while labeling themselves as environmentally friendly based on low ESG ratings alone, leading to accusations of being “green in name only” (Green Post Korea, 2025). Concerns over the misuse of ESG labels and potential greenwashing also persist. Key causes include the absence of clear ESG evaluation standards, which makes it difficult for financial institutions to determine whether a product has been greenwashed during the issuance process (Shin & Han, 2023), as well as insufficient disclosure regulations that allow asset managers or advisors to embellish their ESG considerations (Lee, 2024).

## Major ESG Investment Strategies

ESG investment strategies integrate environmental (E), social (S), and governance (G) factors into traditional financial analysis and are generally classified into seven categories (Global Sustainable Investment Alliance, etc.). This classification system (<Table A2>) was established to provide a unified standard for the use of sustainability-related terminology, thereby preventing investor confusion and minimizing the potential for greenwashing. In addition, this framework is widely used across various areas such as the design of financial products by institutional investors, the implementation of disclosure obligations, and the measurement of performance.

<Table A2> Classification of ESG Investment Strategies

Category	Description
Screening	Applying predefined rules to make investment decisions.
Norms-based Screening	Selecting investments based on international norms established by organizations such as the UN, ILO, OECD, and NGOs, ensuring that companies or issuers meet minimum standards of business conduct.
Negative/Exclusionary Screening	Excluding specific industries, companies, countries, or other issuers from consideration as investment targets in a fund or portfolio (exclusion criteria may include product categories, corporate practices, or controversial activities).
Positive/Best-in-Class Screening	Investing in companies, industries, or projects with superior ESG performance within the same sector. Targets investments in companies that meet or exceed specific evaluation standards.
ESG Integration	An investment approach that aims to improve risk-adjusted returns by continuously considering ESG factors throughout the investment analysis and decision-making process.
Thematic Investing	An investment approach that selects assets to gain access to specific trends.
Stewardship	Activities that utilize investors' rights and influence to protect and enhance the long-term value of clients and beneficiaries. This includes shared interests related to economic, social, and environmental assets.
Impact Investing	An investment approach that seeks to generate positive and measurable social and/or environmental impacts while also pursuing financial returns.

Source: Lee (2025).



**BOX 3****EU Sustainable Finance Disclosure Regulation (SFDR)**

In 2019, the European Commission established the Sustainable Finance Disclosure Regulation (SFDR), which entered into full effect in 2021. The primary objectives of the SFDR are to prevent greenwashing in ESG financial products and to enhance accountability, transparency, and efficiency in the sustainable finance sector.

The SFDR classifies financial products into three categories based on the degree to which they pursue sustainability and assigns different disclosure obligations to each (<Table A3>). Specifically, the SFDR defines the following categories of financial products:

Article 6 Products: General financial products that do not incorporate ESG factors

Article 8 Products: Products that consider certain ESG elements

Article 9 Products: Products that have ESG objectives as their core purpose

The SFDR also requires all categories of financial products to disclose the integration of ESG risks into their investment decision-making processes, as well as the relationship between ESG risks and returns. In addition, separate disclosures are mandated when considering potential the Principal Adverse Impacts (PAI) arising from investments. Through these requirements, the SFDR institutionally ensures the transparent management and disclosure of ESG factors throughout the product design and operation stages, thereby serving as a key policy instrument to enhance the credibility of the sustainable finance market.

<Table A3> **Classification of Financial Products under the SFDR**

Category	Description
Article 9 Financial Products (Dark Green)	<ul style="list-style-type: none"> <li>▪ Financial products with the investment objective of sustainability.</li> <li>▪ The prospectus (pre-contractual disclosure) must specify:               <ul style="list-style-type: none"> <li>- (1) how the stated objective can be achieved;</li> <li>- (2) if a benchmark is referenced, how it aligns with the stated objective and how it differs from a conventional benchmark.</li> </ul> </li> <li>▪ The periodic report must disclose appropriate indicators reflecting sustainability-related impacts.</li> </ul>
Article 8 Financial Products (Light Green)	<ul style="list-style-type: none"> <li>▪ Financial products that promote environmental or social characteristics.</li> <li>▪ The prospectus (pre-contractual disclosure) must specify:               <ul style="list-style-type: none"> <li>- (1) how such environmental and social characteristics are promoted;</li> <li>- (2) if a benchmark is referenced, how that index is aligned with those characteristics.</li> </ul> </li> <li>▪ The periodic report must disclose the extent to which those characteristics have been achieved.</li> </ul>
Article 6 Financial Products (Others)	<ul style="list-style-type: none"> <li>▪ Financial products not classified under Articles 8 or 9.</li> <li>- Includes general disclosure requirements applicable to all financial products.</li> </ul>

Source: European Commission.

A pilot simulation was conducted for the K-PAB and K-CTB indexes based on 807 out of 821 companies listed on the KOSPI. The remaining 14 companies were excluded due to the absence of Scope 1 and 2 emissions data (as provided by Bloomberg). The construction of these indexes applied the decarbonization and sector composition requirements of the PAB and CTB, using an optimization methodology (<Table A4>) designed to minimize the return differentials from the parent index (KOSPI). Specifically, the variance–covariance matrix of stock returns—required for calculating the return differentials—was estimated using the Barra Multiple Factor Model (MFM), following prior studies such as Andersson et al. (2016). Through this methodology, the K-PAB and K-CTB indexes were designed as benchmarks that both reflect the practical decarbonization trajectories of the Korean stock market and maintain close linkage with the parent index.

<Table A4> Optimization Methodology

$\min TE = sd(R_c - R_k),$ $s.t. \begin{cases} \textcircled{1} \sum w_{ci} = 1 & \textcircled{2} w_{ci} \geq 0 & \textcircled{3} CI_c(0) \leq \beta CI_k(0) \\ \textcircled{4} CI_c(t+1) \leq 0.93 CI_c(t) & \textcircled{5} \sum w_{ci}^m \geq \sum w_{ki}^m \end{cases}$	
Objective	<ul style="list-style-type: none"> <li>▪ <math>\min TE = sd(R_c - R_k)</math></li> <li>- The objective function is set to minimize the tracking error (TE).</li> <li>- The tracking error is defined as the standard deviation of the difference between the climate benchmark return (<math>R_c</math>) and the KOSPI return (<math>R_k</math>).</li> <li>- <math>R_j = \sum w_{ji} r_i</math>, while <math>j = k, c</math>, which is calculated as the weighted average sum of the returns (<math>r_i</math>) and investment weight (<math>w_i</math>) of individual stock <math>i</math>.</li> <li>- Accordingly, <math>sd(R_c - R_k) = \sqrt{(W_c - W_k)^T Var(r) (W_c - W_k)}</math>, where <math>W_i</math> denotes the vector of investment weights (<math>I</math> indicates the transpose), and <math>Var(r)</math> represents the variance–covariance matrix of individual stock returns.</li> </ul>
Function	<ul style="list-style-type: none"> <li>▪ Estimation of <math>Var(r)</math>: Application of the Barra MFM</li> <li>- When calculating the ex-ante variance–covariance matrix using historical return data, a large number of stocks may lead to data scarcity, which can cause spurious correlations among variables (Andersson et al., 2016).</li> <li>- This issue can be addressed using the Barra MFM<sup>1)</sup> (refer to prior studies), where <math>Var(r) = x\Omega x^T + U</math>. Here, (<math>\Omega</math>) denotes the variance–covariance matrix of factor returns, and (<math>U</math>) represents the variance matrix of idiosyncratic factors.</li> <li>- In this study, 12 factors were used, including 11 style factors and 1 industry factor from the MSCI Barra Global Equity Model.</li> <li>→ Summarizing the above, <math>sd(R_c - R_k) = \sqrt{(W_c - W_k)^T (x\Omega x^T + U) (W_c - W_k)}</math></li> </ul>

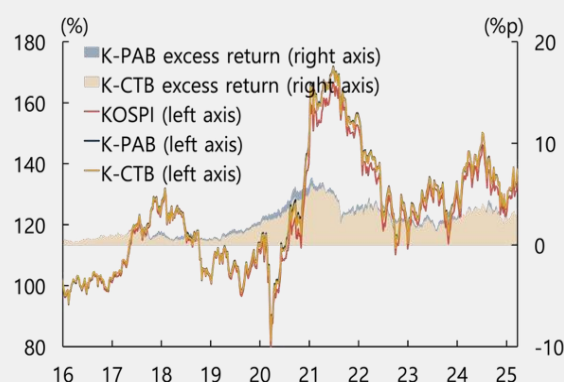
Constra ints	<p>▪ The optimization problem consists of five constraints.</p> <ol style="list-style-type: none"> <li>1. <math>\sum w_{ci} = 1</math> indicates that the total investment weights of all stocks in the climate benchmark must equal 1.</li> <li>2. <math>w_{ci} \geq 0</math> represents a constraint to prevent short positions in the benchmark composition.</li> <li>3. <math>CI_c(0) \leq \beta CI_k(0)</math> specifies that the initial portfolio's carbon intensity<sup>2)</sup> must be reduced by <math>(1 - \beta) \times 100\%</math> compared with that of the KOSPI (PAB=0.5, CTB=0.3) (hereafter based on MSCI data).</li> <li>4. <math>CI_c(t+1) \leq 0.93 CI_c(t)</math> indicates that an annual (YoY) reduction in carbon intensity of 7% or more must be achieved.</li> <li>5. <math>\sum w_{ci}^m \geq \sum w_{ki}^m</math> indicates that the total weight (<math>\sum w_{ci}^m</math>) of the manufacturing sector (<math>m</math>) in the climate benchmark must be no less than that of the KOSPI (<math>\sum w_{ki}^m</math>).</li> </ol> <p>Notes: 1) The Barra MFM explains returns through common factors, modeling the exposure of each stock to these factors. It estimates factor returns using regression analysis, expressed as <math>r = \alpha f + u</math>, where (<math>r</math>) is the vector of returns, (<math>\alpha</math>) is the factor exposure matrix, (<math>f</math>) is the vector of factor returns, and (<math>u</math>) is the vector of specific (idiosyncratic) components not explained by the factors.</p> <p>2) Carbon intensity refers to the weighted average carbon intensity, calculated as the weighted average (<math>w_{ci}</math>) of the individual firms' carbon intensities.</p>
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**BOX 5**

**K-PAB and K-CTB Simulation Results Including Scope 3 Emissions**

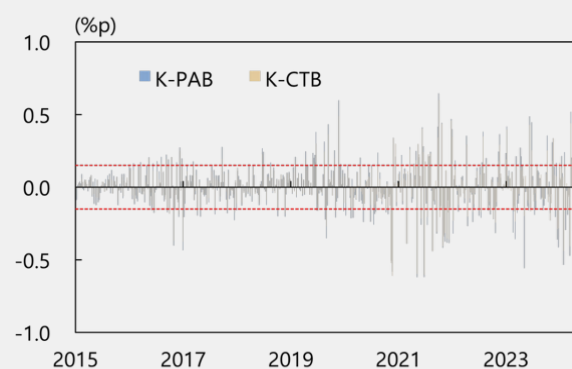
When including Scope 3 emissions in the construction of the K-PAB and K-CTB indexes (excluding industries without available Scope 3 data), the indexes continued to stably track the parent index (<Figure A4>). Based on the analysis period from October 2015 to March 2025, the cumulative excess returns of the K-PAB and K-CTB indexes over the parent index were 3.1 percentage points and 3.2 percentage points, respectively. Moreover, the standard deviations of weekly return differentials were relatively low at 0.17 (K-PAB) and 0.15 (K-CTB), indicating that the stability of returns between the indexes and the parent index was maintained (<Figure A5>).

**<Figure A4> K-PAB and K-CTB Returns**  
(Based on Scope 1, 2, and 3 Emissions)



Source: Authors' compilation.

**<Figure A5> Return Differentials between K-PAB, K-CTB and the Parent Index<sup>1)2)</sup>**  
(Based on Scope 1, 2, and 3 Emissions)



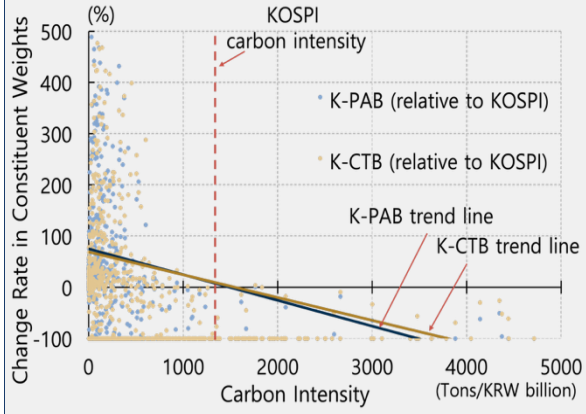
Notes: 1) Based on weekly data.

2) Dashed lines represent the  $\pm 0.15$  range.

Source: Authors' compilation.

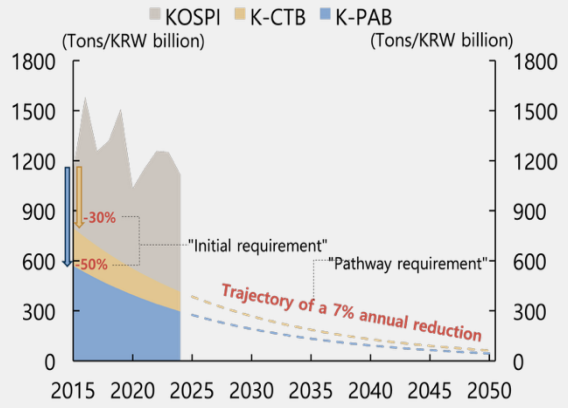
Compared with the parent index (KOSPI), most companies with higher carbon intensity (WACI) saw a decrease in their weights within the index, indicating a clear reallocation of capital from high-carbon to low-carbon firms (<Figure A6>). Furthermore, the pronounced climate-risk mitigation effect of the K-PAB and K-CTB indexes was demonstrated by significant variations in the average annual reduction in carbon intensity across indexes—1.6 percent for KOSPI versus 7 percent for the K-PAB and K-CTB indexes (<Figure A7>). However, since the Bloomberg Scope 1, 2, and 3 emissions data currently exclude Scope 3 information (i.e., financed emissions) for certain sectors such as banking, the analysis faced limitations in evaluating sector-specific performance, particularly within the financial industry.

<Figure A6> Carbon Intensity and Change Rate in Constituent Weights (2024)



Source: Authors' compilation.

<Figure A7> Carbon Reduction Trajectory with Scope 3 Inclusion



Source: Authors' compilation.

**BOX 6**
**Current Status of ESG Fund-naming Regulations in the EU and the U.S.**

In August 2024, the European Securities and Markets Authority (ESMA) announced new guidelines on ESG and sustainability-related fund names (<Table A5>). Recognizing that a fund’s name is often the first piece of information investors encounter and can directly influence investment decisions, these guidelines aim to clarify the criteria for using ESG-related terms in fund names and thereby prevent greenwashing.

The guidelines classify permissible ESG-related terms into five categories—(1) Transition, (2) Social, (3) Environmental, (4) Impact, and (5) Sustainability—and specify detailed criteria for each. Approximately 4,300 funds within the EU fall under the scope of this regulation, and among the 2,500 funds that disclosed detailed information, about 1,600 are expected not to meet the conditions for exclusion (Morningstar, 2025). The guidelines apply immediately to new funds, while existing funds are granted a six-month grace period and will be subject to the rules starting in May 2025.

<Table A5> ESMA Fund Naming Guidelines

Category	Number of Funds	Classification Criteria		
		Investment Criteria <sup>1)</sup>	Sustainability Criteria <sup>2)</sup>	Exclusion Criteria
▪ Transition-related terms (transition, net-zero, improvement, etc.)	225	80% threshold applied	Not applied	CTB criteria
▪ Social-related terms (social, equality, etc.)	124			
▪ Governance-related terms (governance, etc.)	5			
▪ Environmental-related terms (green, environment, climate, ESG, SRI, etc.)	2,384			
▪ Impact-related terms (impact, etc.)	219			
▪ Sustainability-related terms (sustainable, sustainability, etc.)	1,342		50% threshold applied	PAB criteria
Total	4,299	-	-	-

Notes: 1) At least 80 percent of fund assets must be managed for the achievement of environmental, social, governance, or sustainability objectives.

2) At least 50 percent of fund assets must be invested in the sustainable investment segment as defined under Article 2(17) of the SFDR.

Sources: ESMA, Lee (2025).

In September 2023, the U.S. Securities and Exchange Commission (SEC) amended its Names Rule to include ESG-related provisions. The amendment was introduced to prevent investor confusion caused by inconsistencies between a fund’s name and its actual investment strategy or holdings,

and to enhance transparency of fund management.

Under the revised rule, if a fund's name includes references to specific industries, regions, or ESG-related terms (e.g., ESG, Green, Sustainable), the fund is required to invest at least 80 percent of its assets in accordance with the implications of those terms. In addition, funds must disclose definitions of the terms used in their names as well as the criteria for selecting investment targets. A grace period of 24 to 30 months is provided, depending on the size of the fund, and the rule will apply to all applicable funds starting in June 2026. Approximately 10,000 funds—representing about 76 percent of all registered funds—are expected to be affected (SEC, 2023). However, depending on future changes in U.S. government policy direction, the final implementation timeline and scope of the regulation may be subject to adjustment.

**BOX 7**
**Key Features of the EU’s Transition Benchmarks**

In December 2024, the EU Platform on Sustainable Finance—an advisory body to the European Commission—proposed the introduction of the Investing for Transition Benchmarks (ITBs) to promote the low-carbon transition of the European economy (with a draft released in December 2023; see <Table A6>). The existing PAB and CTB impose stringent decarbonization requirements, mandating carbon intensity to be reduced by 50 percent (PAB) and 30 percent (CTB) relative to the parent index, followed by an additional annual reduction of at least 7 percent. As a result, high-emission companies have often been excluded from the benchmarks or assigned significantly lower weights, even when they possess long-term transition plans.

In contrast, the ITBs adopt a more flexible decarbonization requirement, imposing no mandatory initial carbon-intensity reduction, while maintaining the annual 7 percent reduction requirement. Instead, they place greater emphasis on tangible transition efforts, such as the expansion of Green CapEx—capital expenditures on renewable energy, low-carbon technologies, and energy efficiency—as defined under the EU Taxonomy. Accordingly, high-emission companies may still be included in the index if their specific transition trajectories and investment execution can be verified. Through this approach, the ITBs are regarded as a new market-based mechanism that encourages the decarbonization transition of companies.

<Table A6> Minimum Requirements for ITBs and ITBexs

Category	ITBs	ITBex
Decarbonization	<ul style="list-style-type: none"> <li>Annual reduction rate (YoY): At least 7%.</li> <li>Exception: Applied when decarbonization obligations are deferred due to green CapEx considerations.</li> </ul>	
Investment Exclusion	<ul style="list-style-type: none"> <li>Companies involved in controversial arms-related activities</li> <li>Companies engaged in tobacco cultivation or production</li> <li>Companies violating the UN Global Compact (UNGC) principles or the OECD Guidelines for Multinational Enterprises</li> </ul>	<ul style="list-style-type: none"> <li>Coal: 1% or more of revenues and CapEx</li> <li>Oil: 10% or more of revenues and CapEx</li> <li>Gas: 50% or more of revenues and CapEx</li> </ul>
Expansion of Green CapEx	<ul style="list-style-type: none"> <li>(Developed EMEA countries) Annual growth rate (YoY): 5% or higher</li> <li>(Global, U.S., Asia, etc.) Compound annual growth rate (YoY): 1.5% or higher</li> </ul>	
Minimum Green CapEx Ratio	<ul style="list-style-type: none"> <li><math>\text{Green CapEx} \div \text{Market Capitalization} &gt; 1</math></li> </ul>	
Decarbonization Deferral	<ul style="list-style-type: none"> <li>Benchmark setters may adjust or relax the 7% annual reduction target based on the proportion of Green CapEx (as of year-end). → Adjusted reduction rate = <math>7\% \times (1 - \text{share of Green CapEx}^1)</math> (e.g., if the Green CapEx share is 40%, the minimum reduction burden decreases from 7% to 4.2%)</li> </ul>	

Note: 1) Share of Green CapEx in total CapEx.

Source: EU Platform on Sustainable Finance.

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