



South Korea's Export Credit Finance in Transition

National Economic Impacts of the Global Shift
from Fossil Fuels to Clean Energy



Publication Date **November 2025**

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Please cite as

SFOC and GESI (2025), South Korea's Export Credit Finance in Transition:
National Economic Impacts of the Global Shift from Fossil Fuels to Clean Energy

Published by

SFOC
Solutions for Our Climate

GESI
Green Energy Strategy Institute

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South Korea's Export Credit Finance in Transition

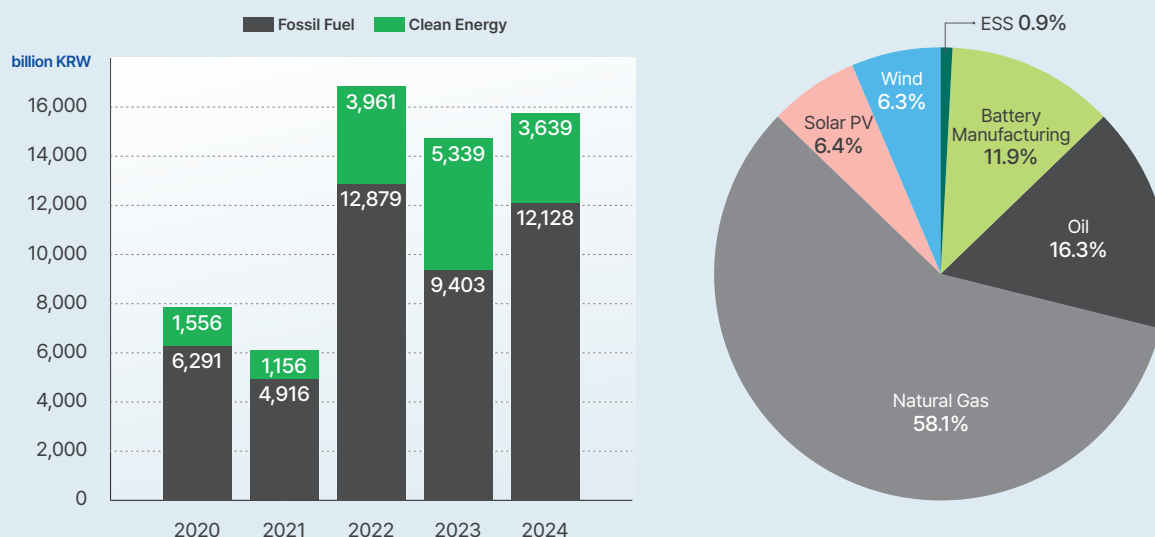
National Economic Impacts of the Global Shift
from Fossil Fuels to Clean Energy

Executive Summary

This study examines how South Korea’s public export finance—currently one of the world’s largest financiers of fossil-fuel infrastructure—can realign with the global shift toward clean energy. Using a newly compiled database of overseas energy projects supported by South Korea’s public export finance agencies (2020–2024), it provides the first quantitative assessment of how this transition reshapes the economic impacts of South Korea’s export credit financing.

South Korea’s key public export finance agencies—KEXIM, K-SURE, and KDB—have each declared a commitment to carbon neutrality by 2050. However, none has yet presented a concrete plan or phased roadmap for reducing oil and gas financing. **Between 2020 and 2024, South Korea’s public export finance remained structurally dominated by fossil fuels, amounting to approximately KRW 61.3 trillion, of which fossil fuels accounted for 74.5%.** These patterns contrast with major economies whose Export Credit Agencies (ECAs) are aligning their portfolios with international climate finance commitments and phasing out fossil-fuel projects.

Fossil Fuel vs. Clean Energy Financing by Infrastructure Type (2020–2024)

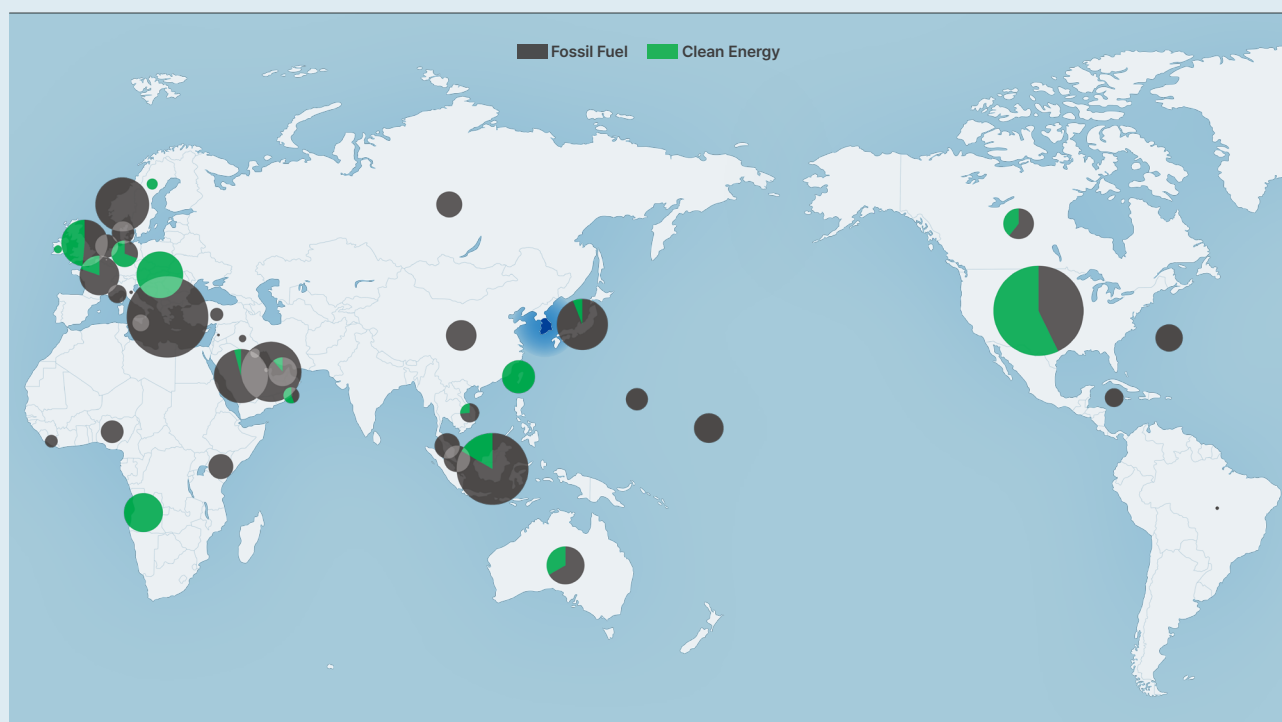


- **Note:** Coal is excluded in line with the global ECA trend to end coal project support. Nuclear and hydrogen were excluded due to environmental risks and policy uncertainty, and energy efficiency and transmission networks because they apply to both fossil and clean energy infrastructure.

Among energy-related financing cases, natural gas (KRW 35.63 trillion, 58.1%) and oil (KRW 9.99 trillion, 16.3%) together accounted for the majority of total financing. In contrast, clean-energy financing was led by battery manufacturing (11.9%), followed by solar PV (6.4%), wind (6.3%), and energy storage systems (0.9%). This distribution indicates that Korea's export finance remains heavily fossil-fuel-oriented, while clean-energy financing has been concentrated in upstream manufacturing activities—particularly battery production—rather than generation or storage assets.

South Korea's public export finance also exhibited distinct geographical patterns. Clean-energy financing was primarily directed toward advanced economies and manufacturing hubs such as the United States and Europe, whereas fossil-fuel financing was concentrated in the Middle East and Southeast Asia, where large-scale support was provided for oil and gas projects. **Continued export credit support for fossil infrastructure risks stranded assets, weak long-term returns, and carbon lock-in effects for developing countries reliant on Korean financing.**

Regional Distribution of Importing Countries (2020–2024)



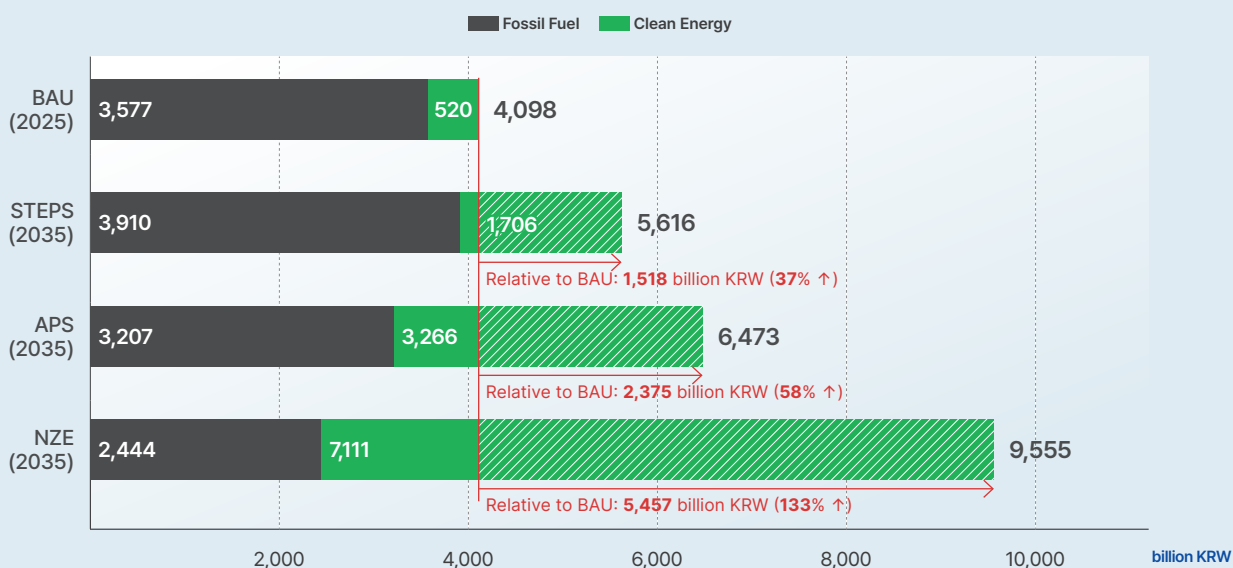
The analysis covers the entire value chain of both fossil-fuel projects (oil and gas production, transportation, refining, petrochemicals, and power generation) and clean-energy projects (solar PV, wind, energy storage systems, and battery manufacturing).

For the economic impact analysis, two sets of scenarios were examined:

- (1) Global Climate Scenarios, based on the IEA (2024) *Net-Zero framework*
- (2) Business-as-Usual (BAU) Scenarios, which assume that the current level of public export support (2020–2024 average) remains unchanged

The results show that deeper global decarbonization yields greater economic benefits for South Korea. Under the NZE scenario, total value added supported by public export finance in 2035 reaches KRW 9.56 trillion—KRW 5.46 trillion higher than under BAU. The expansion of the clean-energy industry investment contributes an additional KRW 6,591 billion in value added (rising from 520 to 7,111 billion) across the economy—an increase of more than tenfold— while value added associated with the fossil-fuel industry declines by KRW 1,134 billion.

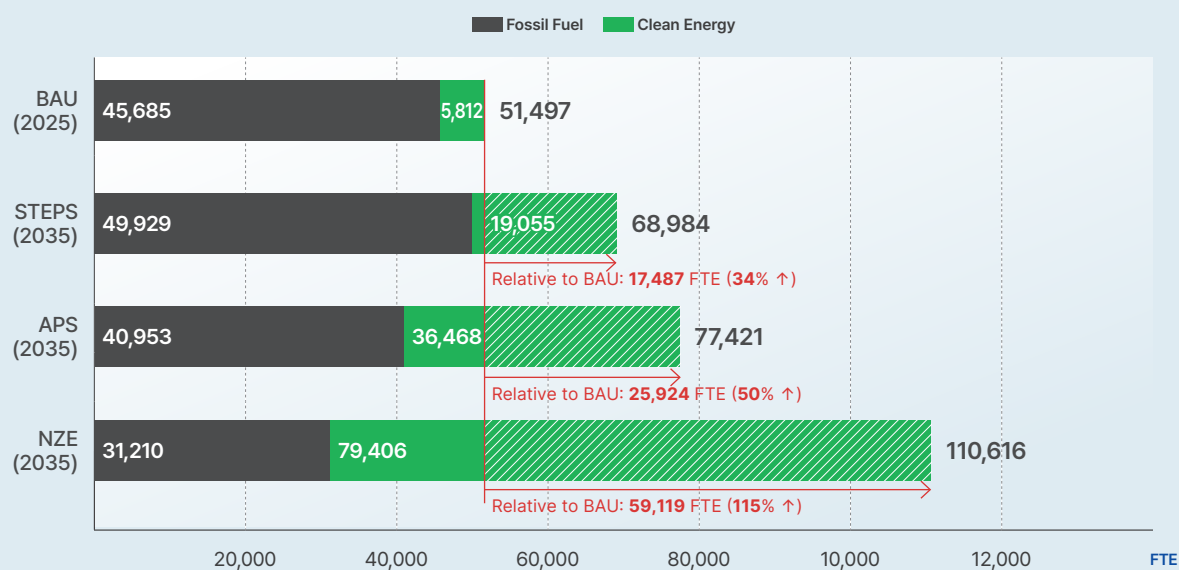
Value-added Impacts supported by Export Credit Finance in 2035



- **BAU (Business-as-Usual):** Maintains current energy mix trajectory with fixed public export finance at the 2020–2024 average of KRW 8,390 billion per year.
- **STEPS (Stated Policies Scenario):** Follows existing policy commitments without additional climate ambition. Export finance volumes decline or grow in line with STEPS assumptions.
- **APS (Announced Pledges Scenario):** Assumes all countries fully achieve their announced climate and energy pledges. Export finance volumes decline or grow in line with APS assumptions.
- **NZE (Net-Zero Emissions Scenario):** A global pathway consistent with limiting warming to 1.5°C. Export finance volumes decline or grow in line with NZE assumptions.

Under the NZE scenario, economy-wide employment supported by public export finance in 2035 reaches 110,616 FTE—59,119 FTE higher than under BAU. The expansion of the clean-energy industry investment contributes an additional 73,594 FTE (rising from 5,812 to 79,406 FTE) across the economy—an increase of more than tenfold— while employment associated with the fossil-fuel industry declines by 14,475 FTE.

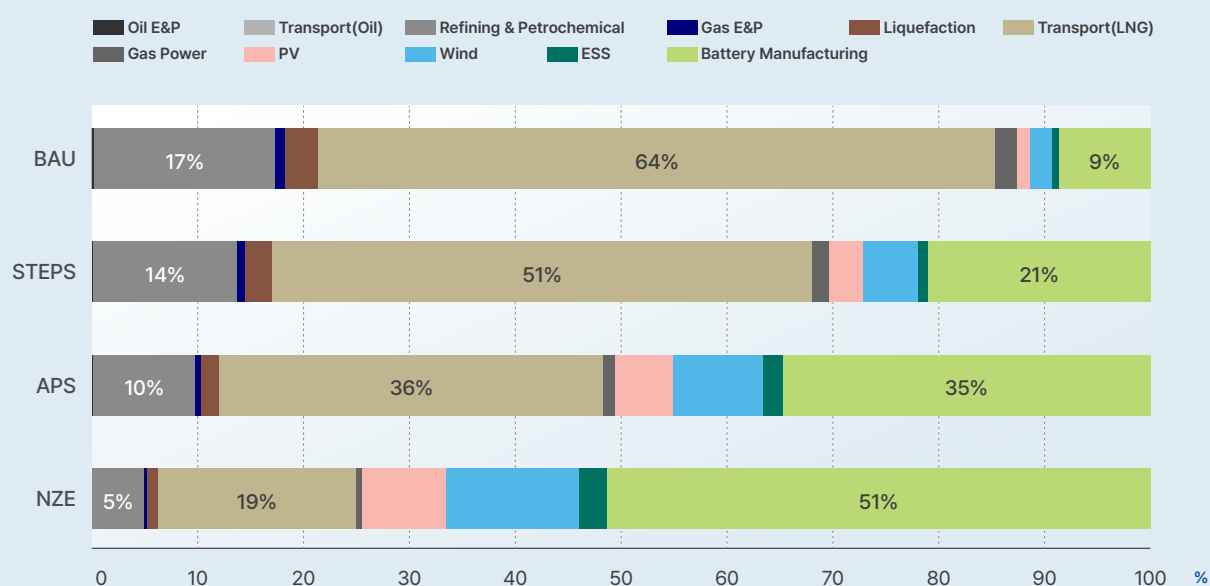
Employment Impacts supported by Export Credit Finance in 2035



▪ **FTE (Full-Time Equivalent):** The number of full-time employees working for one year.

Value-added contributions rise from 0.18% of 2024 GDP under BAU to 0.42% under NZE. Battery manufacturing emerges as the dominant driver of clean-energy impacts, while traditional fossil-fuel value chains—particularly LNG carriers and refining & petrochemicals—gradually lose economic significance across scenarios.

Proportion of Value-added Impacts by Value Chain

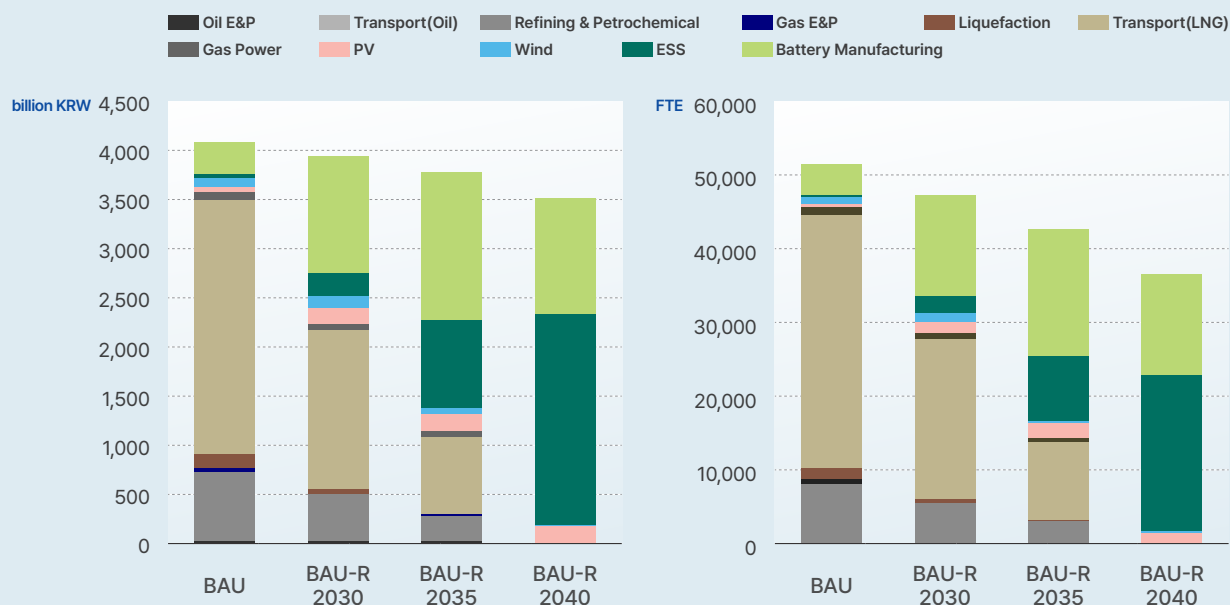


The economic impact results capture the direct, indirect, and induced effects of value added and employment supported across all industries in South Korea.

These results are based on the assumption that South Korea's public export finance agencies expand their total financing in line with global investment growth under each IEA scenario. Accordingly, the estimated impacts reflect both the changing composition of support between fossil fuels and clean energy and the overall increase in total export finance.

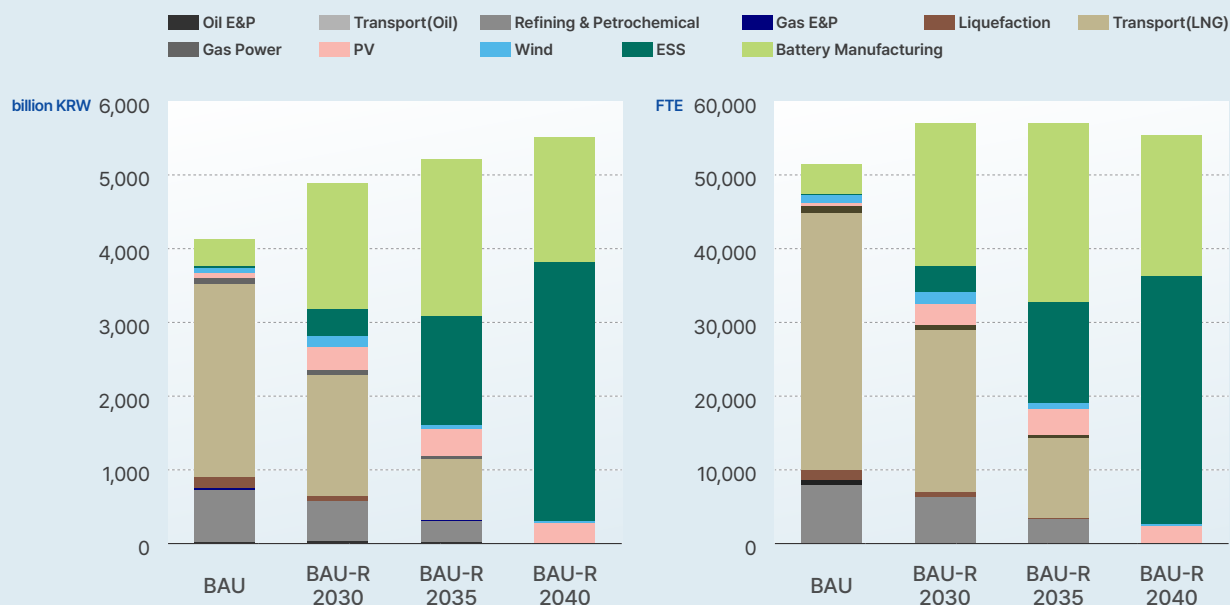
Portfolio redirection analysis shows that maintaining current export-finance levels while fully shifting from fossil fuels to clean energy by 2040 initially reduces unit economic impacts due to lower domestic content in clean-energy value chains. However, with enhanced export competitiveness and localized supply chains—similar to South Korea's dominance in LNG carriers which has benefited from substantial public financing—unit value-added impacts could rise from KRW 0.49 billion to 0.65 billion per billion KRW of financing, while job creation increases from 6.14 to 6.59 FTE per billion KRW.

Export Finance Redirection towards 100% Clean Energy under Current Domestic Content Value Added (Left), Employment (Right)



- **BAU (Business-as-Usual):** Maintains current energy mix trajectory with fixed public export finance at the 2020-2024 average of KRW 8,390 billion per year.
- **BAU-Redirection (Business-as-Usual-Redirection):** The total level of export support remains the same as in BAU, but the portfolio gradually shifts toward 100% clean energy by 2040.
- **Domestic Content:** the proportion of value generated within South Korea—through domestic labor, materials, and services—relative to the total export value of a product or project.

Export Finance Redirection towards 100% Clean Energy under Advanced Domestic Content Value Added (Left), Employment (Right)



The findings demonstrate that the global clean energy transition represents a strategic economic opportunity rather than a threat for South Korea.

The study recommends:

- Integrating clean-energy targets into public export-credit frameworks
- Establishing clear phase-out schedules for oil and gas financing
- Strengthening domestic content in clean-technology value chains
- Promoting innovation in battery production and circular-economy infrastructure

Aligning export-credit policies with global decarbonization goals is both a climate imperative and an economic necessity for sustaining South Korea's export-driven growth.

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Abbreviations

Abbreviation	Full Term	Description
APS	Announced Pledges Scenario	IEA scenario in which all countries fully achieve their announced climate and energy pledges.
BAU	Business-as-Usual	Baseline scenario assuming current level of export credit finance support and energy mix.
BAU-R	Business-as-Usual with Redirection	Scenario maintaining total export-finance volume as BAU while gradually shifting to 100 % clean energy by 2040.
ESS	Energy Storage System	Technology that stores electricity for later use, enhancing grid flexibility and reliability.
CCS	Carbon Capture and Storage	Process of capturing and permanently storing CO ₂ emissions from industrial or power facilities.
COP	Conference of the Parties	Decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC).
ECA	Export Credit Agency	Government-backed institution providing loans, guarantees, and insurance to support exports.
EPC	Engineering, Procurement and Construction	Contracting model that covers design, procurement, and construction of a project.
EU	European Union	Political and economic union of 27 European countries.
EXIM	Export-Import Bank	Government agency providing export credit and guarantees.
FTE	Full-Time Equivalent	Measure of employment equivalent to one full-time job for one year.
GDP	Gross Domestic Product	Total market value of goods and services produced within a country.
HS	Harmonized System	International nomenclature for classifying traded goods.
IEA	International Energy Agency	Organization providing global energy data, modeling, and policy analysis.

Abbreviations

Abbreviation	Full Term	Description
IMF	International Monetary Fund	UN-affiliated institution promoting global monetary cooperation and financial stability.
IO	Input–Output (model/analysis)	Economic framework capturing inter-industry relationships used to estimate value-added and employment impacts.
KDB	Korea Development Bank	Korea’s state-owned policy bank financing industrial and export-linked projects.
KEXIM	Korea Export–Import Bank	Korea’s primary export credit agency providing loans and guarantees for overseas projects.
K-SURE	Korea Trade Insurance Corporation	Korea’s export credit insurer offering guarantees and insurance to Korean exporters.
KITA	Korea International Trade Association	Business organization supporting Korean trade promotion and policy research.
KOPIA	Korea Plant Industries Association	Industry association representing Korea’s plant-engineering and construction sector.
KRW	Korean Won	Official currency of South Korea (Republic of Korea).
LNG	Liquefied Natural Gas	Natural gas converted to liquid form for storage and transport.
NZE	Net-Zero Emissions Scenario	IEA scenario consistent with limiting global warming to 1.5 °C.
OECD	Organization for Economic Co-operation and Development	Intergovernmental organization headquartered in Paris, comprising 38 member countries that promote sustainable economic growth, open markets, and democratic governance.
PV	Photovoltaic	Technology that converts sunlight directly into electricity using solar cells.
STEPS	Stated Policies Scenario	IEA scenario reflecting existing policy commitments without additional climate ambition.
UN	United Nations	International organization promoting peace, security, and cooperation.



Chapter 1. Introduction

1.1. Motivation

South Korea (hereafter Korea) continues to lag in energy transition, both domestically and internationally. At home, it recorded the lowest share of renewable energy in power generation among OECD countries in 2023, with renewables accounting for only 8% of electricity generation.¹ Internationally, it remains the second largest public financier of fossil-fuel infrastructure, supporting carbon-intensive energy projects overseas.² These trends indicate that Korea has not aligned its financial systems with global decarbonization goals despite its commitment under the Paris Agreement.

Fossil fuels have underpinned Korea's rapid industrialization and export-oriented growth. However, the foundations of global competitiveness are shifting as clean energy technologies become increasingly cost-effective and policy frameworks evolve toward low-carbon solutions. The global market for clean-energy infrastructure and related value chains is projected to expand substantially in the coming decades. This raises questions about whether continued public financial support for fossil-fuel infrastructure—particularly through export credit finance—remains a viable long-term strategy for Korea's economy.

Korea is the world's eighth largest exporter in 2023, with exports accounting for around 40 percent of GDP.³ This dependency is quite substantial when compared to Japan's 18% and the UK's 15%. Korea's exports are strongly backed by public export finance agencies that reduce project risks through loans, guarantees, and insurance. A considerable share of this financing has flowed into fossil-fuel related industries, including LNG carriers, oil and gas power plants, and petrochemical facilities.⁴ While such support has attracted investment and bolstered exports, it has also contributed to locking in carbon-intensive assets abroad.

Public export finance provided through Export Credit Agency (ECA) plays a pivotal role in enabling energy projects. By offering long-term risk-mitigation instruments and mobilizing large-scale private investment, ECAs often determine whether a project can move forward. As government-directed and policy-responsive institutions, they ultimately shape the technological composition and geographical distribution of global energy investment.^{5 6 7 8}

Many countries have ended public finance for fossil fuels, while Korea has pledged to restrict only coal support while continuing to provide financial backing for oil and gas projects. This raises concerns about the alignment of Korea's export finance policies with international climate commitments.

Research on the socio-economic impacts of export finance for energy projects remains limited, largely due to difficulties in acquiring reliable data, while most studies are limited to descriptive analysis on public financing patterns. Moreover, Korean research on the socio-economic impacts of clean energy has primarily focused on the domestic market. Given Korea's high export dependence, understanding how export finance decisions and changes in global market affect national employment and value-added outcomes is essential. This study represents the first quantitative assessment of such impacts in Korea.

Analyzing the economy-wide effects of the global shift from fossil fuels to clean energy can help identify both the risks and opportunities faced by export-dependent industries.⁵ Evidence also shows that financial and tax support mechanisms have among the strongest positive impacts on employment across government policy instruments.⁹ Building on existing research demonstrating that public export credit finance plays a vital role in enabling exports, this study aims to analyze the relationship between targeted export finance and the value added and jobs supported in fossil-fuel and clean-energy infrastructure.

1.2. Research Objectives

This study aims to answer the following research questions:

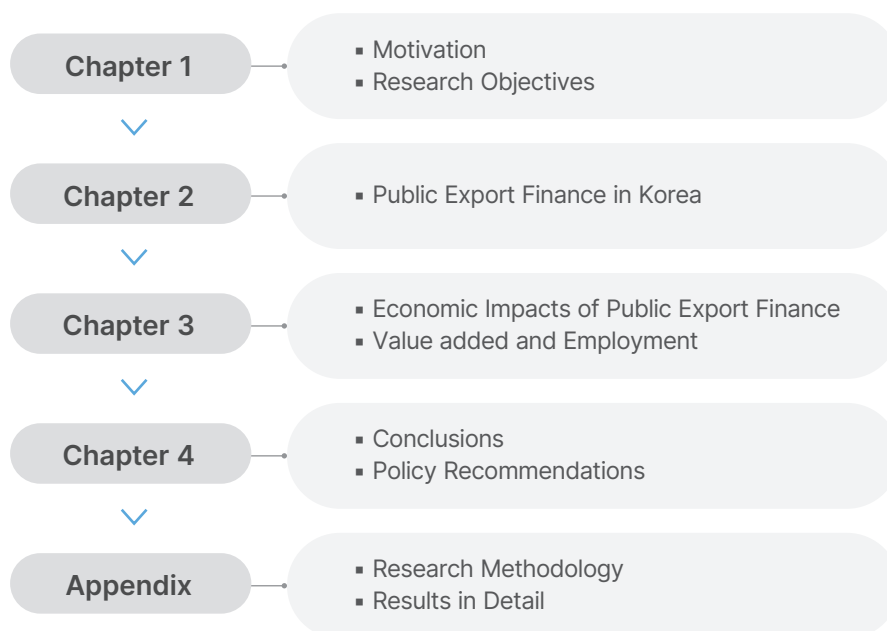
- **How does the global transition toward clean energy reshape the economic and employment impacts of Korea's export credit financing?**
- **How can Korea maximize economic gains?**

The analysis covers the entire value chain—from upstream to downstream—for both sectors:

- Fossil-fuel projects associated with oil and gas production, transportation, and use.
- Clean-energy projects including solar PV, onshore and offshore wind, Energy Storage Systems (ESS; limited to battery-based systems), and battery manufacturing.

Ultimately, this study aims to generate evidence-based insights to inform Korea's export finance strategy and support public and legislative discussions on aligning financial policy with climate goals.

1.3. Structure of the Report



This report is structured into five main chapters:

- **Chapter 1** introduces the motivation, research background, and objectives of the study.
- **Chapter 2** examines Korea's export finance system, outlining its institutional framework, financial instruments, and the current allocation of financing between fossil-fuel and clean-energy projects.
- **Chapter 3** presents the core empirical analysis, quantifying the value-added and employment impacts of export finance across global climate scenarios and portfolio redirection scenarios.
- **Chapter 4** draws from these findings to propose policy recommendations for reforming Korea's export finance strategy in alignment with global decarbonization goals.
- **The Appendix** provides a detailed overview of the research methodology, including data sources, analytical framework, scenario design, and economic impact assessment methods, alongside supplementary results from Chapter 3.

Chapter 2. Public Export Finance in Korea

2.1. Global Public Export Finance Trends

While Korea's public export finance continues to be dominated by fossil fuels, international financial institutions are rapidly shifting away from such investments. As of 2025, 118 global financial institutions have adopted exclusion policies for oil and gas projects, and more than half of the world's 50 largest banks have imposed restrictions on fossil-fuel financing. Public financial institutions are following the same trajectory: 41 governments have joined the Clean Energy Transition Partnership (CETP)^a—of which Korea is not yet a member.¹⁰

In major economies, ECAs are restructuring their portfolios in line with these goals, and their approaches can be broadly categorized into several models. The following classification is derived from official public commitments and policy announcements issued by the agencies, rather than from a comprehensive review of their actual financing activities. **The first group comprises countries that formally prohibited or significantly restricted new fossil-fuel financing** while expanding support for clean energy. The United Kingdom's UKEF, for instance, has halted all new fossil-fuel support since 2021 and announced a plan to provide £10 billion in financing for clean growth by 2029.^{11 12} The Netherlands' Atradius has declared to cease providing support for fossil-fuel exploration, development, and transportation projects since 2023, while increasing the share of sustainable projects within its overall portfolio.¹³ Denmark's EIFO has implemented a complete ban on financing fossil-fuel power plants and related infrastructure starting in 2025, and is establishing a financing framework centered on wind and solar energy projects.¹⁴ **The second group consists of countries that have set medium to long-term reduction targets** and adopted a gradual phase-out strategy for fossil-fuel financing. France's Bpifrance has set a target to significantly reduce its fossil-fuel exposure by 2030,¹⁵ while Germany's Euler Hermes aims to achieve the same by 2045. Germany has increased the share of renewable energy to nearly half of its export credit support for the energy sector, reflecting a strategy that aligns long-term decarbonization goals with tangible short-term progress.¹⁶ **The third group includes countries that expand clean-energy financing through institutionalized internal allocations**, such as the United States. The U.S. EXIM Bank is legally required to allocate

^a The Clean Energy Transition Partnership (CETP), launched at COP26, is a coalition of countries and public finance institutions committed to shifting international public support from unabated fossil fuels to clean energy within a year of signing, to help keep the 1.5°C climate goal within reach.

at least 5% of its total authorization each year to clean-energy exports, thereby advancing portfolio transformation through a legislated mechanism.¹⁷ **The fourth group comprises countries that have publicly declared international commitments to phase out fossil-fuel support, while still maintaining certain indirect or transitional fossil-related financing.** Canada's EDC announced the cessation of new overseas fossil-fuel support after 2022, in line with the pledges made at COP26 and other international agreements.¹⁸ Japan has also declared to halt new coal, oil, and gas project financing under the G7 commitment, shifting its strategy toward green bond investments.¹⁹

Table 2.1 below summarizes the ECA policies of major economies on fossil-fuel and clean-energy investment.

[Table 2.1] ECA Policies on Fossil-Fuel and Clean-Energy Investment

Country	Fossil-Fuel Policy	Clean-Energy Policy
Netherlands (Atradius)	Declared to end public financial support in 2023 for upstream oil and gas exploration, extraction, storage, and related fossil-fuel projects, including new LNG carriers and overseas fossil-fuel developments.	Operating a "Green Label" program to support environmentally responsible export transactions.
Denmark (EIFO)	Support for fossil-fuel power generation, exploration, extraction, and transportation is set to end by 2025, and EIFO has already excluded LNG carriers and LNG bunkering vessels from financing under its current policy.	Focused on financing wind and solar; strengthened clean-energy support.
France (Bpifrance)	Since 2022, France has stopped export finance guarantees and insurance for new coal, oil, and gas power generation, exploration, extraction, and transportation projects.	Expanded support for clean energy and efficiency projects; cumulative support exceeding EUR 7.6 billion.
Germany (Euler Hermes)	Ended new direct public support for unabated fossil fuels, including LNG vessels; committed to achieve net zero by 2045.	Expanded guarantees for renewable projects; increased renewable share within export credit guarantees.
United Kingdom (UKEF)	Ended new direct support for overseas fossil-fuel projects including LNG vessels in 2021 (with very limited exceptions).	"Clean Growth Strategy" launched, targeting GBP 10 billion portfolio by 2029, including hydrogen, offshore wind, and other clean sectors.
United States (EXIM)	Although a commitment was announced at COP26, EXIM recently lifted its restrictions on financing overseas coal-fired power projects.	Minimum 5% of total financing allocated to clean energy.
Canada (EDC)	Ended new direct financing for overseas fossil-fuel projects after 2022.	Expanded renewable energy project financing.
Japan (NEXI, JBIC)	Ended support for new, non-abated fossil-fuel projects in line with the 2022 G7 commitment.	Expanded renewable energy project financing

Source: Author's compilation from national ECA materials [12](#) [13](#) [16](#) [18](#) [19](#) [20](#) [21](#) [22](#)

Although these commitments represent important progress, gaps remain between pledges and actual financing practices. For example, Atradius DSB supported Brazilian offshore oil and gas development in 2023 and LNG-related assets in 2024.²³ Japan, a non CETP country, continues to support large-scale oil and gas projects globally; JBIC alone has issued approximately USD 3.9 billion since 2023 (as of August 2024),²⁴ contrary to its G7 pledge.

While implementation approaches vary, CETP members share three features absent in Korea's framework: (i) Specific fossil-fuel restrictions with defined timelines, (ii) transparent classification systems preventing fossil assets from being labeled as climate finance, and (iii) measurable clean-energy targets. These features have produced a consistent trend—declining fossil-fuel shares and rising clean-energy allocations, with transparent reporting enabling verification.

Meanwhile, Korea Export–Import Bank (KEXIM), Korea Trade Insurance Corporation (K-SURE), and Korea Development Bank (KDB) have all declared carbon neutrality by 2050 but have yet to present specific plans or phased roadmaps for reducing oil and gas financing. KEXIM has announced a goal to provide KRW 115 trillion in green finance by 2030. However, both the definition of “green” or “environmentally friendly” finance and the institution’s stance on oil and LNG financing remain ambiguous. Critics have pointed out that the Financial Services Commission’s green finance classification standards, which categorize certain projects as “climate finance,” amount to greenwashing. This concern has been substantiated by findings that KEXIM is classifying LNG carriers—fossil-fuel infrastructure—as “green finance” and providing large-scale financial support for them.²⁵ The so-called green portfolio still includes projects such as hydrogen and carbon capture and storage (CCS), which blur the boundary between fossil-based and genuinely low-carbon investments”.²⁶ K-SURE has also pledged to expand support for environmentally friendly projects but has not specified any restrictions on fossil-fuel financing.²⁷ Similarly, KDB announced plans to provide KRW 154 trillion in green finance from 2024 to 2030, yet this target covers its overall lending portfolio rather than outlining a strategy specific to export finance.²⁸

Table 2.2 below summarizes the De-gas and De-Oil Targets by countries.

[Table 2.2] De-gas and De-Oil Targets by Countries

Countries	2025	2030	2040	2050
Korea (K-SURE, KEXIM, KDB)	None			
Germany (2045-)			100%	100%
France, Austria, Poland		100%	100%	100%
UK, Netherlands, Denmark, Canada, Japan	100%	100%	100%	100%

Source: Author’s compilation from national ECA-related materials ²⁹ ³⁰

2.2. Landscape of Public Export Finance Supports in Korea

LEGAL BASIS AND INSTITUTIONAL ROLES OF MAJOR AGENCIES

Korea Export-Import Bank (KEXIM): Established in 1976 under the *Export-Import Bank of Korea Act*, KEXIM is the country's primary ECA. Its mandate is to provide financing for exports, imports, overseas investment, and international resource development, thereby supporting Korea's external economic cooperation. The bank offers long-term, low-interest loans and guarantees for capital-intensive export industries such as power plants, industrial plants, and shipbuilding. It also plays a central role as a project finance arranger, coordinating co-financing with commercial banks and facilitating financial closure.³¹

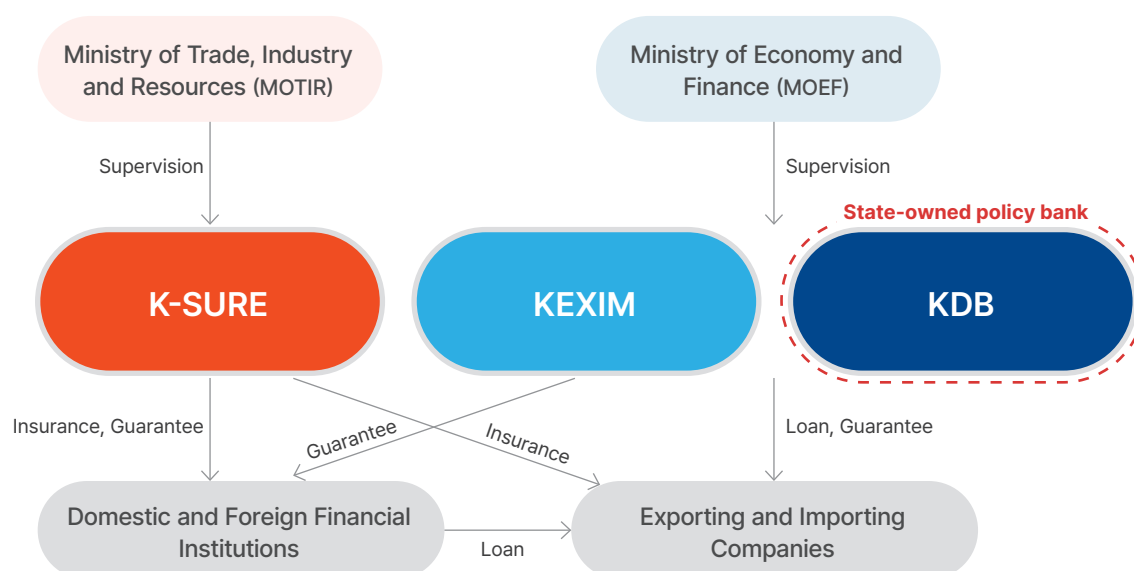
Korea Trade Insurance Corporation (K-SURE): Established in 1992 under the *Trade Insurance Act*, K-SURE is an ECA that promotes trade and overseas investment by providing insurance and guarantees. It compensates exporters and financial institutions for losses arising from commercial defaults or political risks involving foreign buyers. By attaching repayment guarantees to bank loans, K-SURE encourages greater participation from private financial institutions. Through a range of instruments—including short and medium-to-long-term export insurance, import insurance, and foreign exchange risk insurance—it enhances the financial stability and competitiveness of Korean exporters.³²

Korea Development Bank (KDB): Established in 1954 under the *Korea Development Bank Act*, KDB is a state-owned policy bank that provides public financing for industrial development and export-linked projects. Although it is not legally classified as an ECA, KDB plays a pivotal role as a co-arranger and co-lender in large-scale overseas project financing.³³ There are three key reasons for including KDB in the analysis of Korea's public export finance system: (i) Institutionally, KDB functions as a government-operated public finance instrument designed to fulfill policy objectives. (ii) Structurally, it supplements the financing capacity that cannot be met solely by KEXIM and K-SURE, enabling financial closure through syndicated and coordinated loans. (iii) Empirically, KDB participates in many large-scale projects such as LNG carriers and overseas power plants—often with a larger lending share than KEXIM. Excluding KDB would therefore underestimate the actual structure and magnitude of Korea's public export finance system.

Throughout this report, KEXIM, K-SURE, and KDB are collectively referred to as *Public Export Finance Agencies*. Figure 2.1 shows how these agencies interact within Korea's public export finance system.

EXPORT FINANCE MECHANISM

[Figure 2.1] Structure of Korea's Public Export Finance System



Source: Author's compilation based on data from the official websites of KEXIM, K-SURE, and KDB **34 35 36**

Korea's public export finance system is an integrated structure that combines loans, guarantees, and insurance. Within this framework, KEXIM focuses on loans, K-SURE on guarantees and insurance, and KDB on complementary policy finance and large-scale project support—together enhancing overall financial closure.

Loans are the most fundamental instrument, providing direct funding to exporters and overseas projects. This function is primarily carried out by KEXIM and KDB, which constitute the capital backbone of Korea's public export finance by extending project financing (PF) and export base loans. In this context, PF refers to debt-based financing secured by project cash flows, rather than equity investment.

Guarantees mitigate financial risks that may arise during overseas transactions and project execution, thereby facilitating the participation of private financial institutions. All three institutions engage in this function, but K-SURE serves as the lead agency, with KEXIM and KDB playing supplementary roles.

Insurance absorbs commercial and political risks faced by exporters and lenders, providing coverage for long-term and uncertain international projects. K-SURE offers a wide range of products covering risks such as payment default and political instability in overseas investments. While KEXIM does not independently manage insurance, it collaborates with K-SURE to provide hybrid guarantee–insurance instruments for selected transactions. The key distinction between a guarantee and insurance is

that a guarantee protects lenders by ensuring repayment to financial institutions, whereas insurance compensates exporters or investors for their direct losses arising from commercial or political events. Table 2.3 below summarizes the export finance mechanisms — loans, guarantees, and insurance — provided by each public export finance agency.

[Table 2.3] Export Finance Mechanisms by Agency^b

Category	KEXIM	K-SURE	KDB
Loan	• Export Promotion Loan • Export Growth Loan • Export Project Loan (PF Loan) • Export Facilitation Loan	–	• Senior Loan • Subordinated Loan • Export Base Loan • Export Execution Loan • Local Subsidiary Loan
Guarantee	<i>(Guarantees for loans provided by financial institutions or for intergovernmental transactions)</i> • Export-Related Financial Guarantee • Overseas Business-Related Financial Guarantee	• Export Credit Guarantee (Pre-shipment) • Export Credit Guarantee (Post-shipment) • Export Credit Guarantee (Negotiation) • Export Credit Guarantee (Comprehensive Negotiation)	<i>(Limited Scope)</i> • Advance Payment Bond • Export Credit Guarantee • Performance Bond
Insurance	<i>(In collaboration with K-SURE)</i> • Medium- and Long-term Export Insurance • Overseas Investment Insurance • Export Credit Insurance • Export Bond Insurance	• Short-term Export Credit Insurance • Medium and Long-term Export Credit Insurance • Export Bond Insurance • Export Infrastructure Insurance • Interest Rate Risk Insurance • Overseas Business Credit Insurance • Overseas Investment Insurance • Foreign Exchange Risk Insurance	–

Source: Author's compilation based on data from the official websites of KEXIM, K-SURE, and KDB **37 38 39**

^b Terminologies such as “Advance Payment Bond,” “Export Credit Guarantee,” and “Overseas Investment Insurance” follow the standard definitions used in the OECD Arrangement and by major export credit agencies, including OECD, UK Export Finance (UKEF), and Euler Hermes.

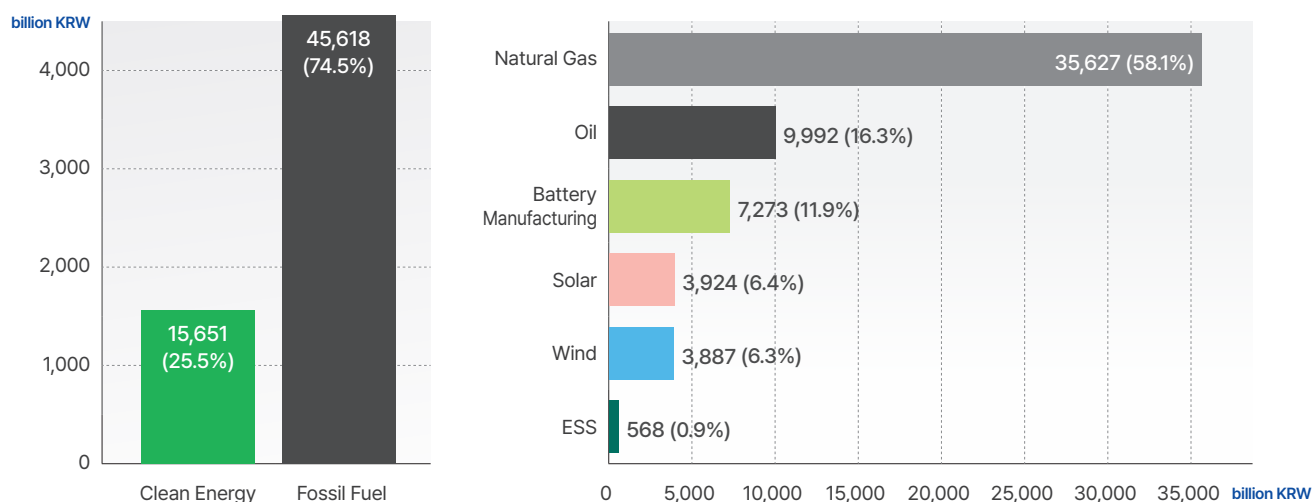
2.3. Export Finance for Energy Projects: Fossil Fuel vs. Clean Energy

This section quantitatively compares how Korea's public export finance has been allocated between fossil-fuel and clean-energy financing cases. The analysis is based on overseas energy financing cases supported by Korea's public export finance agencies from 2020 to 2024. Energy types are classified under two infrastructure categories: fossil fuels, which include oil and gas projects, and clean energy, which comprises solar, wind (both onshore and offshore), ESS, and battery manufacturing. After the data screening process detailed in Appendix A, a total of 422 financing cases were identified, amounting to KRW 61,270 billion between 2020 and 2024.^c

TOTAL PROJECT SUPPORT VALUE

Figure 2.2 below illustrates the aggregate value and composition of Korea's public export finance from 2020 to 2024.

[Figure 2.2] 2020-2024 Aggregate Support Value and Composition (%)



▪ **Note:** Coal is excluded in line with the global ECA trend to end coal project support. Nuclear and hydrogen were excluded due to environmental risks and policy uncertainty, and energy efficiency and transmission networks because they apply to both fossil and clean-energy infrastructure.

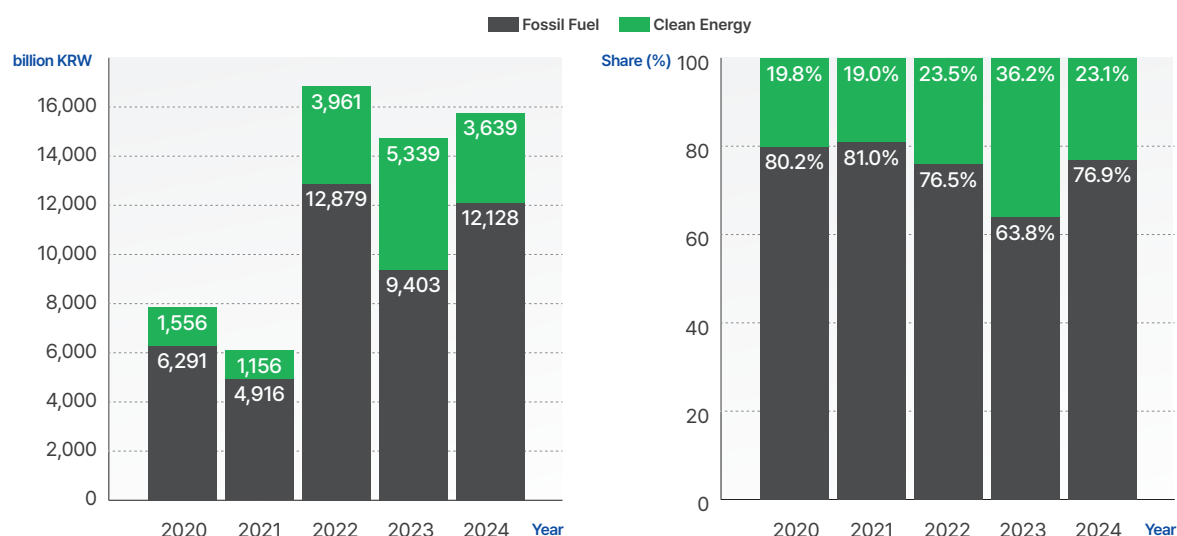
^c Despite efforts to obtain complete datasets and supplement missing cases through desktop searches, some data gaps may remain. Fluctuations in fossil-fuel financing reflect the cyclical nature of large-scale project pipelines, resulting in irregular annual volumes. Multi-year averages therefore provide a more reliable indicator of Korea's export finance structure than single-year figures.

Between 2020 and 2024, Korea provided a total of KRW 61,270 billion in public export finance for energy-related projects. Of this amount, KRW 45,618 billion (74.5%) was directed toward fossil fuels, reflecting their continued dominance in public export finance. Within fossil fuels, natural gas received KRW 35,627 billion (58.1%) and oil KRW 9,992 billion (16.3%), together representing nearly three-quarters of all energy support.

In contrast, clean energy totaled KRW 15,651 billion (25.5%). Battery manufacturing led clean-energy financing with KRW 7,273 billion (11.9%), followed by solar PV at KRW 3,924 billion (6.4%), wind at KRW 3,887 billion (6.3%), and ESS at KRW 568 billion (0.9%). While fossil fuels remain dominant, the sizable support for battery manufacturing signals a growing strategic focus on emerging clean-energy industries.

Figure 2.3 below illustrates the yearly value and composition of Korea's public export finance from 2020 to 2024.

[Figure 2.3] 2020-2024 Yearly Support Value and Composition

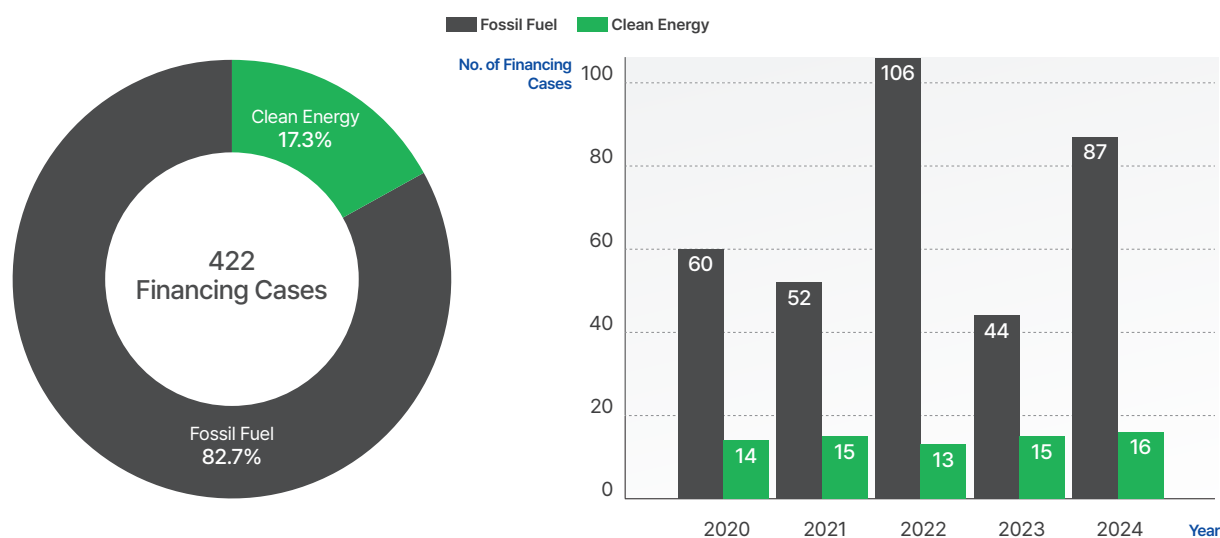


Total financing peaked at KRW 16,841 billion in 2022, followed by a slight decline in 2023 and a partial rebound in 2024. Figure 2.3 illustrates that fossil fuels remained the dominant focus of Korea's export-finance support between 2020 and 2024. However, their share temporarily dropped in 2023, when clean-energy financing rose to 36.2% of the total, before returning to 23.1% in 2024. This indicates a gradual yet inconsistent shift toward cleaner portfolios, rather than a sustained structural transition.

Between 2020 and 2024, Korea provided an annual average of KRW 12,254 billion in public export finance for energy-related projects over the five-year period. Accordingly, this figure, once appropriately adjusted as illustrated in Appendix A, will serve as the baseline for the economic analysis presented in Chapter 3.

Figure 2.4 below illustrates the yearly number of financing cases and composition from 2020 to 2024.

[Figure 2.4] 2020-2024 Aggregate (Left) and Yearly (Right) Financing Cases



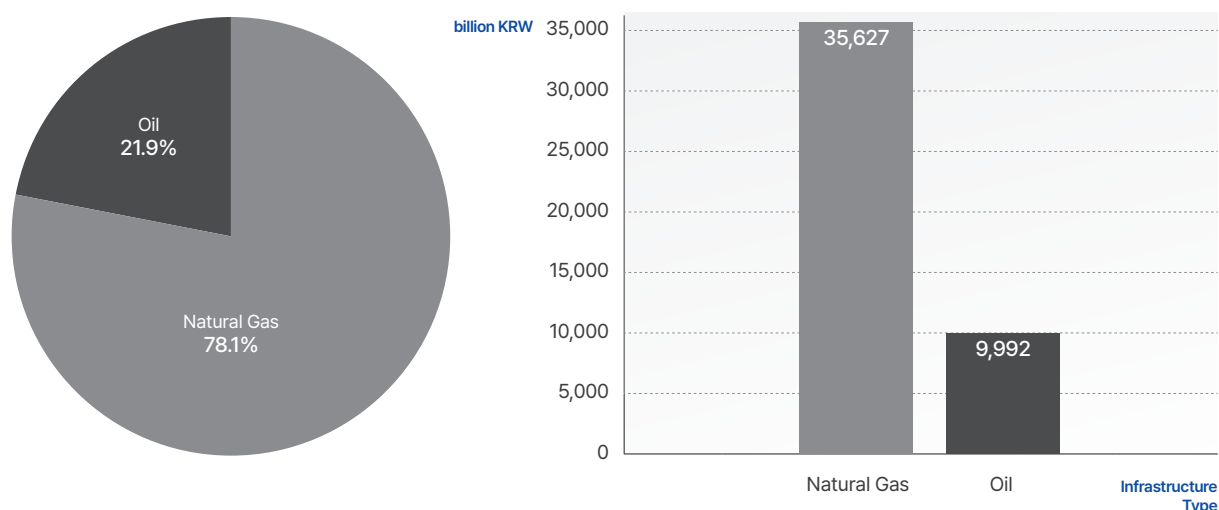
Between 2020 and 2024, a total of 422 export financing cases were supported. Among them, fossil-fuel financing cases accounted for 349 cases (82.7%), while clean-energy financing cases represented 73 cases (17.3%). This indicates that Korea's export finance portfolio remains heavily fossil-fuel-oriented, despite increasing global pressure for decarbonization.

Financing activity peaked in 2022 with 119 cases, followed by a temporary decline in 2023 and a partial rebound in 2024. Fossil-fuel cases consistently outnumbered clean-energy ones, with the latter's share remaining modest and largely unchanged over the period.

FOSSIL FUEL PROJECT SUPPORT VALUE

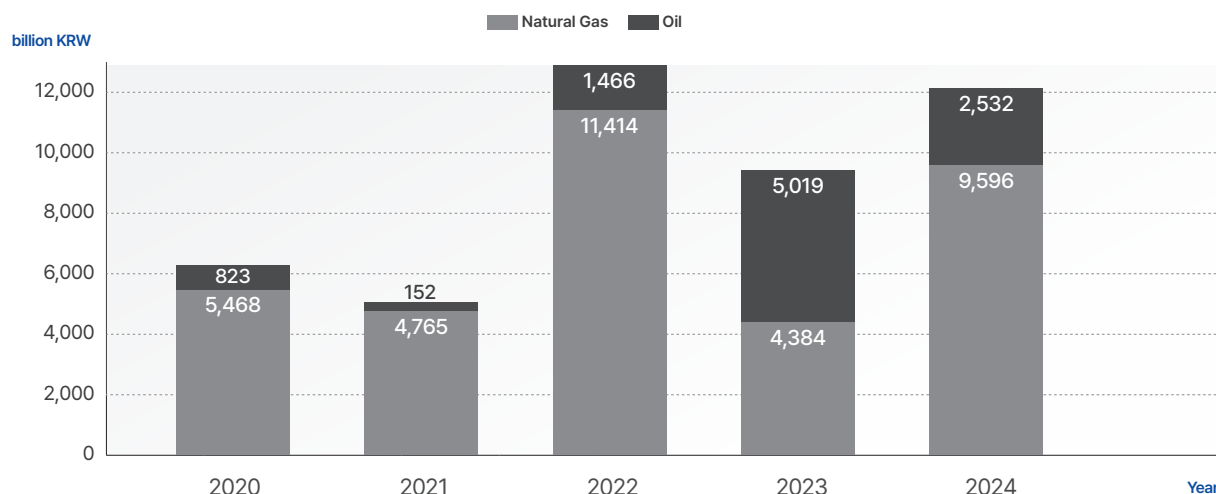
Figures 2.5 and 2.6 below illustrate the aggregate and yearly value of fossil-fuel support from 2020 to 2024.

[Figure 2.5] 2020-2024 Aggregate Support Value of Fossil Fuels



Fossil-fuel export finance totaled KRW 45,618 billion, of which natural gas accounted for 78.1% (KRW 35,627 billion) and oil for 21.9% (KRW 9,992 billion) between 2020 and 2024. A significant share of this financing appears to be driven by Korea's strong LNG vessel construction industry and related midstream infrastructure, reflecting the country's dominant market share in the global LNG supply chain.

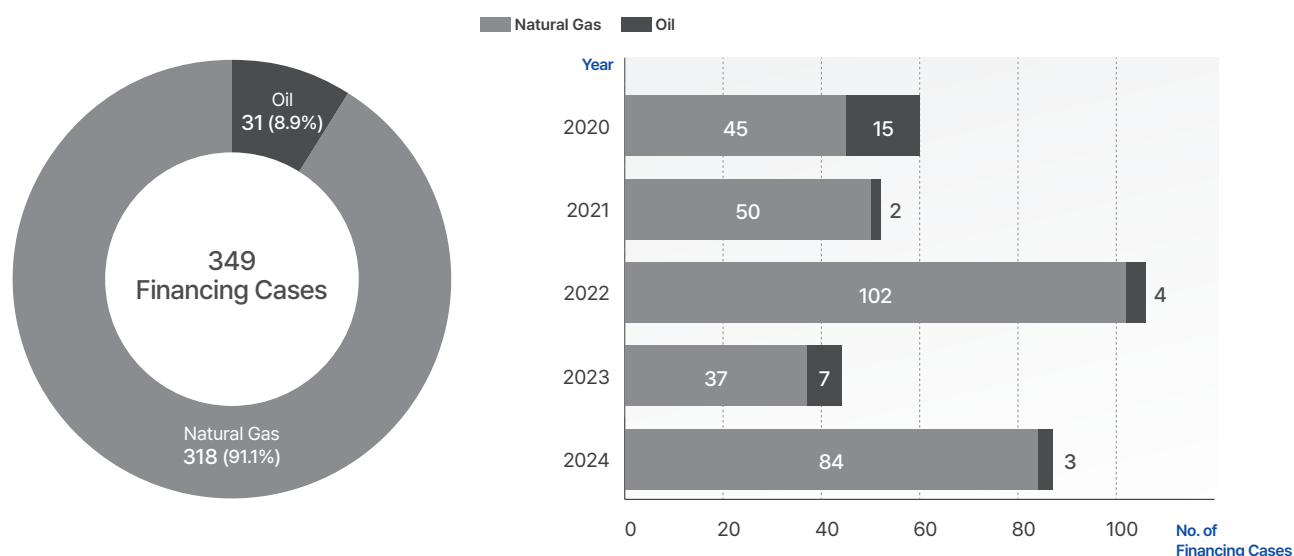
[Figure 2.6] 2020-2024 Yearly Support Value of Fossil Fuels



Fossil-fuel export finance fluctuated considerably between 2020 and 2024, driven mainly by changes in natural gas financing. Oil remained relatively small throughout the period, except for a temporary surge in 2023.

Figure 2.7 below illustrates the aggregate and yearly financing cases of fossil-fuel support from 2020 to 2024.

[Figure 2.7] 2020-2024 Aggregate (Left) and Yearly (Right) Financing Cases of Fossil Fuels

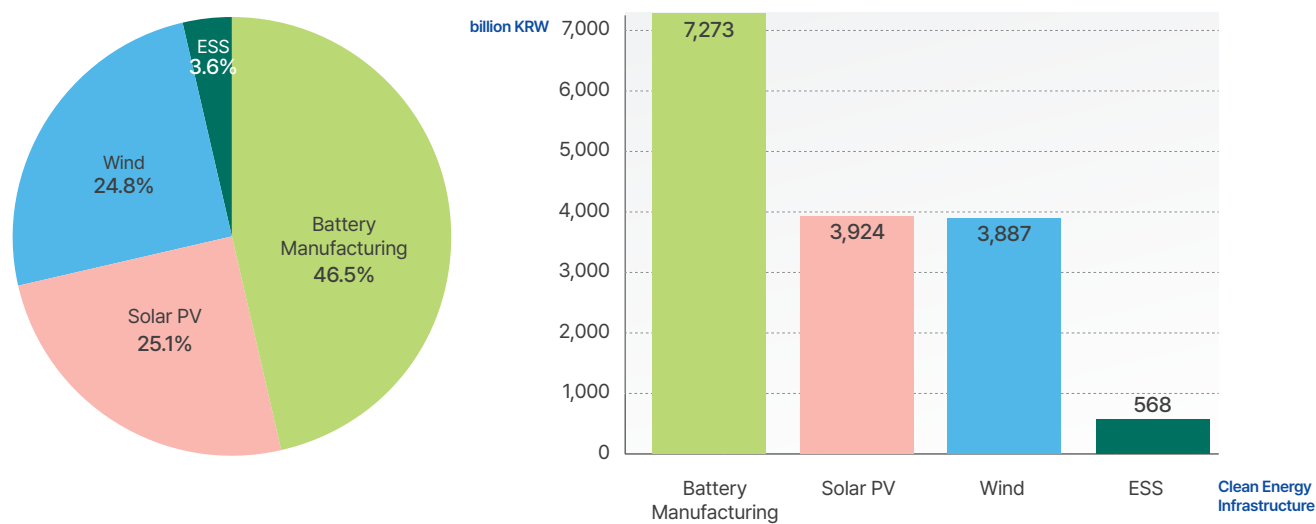


While natural gas continues to serve as the structural backbone of fossil-fuel financing, oil generates occasional spikes through high-value, capital-intensive projects. In 2023, oil financing exceeded KRW 5,019 billion despite being supported by only a handful of projects. This disproportionate rise suggests that Korea's oil-related export finance remains concentrated in a few large-scale petrochemical and refinery projects—primarily EPC contracts in Southeast Asia.

CLEAN ENERGY PROJECT SUPPORT VALUE

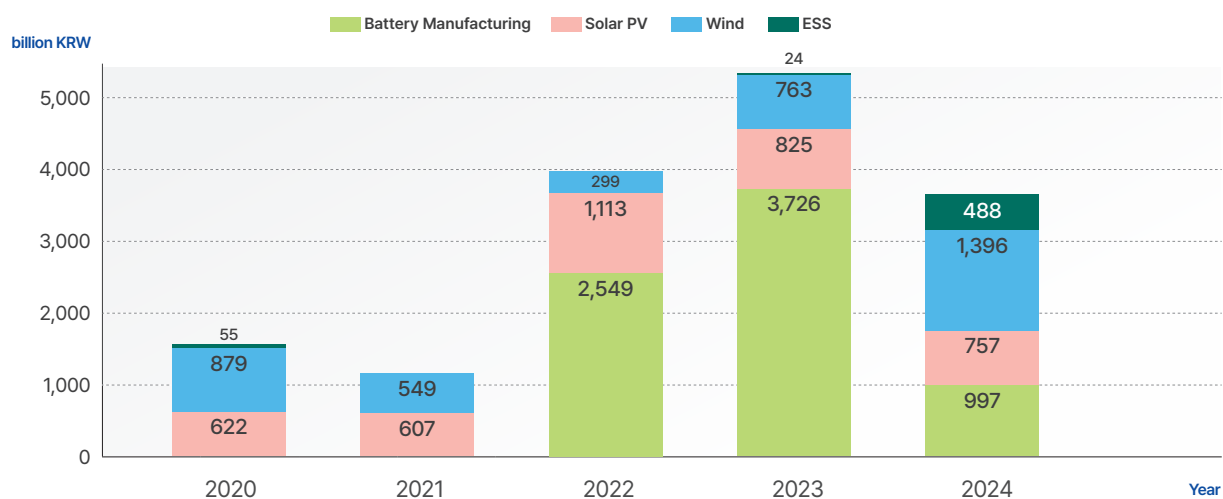
Figures 2.8 and 2.9 below illustrate the aggregate and yearly value of clean-energy support from 2020 to 2024.

[Figure 2.8] 2020-2024 Aggregate Support Value of Clean Energy



Between 2020 and 2024, clean-energy financing totaled KRW 15,651 billion. Battery manufacturing accounted for nearly half of this support (46.5%), while solar PV and wind each contributed around 25%. ESS remained minimal at just 3.6%. The results show that Korea's clean-energy financing has been concentrated in upstream manufacturing activities, particularly battery production, rather than in generation or storage assets.

[Figure 2.9] 2020-2024 Yearly Support Value of Clean Energy

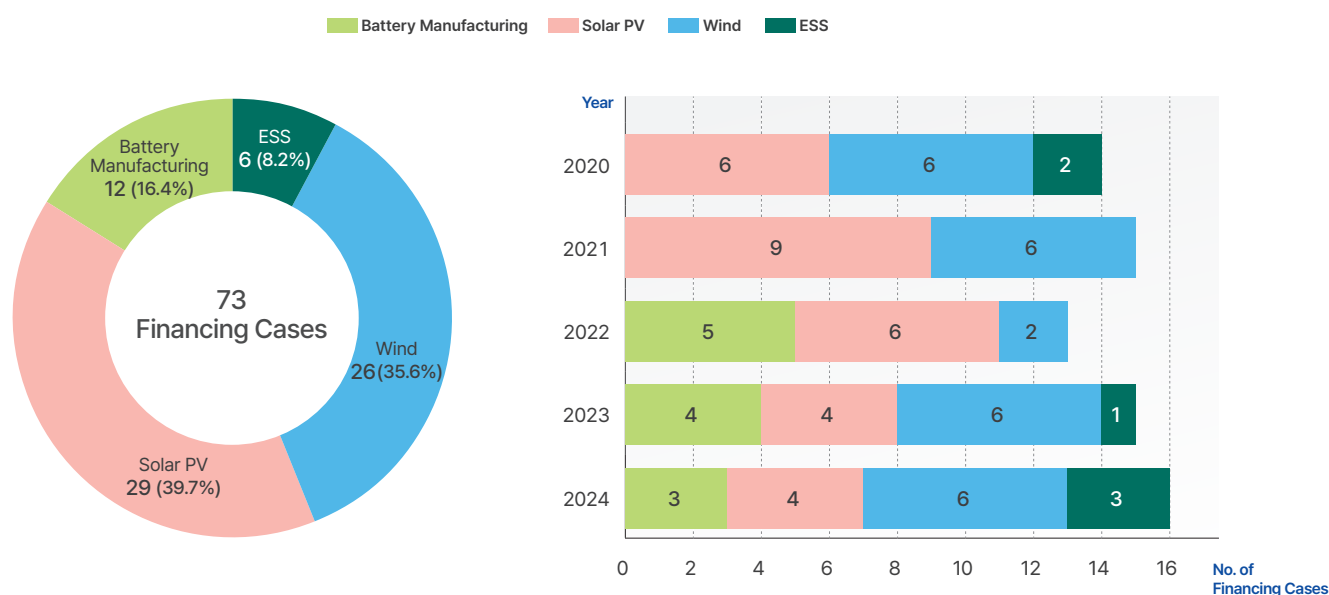


▪ **Note:** Projects combining solar and ESS components are classified under Solar.

Between 2020 and 2024, clean-energy financing exhibited significant fluctuations. Support changed modestly in 2020–2021, surged sharply in 2022–2023 led by battery manufacturing, and then declined in 2024. Throughout the period, battery manufacturing remained the dominant component, while wind showed visible expansion since 2023. ESS support emerged more recently and still represents a small share of the total. Overall, the trend highlights a battery-centric portfolio, with gradual diversification into other clean-energy technologies.

Figure 2.10 below illustrates the aggregate and yearly financing cases of clean-energy support from 2020 to 2024.

[Figure 2.10] 2020-2024 Aggregate (Left) and Yearly (Right) Financing Cases of Clean Energy



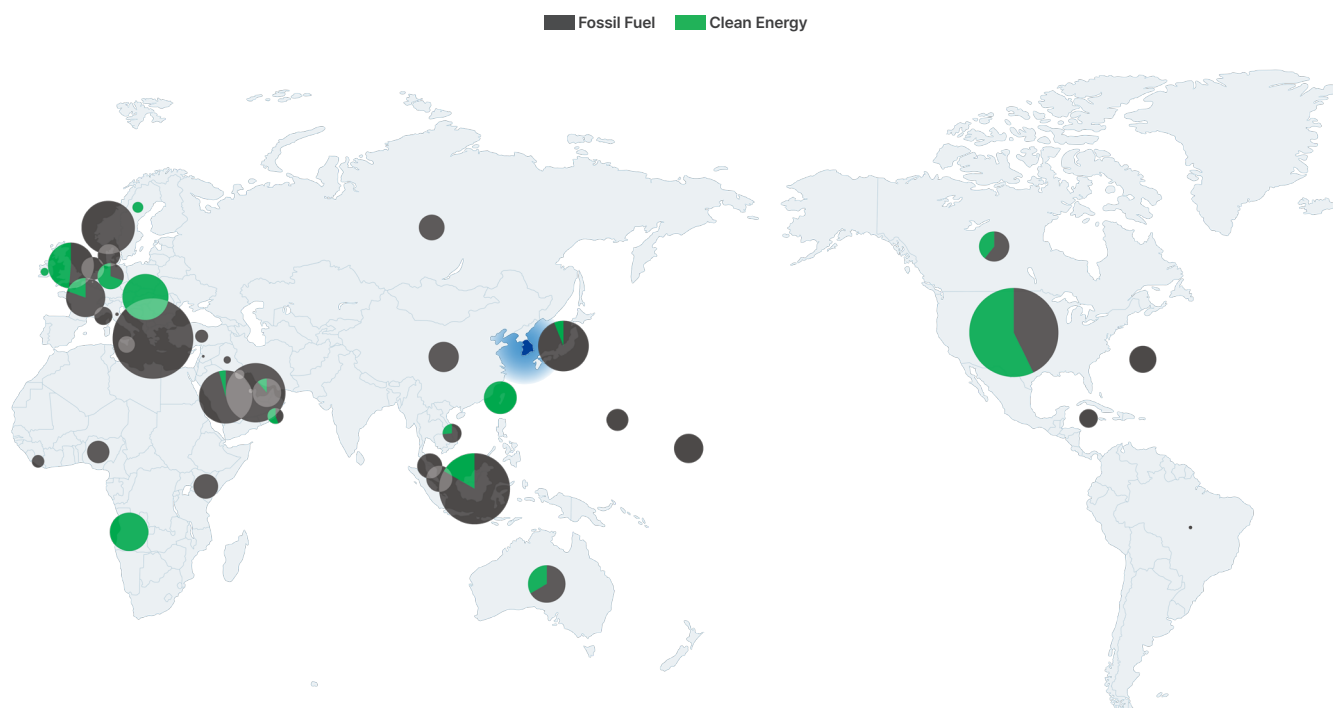
Clean-energy financing cases remained relatively small between 2020 and 2024, with solar PV and wind representing the majority of activities, while battery manufacturing and ESS contributed fewer but gradually increasing numbers of financing cases.

Notably, the distribution of financing cases contrasts with financing volumes. Battery manufacturing represents a manufacturing-oriented structure, with large-scale investments concentrated in a few high-value projects. In contrast, wind and solar PV financing exhibit a deployment-oriented structure, characterized by numerous smaller projects supporting widespread renewable energy installation.

REGIONAL DISTRIBUTION OF IMPORTING COUNTRIES

Figure 2.11 illustrates the regional distribution of importing countries that host Korea's export activities and associated public export finance flows.

[Figure 2.11] Regional Distribution of Importing Countries

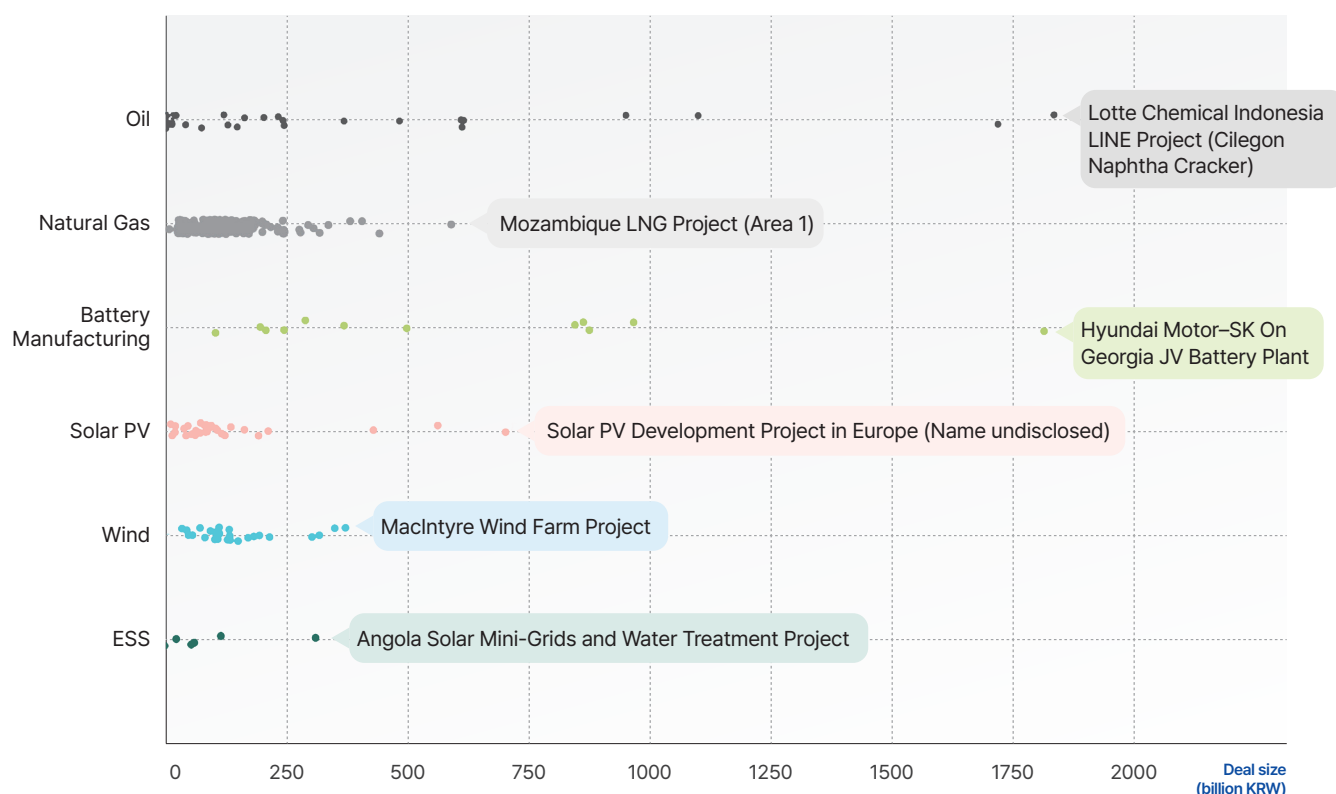


Between 2020 and 2024, Korea's public export finance exhibited a clear geographical concentration by energy type. The clean-energy sector was primarily directed toward advanced economies and manufacturing hubs, with major investments in battery manufacturing and wind power projects concentrated in the United States and Europe. In contrast, the fossil-fuel sector was heavily focused on the Middle East and Southeast Asia, where large-scale financing was provided for oil and gas projects—mainly driven by Korean companies' participation in EPC contracts and overseas resource development projects.

OTHER DESCRIPTIONS

Figure 2.12 illustrates the distribution of deal sizes by financing case for each energy source between 2020 and 2024.

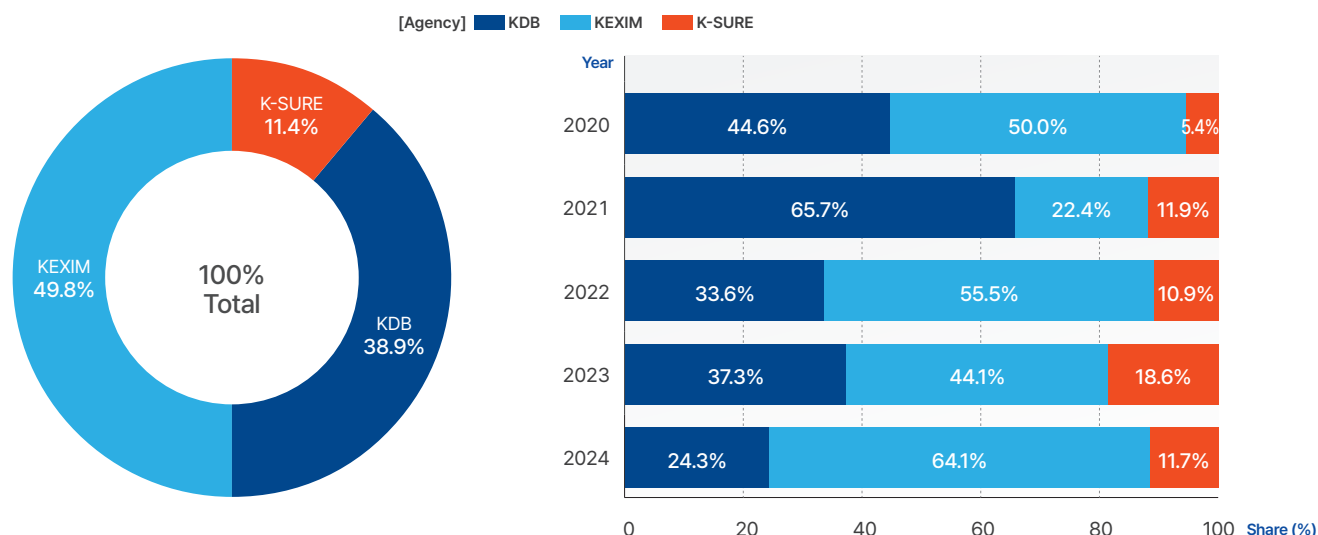
[Figure 2.12] Distribution of Financing Deal Sizes by Energy Source (2020–2024)



The distribution shows that the largest single project belongs to the clean-energy sector, represented by the *Hyundai Motor-SK On Georgia JV Battery Plant*. Oil and natural gas financing cases, such as the *Lotte Chemical Indonesia LINE Project (Cilegon Naphtha Cracker)* and *Mozambique LNG Project (Area 1)* remain substantial in scale, yet clean-energy projects—particularly those in battery manufacturing and wind power—now rival fossil-fuel projects in deal size, even though they are fewer in number.

Figure 2.13 shows the aggregate and yearly distribution of Korea's public export finance for energy-related projects among the three agencies between 2020 and 2024.

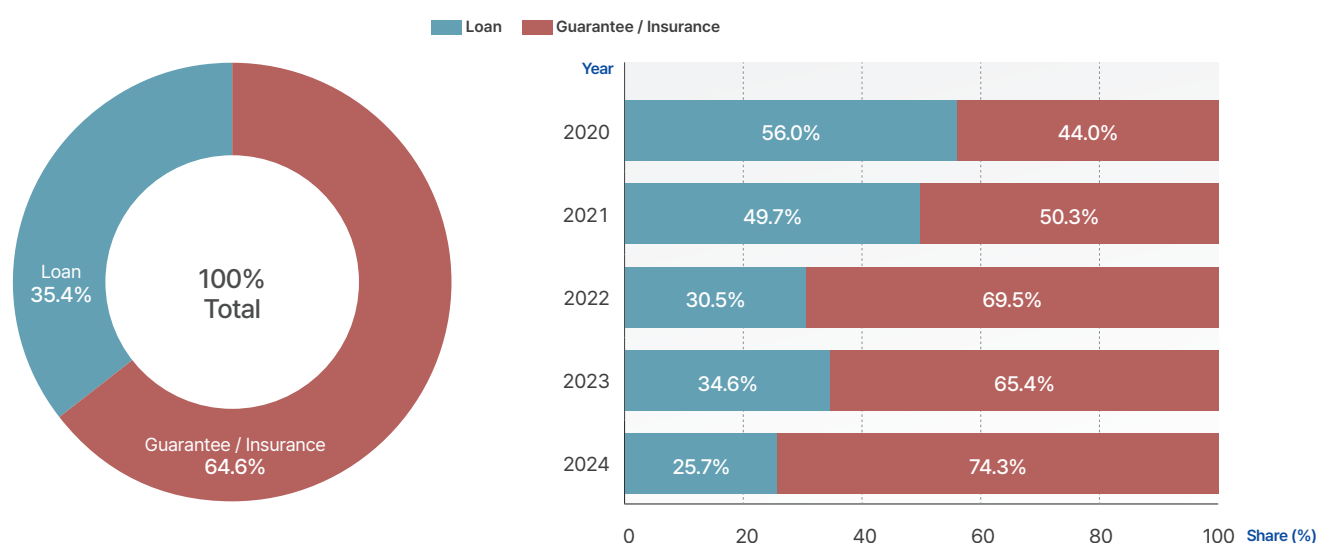
[Figure 2.13] 2020-2024 Aggregate (Left) and Yearly (Right) Distribution of Public Export Finance by Agency



The overall distribution indicates that KEXIM held the largest share of Korea's export finance between 2020 and 2024, followed by KDB and K-SURE.

Figure 2.14 presents the aggregate and yearly composition of financial instruments used in public export support between 2020 and 2024.

[Figure 2.14] 2020-2024 Aggregate (Left) and Yearly (Right) Composition of Financial Instruments in Public Export Support



▪ **Note:** Financing cases involving both guarantee/insurance and loan instruments are counted in both categories.

Guarantee and insurance instruments consistently accounted for around two-thirds of total support, while loans made up the remaining one-third. This distribution indicates that Korea's export finance has been shaped primarily by risk-sharing instruments rather than direct lending. The share of loan financing fluctuated, but showed a declining trend. This shift likely reflects changes in global financial conditions, policy priorities, and the timing of large-scale infrastructure projects.

Chapter 3. Economic Impacts Analysis: Fossil Fuel vs. Clean Energy Export Finance

3.1. Introduction

In the previous chapter, we examined how Korea's public export finance remains heavily oriented toward fossil fuels. In this chapter, we assess its potential to support jobs and value added under different global climate scenarios. The aim is to explore how the global shift toward clean energy reshapes the national economic impacts of Korea's public export financing.

We analyzed future trends in Korea's public export finance and their economic impacts under two sets of scenarios:

- **Global Climate Scenarios:**

Based on the IEA (2024)⁴⁰ *Net-Zero Framework*, these scenarios reflect changes in global investment trends driven by the energy transition, assuming Korea maintains its global market share across three climate pathways.

- ① **STEPS** (Stated Policies Scenario), ② **APS** (Announced Pledges Scenario), and
- ③ **NZE** (Net-Zero Emissions Scenario)

- **Business-as-Usual (BAU) Scenarios:**

- ① **BAU**: A domestic baseline assuming that the current (2020–2024 average) level of public export support for fossil fuels and clean energy remains constant.
- ② **BAU-Redirection**: The total level of export support remains the same as in BAU, but the portfolio gradually shifts toward 100% clean energy by 2040.

A summary of the scenarios is presented in Table 3.1 below. Detailed assumptions and analytical procedures, from data screening to economic impact assessment, are provided in Appendix A.

[Table 3.1] Scenario Description Summary

Scenarios	Description	Total Investment
STEPS	Follow existing policy commitments without additional climate ambition	Declines or grows in line with STEPS assumptions
APS	Assumes all countries fully achieve their announced climate and energy pledges	Declines or grows in line with APS assumptions
NZE	A global pathway consistent with limiting warming to 1.5 °C	Declines or grows in line with NZE assumptions
BAU	Maintains current energy mix trajectory with fixed public export finance	Fixed at 2020-2024 average export support (KRW 8,390 billion/year)
BAU-Redirection	Shifts to 100% clean energy by 2040 within current budget	Fixed at BAU level

Source: IEA (2024)⁴⁰

3.2. Global Climate Scenarios

This section examines the value added and job creation supported by Korea's public export finance under three global climate scenarios, in which total export support evolves in line with the IEA *Net-Zero Framework* (Table 3.2).

Across all scenarios, clean-energy investment increases relative to BAU, with progressively larger gains from STEPS to NZE. In contrast, fossil-fuel investment rises slightly under STEPS (approximately 9 %) but declines steadily under APS and NZE, reflecting accelerated global decarbonization trends.

[Table 3.2] Projected Public Export Finance by Scenario, 2035 (unit: billion KRW)

2035	FF Investment	CE Investment	Total Investment	Clean Energy %
BAU	7,214	1,177	8,390	14%
STEPS	7,884	3,858	11,742	33%
APS	6,466	7,384	13,851	53%
NZE	4,928	16,079	21,007	77%

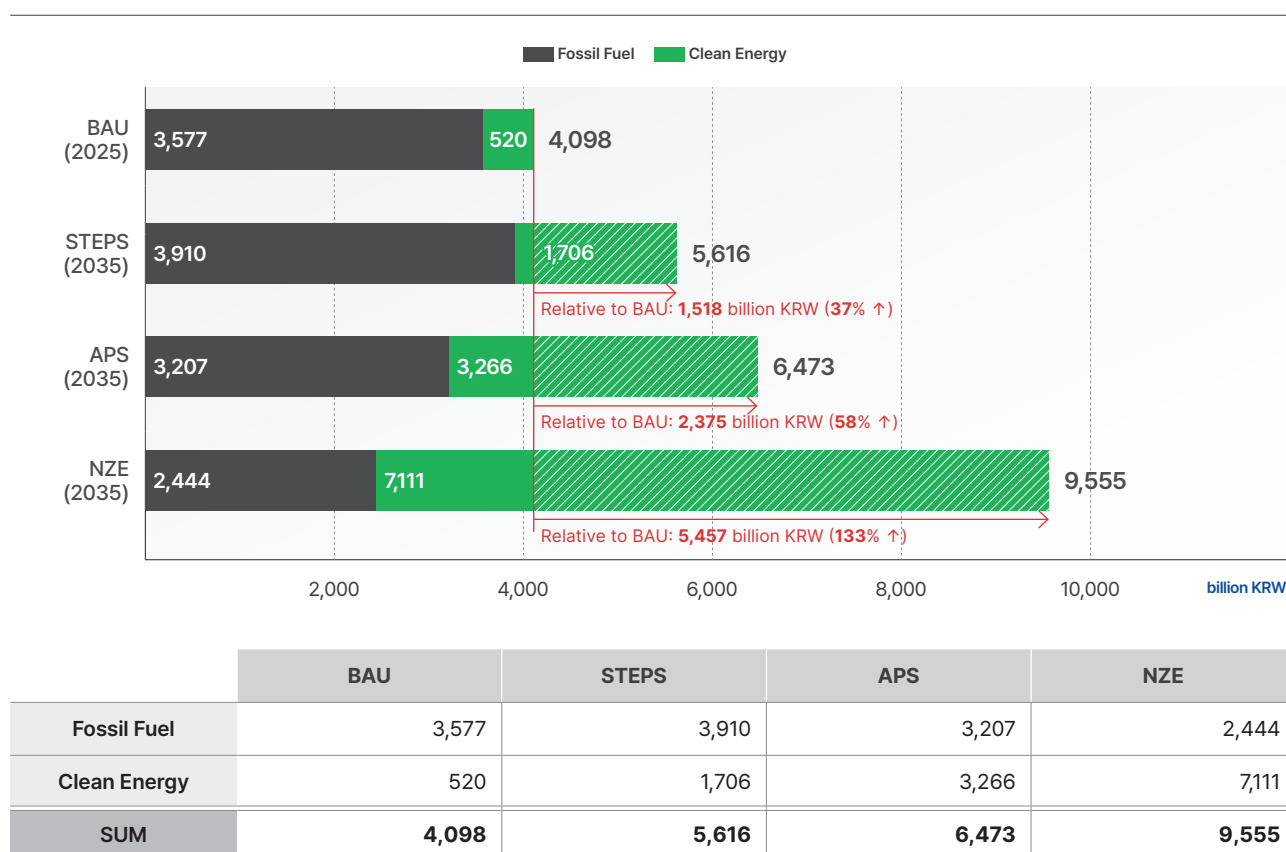
Source: Author's calculations using data from the IEA (2024)⁴⁰

ECONOMIC AND EMPLOYMENT IMPACTS UNDER GLOBAL CLIMATE SCENARIOS

Building on these investment projections, the corresponding economic impacts in 2035 are illustrated in Figures 3.1 and 3.2 below. The results capture not only the direct effects but also the indirect and induced value added and employment arising from fossil-fuel or clean-energy activities across all industries in Korea.

Although global demand for fossil-fuel infrastructure declines, Korea's economy continues to experience net positive outcomes as clean-energy investment expands. The resulting value-added and employment gains increase steadily from STEPS to APS and reach their maximum under NZE, demonstrating how deeper global climate ambition translates into stronger domestic economic performance. This highlights the additional market opportunities Korea could realize by 2035 if its export finance evolves beyond the 2025 BAU baseline.

[Figure 3.1] Value-added Impacts supported by Export Credit Finance in 2035

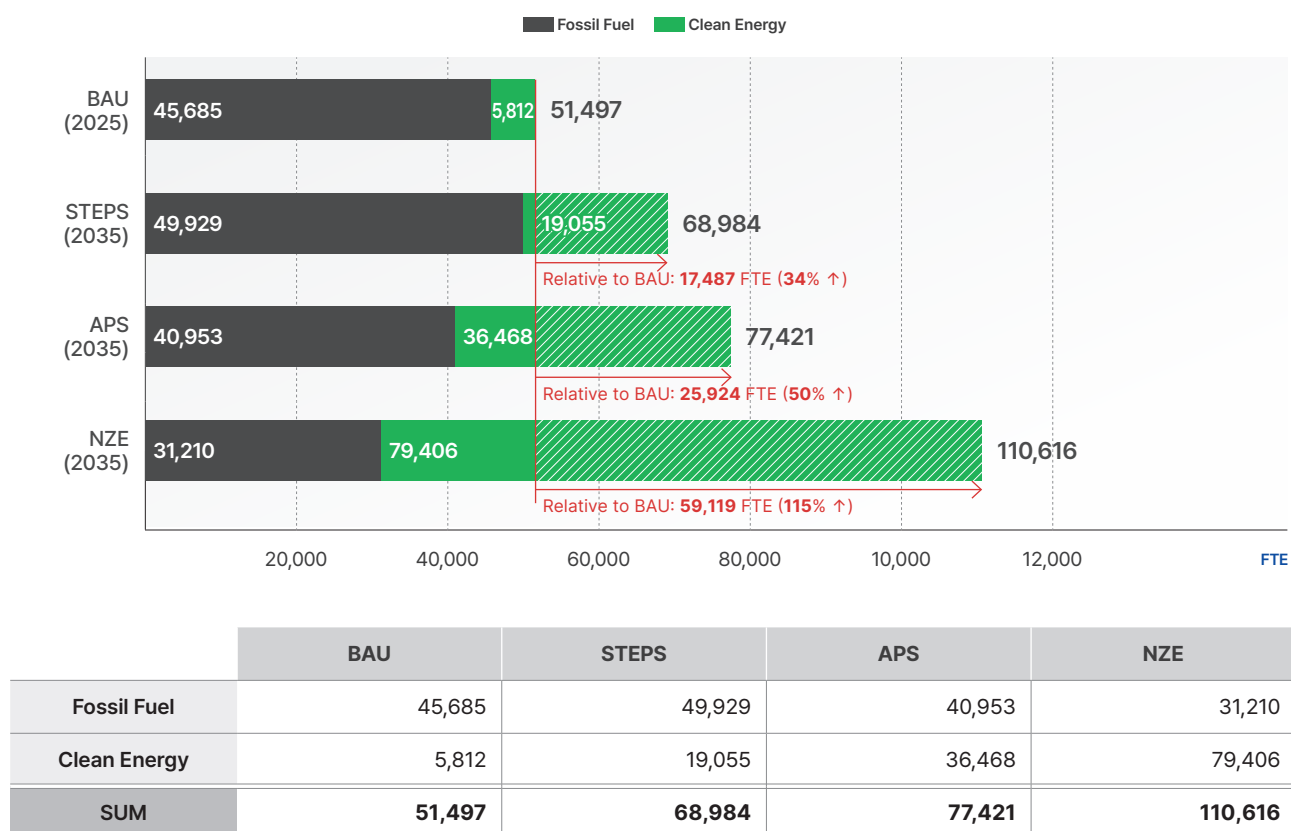


▪ **Note:** Due to rounding, figures may not sum exactly to totals.

Under the NZE scenario, total value added supported by public export finance in 2035 is KRW 9,555 billion, which is 5,457 billion higher than under BAU.

The expansion of the clean-energy investment contributes an additional KRW 6,591 billion in value added (rising from 520 to 7,111 billion) across the economy—an increase of more than tenfold—while value added associated with the fossil-fuel industry declines by KRW 1,134 billion.

[Figure 3.2] Employment Impacts supported by Export Credit Finance in 2035



Under the NZE scenario, economy-wide employment supported by public export finance in 2035 is 110,616 FTE, an increase of 59,119 FTE relative to BAU.

The expansion of the clean-energy investment contributes an additional 73,594 FTE (rising from 5,812 to 79,406 FTE) across the economy—an increase of more than tenfold— while employment associated with the fossil-fuel industry declines by 14,475 FTE.

These results are based on the assumption that Korea's public export finance agencies expand their total financing in line with global investment growth under each IEA scenario. Thus, the estimated impacts reflect both the changing composition of support between fossil fuels and clean energy and the overall increase in total export finance.

VALUE ADDED AND JOBS SUPPORTED ALONG VALUE CHAIN

Figures 3.3 and 3.4 below illustrate the projected value-added and employment impacts of Korea's public export finance under different global climate scenarios in 2035 across eleven value chains.

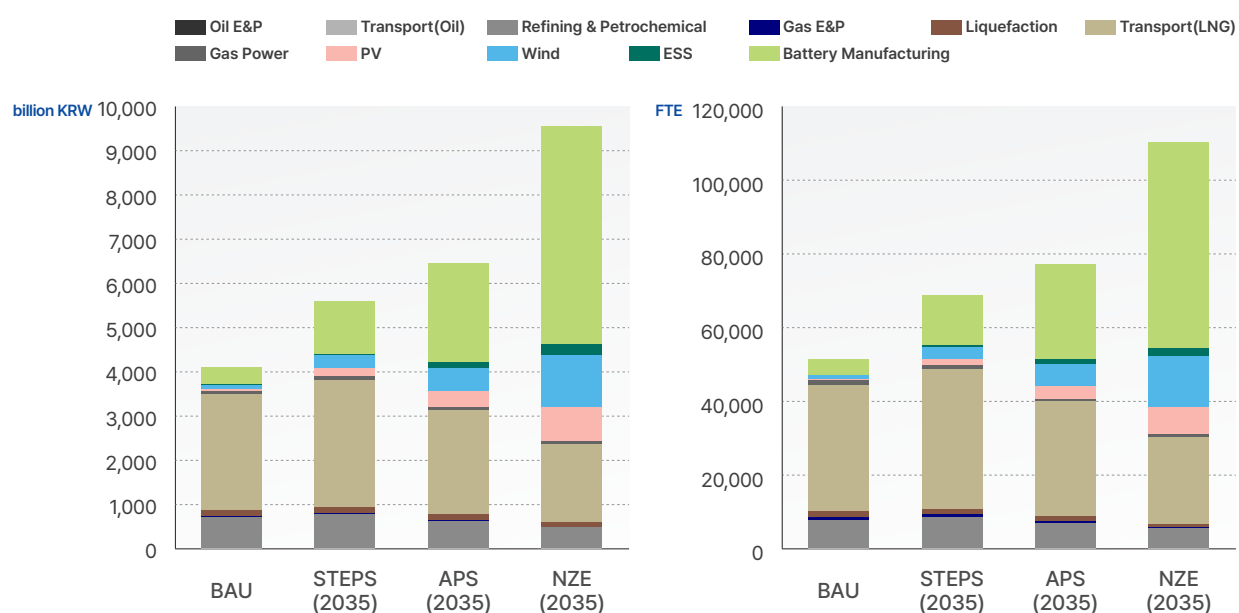
Fossil-fuel value chains are ① Oil Exploration & Production (E&P), ② Oil Transportation, ③ Refining and Petrochemical Production, ④ Gas Field E&P, ⑤ LNG Liquefaction, ⑥ LNG Transportation, ⑦ Gas-fired Power Generation.

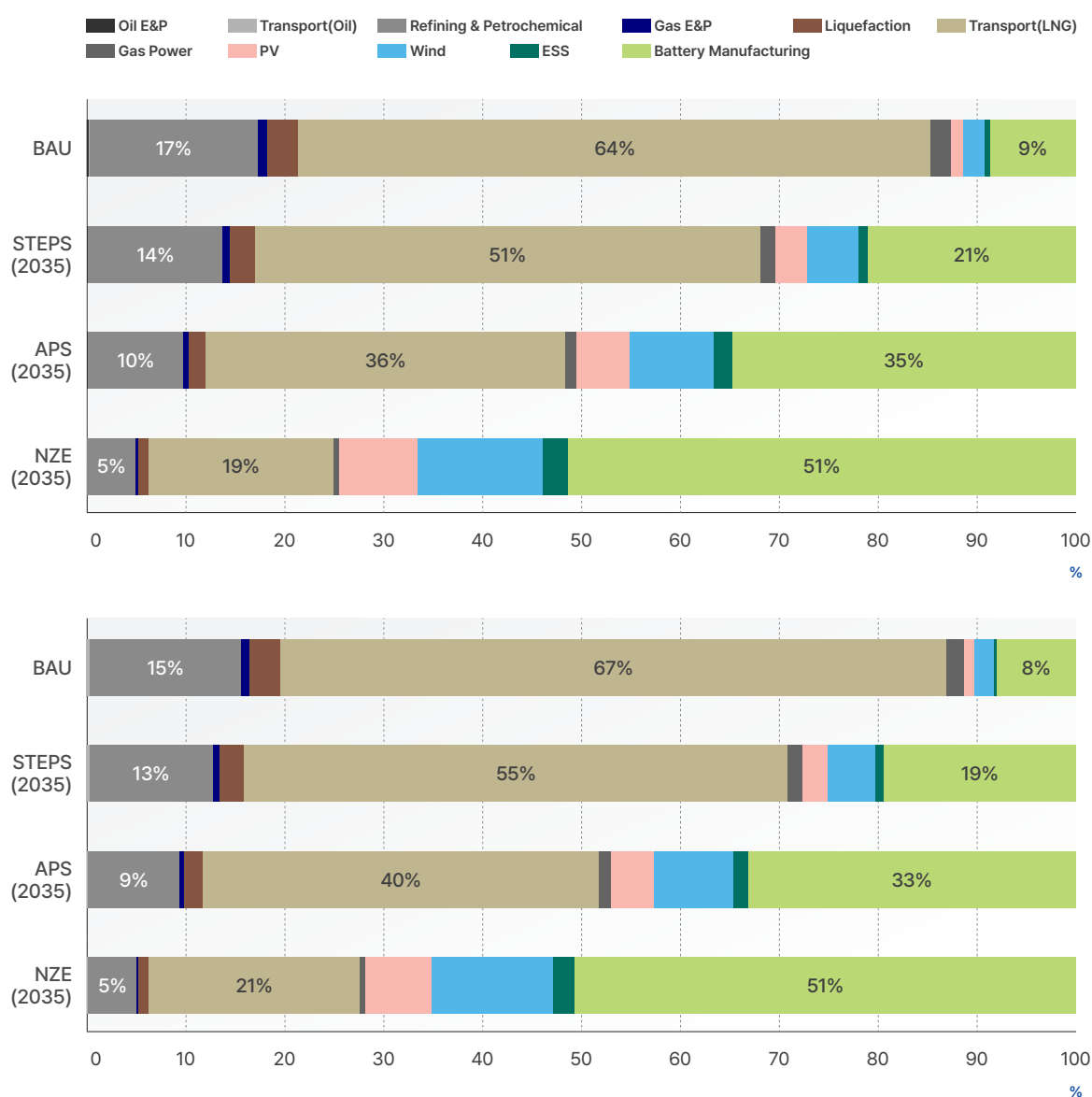
Clean-energy value chains are ⑧ Solar PV, ⑨ Wind Power, ⑩ Energy Storage Systems (ESS), ⑪ Battery Manufacturing.

Under BAU, LNG transport dominates. However, as clean-energy investments expand across the STEPS, APS, and NZE pathways, value-added and employment contributions from solar PV, wind, ESS, and especially battery manufacturing increase substantially, reaching near parity with fossil-fuel value chains in APS and surpassing them under NZE by 2035.

By the NZE scenario, total value added reaches nearly KRW 9.6 trillion, and employment exceeds 110,000 FTEs, representing a significant increase compared with the BAU and STEPS scenarios.

[Figure 3.3] Value-added (Left) and Employment (Right) Impacts by Value Chain



[Figure 3.4] Proportion of Value-added (Top) and Employment (Bottom) Impacts by Value Chain

In particular, value added and job creation supported along the battery manufacturing value chain under NZE in 2035 amount to KRW 4,910 billion and 56,011 FTEs, respectively—accounting for 51% of the total economic impacts. This clearly indicates that Korea’s economy could benefit more from a world aligned with deeper clean-energy transitions, as global market demand shifts toward clean technologies, provided that public export finance agencies expand their total financing accordingly.

Across scenarios, the contribution of public export finance–supported activities to Korea’s GDP is modest but material. Using Korea’s 2024 GDP KRW 2,292,202 billion as the reference base, the value added generated in 2035 corresponds to 0.25–0.42% of GDP, rising with deeper global clean-energy transitions (Table 3.3).

[Table 3.3] Contribution to 2024 GDP by Total Value-added Creation in 2035

Scenarios	Value Added (billion KRW)	GDP (%)
BAU (2025)	4,098	0.18%
STEPS (2035)	5,616	0.25%
APS (2035)	6,473	0.28%
NZE (2035)	9,555	0.42%

Source: Statistics Korea (KOSTAT)

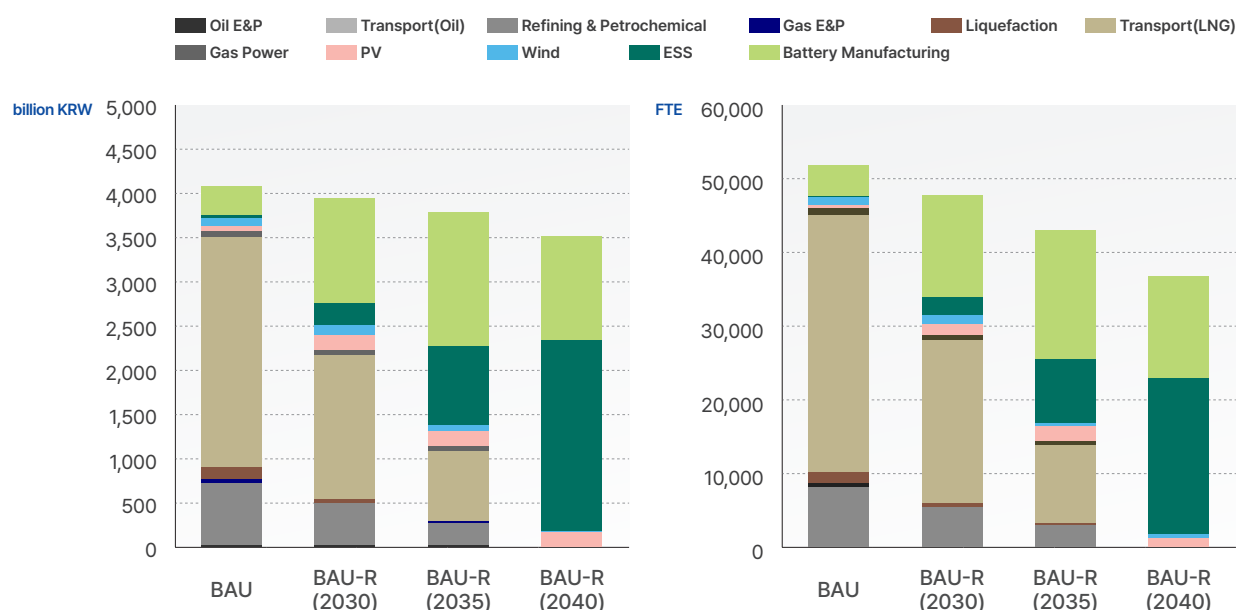
3.3. Portfolio Redirection from Fossil to Renewable and Domestic Content Effects

In the BAU scenarios, total financial support from public export finance agencies remains fixed at the current level of KRW 8,390 billion, representing the annual average between 2020 and 2024. Although this approach does not fully capture the effects of changing global investment levels, it allows the analysis to isolate and examine the impact of export trends and domestic content^d in export products and services on Korea’s national economy.

In these scenarios, the total support budget is kept constant throughout the projection period. However, the share of clean energy in the portfolio gradually increases, reaching 100 percent by 2040 under the BAU-Redirection scenario. This pathway mirrors the phase-out commitments announced by major economies discussed in Chapter 2. The results are illustrated in Figures 3.5 and 3.6.

^d Domestic content is defined as the proportion of value generated within Korea—through domestic labor, materials, and services—relative to the total export value of a product or project. In other words, it reflects the share of Korea’s industrial and employment contribution embedded in each exported item or service.

[Figure 3.5] Export Finance Redirection towards 100% Clean Energy under Current Domestic Content
Value Added (Left), Employment (Right)



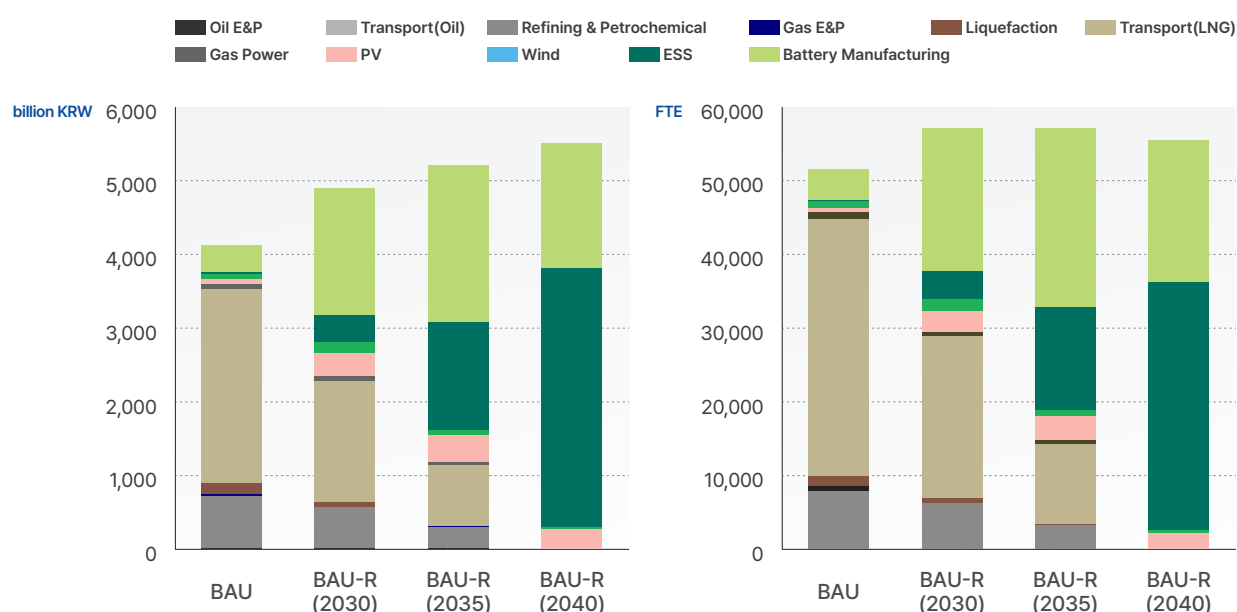
In BAU 2025, every KRW 1 billion loaned, guaranteed, or insured exports supports KRW 0.49 billion of value added within Korea and 6.14 jobs (FTE). Under the BAU-Redirection scenario, these figures decline to KRW 0.42 billion and 4.33 FTEs, respectively, by 2040.

As detailed in Appendix A, these outcomes combine the value-added and employment impact coefficients of each energy value chain with their respective domestic-content ratios.

Korea currently specializes in fossil-fuel-related exports with high domestic content, whereas clean-energy exports show relatively lower domestic contribution. This is because Korea's export ecosystem remains deeply integrated with fossil and LNG-related industries, particularly shipbuilding, while PV modules and battery cells rely more heavily on imported components.

Nevertheless, redirecting public financial support toward clean energy, alongside targeted industrial policies and measures to enhance export competitiveness, can increase domestic value retention—just as it did for fossil-fuel infrastructure exports in the past, most notably LNG carriers, which benefited from significant public financing and industrial policy support.⁴¹

[Figure 3.6] Export Finance Redirection towards 100% Clean Energy under Advanced Domestic Content
Value Added (Left), Employment (Right)



With advancements in export competitiveness, every KRW 1 billion loaned, guaranteed, or insured exports could generate KRW 0.65 billion of value added within Korea and support 6.59 jobs (FTE) by 2040.

Figures 3.5 and 3.6 also show that battery-related value chains—ESS and battery manufacturing—dominate Korea’s clean-energy export structure. This slightly differs from the global climate scenarios, where Korea’s global market share was assumed constant. In the BAU-Redirection scenario, however, the total export value is fixed while the composition of export finance shifts from fossil fuels toward clean energy. Accordingly, total export support was first estimated by infrastructure type (fossil vs. clean) and then distributed across eleven value chains based on Korea’s actual export structure and trends, following the approach of Cambridge Econometrics (2022). These results highlight that battery-related energy infrastructure presents particularly strong potential for Korea’s future exports.

Table 3.4 provides a summary of the unit impacts, and Table 3.5 presents the domestic-content rates for key industrial activities.

[Table 3.4] Unit Impacts on Value Added and Employment from Redirection

Impacts	Value Added		Employment (FTE/billion KRW)		% Clean Energy
	Current	Advancement	Current	Advancement	
BAU (2025)		0.49		6.14	14%
BAU-R (2030)	0.47	0.58	5.65	6.78	46%
BAU-R (2035)	0.45	0.62	5.10	6.79	73%
BAU-R (2040)	0.42	0.65	4.33	6.59	100%

[Table 3.5] Domestic Content for Key Industrial Activities in Clean Energy

Technical Maturity Group	Domestic Content	
	Current	Advancement
Professional Engineering Services	H	VH
PV Module	L	M
PV Cell	L	M
Cable (Offshore Wind)	M	H
Structure (Offshore Wind)	M	H
Construction / Installation	L	L
Equipment (Battery)	M	VH
Equipment (Battery Manufacturing)	M	VH

▪ **Note:** VH (90%), H (70%), M (50%), and L (20%). Content recreated from Table A.14 in Appendix A.4.

Chapter 4. Conclusions

4.1. Key Findings

This study addresses two key questions:

- How does the global transition toward clean energy reshape the economic and employment impacts of Korea's export credit financing?
- How can Korea maximize GDP and employment gains in this transition?

The analysis finds that Korea's economic benefits increase with the scale and pace of global decarbonization, provided its public export finance agencies expand clean-energy support in line with global investment trends. As export credit finance support expands alongside global decarbonization, economic and employment gains rise consistently across the IEA scenarios—from STEPS to APS and NZE—demonstrating that deeper global decarbonization translates into stronger economic outcomes for Korea.

Even as fossil-related exports such as LNG carriers and heavy EPC projects decline, rising global demand for clean-energy infrastructure—particularly within battery value chains—creates new growth opportunities for Korean industries.

Under the NZE scenario, public export finance grows in step with global investment trends aligned with the 1.5 °C pathway. Assuming Korea maintains its global market share, total value added supported by public export finance in 2035 reaches KRW 9,555 billion, which is KRW 5,457 billion higher than under the BAU scenario. The expansion of clean-energy investment contributes an additional KRW 6,591 billion of value added (from KRW 520 billion to KRW 7,111 billion), an increase of more than tenfold, while value added associated with the fossil-fuel industry declines by KRW 1,134 billion.

Similarly, economy-wide employment supported by public export finance in 2035 reaches 110,616 FTE, representing an increase of 59,119 FTE relative to BAU. The expansion of clean-energy investment contributes an additional 73,594 FTE (from 5,812 to 79,406 FTE), an increase of more than tenfold, while employment associated with the fossil-fuel industry declines by 14,475 FTE.

Even with constant financing levels under the BAU-Redirection scenario, **shifting portfolios from fossil fuels to clean energy—combined with higher domestic content and improved technological competitiveness—yields measurable gains in Korea’s GDP and employment.** This underscores that the structure of Korea’s export ecosystem—including its financial institutions, clean-energy industries, and supply chains—plays a crucial role in determining how much value and employment remain within the domestic economy.

In short, the global clean-energy transition represents not a threat but a strategic economic opportunity for Korea. Failing to align export-finance policy with global decarbonization trends would mean forfeiting substantial potential growth—amounting to trillions of won in GDP and thousands of jobs.

4.2. Policy Recommendations

Continuing fossil-fuel spending may preserve jobs in legacy sectors in the near term but gradually weakens competitiveness as global markets decarbonize, allowing other countries to build early advantages in emerging clean-energy industries. This underscores the need for a just and well-managed transition that protects current workers while laying the foundation for long-term job creation in clean-energy sectors.⁴²

- **Integrate Clean-Energy Targets into Export Finance Frameworks**

Korea’s public export finance institutions should progressively increase the share of clean-energy projects within their portfolios. Institutionalizing such targets would provide a predictable mechanism for portfolio transformation and ensure alignment with international climate commitments. To remain consistent with the global decarbonization trend, Korea should fully redirect all public export credit finance from fossil fuels to clean energy by 2040.

- **Phase Out Fossil-Fuel Support and Prevent Carbon Lock-in**

Continuing export credit support for fossil infrastructure risks stranded assets, weak long-term returns, and carbon lock-in effects for developing countries reliant on Korean financing.⁴³ Korea should adopt clear phase-out schedules for fossil-fuel project, including oil and gas, and revise relevant financial and investment regulations to restrict lending to companies deriving a substantial share of revenue from fossil-based operations.⁴⁴

- **Strengthen Domestic Content and Industrial Competitiveness**

Enhancing domestic value capture within export-supported sectors is essential. The government should expand incentives for domestic production of key clean-energy components (e.g., PV modules, offshore wind, and battery cells), strengthen engineering and project management capabilities, and promote the localization of supply chains within Korea.

- **Promote Innovation and Circular Economy Opportunities**

Korea's future competitiveness will depend on innovation across the battery value chain, including materials, manufacturing, and recycling. Although Korea ranks among the global frontrunners in batteries, it faces increasing pressure from China's cost advantages, state subsidies, expanding supply chains, and fluctuations in Electric Vehicle (EV) demand. However, global battery capacity has not yet reached saturation, leaving room for growth, particularly in non-EV markets such as ESS, drones, humanoids, and emerging Urban Air Mobility (UAM) applications.⁴⁵ To sustain growth, Korean firms must strengthen their supply-chain competitiveness.

At the same time, battery recycling, reuse, and material recovery are emerging as strategic opportunities that link sustainability with profitability. Public finance should prioritize research and development, demonstration projects, and circular-economy infrastructure to support Korea's transition from manufacturing strength toward both export growth and environmental sustainability.

Korea's export finance system stands at a turning point. The results of this analysis make clear that aligning export credit finance with the global clean energy transition is not only a climate imperative but also an economic opportunity. Directing financial flows toward clean energy and enhancing domestic competitiveness can collectively deliver stronger and more resilient growth for the Korean economy in a decarbonizing world.

Appendix A. Methods

This section outlines the analytical process used to estimate the economic impacts presented in Chapter 3. Figure A.1 below provides an overview of the overall framework.

[Figure A.1] Analytical Framework for Economic Impact Analysis



Evaluating the economic impacts of public export finance agency support for energy infrastructure presents a unique methodological challenge. Traditional input–output (IO) analysis operates at the industry level, while export finance support is provided at the project level, where activities and services vary widely.

To address this micro–macro gap, this study develops a four-layer analytical framework linking project-level data to economy-wide IO analysis. The framework quantifies value-added and employment impacts across different energy value chains and under alternative climate scenarios.

The methodological approach builds on prior work by Cambridge Econometrics (2022)⁴², Van den Berg et al. (2017)⁴⁶, and UKEF (2025)⁴⁷, all of which applied IO-based economic impact modeling. The categorization and visualization of energy value chains were adapted from Censkowsky, P., et al. (2025)⁵. The starting point of the analysis is to determine the insured, guaranteed, or loaned export contract values, classified by the relevant IO industries and adjusted for domestic-content ratios. The following four sections describe the four-layer analytical framework in detail.

A.1. Data Collection and Project Reality Analysis

For this study, we compiled a new database of overseas energy projects supported by Korea's public export finance agencies. The dataset was reconstructed using materials from Oil Change International (OCI)⁴⁸, official documents submitted to the National Assembly by KEXIM, K-SURE, and KDB, and supplemented through extensive desktop research.

This comprehensive database integrates multiple data sources into a unified framework (Table A.1) covering contract years 2020–2024. It focuses on energy infrastructure projects across the full value chain, from upstream to downstream, grouped into two broad categories:

Fossil-fuel technologies: Oil and gas projects are included to reflect their relevance in current transitional financing practices, whereas coal is excluded in accordance with the global trend among ECAs to end support for coal-related projects.

Clean-energy technologies: Our analysis focuses on solar, wind, and battery value chain which are universally recognized as low-carbon technologies contributing to deep decarbonization.

Nuclear and hydrogen were excluded due to their environmental risks and policy uncertainty, whereas energy efficiency and transmission networks were excluded because they are relevant to both fossil-fuel and clean-energy infrastructure, making it difficult to isolate their impacts within the clean-energy scope.

[Table A.1] Database Structure Overview

Category	Item	Description
Project Overview	Project Name	Name of the project in the database
	Beneficiary Country	Country where the financed project is implemented
Infrastructure	Infrastructure Type	▪ Fossil Fuel: Oil, Gas (including LNG) ▪ Clean Energy: Solar PV, Wind Power, ESS (Battery), Battery manufacturing
	Total Project Cost	Total investment cost of the project
Export Credit / Financing Information	Institution (Agency)	ECA or state-owned policy bank providing loans, insurance or guarantees
	Contract Amount	Actual committed loan or financing amount for the project
	Approval Date	Official approval date of the export financing contract
	Supported Company	Korean company receiving the export financing
Domestic Participants	EPC Contractor	Company responsible for engineering, procurement, and construction (EPC)
	Role of Participant	Type of participation by domestic firms (e.g., construction, equipment supply, operation)

DATA SCREENING PROCESS

Because the data were collected from multiple institutions and compiled at different points in time, a rigorous screening process was required to align categorizations, remove duplicates, correct errors, and identify the types of domestic company participation. The following key steps were taken:

i. Eliminating overlapping support records:

Identical entries reported by multiple institutions (e.g., KDB and OCI) were merged to ensure each financing case of a project was counted once.

ii. Defining export scope for LNG carriers:

LNG carriers posed a classification challenge, as they are mobile assets with ownership and operation often divided between domestic and foreign entities. Following the IMF and UN definitions of export—which state that “the acquisition of ships, aircraft, and satellites is recorded as imports or exports of goods if ownership changes between residents and non-residents, even if the equipment never enters or leaves the economy’s territory.”—this study excluded all cases in which the ship owner was a Korean entity. Accordingly, although Korean-owned LNG carriers may operate in overseas projects, such cases are considered outside the scope of this research.^e

iii. Adjusting for inflation and real value estimation:

As the latest available IO tables (2022)⁵⁹ are based on a 2020 benchmark year, inflation adjustments were applied using the GDP deflator, following the approach used by UKEF (2025)⁴⁷. Real values reflect constant prices, removing the effects of inflation from nominal output values.

Additional adjustments were made for Chapter 3 economic impact analysis, as the goal was to estimate the domestic value creation resulting from export-linked activities.

i. Classification of domestic company participation:

Five patterns of domestic participation were identified (Table A.2). Projects without any domestic supply-chain link were excluded, as they represent investment-only activities rather than exports. Exceptions were made where domestic subcontractors were involved, especially in renewable projects deliberately supported by the public export finance agencies to strengthen SME competitiveness.⁴⁹

^e IMF BPM6 (Balance of Payments Manual, Sixth Edition, 2009) Paragraph 10.16 (Special cases – ships, aircraft, satellites)

[Table A.2] Domestic Company Participation Classification

Domestic Company Participation	Included in Scope
Domestic Contractor (EPC)	O
Equity by Domestic Company	X
Equity by Domestic Company (+Domestic Sub-contractor)	O
Equity by Foreign Company (+Domestic Sub-contractor)	O
No Domestic Participation	X

ii. Comparison between ECA contract amount and subcontract value:

In cases classified as Equity (+ Domestic Subcontractor) participation, the export credit contract amount should not exceed the total value of the domestic subcontract. Otherwise, this would lead to an overestimation of the domestic supply chain effect. Such discrepancies can occur when ECA financing also supports foreign components or project elements that do not generate value within the Korean economy. Therefore, the two values were compared and adjusted accordingly.

iii. Exclusion of import-related activities:

Loans for import-related activities or expenditures spent entirely abroad (e.g., overseas subsidiary loans or import financing for export production) were excluded.

iv. Adjustment for overlapping financial instruments:

To avoid double counting, we filtered out multiple financing cases that essentially support the same underlying export project. (e.g. Loan& Guarantee support, Insurance& Guarantee support at different production/credit stages for the same project needs to be adjusted to account only once). This was based on Van den Berg et al. (2017)⁴⁶ and Censkowsky, P., et al. (2025)⁵ frameworks.

Initially, the database contained 422 energy infrastructure financing cases (see Chapter 2). After screening and adjustments, 290 cases (2020–2024) remained for the economic impact analysis in Chapter 3.

Box. Comparison with External Database

According to the OCI database, Korea's fossil-fuel financing between 2020 and 2022 amounted to approximately USD 30.4 billion, with an annual average of about USD 10.1 billion. In comparison, our database shows an annual average of USD 9.8 billion (KRW 12,254 billion, converted at 1,250 KRW/USD) for fossil-fuel financing between 2020 and 2024.

The discrepancies between databases mainly stem from differences in scope and data treatment. The OCI database includes the Korea Finance Corporation and coal projects, as well as domestic transactions where the recipient country is Korea.

Criteria	OCI DB ⁴⁸	SOFC & GESI DB (Chapter 2)	SOFC & GESI DB (Chapter 3)
Annual Average of Fossil-fuel Financing	USD 10.1 billion (2020–2022)	USD 9.8 billion (2020–2024)	USD 6.7 billion (2020–2024)
Institutional Coverage	Includes Korea Finance Corporation as well as KDB, KEXIM, and K-SURE	KDB, KEXIM, and K-SURE	KDB, KEXIM, and K-SURE
Energy Coverage	Coal, Oil, and Gas	Oil and Gas	Oil and Gas
Project Scope	Includes cases where recipient country = Korea (non-export projects)	Export-related projects only	Export-related projects only
Public Financing Contracts	All public financing	All public financing	Includes only projects with confirmed participation of Korean EPC firms or subcontract suppliers
Data Treatment	-	-	Multiple supports consolidated

A.2. Value-chain Categorization

VALUE-CHAIN PORTFOLIO (2020-2024)

After the screen process, we categorized these projects into eleven distinct value chains based on their position in the energy system:

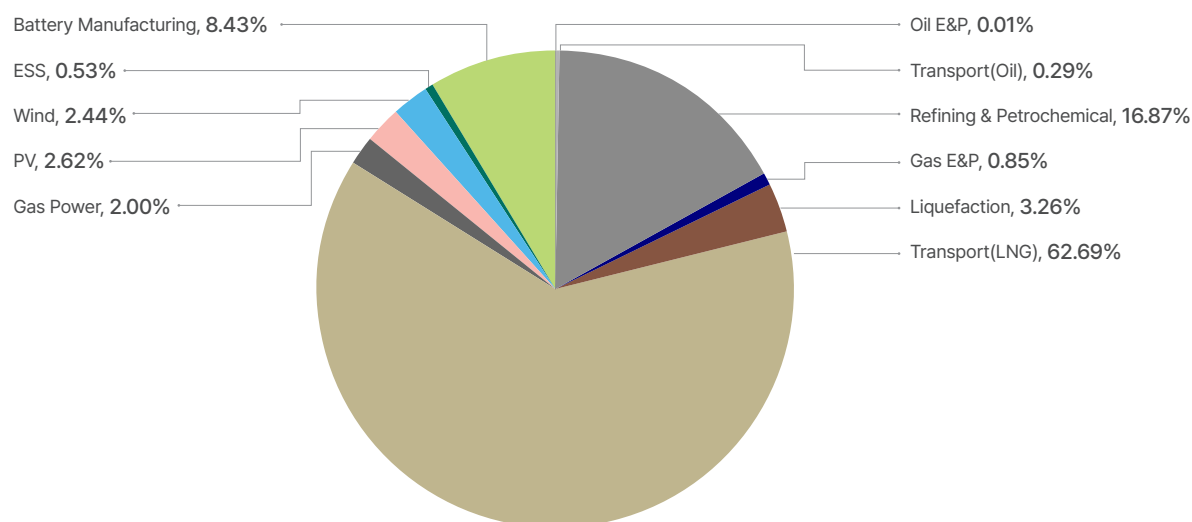
Fossil-fuel value chains are ① Oil Exploration & Production (E&P), ② Oil Transportation, ③ Refining and Petrochemical Production, ④ Gas Field E&P, ⑤ LNG Liquefaction, ⑥ LNG Transportation, ⑦ Gas-fired Power Generation.

Clean-energy value chains are ⑧ Solar PV, ⑨ Wind Power, ⑩ Energy Storage Systems (ESS), ⑪ Battery Manufacturing.

Table A.3 below summarizes the export support value aggregated over 2020 to 2024 under each value chain.

[Table A.3] Value-chain Portfolio from 2020 to 2024 Aggregated and Averaged (unit: billion KRW)

Infra	Fossil-fuel Infrastructure							Clean-energy Infrastructure			
Sub-Infra	Oil		Natural Gas					PV	Wind	ESS	Battery Manufacturing
Value chain	Oil E&P	Transport (Oil)	Refining & Petrochemical	Gas E&P	Liquefaction	Transport (LNG)	Gas Power	PV	Wind	ESS	Battery Manufacturing
2020-2024 SUM	5	122	7,078	356	1,369	26,298	839	1,101	1,022	224	3,537
Annual AVG	1	24	1,416	71	274	5,260	168	220	204	45	707
%	0.01%	0.29%	16.87%	0.85%	3.26%	62.69%	2.00%	2.62%	2.44%	0.53%	8.43%

[Figure A.2] Value-chain Portfolio from 2020 to 2024 Averaged (%)

SUB-CHAIN IDENTIFICATION

For each value chain, we identified recurring activities based on detailed project documentation. The activities consist of either one of or combined activities of EPC (Engineering, Procurement, Construction) and material and equipment supply.

When project entries included both EPC and supply components together, we separated them into their respective activity types using project documentation or typical cost-share estimates for each package.

Through statistical analysis of historical project data and CAPEX information⁵⁰, we then calculated the average share of each activity type within each value chain. These activity types are referred to as 'sub-chains'. Each value chain is thus composed of several sub-chains, defined by the specific firm-level activities involved. The proportional breakdown of the 22 sub-chains is presented in Table A.4 below.

[Table A.4] Value-chain & Sub-chain Mapping Matrix with Percentages

Value chain	Sub-value chain	%
Oil E&P	1. Oilfield Development EPC	100%
Transport (Oil)	2. Ship Construction	100%
Refining & Petrochemical	3. Refinery Plant EPC	30%
	4. Petrochemical Plant EPC	69%
	5. Pollution Control Facility EPC	0.30%
	6. Offshore Loading Terminal EPC	0.50%
Gas E&P	7. FPSO (Gas Production) EPC	89%
	8. CPF (Gas Production) EPC	11%
Liquefaction	9. FLNG EPC	25%
	10. LNG Liquefaction Plant EPC	54%
	11. Offshore Export Terminal EPC	22%
Transport (LNG)	12. Ship Construction	100%
Gas-fired Power Generation	13. Gas-fired Power Plant EPC	100%
Solar Power Generation	14. Solar Power Plant EPC	26%
	15. Solar PV Module Supply	74%
Wind Power Generation (Offshore)	16. Offshore Power Cable Supply	67%
	17. Offshore Wind Structure EPC	33%
Energy Storage Systems (ESS)	18. ESS EPC	19%
	19. Battery Supply	73%
	20. Equipment Supply	8%
Battery Manufacturing	21. Battery Manufacturing Facility EPC	66%
	22. Equipment Supply	34%

A.3. Energy Transition Scenarios and Export Finance Projections

We analyzed future trends in Korea's public export finance and their economic impacts under two sets of scenarios:

- **Global Climate Scenarios**

Based on the IEA (2024)⁴⁰ *Net-Zero Framework*, these scenarios reflect changes in global investment trends driven by the energy transition, assuming Korea maintains its global market share across three climate pathways.

- ① **STEPS** (Stated Policies Scenario), ② **APS** (Announced Pledges Scenario), and
- ③ **NZE** (Net-Zero Emissions Scenario)

- **Business-as-Usual (BAU) Scenarios:**

- ① **BAU:** A domestic baseline assuming that the current (2020–2024 average) level of public export support for fossil fuels and clean energy remains constant.
- ② **BAU-Redirection:** The total level of export support remains the same as in BAU, but the portfolio gradually shifts toward 100% clean energy by 2040.

A summary of the scenarios is presented in Table A.5 below.

[Table A.5] Scenario Description Summary

Scenarios	Description	Total Investment
STEPS	Follow existing policy commitments without additional climate ambition	Declines or grows in line with STEPS assumptions
APS	Assumes all countries fully achieve their announced climate and energy pledges	Declines or grows in line with APS assumptions
NZE	A global pathway consistent with limiting warming to 1.5 °C	Declines or grows in line with NZE assumptions
BAU	Maintains current energy mix trajectory with fixed public export finance	Fixed at 2020–2024 average export support (KRW 8,390 billion/year)
BAU-Redirection	Shifts to 100% clean energy by 2040 within current budget	Fixed at BAU level

Source: IEA (2024)⁴⁰

Under the BAU scenarios, the total public export finance support remains fixed at the current average of KRW 8,390 billion per year (2020–2024).

Although this approach does not fully capture the effects of changing global investment levels, it allows us to isolate and assess how domestic content in export-supported products and services influences Korea’s national economy.

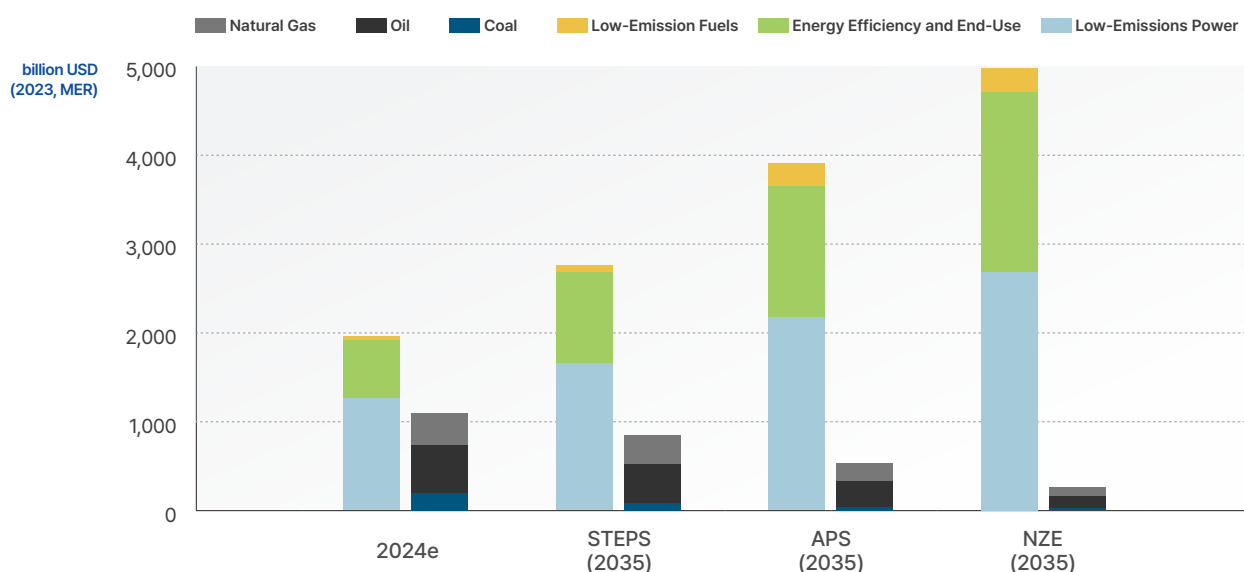
The global climate scenarios and the BAU-Redirection scenario were analyzed separately to maintain methodological consistency. The redirection scenario reflects policy-driven portfolio shifts that are also closely linked to evolving global market dynamics. Integrating both the IEA-based global investment trends and this policy-induced portfolio adjustment would require modeling complex interactions between global and domestic factors—an analysis that lies beyond the scope of this study but could be pursued in future research.

GLOBAL CLIMATE SCENARIOS: STEPS, APS, NZE

Export support volumes are derived from IEA scenario projections for various energy infrastructure and value chains as indicated in Table A.6 below.

[Table A.6] STEPS, APS, BAU Scenario Projection Assumptions

Value chain	Assumptions	Reference
Fossil-fuel Index	Oil supply, Oil consumption, Oil industry final consumption, Gas supply, Gas final consumption	IEA <i>World Energy Outlook</i> dataset (free access) 51
Clean-energy Index	Fossil-fuel Index × 2 (STEPS), × 7 (APS), × 20 (NZE) by 2035	IEA <i>World Energy Outlook 2024</i> 40

[Figure A.3] Annual Energy Sector Investment by Sector and Scenario

For every USD 1 invested in fossil fuels today, around USD 2 is invested in clean energy. By 2035, this rises to USD 3 in the STEPS in 2035, USD 7 in the APS, and USD 20 in the NZE Scenario.

▪ **Note:** MER = market exchange rate; 2024e = estimated value for 2024.

Source: IEA (2024)⁴⁰ p239

Incorporating these projections produces the pathway shown in Table A.7 below. Investment values were not estimated beyond 2035 due to data limitations and increasing uncertainty. The analysis assumes that Korea maintains a constant market share in the expanding global market.

[Table A.7] Public Export Finance Projection by Scenario (unit: billion KRW)

2035	FF Investment	CE Investment	Total Investment	Clean Energy %
BAU	7,214	1,177	8,390	14.0%
STEPS	7,884	3,858	11,742	32.9%
APS	6,466	7,384	13,851	53.3%
NZE	4,928	16,079	21,007	76.5%

Source: Author's calculations using data from the IEA (2024) ⁴⁰

BAU SCENARIOS AND REDIRECTION RATE

The redirection pathway under the BAU-Redirection scenario was developed based on the phase-out pledges announced by major economies, as discussed in Chapter 2.

As shown in Table A.8, most advanced economies have already committed to fully phasing out public finance for oil and gas projects by 2040, in line with their national net-zero targets.

[Table A.8] De-gas and De-Oil Targets by Countries

Countries	2025	2030	2040	2050
Korea (K-SURE, KEXIM, KDB)	None			
Germany (2045-)			100%	100%
France, Austria, Poland		100%	100%	100%
UK, Netherlands, Denmark, Canada, Japan	100%	100%	100%	100%

Source: Author's compilation from national ECA-related materials **29 30**

Following this global benchmark, Korea's BAU-Redirection pathway assumes a linear phase-out of fossil-fuel export finance by 2040, starting from the 2024 baseline when clean energy accounted for 14% of total infrastructure support. The progression of this redirection is illustrated in Table A.9 below.

[Table A.9] Redirection Pathway under BAU-R Scenario

Years	Fossil Fuels (%)	Clean Energy (%)
2024	86.0%	14.0%
2025	80.6%	19.4%
2030	53.7%	46.3%
2035	26.9%	73.1%
2040	0.0%	100.0%

Since Korea's global market share was assumed to remain constant in the global climate scenarios, the country's export volume was treated as proportional to global demand. In other words, as the world invests more in clean energy, Korea's exports increase in the same proportion, making it unnecessary to project separate export growth trajectories for individual value chains.

In contrast, for the BAU-Redirection scenario—assuming a constant total export value—the composition of Korea’s export finance portfolio shifts from fossil fuels toward clean energy. Therefore, the total export support was first estimated by infrastructure type (fossil fuels vs. clean energy) and then distributed across eleven value chains according to Korea’s actual export structure and trends. This approach follows Cambridge Econometrics (2022).

The proportions within the fossil-fuel and clean-energy categories evolved based on the average annual growth rates derived from log-linear regressions estimated using historical export data. Because service-based activities such as engineering and construction do not have direct HS codes^f, the projections combined data from UN Comtrade⁵², KOPIA⁵³ and KITA⁵⁴ statistics to estimate export market size and trends.

It is important to note that the results are highly sensitive to the choice of compound annual growth rates (CAGR) used for future projections. A short-window CAGR (2020–2024) captures recent market dynamics but may overstate growth if short-term fluctuations or temporary policy shocks are included. In contrast, a long-window CAGR (2015–2024) reflects more stable, long-term trends but may understate growth in rapidly expanding sectors.

To balance these effects, both long-window (2015–2024) and short-window (2020–2024) log-OLS regressions were analyzed and compared, as shown in Table A.10. As the table indicates, large discrepancies exist across clean-energy value chains between the two periods, often due to recent policy shifts or the maturation and saturation of certain export markets.

To avoid over-projection, this study generally applied the long-window rate for value chains with discrepancies of less than 30%. For those exceeding 30%, a blended rate was used, calculated as 70% of the short-window CAGR and 30% of the long-window CAGR. While this study applies one selected growth path, future work may test alternative growth rates to further assess sensitivity.

^f HS codes (Harmonized System codes) are standardized numerical codes used internationally to classify traded goods.

[Table A.10] Korea Export Projection by Value Chain

Value chain	Long-window CAGR (OLS, %)	Short-window CAGR (OLS, %)	Source
Oil E&P	0.65%	-29.67%	KOPIA
Transport (Oil)	-6.58%	-3.76%	COMTRADE (8901.20)
Refining & Petrochemical	-5.40%	-32.62%	KOPIA
Gas E&P	-26.69%	0.91%	KOPIA
Liquefaction	-17.44%	NA	KOPIA
Transport (LNG)	-6.58%	-3.76%	COMTRADE (8901.20)
Gas Power	-3.27%	-24.40%	KOPIA
PV	23.29%	52.96%	KOPIA
Wind	67.54%	3.31%	KOPIA
ESS	9.50%	114.74%	KOPIA
Battery Manufacturing	134.44%	8.58%	KOPIA

Source: Author's calculations using data from the UN Comtrade, KOPIA, KITA **52 53 54**

With public export finance support projections established across all scenarios, the IO-based coefficients developed in the following section are applied to quantify the corresponding value-added and employment impacts of each pathway.

A.4.Economic Impact Calculation

As discussed earlier, a key methodological challenge arises because traditional IO analysis operates at the industry level, while export credit support occurs at the project level, where activity composition varies widely. To bridge this gap, export finance amounts are translated into economic impacts through three sequential steps:

- **Mapping export contracts:**

Each contract is assigned to one of eleven value chains and, within each, to one of more of 21 sub-chains that reflect specific activity mixes (e.g., EPC or equipment supply), as defined in Section A.2.

- **Linking to IO industries:**

Each sub-chain is connected to a set of IO industries using standardized “IO combinations” derived from empirically based cost-share structures. Scenario-specific domestic-content ratios are then applied to each IO industry, and domestically attributable spending is multiplied by the Bank of Korea (2020) value-added and employment multipliers to obtain sub-chain (IO-combination) impact coefficients.

- **Aggregating to value chains:**

Value-chain unit impacts are computed as share-weighted sums of their constituent sub-chains and scaled by export-finance allocations under each scenario.

Table A.11 illustrates the roll-up process from sub-chain (IO-combination) coefficients to value-chain unit impacts.

[Table A.11] Roll Up to Value-chain Unit Impacts

Value chain	Sub-chain	Sub-chain Proportion	IO Combination Coefficient	IO Multiplier (Value added, Employment)	IO Industry Cost Proportion	Domestic Content
Wind Power	16. Offshore Power Cable Supply	66.9%	7. Cable / Equipment Supply	374 Electric Wires & Cables	100%	M
	17. Offshore Wind Structure EPC	33.1%	8. Offshore Wind Structure	301 Metal Products & Tanks for Structures	70%	M
				410 Shipbuilding	15%	M
				423 Industrial Facility Construction	15%	L

Throughout the analysis, Type II IO multipliers are used, capturing direct, indirect, and induced effects for both value added and employment.

INTRODUCTION TO INPUT-OUTPUT ANALYSIS

Input-output analysis is a useful method for examining a country's industrial structure and the interdependence among sectors.⁹ The model illustrates how the output of one sector serves as the input for another, as shown in Figure A.4.

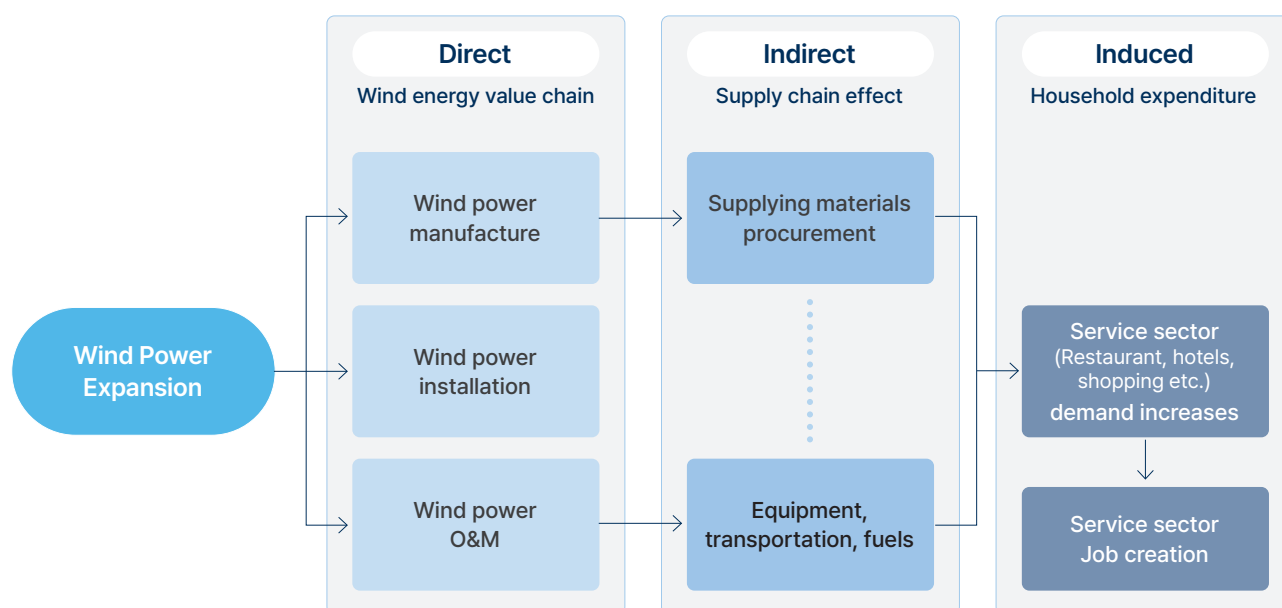
[Figure A.4] Input-Output Table Structure

		PRODUCERS AS CONSUMERS								FINAL DEMAND			
		Agric.	Mining	Const.	Manuf.	Trade	Transp.	Ser- vices	Other	Personal Consumption Expenditures	Gross Private Domestic Investment	Govt. Purchases of Goods & Services	Net Exports of Goods & Services
PRODUCERS	Agriculture												
	Mining												
	Construction												
	Manufacturing												
	Trade												
	Transportation												
	Services												
	Other Industry												
VALUE ADDED	Employees	Employee compensation								GROSS DOMESTIC PRODUCT			
	Business Owners and Capital	Profit-type income and capital consumption allowances											
	Government	Indirect business taxes											

Reference: Miller & Blair (2009) **55**

In an IO table, columns represent inputs required by each sector, while rows show outputs produced. A change in demand for one industry affects the activity levels of others connected to it, allowing the model to capture direct, indirect, and induced effects throughout the economy. Figure A.5 illustrates how rising demand for wind-power projects generates local employment through multiple spill-over channels.

⁹ The IO model was originally developed by Wassily Leontief in 1951 to study the structure of the American economy. Walter Isard, a key figure in the field of regional science and location theory, assisted Leontief in modifying the model for application to local economies.

[Figure A.5] Pathway of Economic Spill-over Effects

Reference: Kim B. (2023)⁵⁶, adapted from Breitschopf, Nathani, & Resch (2011)⁵⁷

Direct effects are the immediate impacts of a renewable energy project. Indirect effects arise from supply-chain impacts related to these direct effects, while induced effects refer to broader economic impacts stemming from increased income spent in service sectors like restaurants and retail. These indirect and induced effects are often called the ‘ripple effect’ or ‘spillover effect’, and accounting for them in the planning stage can help maximize benefits.⁵⁸

The study uses the Bank of Korea 2020 national IO table (165 sectors)⁵⁹—the most recent standard-year dataset available.

MAPPING INDUSTRY CLASSIFICATION BRIDGE

This step converts previously defined sub-chains into standardized industry classifications compatible with national accounts.

A triangulation approach, adapted from the Van den Berg et al. (2017)⁴⁶ methodology, was used to map sub-chains to Korean Standard Industrial Classification (KSIC) codes through:

- Business Report Analysis: Reviewing annual reports from major contractors to identify self-reported industrial classifications for similar projects⁶⁰
- Self-reported KSIC codes in the database (when present)
- Desktop Research: Independent classification based on project descriptions and industry standards

The triangulated KSIC codes were subsequently mapped to Bank of Korea 2020 National IO table classifications at the small-category sectors (165 number of sectors). This mapping revealed ten recurring patterns of “IO combinations”, each representing a unique mix of IO codes.

[Table A.12] IO Combination x IO industry Mapping

IO Combination		IO Industries
1	EPC	423 Industrial Facility Construction
		721 Architectural & Civil Engineering Services
2	Transport	410 Shipbuilding
3	Port Infrastructure	721 Architectural & Civil Engineering Services
		511 Transport Infrastructure Construction
4	Gas Production EPC	410 Shipbuilding
		301 Metal Products & Tanks for Structures
5	Gas-fired Power Plant EPC	423 Industrial Facility Construction
		381 Internal Combustion Engines & Turbines
		721 Architectural & Civil Engineering Services
6	Solar PV Supply	371 Generators & Motors
		310 Semiconductors
7	Cable / Equipment Supply	374 Electric Wires & Cables
8	Offshore Wind Structure	301 Metal Products & Tanks for Structures
		410 Shipbuilding
		423 Industrial Facility Construction
9	Battery Supply	373 Batteries
10	Battery Manufacturing Equipment Supply	399 Other Special-Purpose Machinery
		394 Semiconductor & Display Manufacturing Equipment

BUILDING IO COMBINATIONS AND ECONOMIC COEFFICIENTS

For each IO combination, a vector of IO-sector cost shares summing to 100 % was created to determine value-added and employment coefficients. Cost proportions were based on CAPEX benchmarks (e.g., industrial construction vs. engineering-service splits in EPC projects). Each IO sector was assigned a domestic-content ratio (share of spending captured in Korea) corresponding to the scenario level: Low (L), Medium (M), High (H), and Very High (VH). For each IO combination, we calculated weighted-average coefficients using:

$$\text{IO Combination Coefficient} = \sum_{j=1}^n \text{IO Multiplier}_j \times \text{Cost Proportion}_j \times \text{Domestic Content Ratio}_j$$

Where j denotes each IO industry within the combination, and n denotes total number of IO industries in the combination. The resulting coefficients are presented in Table B.7 in Appendix B.

DOMESTIC CONTENT SCENARIO DEVELOPMENT

This study assesses the extent to which export-financed projects executed abroad generate domestic value and employment through Korean suppliers. Since Korea's ECAs do not publicly disclose detailed data on domestic procurement, assumptions were established based on OECD Arrangement standards, ECA policy benchmarks, expert consultations, and literature reviews.^h

Table A.13 summarizes the minimum domestic-content requirements adopted by major ECAs, which served as reference benchmarks for constructing four domestic-content levels, as detailed below.

[Table A.13] Minimum Required Domestic Content

Category	%	ECA Countries
Low	20	United Kingdom ⁶¹ , France ⁶² , Netherlands ⁴²
Medium	50-60	Germany ⁶³ , Canada ⁶⁴ , Australia ⁶⁵ , OECD Arrangement ^{i 66}
High	85	United States ⁶³
Precedent Study	70	Cambridge Econometrics (2022) ⁴²

^h When asked about domestic content requirements, Korea's public export finance agencies stated that no such requirements exist and that no related data are managed. KEXIM noted an exception: for export transactions involving ships and industrial facilities, a minimum foreign exchange earnings ratio of 25% is required, although no separate statistics are maintained. For export credits subject to the OECD Arrangement, support limits are determined in accordance with OECD standards.

ⁱ Arrangement on Officially Supported Export Credits: High-income countries (Category 1): Up to 40% of the export contract value may be spent in the destination country. Other countries (Category 2): Up to 50% may be spent locally.

Domestic-content ratios vary widely by value chain. For instance, LNG vessel exports typically exhibit about 50% domestic content in Korea based on the assumption that all steel is sourced domestically; however, with 20-50% of steel inputs now imported,⁶⁷ the real domestic share could be lower. Conversely, construction-intensive projects executed overseas often reach 80–100% localization in the host country, as most materials and labor are sourced locally.^{68 69 70} Engineering services and value chains related to natural gas power generation, solar PV, wind, and ESS were consolidated based on precedent studies.^{50 56 71 72} For value chains where sufficient evidence was unavailable, a “Medium” level was applied, reflecting the average of minimum domestic-content standards among major ECAs and the OECD Arrangement (Table A.13). Future studies could further refine these ratios as more detailed data become available.

Building on these references, four domestic-content levels were defined:

- **Low (L) - 20%:** Pure construction activities with minimal Korean equipment, primarily using local labor and materials.
- **Medium (M) - 50%:** Standard equipment supply with mixed sourcing, combining Korean technology with international procurement.
- **High (H) - 70%:** Specialized equipment with significant Korean technology content and engineering services.
- **Very High (VH) - 90%:** Professional engineering services, software development, and proprietary Korean technology with high domestic content.

Two domestic-content scenarios were modeled:

- i. Current Domestic Content:** Reflects current observed levels in Korea, based on literature and expert consultations.
- ii. Advanced Domestic Content:** Represents an improved competitiveness case derived from a break-even analysis identifying the domestic-content level at which the economic impact of clean energy generated in Korea equals that of fossil fuels. This scenario also assumes modest improvements in fossil-fuel domestic content through shared IO industries.

This framework highlights how varying domestic-content levels influence Korea’s capacity to retain economic value and jobs from export-financed projects, informing policy discussions on enhancing domestic benefits during the transition from fossil-based to clean-energy exports.

[Table A.14] Domestic Content Scenario

	IO Combination	IO Industries (Small Classification)	Cost Share	Domestic Content	
				Current	Advancement
1	EPC	423 Industrial Facility Construction	67%	L	L
		721 Architectural & Civil Engineering Services	33%	H	VH
2	Transport	410 Shipbuilding	100%	M	M
3	Port Infrastructure	721 Architectural & Civil Engineering Services	20%	H	VH
		511 Transport Infrastructure Construction	80%	L	L
4	Gas Production EPC	410 Shipbuilding	45%	M	M
		301 Metal Products & Tanks for Structures	55%	M	M
5	Gas-fired Power Plant EPC	423 Industrial Facility Construction	30%	L	L
		381 Internal Combustion Engines & Turbines	57%	M	M
		721 Architectural & Civil Engineering Services	12%	H	VH
6	Solar PV Supply	371 Generators & Motors	47%	L	M
		310 Semiconductors	53%	L	M
7	Cable / Equipment Supply	374 Electric Wires & Cables	100%	M	H
8	Offshore Wind Structure	301 Metal Products & Tanks for Structures	70%	M	H
		410 Shipbuilding	15%	M	M
		423 Industrial Facility Construction	15%	L	L
9	Battery Supply	373 Batteries	100%	M	VH
10	Battery Manufacturing Equipment Supply	399 Other Special-Purpose Machinery	80%	M	VH
		394 Semiconductor & Display Manufacturing Equipment	20%	M	VH

VALUE CHAIN COEFFICIENT AGGREGATION

As each sub-chain is assigned to one IO combination, and each value chain containing one or more sub-chains, the value-added and employment coefficients for each value chain are calculated as weighted averages of their constituent IO combinations:

$$\text{Value Chain Coefficient} = \sum_{i=1}^m \text{IO Combination Coefficient}_i \times \text{Sub-chain Proportion}_i$$

Where ***i*** denotes each sub-chain within a particular value chain and ***m*** denotes the total number of sub-chains in the specific value chain. This approach ensures that coefficients accurately reflect the actual composition of Korean export projects rather than theoretical industry averages. For instance, the offshore wind value-chain coefficient incorporates the specific mix of foundation construction and submarine cable installation etc. observed in our database.

APPLICATION TO SCENARIO ANALYSIS

This methodological framework enables evaluation of three energy transition scenarios (STEPS, APS, NZE) by applying derived coefficients to projected export support volumes. For each scenario-year combination, total impact is calculated by:

$$\text{Total Impact}_{t,s} = \sum_{v=1}^V \text{Export Support Volume}_{v,t}(v, t) \times \text{Value-chain Coefficient}_{v,s}$$

Where ***v*** denotes value chains ($V=11$ in our analysis), ***t*** denotes time periods (e.g., 2030, 2040), and ***s*** denotes domestic content scenarios (L, M, H, VH). Export-support volumes are either derived from IEA projections or adjusted for Korea's export trends, as detailed in Section A.3.

LIMITATIONS

This analysis involves several methodological limitations, and results should be interpreted with caution.

Additionality. This analysis does not quantify additionality. Therefore, results reflect jobs and value added supported by export credit rather than net-created outcomes relative to a no-support counterfactual.

Fixed-coefficient IO and omitted dynamics. Projections for 2030–2040 use 2020 IO coefficients, implicitly assuming stable inter-industry relationships. We also do not model dynamic mechanisms—price changes, learning curves, economies of scale, spillovers, or supply-chain reconfiguration—that would change those coefficients and multipliers over time.

COVID-19 year effects. Using 2020 IO multipliers may carry pandemic-related distortions in sectoral spending and trade patterns into our coefficients.

Scope of value chains. Some activities material to renewable integration and sector coupling—e.g., large-scale battery manufacturing and transmission/distribution grid investments—are excluded due to data limitations or classification ambiguity. Their omission likely understates benefits where such assets are central.

Domestic-content assumptions. Domestic-content ratios are applied at the IO-industry level and vary by scenario. Divergence between assumed and actual sourcing will shift realized impacts.

Timing of impacts. Estimates reflect forward-looking impacts associated with credit and insurance issued in a given year, realized over subsequent years as contracts are executed. We do not align impacts to shipment timing, nor do we discount or deflate future flows to present values.⁴⁷

Data completeness. Despite extensive efforts to compile comprehensive datasets and supplement missing cases through desktop research, some data gaps may remain, which could lead to minor underestimation or overestimation of sectoral impacts.

Appendix B. Results in Detail

[Table B.1] Summary of Value-added Impacts under Global Climate Scenarios (unit: billion KRW)

	BAU	2035	2035	2035
		STEPS	APS	NZE
Oil E&P	0	1	0	0
Transport (Oil)	12	13	11	8
Refining & Petrochemical	699	764	627	478
Gas E&P	37	40	33	25
Liquefaction	130	142	117	89
Transport (LNG)	2,618	2,862	2,347	1,789
Gas Power	80	88	72	55
PV	55	181	346	754
Wind	88	289	552	1,202
ESS	18	59	112	245
Battery Manufacturing	359	1,178	2,255	4,910
	4,098	5,616	6,473	9,555

[Table B.2] Summary of Value-added Impacts under Redirection Scenario (unit: billion KRW)

	BAU	2025	2030	2035	2040
		BAU-R	BAU-R	BAU-R	BAU-R
Oil E&P	0	0	0	0	-
Transport (Oil)	12	11	8	4	-
Refining & Petrochemical	699	666	474	250	-
Gas E&P	37	27	5	1	-
Liquefaction	130	108	39	10	-
Transport (LNG)	2,618	2,463	1,647	816	-
Gas Power	80	78	62	37	-
PV	55	77	169	196	143
Wind	88	104	103	53	17
ESS	18	32	232	894	2,166
Battery Manufacturing	359	508	1,212	1,520	1,198
	4,098	4,075	3,953	3,782	3,525

[Table B.3] Summary of Value-added Impacts under Redirection Scenario with Advanced Domestic Content (unit: billion KRW)

	BAU	2025	2030	2035	2040
		BAU-R	BAU-R	BAU-R	BAU-R
Oil E&P	0	1	1	0	-
Transport (Oil)	12	11	8	4	-
Refining & Petrochemical	699	789	562	297	-
Gas E&P	37	27	5	1	-
Liquefaction	130	122	44	12	-
Transport (LNG)	2,618	2,463	1,647	816	-
Gas Power	80	84	67	39	-
PV	55	141	311	361	263
Wind	88	142	140	72	24
ESS	18	51	377	1,451	3,514
Battery Manufacturing	359	713	1,701	2,132	1,681
	4,098	4,544	4,863	5,185	5,482

[Table B.4] Summary of Employment Impacts under Global Climate Scenarios (unit: FTE)

	BAU	2035	2035	2035
		STEPS	APS	NZE
Oil E&P	5	6	5	4
Transport (Oil)	161	176	144	110
Refining & Petrochemical	7,897	8,631	7,079	5,395
Gas E&P	445	487	399	304
Liquefaction	1,542	1,685	1,382	1,053
Transport (LNG)	34,729	37,956	31,132	23,725
Gas Power	905	989	811	618
PV	534	1,752	3,353	7,300
Wind	1,004	3,291	6,299	13,715
ESS	174	571	1,092	2,379
Battery Manufacturing	4,099	13,441	25,724	56,011
	51,497	68,984	77,421	110,616

[Table B.5] Summary of Employment Impacts under Redirection Scenario (unit: FTE)

	BAU	2025	2030	2035	2040
	BAU-R	BAU-R	BAU-R	BAU-R	BAU-R
Oil E&P	5	5	5	4	-
Transport (Oil)	161	152	101	50	-
Refining & Petrochemical	7,897	7,521	5,357	2,825	-
Gas E&P	445	329	65	10	-
Liquefaction	1,542	1,281	462	123	-
Transport (LNG)	34,729	32,664	21,851	10,825	-
Gas Power	905	882	702	414	-
PV	534	744	1,641	1,902	1,387
Wind	1,004	1,189	1,170	605	197
ESS	174	308	2,258	8,698	21,069
Battery Manufacturing	4,099	5,795	13,830	17,338	13,671
	51,497	50,869	47,443	42,793	36,323

[Table B.6] Summary of Employment Impacts under Redirection Scenario with Advanced Domestic Content (unit: FTE)

	BAU	2025	2030	2035	2040
	BAU-R	BAU-R	BAU-R	BAU-R	BAU-R
Oil E&P	5	6	6	4	-
Transport (Oil)	161	152	101	50	-
Refining & Petrochemical	7,897	8,817	6,280	3,312	-
Gas E&P	445	329	65	10	-
Liquefaction	1,542	1,428	515	138	-
Transport (LNG)	34,729	32,664	21,851	10,825	-
Gas Power	905	940	748	441	-
PV	534	1,279	2,821	3,270	2,384
Wind	1,004	1,616	1,591	823	268
ESS	174	490	3,592	13,832	33,507
Battery Manufacturing	4,099	8,105	19,343	24,248	19,120
	51,497	55,826	56,914	56,953	55,278

[Table B.7] Economic Impact Coefficients Derived from the Study (Current Domestic Content)

IO Combination		2020 Value-added Impact Coefficient				2020 Employment Impact Coefficient (FTE/billion KRW)			
		Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced
1	EPC	0.49	0.24	0.08	0.17	5.58	2.37	0.99	2.22
2	Transport	0.50	0.07	0.27	0.16	6.60	1.19	3.26	2.15
3	Port Infrastructure	0.40	0.18	0.09	0.13	4.63	1.79	1.06	1.78
4	Gas Production EPC	0.52	0.10	0.25	0.16	6.25	1.10	2.94	2.21
5	Gas-Fired Power Plant EPC	0.48	0.16	0.16	0.16	5.39	1.46	1.84	2.09
6	Solar PV Supply	0.17	0.07	0.05	0.04	1.34	0.24	0.55	0.56
7	Cable / Equipment Supply	0.40	0.09	0.19	0.12	4.54	0.90	2.05	1.59
8	Offshore Wind Structure	0.49	0.11	0.22	0.16	5.66	1.10	2.48	2.08
9	Battery Supply	0.37	0.13	0.15	0.10	3.37	0.58	1.39	1.40
10	Battery Manufacturing Equipment Supply	0.53	0.15	0.21	0.17	6.21	1.61	2.35	2.26

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Publication Date **November 2025**

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Please cite as

SFOC and GESI (2025), South Korea's Export Credit Finance in Transition: National Economic Impacts of the Global Shift from Fossil Fuels to Clean Energy

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