

Climate Clubs: Their Emergence and Implications for Trade Policy

Jukwan LEE Research Fellow, New Trade Strategy Team, Trade Investment and Economic Security Department (jklee@kiep.go.kr)

I. Introduction

As disruption of the global order continues and the climate crisis worsens, a new form of cooperation led by major countries is emerging: climate clubs. These club-style arrangements are designed to address the limitations of multilateral efforts and unilateral climate-trade measures in tackling climate change within the context of international trade.

The World Trade Organization (WTO) and the Paris Agreement have both struggled with the dilemmas arising from trade carbon leakage and free-riding in climate response. Meanwhile, unilateral measures taken by individual countries to address climate change and protect the environment have begun to distort the free trade order, as they often serve to protect domestic industries.

In response, climate clubs offer a novel approach to cooperation. By providing common goals and participation incentives, climate clubs aim to accelerate progress towards carbon neutrality and the goals of the Paris

Agreement. While it is difficult to find a real-world example that perfectly matches the theoretical components of a climate club, arrangements such as the G7-driven Climate Club and the Global Sustainable Steel and Aluminum Agreement (GSSA) between the U.S. and EU can be classified as types of climate clubs.

As a top 10 country in both trade volume and carbon emissions, Korea is increasingly being asked to participate in various climate-related cooperation bodies and climate club discussions. Korea has already responded to the invitation extended by the G7 to join its Climate Club, and declared participation in May 2023. Seoul's response to unilateral and protectionist climate-trade policies on the part of major countries is also drawing attention from developing economies. From the perspective of the Korean government, it is essential to prepare for and respond to international discussions on

such issues. It will be crucial for Korea to establish a well-informed stance based on a thorough understanding of recent developments in these discussions.

Climate trade-related plurilateral discussions are taking place simultaneously across various forums, including the Indo-Pacific Economic Framework (IPEF), APEC Summit, G7-led Climate Club, G20, and the U.S.-EU GSSA. As these discussions spread, it will be essential to understand the key contents and issues surrounding climate clubs, analyze the effects of joining, and gather opinions from domestic industries to set a clear direction for participation and negotiation in international climate club discussions.

This paper aims to provide a foundation for Korea's response to climate clubs by exploring the economic theory behind climate clubs, examining the formation trends of club-style climate cooperation in reality, and presenting

findings from policy experiments using simulation models and in-depth industry interviews.

II. The Concept of Climate Clubs

1. Conceptual framework and applications

Within the concept of climate clubs has emerged a cooperation model that aims to incentivize member countries to provide a level of climate change mitigation efforts that can accelerate the achievement of carbon neutrality. In this model, member countries pay a “membership fee” in the form of additional carbon reduction efforts, and in return, they receive exclusive benefits such as exemption from penalties imposed on non-participating countries or reduced carbon reduction costs through joint efforts within the club (Nordhaus, 2015).

Table 1. Incentive Structure of Climate Clubs

		Import Country	
		Member	Non-Member
Export Country	Member	Club Goods (reducing mitigation cost)	None
	Non-Member	Penalty (tariffs, CBAM, trade measures)	None

Source: Modified from Nordhaus (2015), p.1355

Climate clubs differ from international initiatives, which are alliances formed between countries or private entities that lead discussions on specific topics but lack enforcement power. In contrast, climate clubs are cooperation bodies between countries that have a structure of penalty or sanctions against non-participating countries and exclusive benefits for participating countries under a common goal, representing a more evolved form of cooperation (Falkner et al. 2021).

While it is difficult to find a real-world example of a climate club that possesses all the theoretical components, arrangements such as the Paris Agreement, the Kyoto Protocol regime, the G7 Climate Club, and the Global Sustainable Steel and Aluminum Agreement

(GSSA) can be classified as types of climate clubs, as they provide common goals and participation incentive structures, as described in Table 2.

When examining the concept of climate clubs, it is essential to look closer at two recent cases that align with the theoretical framework: the G7 Climate Club and the Global Sustainable Steel and Aluminum Agreement (GSSA) between the United States and the European Union. These cases are particularly relevant as they represent new, evolving forms of cooperation that aim to address the challenges of climate change mitigation in the context of international trade. The G7 Climate Club provides valuable insights into how climate clubs operate in practice, the incentives they offer for

Table 2. Elements and Examples of Climate Clubs

Element	Nordhaus	G7 Climate Club	GSSA	Paris Agreement	Kyoto Protocol
Object	Secure mitigation effort	Accelerate Paris Agreement goals	Respond to Climate change, trade dispute, overproduction	Limit temperature rise compared to pre-industrial levels	Greenhouse gas emission reduction
Target	Minimum carbon pricing	Industry transition	Low carbonization	1.5°C	Emission target
Agenda	Carbon price level	Cooperation for decarbonization	Low carbon trade in steel and aluminum	NDC	Emission targets
Decision Making	Bottom up	Top down	Bilateral	Bottom up	Top down
Incentive	Tariff revenue + mitigating climate damage	Technical cooperation, interoperability, standardization	Standard formation, Exemption from export restrictions	Voluntary	Voluntary
Penalty	CBAM, tariffs	None	Tariffs, export restrictions	None	Deduction of emission allowance
Member	16 countries	G7 + n	U.S., EU	193	192
Status	Theory	Launched	Under negotiation	In effect	Expired

Source: Author

participation, and the challenges they face in achieving their objectives. On the other hand, the GSSA represents a novel approach to tackling emissions in carbon-intensive industries, demonstrating how climate clubs can be tailored to specific sectors and contribute to the decarbonization of global supply chains.

The G7 Climate Club, led by the G7 countries, aims to support the effective implementation of the Paris Agreement and its goals in an open, cooperative, and inclusive manner. The club officially launched in December 2023 at COP28 with the support of 36 member countries, serving as a plurilateral cooperation body that promotes the introduction of more active institutional mechanisms and cooperation to effectively achieve the goals of carbon

neutrality by 2050 and limiting temperature rise to 1.5°C (G7 2022).

The key functions of the G7 Climate Club include convening a high-ambition intergovernmental forum to accelerate the industrial production transition towards carbon neutrality, enhancing cooperation, improving coordination, and providing a framework for potential joint actions. The main issue in the G7 Climate Club discussions is the establishment of an incentive system to accelerate carbon neutrality, which will determine its future influence based on the ability to appropriately set goals, governance, participation incentive structures, and penalties to curb free-riding by non-participating countries.

Table 3. G7 Climate Club Structure

Pillar I	Pillar II	Pillar III
Advancing ambitious and transparent climate change mitigation policy	Transforming Industries	Boosting international cooperation and partnership
I-1 Overcoming the challenges facing the computation of emissions intensity metrics	II-1 Building international common understanding on comparable and interoperable standards	III-1 Mapping of relevant work and initiatives covering public financing and technical assistance programs for industry decarbonization
I-2 Strategic dialogue on causes and relevance of spill overs from mitigation policies	II-2 Promoting markets for near zero GHG emissions materials to accelerate the industry transition	III-2 Developing a better understanding of successful financing instruments and enabling conditions to mobilize private capital
I-3 Tracking progress on the Climate Club's objectives and deliverables	II-3 Toolkit for industry transition and assembling targeted support policies	III-3 Developing a matchmaking focused on improving industry decarbonization projects

Source: Climate Club (2023), Climate Club Work Program 2024.

Table 4. Climate Club Example 2: GSSA

Classification	U.S. Proposal	EU Proposal
Nature of Climate Club	Exclusive, Mandatory	Cooperative, Facilitative, Inclusive (Aligned with G7 Initiative)
Membership Criteria	Based on average embedded carbon emissions per product, contribution to non-market supply surplus, and minimum share of low-carbon steel and aluminum in public procurement	Countries that comply with the obligation to refrain from export restrictions on raw materials, intermediate inputs, and other related products
Obligations	<p>GSSA member countries' average embedded emissions must not exceed a certain percentage above the U.S. and EU averages for steel and aluminum emissions reduction commitments.</p> <p>Obligation to prevent backsliding based on improvements from the two member countries with the lowest carbon emissions</p> <p>Mandatory consideration of additional measures for emission reductions</p>	<p>Legal commitments and domestic legislative compliance for achieving net-zero carbon emissions in the steel and aluminum sectors</p> <p>Legally binding transparency commitments</p> <p>Government procurement of low-carbon steel and aluminum</p> <p>Collaboration on clean technology R&D</p> <p>Mandatory support for least developed countries and carbon non-emitting countries</p>
Exemptions	Request for exemption from EU CBAM for U.S.-produced steel and aluminum	Request for exemption from U.S. Section 232 tariffs for EU-produced steel and aluminum
Punitive Tariffs	Support Joint tariff based on membership status and emission reduction commitment	Opposition
Introduction of Subsidy	Not Identified	Agree
Other	Ultimate replacement of CBAM between U.S. and EU.	Continuation of EU CBAM

Note: The original texts of the USTR proposal in December 2022 and the EU proposal in January 2023 have not been publicly disclosed. Therefore, the following summary is based on elements confirmed through media and secondary sources.

As depicted in Table 3, the G7 Climate Club exhibits a unique modular structure that separates sub-objects, providing flexibility and dynamism within its framework. Additionally, it underscores the challenges associated with establishing a robust incentive and penalty structure at the international level.

In October 2021, the United States and the European Union announced a joint declaration agreeing to initiate negotiations on a “Global Sustainable Steel and Aluminum Agreement”

(GSSA) to restore market-oriented conditions and address carbon intensity. The two parties established a technical working group to discuss and share information on the calculation methods for the carbon intensity of steel and aluminum (European Commission 2021).

The main issues in the GSSA negotiations include the phase-out of carbon-intensive production methods for sustainable steel and aluminum production and trade in response to climate change, and agreeing on effective

measures to curb non-market overcapacity (U.S. Department of Commerce 2021).

2. Economic impact of climate clubs

The issue of international cooperation for addressing climate change can be divided into three main stages. The first stage involves pre-Kyoto Protocol studies, which concluded that free-rider incentives would result in only a few countries forming a coalition (d'Aspremont et al. 1983, Palfrey and Rosenthal 1984).

The second stage encompasses the Kyoto Protocol, where research focused on emission reduction targets and reward systems within cooperation, with institutional designs accommodating developing countries (Barret 2003, Finus 2003).

The third stage, following the Paris Agreement, introduced a new climate regime where all countries voluntarily participate and determine their own reduction obligations. Recent studies have concentrated on resolving free-rider issues through institutional designs and maintaining individual countries' competitiveness through policy responses (Barrett 2006, Hoel and de Zeeuw 2010, Rubio 2017).

In this context, the climate club discussion seeks to overcome the limitations of voluntary participation by increasing rewards through cooperative games. Key elements for forming a stable coalition include joint R&D and technological development, with proposed penalties for non-participating countries, such as trade sanctions.

To assess the impact of climate clubs on countries under the Paris Agreement, as well as figure out the proper incentive structure that gives stability to a club, a simulation was conducted using the GTAP 11 E Power Model with 2017 as the base year.

In the analysis of climate clubs, quantitative analysis based on structural models like the general equilibrium model has several advantages over theoretical models. First, as a new regime, the climate club introduces assumptions that have not been realized before, allowing for analysis of new situations where traditional methodologies (causal and correlation analysis) cannot be applied. Second, it enhances the understanding of economic impacts by implementing specific scenarios of climate club membership under the NDC targets set by each country.

The computable general equilibrium (CGE) model was employed to analyze two distinct scenarios, based on the assumption that every country would try to achieve their Nationally Determined Contributions (NDCs). The first scenario assumed that all countries would independently strive to meet their respective NDCs, while the second scenario introduced a climate club framework wherein member countries engage in emissions trading and share the benefits of collaborative technological innovations.

As described in Table 5, the simulation results suggest that the stability and effectiveness of a climate club hinge on two critical factors: the

Table 5. Simulation Scenarios

Scenario (Climate Club Participants)		Features
0	non cooperation	Pursuing NDC achievement individually
1	G7, Korea and other climate club members	Allowing regional emissions trading systems
1-1	G7, Korea and other climate club members + China	Allowing regional emissions trading systems
2	G7 + Korea and other climate club members	Sharing technological innovation in renewable energy
2-1	G7, Korea and other climate club members + China	Sharing technological innovation in renewable energy

Table 6. Summary of Simulation Results

	Non cooperation		Club 1		Club 1-1	
	Carbon Price	Welfare Change	Carbon Price	Welfare Change	Carbon Price	Welfare Change
China	2.8	-3267	2.8	-3258	9.75	-125
EU28	46.8	-9200	24	-7127	9.75	-2856
USA	14.6	-6699	24	-3450	9.75	-6110
Others	29.4	-7075	24	-7619	9.75	-6131
	All Countries Join		Club 2		Club 2-1	
	Carbon Price	Welfare Change	Carbon Price	Welfare Change	Carbon Price	Welfare Change
China	8.1	-1002	2.8	-2841	8.56	2008
EU28	8.1	-3844	21.9	359370	8.56	39202
USA	8.1	-5481	21.9	3664	8.56	1767
Others	8.1	-3244	21.9	-4166	8.56	-2379

Source: Author's calculations.

Note: Units are \$ for Carbon Price, US\$ million for Welfare Change.

provision of exclusive innovative technologies in the renewable energy sector through joint investments and the participation of major emitting nations. By supplying club members with access to cutting-edge technologies developed through shared investments, the costs associated with carbon abatement can be significantly reduced. Moreover, the inclusion of key developing countries with substantial emissions, is crucial for mitigating free-riding

behavior and leveraging their emission reduction capacities. This participation can enhance the stability of the climate club.

3. Response from domestic industry

In order to address the decarbonization efforts pursued by climate clubs, in-depth interviews were conducted focusing on the chemical in-

dustry, particularly petrochemicals and plastics, categorized as high-emission industries with high trade dependence and carbon intensity. These interviews aimed to examine the current decarbonization status and challenges within Korea's key industries, derive industry-specific strategies and policy priorities for responding to the emergence of climate clubs.¹

In-depth interviews were conducted with the steel, cement, petrochemical, and plastic industries, classified as high-emission sectors, to investigate each industry's current response to climate clubs and carbon neutrality, difficulties faced in the process, demand for government support, expected benefits and burdens associated with joining climate clubs, and opinions on policy tasks.

The steel industry shows a positive stance toward joining climate clubs due to expectations such as leading standards, supply chain cooperation, and the possibility of exemption from CBAM. When cooperating with climate club member countries, the steel industry shows high interest in establishing a green supply chain and developing standards, but at the same time, expresses concerns about pressure to raise NDC targets and strengthen carbon regulations. During the low-carbon transition process, the steel industry faces difficulties such as pressure for decarbonization, weakened competitiveness of countries with blast furnace production methods, transition to free

allocation and information security, lack of green energy infrastructure, and shortage of steel scrap. Therefore, the steel industry requests policy tasks such as participating in international standard rule-setting, discussing emission calculation methods, prohibiting restrictions on steel scrap exports, and expanding government financial support for the introduction of electric furnaces and hydrogen reduction steelmaking.

The cement industry has limited potential for greenhouse gas reduction due to its high proportion of process emissions but nevertheless looks forward to the establishment of criteria reflecting the characteristics of each country during the discussion process of developing standards. In the climate club negotiation discussions, the cement industry aims to propose the establishment of a council on cement safety and emphasizes the need for domestic institutional improvement for cement decarbonization. Other issues include improvement of the production structure focused on Portland cement, and revision and preparation of domestic standards for expanding use of mixed cement. There are also policy demands such as incentive systems and allocation systems to expand the demand for mixed cement.

The petrochemical industry argues that it is necessary to adjust the speed of sector-specific low-carbon transition discussions in climate

¹ The in-depth interviews were conducted with in-

dustry associations and companies willing to participate in research related to climate clubs.

clubs because of the limitations it faces in further reducing carbon emissions under the current energy infrastructure environment due to continuous improvements in emission efficiency. Efforts are being made to develop alternative raw materials for fossil fuels, such as bio-naphtha, and secure a stable supply chain, but the improvement of South Korea's energy transition environment should be prioritized for decarbonization. There is also demand for reorganization of the domestic emission trading system and support to secure emission rights and contribute to NDC implementation by utilizing international reductions.

The plastic industry is positive about the introduction of international standards through joining climate clubs as it is not subject to direct emission regulations. The expansion of bioplastics and the establishment of a separate collection infrastructure for waste plastics are both issues highly related to policies and regulations. As so, the industry is expecting the introduction of global best practices and policy benchmarking through participation in climate clubs, as well as the improvement of domestic plastic recycling policies that are unclear or inconsistent with international standards.

III. Policy Implications

As the global community grapples with the urgent need to address climate change, the emergence of climate clubs presents a positive avenue for cooperation and collective action.

By bringing together countries committed to ambitious climate goals and providing a framework for collaboration, climate clubs have the potential to accelerate the transition towards a low-carbon future. However, joining a climate club also presents challenges and considerations for individual countries, particularly in terms of balancing economic interests, industrial competitiveness, and environmental objectives.

For South Korea, actively participating in climate club discussions and shaping the norms and standards that govern these arrangements is crucial. As a major trading nation and an economy heavily dependent on carbon-intensive industries, South Korea must navigate the complex landscape of climate trade measures while safeguarding its economic interests and promoting the low-carbon transition of its industries.

To ensure that climate clubs contribute to a fair and effective global response to climate change, South Korea should advocate for the following principles and directions:

1. Compliance with WTO rules: Climate clubs should be designed and operated in a manner that is consistent with international trade rules, avoiding excessive trade distortions and protectionist measures.
2. Practical cooperation for cost reduction: Climate clubs should facilitate practical cooperation among member countries to reduce the

costs of carbon reduction and foster innovation through joint investments, technology sharing, and capacity building.

3. Inclusion and support for developing countries: Climate clubs should be inclusive and provide support for developing countries to enhance their carbon neutrality capabilities and ensure a just transition.

4. Alignment with economic security goals: Climate clubs should contribute to creating and maintaining stable global green goods and services markets and supply chains, securing key raw materials and technologies for the low-carbon transition, and adapting to the changing global economic order.

To operationalize these principles, South Korea should pursue the following policy actions:

1. Engage proactively in climate club negotiations and initiatives, seeking to shape the rules and standards for carbon accounting, product certification, and environmental subsidies in a manner that reflects domestic industry characteristics and interests.

2. Strengthen cooperation on key technologies and supply chains, such as hydrogen and critical minerals, to ensure stable access to essential inputs for the low-carbon transition and create new market opportunities.

3. Establish a Korean-style climate club that brings together like-minded countries with similar economic and environmental challenges, focusing on practical cooperation and benefit-sharing for carbon neutrality.

4. Provide targeted support and policy coordination for industries affected by the low-carbon transition, such as steel, cement, petrochemicals, and plastics, to help them adapt to changing market conditions and regulatory requirements.

By pursuing these strategies, South Korea can play a constructive role in shaping the emerging climate club architecture while safeguarding its economic interests and promoting the low-carbon transition of its industries. As the global community moves towards a more fragmented and complex landscape of climate cooperation, proactive engagement and strategic alignment with partners will be key to achieving the shared goal of carbon neutrality and a sustainable future. **KIEP**

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