Policy Brief | nextgroup.or.kr
forourclimate.org

Revisiting Korean Green Public Procurement Policies to Promote Green Steel Demand

NEXT Group
Solutions for Our Climate

Rachel Eun Ko
Geunha Kim

August 8, 2022

NEXT group

SFO°C
Solutions for Our Climate

EXECUTIVE SUMMARY

As climate becomes an essential agenda for business operations, corporates and governments are paying increasing attention to decarbonizing the steel industry, which is one of the most carbon intensive industries in the world. Global steel companies are scrambling to announce technological development plans to transfer their production system to low-carbon steel mainly by closing facilities using the blast furnace-basic oxygen furnace (BF-BOF) method and adopting hydrogen direct-reduced iron (H2 DRI). In Korea, POSCO has also started developing H2 DRI steelmaking technologies and is planning to expand electric arc furnaces (EAFs). However, low-carbon steel is expected to be more expensive than conventional steel products by about 30%, which creates uncertainties around demand for low-carbon steel. The uncertainties definitely are one of the factors that delay the low-carbon transition of the steel industry.

Governments play an active role in creating market demand to induce the development and purchase of innovative products that are not yet commercial enough on the market. As an entity with significant purchasing power, public organizations can play a leading role in purchasing sustainable materials and products, which directly contributes to enhancing the sustainability of markets and industries. The majority of Organization for Economic Cooperation and Development (OECD) members have green public procurement (GPP) policies aimed at minimizing the environmental impact of products' lifecycles. Korea's GPP policies consist of the Mandatory Purchase of Green Products (MPG) Program, Minimum Green Standard Product Purchase (MGS) Program, and Low Carbon Product Certification Program of public institutions.

No study has yet investigated whether the GPP policies of Korea contribute to encouraging the production of low-carbon steel. This brief aims to analyze the effects of current GPP programs in Korea on creating demand for low-carbon steel and to propose policy suggestions to enhance these effects.

Green Public Procurement Policies in Korea

Mandatory Purchase of Green Products Program

In accordance with Article 6 of the Act on the Promotion of the Purchase of Green Products, public institutions (central government, local governments, and other public institutions) must purchase green products if there are green products among the items that they intend to buy. Each public institution establishes and implements green product purchase plans every year referring to the guidelines of the Ministry of Environment (ME). Green products are defined as 1) eco-label products, 2) low-carbon products, 3) good recycled products, and 4) products announced by the ME after consultation with relevant ministers.

Minimum Green Standard Product Purchase Program

The Minimum Green Standard Product Purchase (MGS) Program run by the Public Procurement Service (PPS) does not allow in the public procurement market the products that do not satisfy minimum green standards, which assess a number of environmental factors of the product. Although the MGS Program and the MPG Program share the common objective, the MGS Program is different from MPG, in the sense that it 'restricts' bidding of products that do not satisfy the criteria at all, while MPG mandates the duty to 'prioritize' purchasing green products.

In the 109 items that are subject to the minimum green standards, including consumer goods, machinery, and construction materials, steel products are not included. The major assessment points of minimum green standards include energy performance efficiency, high-efficiency energy certification, limit in use of hazardous materials, and recycling rate, but greenhouse gas (GHG) emissions are not one of them.

Low-Carbon Product Certification Program

A low-carbon product, which is considered as a type of green product, is defined as an Environmental Product Declaration (EPD) product of which carbon footprint is not higher than the 'maximum carbon limit' and that achieves greater GHG reductions than the 'minimum carbon reduction rate' (a reduction of 3.3% over 3 years) as specified in the notice on low-carbon product standards. However, the maximum carbon limit is not applicable to steel products, because in Korea, there is often no more than one producer per steel product, so the average carbon contents of products cannot be calculated. In other words, steel products that achieve a GHG reduction rate of 3.3% in 3 years, can be certified as low-carbon products, regardless of the absolute carbon intensity of the product.

Policy Recommendations to Create Low-Carbon Steel Market

Revising Performance Indicators for the MPG Program

Although the absolute purchase number of green products is increasing each year, the increase has still not exceeded the growth rate of the entire public procurement size. Consequently, the proportion of green products accounts for no more than 2% level of the public procurement for the past years. This means that the public demand for green products is not being boosted effectively. To resolve this issue, the performance indicator of 'absolute purchases of green products' should be reformulated as the 'percentage of green product purchases relative to the public purchase size,' and GHG emissions should be added as an effect indicator, so the actual climatic effects of the program can be monitored.

Adding Steel Products and Emission Intensity Evaluation Criteria to MGS Program

The MGS program failed to consider the responses to climate change and decarbonization. An example is the failure to include steel products in the items subject to the minimum green standards and greenhouse emissions in the assessment criteria in the minimum green standards. If 1) steel products are added to the subject products, and 2) emission intensity criteria are added to the minimum green standard and recommended green standard, public institutions will be unable to procure steel products that do not satisfy the minimum green standards; as a result, the steel products procured by public institutions will be all low carbon.

Adopting maximum carbon limit in the Low-Carbon Product Certification Program

The minimum carbon reduction of 3.3% over 3 years, which is currently the only criterion applied to the low-carbon certification of steel products, does not incentivize manufacturers to adopt innovative technologies, nor does it contribute to achieving the industrial emission reduction target of the 2030 Nationally Determined Contribution (NDC).

Due to the oligopolistic structure of the steel industry in Korea, even if a maximum carbon limit is proposed based on the industrial average, it will only work as a standard that is customized for a particular company, failing to incentivize steelmakers to decarbonize. Therefore, this brief suggests that the government should set a new maximum carbon limit at a level that induces industrial transitions required to meet the NDC target. It is suggested that the maximum carbon

limit for hot-rolled steel from the BF-BOF route is set at 1.22-1.72 tCO_2/t, the carbon intensity of the steel products made by Nucor, American steelmaker that operates scrap-based EAFs, and 0.25 tCO_2/t for rebars and structural steel section products from the EAF route, reflecting clean power mix target of the NDC. This would result in a positive incentive for investments in replacing BF-BOF with EAF and decarbonizing the power grid.

If all the recommendations made in this brief are adopted, all steel products purchased by the government agencies and public institutions would be low-carbon steel. The amount of steel products purchased by public institutions in 2021 was approximately 1.09 million tons, most of which are for construction. It is estimated that the BF-BOF route account for about 10% of the products and the EAF route the remaining 90%. Based on this, if products made from BF-BOF hot-rolled steel are all produced from the EAF with scrap and DRI, and if products from EAF route such as steel bars, structural steel sections, and piles are produced using a cleaner source of power, the emissions of the public steel procurement market in the future is expected to be reduced by 38%.

GPP can Prime the Pump

The GPP policy is designed to make the public sector pay a price premium in an effort to guarantee the demand for low-carbon products, stimulating their usage even if they are less price competitive. The fact that demand for low-carbon steel is guaranteed by the government resolves partially the uncertainty of low carbon investments, thereby providing a strong incentive to business executives to make investment decisions.

Moreover, reinforced GPP policy would send a signal to the market that the government is willing to expand the demand for low-carbon steel not only for public construction but also for other applications and private procurement. Carrying out such an action in public makes the industry realize the urgency of the low carbon transition and accelerates the climate actions from the market.

Starting with revising GPP, the government should consider ways to promote the demand for low-carbon steel in the private sector in the long-term. Considering the product mix of the

Korean steel, the government should focus on creating low-carbon steel demand in the automotive and shipbuilding industries as the next step, because these sectors procure BF-BOF steel products mainly. Policy incentives and a testing ground that can preferentially use low-carbon products are critical to accelerate steel decarbonization and thus to minimize the potential loss of export competitiveness of the steel industry in the future.

I. Introduction

The word 'climate change' reminds most people of oil from the deep ocean floor, coal-fired power plants that release air pollutants, and cars emitting exhaust smoke. However, very few people would think of the shiny envelope of tall buildings that stand at the center of Jamsil, the railroad beneath the fast KTX trains, apartments that fill the city of Seoul, and 31 bridges that run across the Han River as the main reasons for climate change. Many people would be surprised to learn that the steel products used to build and maintain these infrastructures have adverse effects on climate in the production process.

Steel does not emit greenhouse gases (GHGs) at the usage stage. However, a tremendous amount of coal is consumed in the production process of steel using the traditional integrated steelmaking process, accounting for about 8%[1] of global GHG emissions. In Korea, where the steel industry accounts for a higher proportion of economic activity, the steel industry accounts for 15% of national GHG emissions as of 2019.

The decarbonization agenda of the steel industry is emerging rapidly throughout the world, especially within the governments of countries that need to reduce GHGs urgently, as well as European steelmakers such as ArcelorMittal and SAAB. Global steel companies are scrambling to announce technological development plans to transfer their production system to low-carbon steel mainly by closing facilities using the blast furnace-basic oxygen furnace (BF-BOF) method and adopting hydrogen direct-reduced iron (H2 DRI). In Korea, POSCO has also started developing H2 DRI steelmaking technologies and is planning to expand electric arc furnaces (EAFs). Although there are technical difficulties associated with low-carbon steel production, what matters more is that there will not yet be a demand pool for low-carbon steel, which is clean but inevitably expensive. Low-carbon steel is expected to be more expensive than conventional steel products by about 30%[2].

The market demand is the driving force of technological innovation. Governments play an active role in creating market demand to induce the development and purchase of innovative products that are not yet commercial enough on the market. As an entity with a significant purchasing power, public organizations can play a leading role in purchasing sustainable materials and products, which directly contributes to enhancing the sustainability of markets and industries. This has brought discussions on the role of public procurement of low-carbon steel to the forefront.

[1] World Steel Association (2018)
[2] Paulsson (2021)

The majority of Organization for Economic Cooperation and Development (OECD) members have green public procurement (GPP) policies aimed at minimizing the environmental impact of products' lifecycles, and about 69% of these countries are measuring the results of GPP policies and strategies[3]. For example, the Buy Clean California Act, implemented in California, United States, since 2017, prohibits bidding on designated subject items such as steel for construction and plate glasses that exceed the maximum carbon limit. In addition, manufacturers must submit an Environmental Product Declaration (EPD) certificate as an obligation. In February 2022, the Biden Administration launched a task force for expanding the Buy Clean California Act into the federal government and state government units and is actively promoting the formation of a national-scale low-carbon construction material market and the purchase of the materials.

Korea has been operating the Mandatory Purchase of Green Products (MPG) Program of public institutions since 2005 and the Minimum Green Standard Product Purchase (MGS) Program since 2010. The green products purchased by public institutions in 2020 add up to approximately 3.8 trillion KRW, and the industrial ecosystem related to certification has been activated, with products that belong to 169 types of product lines receiving green product certifications. Compared to neighboring countries including Japan and China, the results are overwhelmingly superior in terms of the number of green products purchased[4].

However, the measurement of the results is limited to procurement size (in financial terms), which does not provide information on other aspects of the environmental impact. Moreover, although projects to reduce industrial GHG emissions are becoming urgent, no study has been conducted on whether the public procurement policies in Korea significantly encourage the production of low-carbon steel in reality.

This brief aimed to analyze the effects of current GPP programs in Korea on creating demand for low-carbon steel and to propose policy suggestions to enhance these effects. In addition, it proposes a new standard for low-carbon steel, which has not yet been defined clearly.

[3] OECD
[4] UNEP (2017)

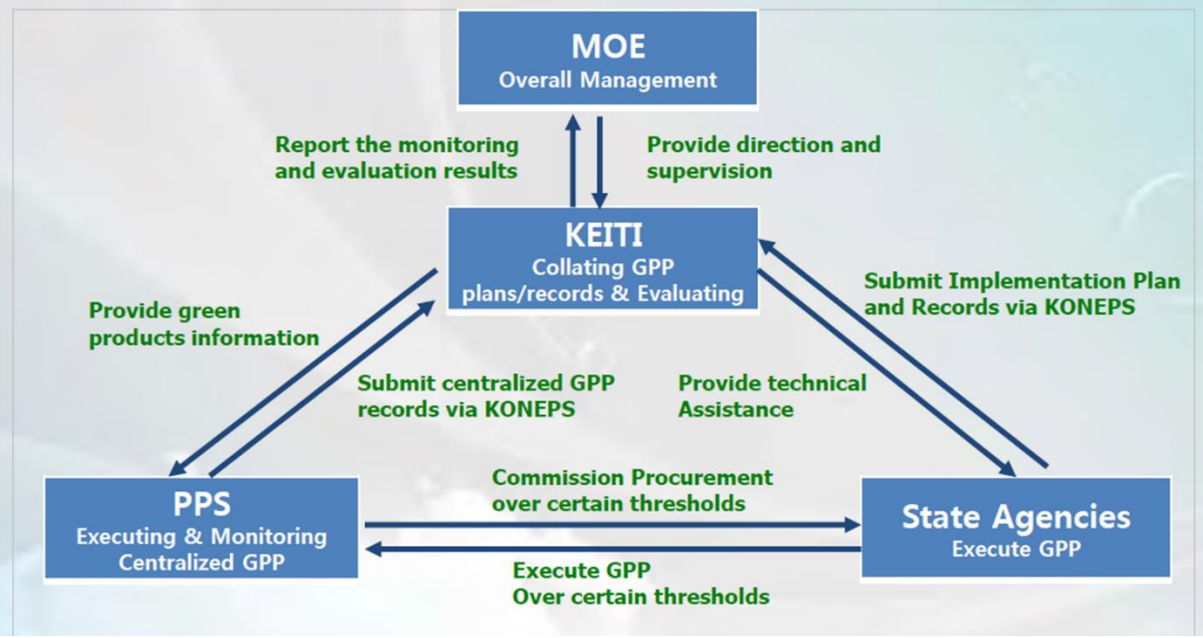
II. Green Public Procurement Policies of Korea

1. Mandatory Purchase of Green Products Program

1.1. Program Overview

In accordance with Article 6 of the Act on the Promotion of the Purchase of Green Products, domestic public institutions (central government, local governments, and other public institutions) must purchase green products if there are green products among the items that they intend to buy. The ME establishes basic plans for the promotion of green product purchases every five years and annually prepares the green product purchase guidelines for the next year. Each public institution establishes and implements green product purchase plans every year referring to these guidelines and reports their results to the ME.

Figure 1. ROLE OF EACH INSTITUTION IN MANDATORY PURCHASE OF GREEN PRODUCTS PROGRAM



Source: 한국환경산업기술원(2019)

Green products are defined as 1) eco-label products, 2) low-carbon products, 3) good recycled products, and 4) products announced by the ME after consultation with relevant ministers. Although public institutions have to purchase green products mandatorily if there are green products among the items that they intend to purchase, this requirement is not applicable if the items they intend to purchase are irreplaceable. This requirement applies to all cases where institutions directly purchase products, where they make a service contract, and where constructors contracted with public

institutions make purchases. For example, in the construction industry, materials purchased by constructors are classified as green products purchased by public institutions. In particular, if public institutions purchase green construction materials, the application of green products should be specified at the design request stage, and grounds for whether it is reflected in the blueprint should be performed.

Table 1. Classification and Definition of Green Products

	Eco-label Product	Good Recycled Product	Low-carbon Product
Definition	Products with excellent environmental impacts by LCA evaluation	Products made by recycled materials	Products satisfying lower carbon footprints
Product Categories	169 product categories including stationary, construction materials, and daily goods	17 product categories, including paper, wood, and plastics	52 product categories, including daily goods and construction materials
Label Design			

Source: 한국환경산업기술원 녹색제품정보시스템

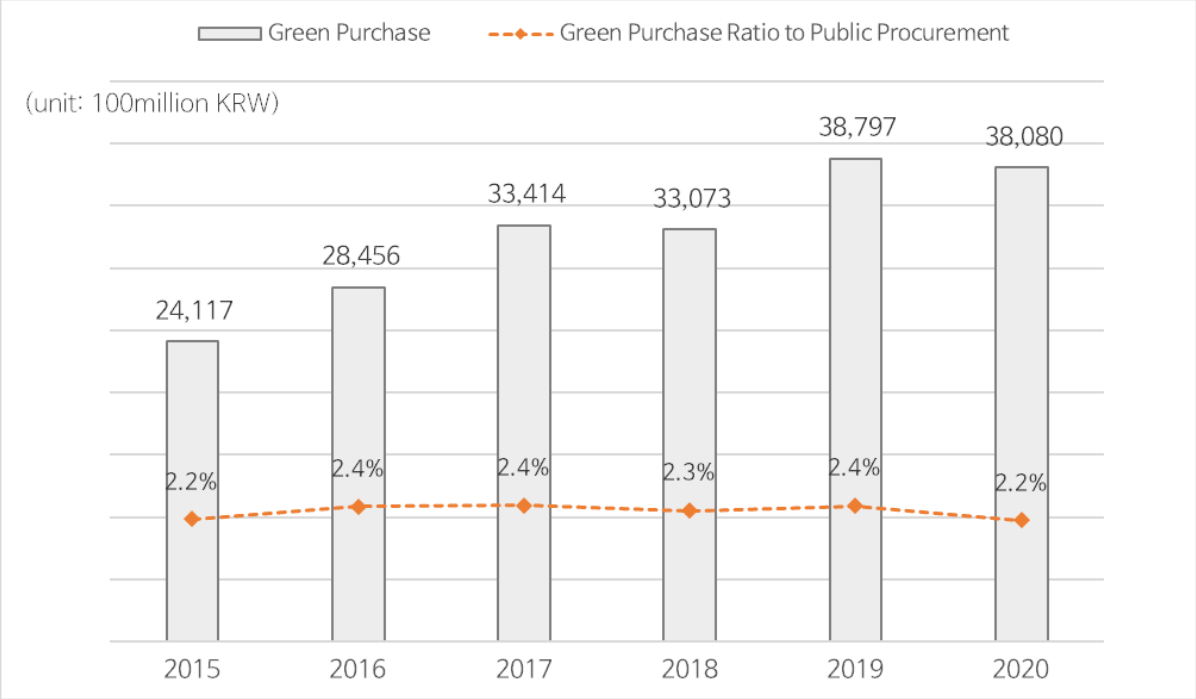
1.2. Past Performance

In 2020, the amount of green products purchased by Korean public institutions, government departments, local governments, and educational institutions was about 3.8 trillion KRW, which was 2% of the total public procurement amount of 175.8 trillion KRW.[5] More than half of the products were purchased by local governments and educational institutions[6]. This result reflects a fourfold increase from 861.4 billion KRW in 2006, the first year for which data were available after the program was implemented. The performance of Korea's MPG Program continues to expand. In 2020, three fields—civil engineering/building materials (46.1%), electronics/information/communications (20.1%), and office/education/video/home appliances (16.0%)—accounted for 82.2% of the total. The results are not separately aggregated and disclosed for individual items.

[5] 조달청(2021b)

[6] 환경부(2021.7)

Figure 2. Total Purchase Amount of Green Products and Ratio to Public Procurement (2015-2020)



Source: 환경부(2021.7), 조달청(2021b)

Table 2. Green Product Purchase Amount and Composition Ratio by Individual Items in 2020

Product Group	100mil KRW	Share (%)
Construction materials	17,561	(46.1)
Electronics & IT	7,660	(20.1)
Office supplies & visual devices	6,108	(16.0)
Electric testing and metering	3,328	(8.7)
Textile & sanitary goods	1,258	(3.3)
Chemicals & safety	691	(1.8)
Machinery	841	(2.2)
Street supplies	384	(1.0)
Raw materials & others	249	(0.7)
Car shipping	1	(0.003)
Total	**38,080**	**(100)**

Source: 환경부(2021.7)

1.3. Limitations

Although the absolute purchase amount of green products is increasing each year, the increase has still not exceeded the growth rate of the entire public procurement size. Consequently, the proportion of green products accounts for no more than 2% level of the public procurement for the past years. This means that rather than reflecting an effective promotion of public consumption of green products, the increase in the amount of green product purchases is correctly understood as the result of an increase in the purchasing power of the country. This is partly because there is no unified target for the green product purchase amount nationally, and since each institution sets its own performance targets, there is no strong driving force to stimulate demand for green products.

A weakness of the MPG Program is that even products that are not certified as Low Carbon Products are classified as green products if they are certified as eco-label products or GR products. The fact that eco-label products or GR products do not need to meet the criteria for low-carbon products implies that this program has limitations in promoting low-carbon products.

2. Minimum Green Standard Product Purchase Program

2.1. Program Overview

The MGS Program run by the Public Procurement Service (PPS)[7] does not allow in the public procurement market the products that do not satisfy minimum green standards, which assess a number of environmental factors of the product. Although the MGS Program and the MPG Program shares the common objective, the MGS Program is different from MPG, in the sense that it 'restricts' bidding of products that do not satisfy the criteria at all, while MPG mandates the duty to 'prioritize' purchasing green products. In terms of jurisdiction, the PPS is an affiliate of the Ministry of Economy and Finance and is structurally independent from the ME.

According to the PPS Notice No. 2019-28 "Purchase Guidelines for the Promotion of Public Purchasing of Green Products," "the Commissioner of the Public Procurement Service [...] can designate and announce items deemed necessary to directly purchase as green products for public institutions," and "the heads of public institutions [...] must directly purchase items designated and announced by the Commissioner of the Public Procurement Service as long as they do not interfere with the achievement or performance of the institution." That is, among materials purchased by public institutions subject

[7] The Public Procurement Service is an affiliate of the Ministry of Economy and Finance and is structurally independent from the Ministry of Environment.

to the minimum green standards designated by the Commissioner of the PPS, products that do not meet the minimum green standards cannot be registered in the procurement market in the first place.

The items subject to the minimum green standards are 109 product groups selected with a focus on products in high demand by public institutions, ranging from consumer goods such as computers and washing machines to machinery such as cooling towers and power generators, and building materials such as cement and flooring. However, steel products are not included. Individual minimum green standards applied to the 109 items have been established and published. The major assessment points of minimum green standards include energy performance efficiency, high-efficiency energy certification, use of hazardous materials, and recycling rate, individually applied to the 109 product groups, but GHG emissions are not one of them (Box 1).

Box 1. Minimum Green Standards for Cement Public Procurement

Minimum Green Standards for Cement Public Procurement

- Target Product
  - Ordinary Portland cement (KSL5201), slag cement (KSL5210)
- Green purchase standard
  - Minimum: Hexavalent chrominum should be 20mg/kg or less.
  - Recommended: Hazardous contents have to meet the following criteria.

Material	Less than (mg/L)	Material	Less than (mg/L)
Cd	0.3	CN-	1
Pb	3	Organic phosphorous	1
Cu	3	trichloroethylene	0.3
As	1.5	tetrachloroethylene	0.1
Hg	0.005		

2.2. Limitations

Although the items subject to the minimum green standards have been steadily expanded since the program was created in 2010, a limitation of the program is that it does not cover steel products; therefore, it cannot effectively induce the development of green technology in the most emission-intensive industry of the country.

Another major limitation is that GHG emissions are not included as a criterion in the minimum green standards. Given the rapidly increasing awareness of the need for national carbon neutrality, the green technology promoted by the public sector should be revised to incorporate climate effects and low-carbon transition.

3. Low-Carbon Product Certification Program

3.1. Program Overview

A low-carbon product, which is considered as a type of green product, is defined as an EPD product of which carbon footprint is not higher than the 'maximum carbon limit[8]' and that achieves greater GHG reductions than the 'minimum carbon reduction rate[9]' (a reduction of 3.3% over 3 years) as specified in the notice on low-carbon product standards. The maximum carbon limit is defined as lower-than-average GHG emissions compared to similar products, and the minimum carbon reduction rate refers to the carbon reduction rate to be achieved in 3 years after certification (currently set at 3.3%)[10]. While the maximum carbon limit is a criterion for a product to be newly certified, the minimum carbon reduction rate is a condition to maintain the certification.

As of April 2022, 376 products have been registered as low-carbon products in South Korea. Construction materials such as concrete, wallpaper, insulation, and steel account for the majority of these products, and there are some consumer goods such as bottled water, beverages, textbook paper, toothbrushes, and wet wipes. Low-carbon products are important because they are included as items for the MPG Program.

3.2. Low-Carbon Steel Products in Korea

As of April 2022, 17 low-carbon steel products were registered in South Korea, all produced by POSCO. The maximum carbon limit is not applicable to steel products, because in Korea, there is often no more than one producer per steel product, so the average carbon contents of products cannot be calculated. Therefore, when steel products meet the minimum carbon reduction rate standard, they are acknowledged as low-carbon products. In other words, steel products that achieve a GHG reduction rate of 3.3% in 3 years[11], can be certified as low-carbon products, regardless of the absolute carbon intensity of the product.

[8] The maximum carbon limit refers to the maximum value of GHG emissions for which a product can be certified as a low-carbon product within a single category of products.
[9] The minimum carbon reduction rate refers to the minimum rate of GHG emission reduction for a product to be certified as a low-carbon product.
[10] The reduction rate is based on the Nationally Determined Contribution (NDC) goal before the raise in 2021.
[11] The reduction rate is based on the Nationally Determined Contribution (NDC) goal before the raise in 2021.

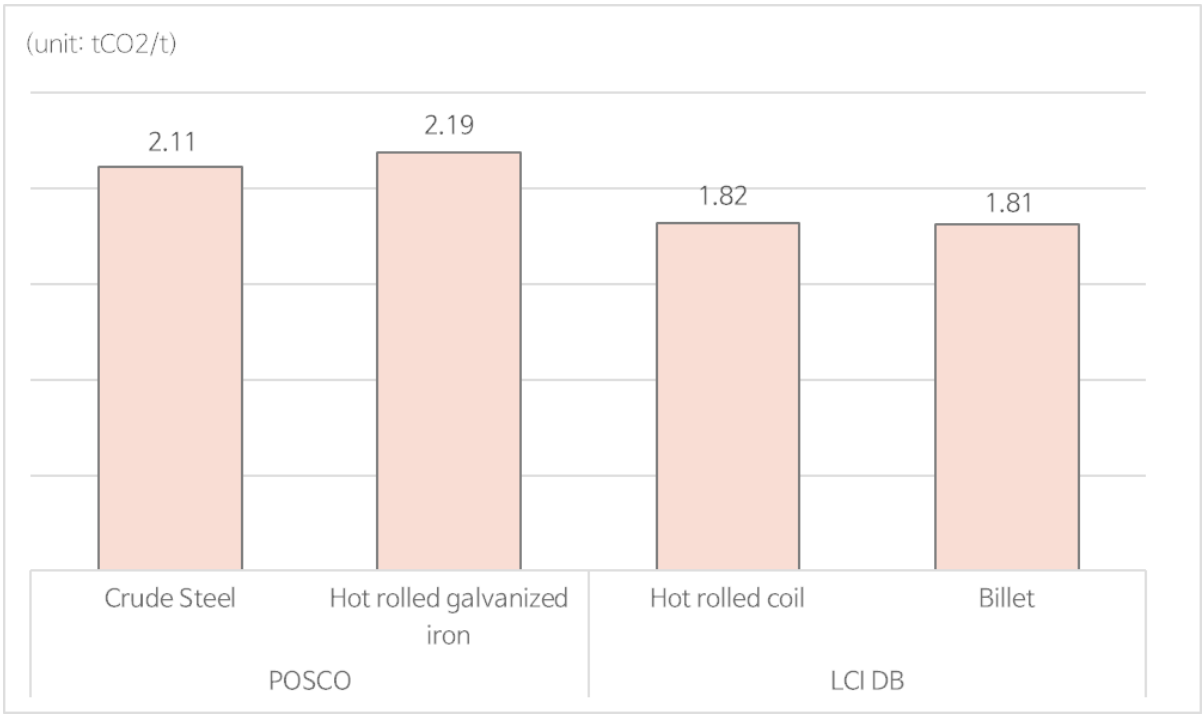
Table 2. Low-Carbon Steel Products in South Korea (as of April 2022)

Company	Certification #	Product Group	Product Name	Carbon Footprint
POSCO	2019-117	Production goods	Structural Steel	No information
POSCO	2019-117	Production goods	Welding Structural Steel	No information
POSCO	2019-117	Production goods	Building Structure	No information
POSCO	2019-117	Production goods	Bridge Structure	No information
POSCO	2019-117	Production goods	Weather Resistant Steel	No information
POSCO	2019-117	Production goods	Mechanical Structure	No information
POSCO	2019-117	Production goods	Abrasion Resistant Steel	No information
POSCO	2019-117	Production goods	High Strength Steel	No information
POSCO	2019-207	Production goods	Hot-rolled Structural Steel	No information
POSCO	2019-207	Production goods	Weather Resistance Steel	No information
POSCO	2019-207	Production goods	Automotive Structural Uses	No information
POSCO	2019-207	Production goods	Hot-Rolled steel for Gas Cylinders	No information
POSCO	2019-207	Production goods	Carbon steel for Pipe and Tube	No information
POSCO	2019-207	Production goods	High Carbon Steel	No information
POSCO	2019-207	Production goods	Cold Rolled Steel	No information
POSCO	2019-207	Production goods	Steel for Oil Well Pipes	No information
POSCO	2019-207	Production goods	Steel for Pipeline	No information

Unlike other product groups, the carbon footprints of steel products are not disclosed, and the reasons for non-disclosure are also not specified. An issue with the objectivity of the certification system is that even the basic information that allows consumers to determine whether the products are low-carbon products has not been disclosed.

Based on the emission information of the company's other hot-rolled steel products for which the carbon footprint was disclosed, it is estimated that the emission of low-carbon steel products in South Korea is 1.81-2.19 tCO_2/t. The scope of emissions includes the pre-production, product manufacturing, usage, and disposal stages, similar to the standard for low-carbon products in Korea.

Figure 3. Carbon Intensity of Hot-Rolled Steel Products from The Bf-BOF Route Disclosed by POSCO and the National LCI DB



Note 1. Carbon intensity range: GHG emission in the pre-production, product manufacturing, usage, and disposal stages

Note 2. Since carbon intensity in the disposal stage is omitted in the LCI DB, the values of adding 0.07 tCO_2/t of GHG emissions in the disposal stage were determined by referring to the case of Hyundai Steel (2020)

Source: 포스코(2020), 한국환경산업기술원(1999, 2022)

3.3. Limitations

The current low-carbon product certification standards for steel products are not clear. Since 17 POSCO products were first registered as low-carbon products in 2019, they were not subject to the minimum carbon reduction rate, which is calculated based on the carbon emissions from three years ago, and steel products are not subject to the maximum carbon limit. Moreover, the carbon footprint of the certified products is not disclosed, so it is not clear on what basis the low-carbon certification was obtained.

The minimum carbon reduction of 3.3% over 3 years, which is currently the only criterion applied to the low-carbon certification of steel products, does not incentivize manufacturers to adopt innovative technologies, nor does it contribute to achieving the industrial emission reduction target set up by the 2030 NDC. The application of this criterion gives incentives to pursue reduction measures within

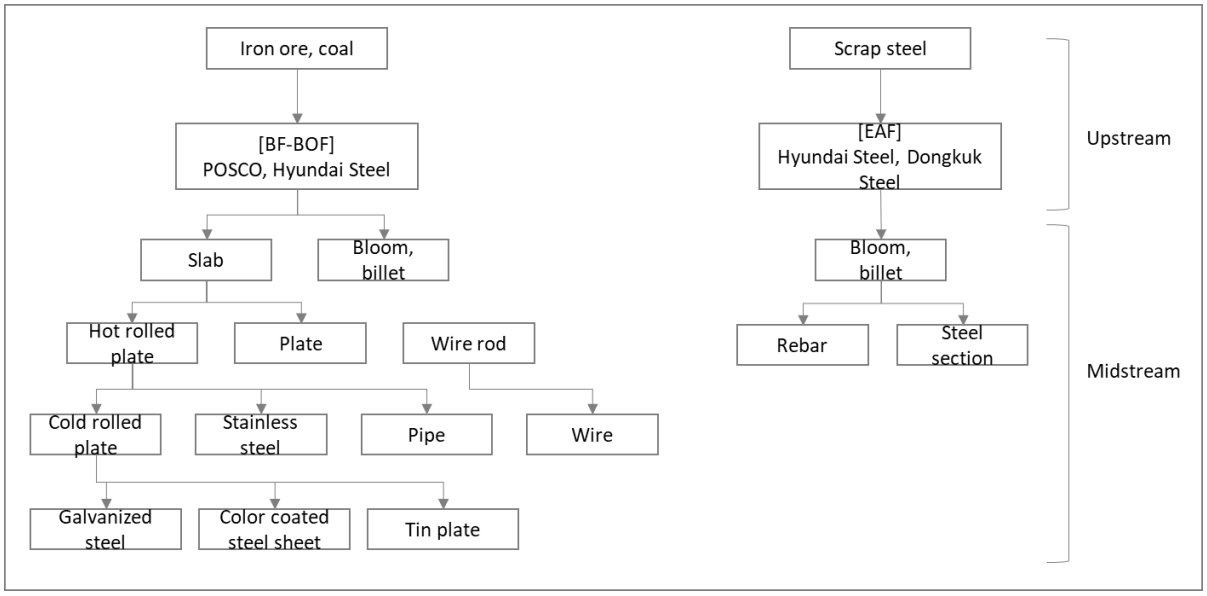
existing processes, such as energy efficiency, fuel replacement, and economies of scale, but does not induce process conversion for more significant reductions.

III. Steel Public Procurement Market in Korea

1. Structure of the Supply Chain and Composition of Manufacturing Technology in the Korean Steel Market

In the Korean steel industry, three major companies—POSCO, Hyundai Steel, and Dongkuk Steel—dominate the upstream in the steel industry chain, while many small and medium-sized companies are operating in the midstream of the steel industry chain[12]. POSCO produces all of its products through BF-BOF, Dongkuk Steel through EAF, and Hyundai Steel uses both BF-BOF and EAF. In BF-BOF, various products such as hot-rolled steel plates, steel plates, wire rods, and galvanized steel plates are produced for automobiles, ships, construction, and machinery, whereas construction materials such as structural steel sections and piles and rebar are mainly produced using EAF.

Figure 4. Structure of Steel Industry Supply Chain in Korea



Source: Referring to Lee (Aug 2020), it has been revised to reflect the latest changes.

Table 3. Manufacturing Process and Products of Three Major Steel Companies in Korea

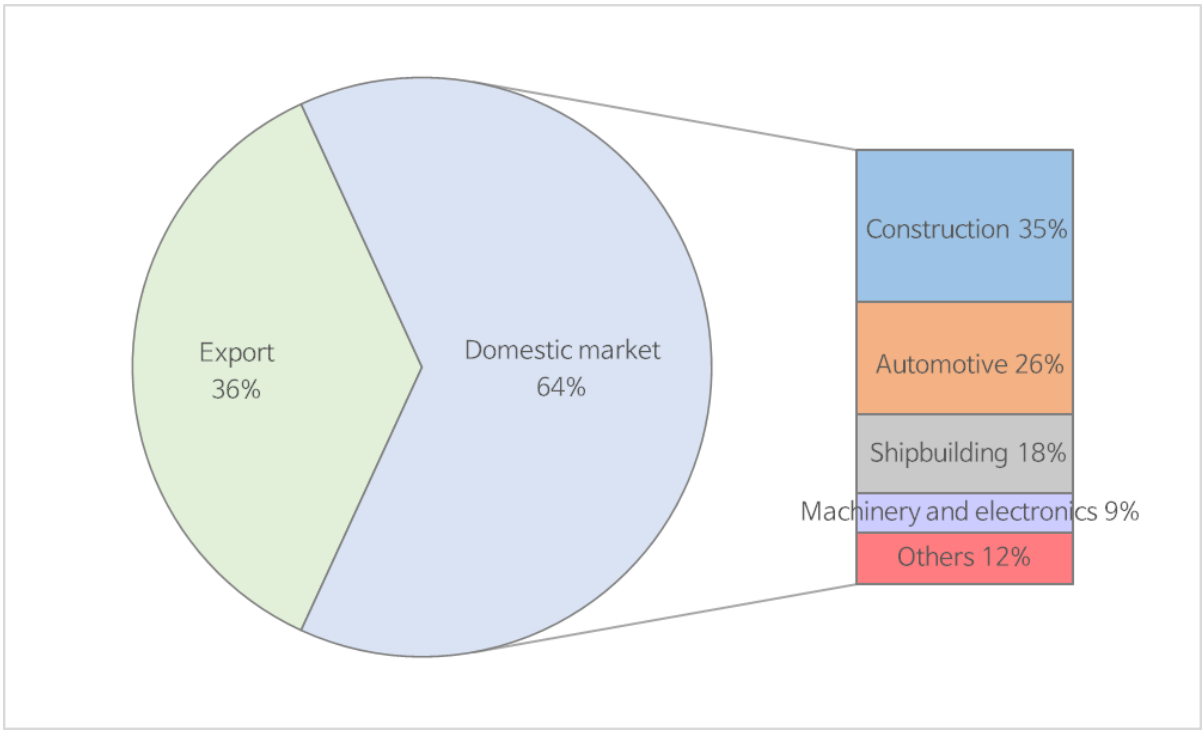
Company	Production technology	Crude steel production (mil. ton)	Product types
POSCO	BF-BOF	4,030	Hot-rolled, cold-rolled, plate, wire, galvanized plate
Hyundai Steel	BF-BOF	1,200	Hot-rolled, cold-rolled, plate, wire, galvanized plate
	Scrap-based EAF	1,200	Structural section, rebar
Dongkuk Steel	Scrap-based EAF	336	Structural section, rebar

[12] The term "upstream" in the steel industry chain refers to the manufacturing process up to intermediate products such as slabs, blooms, and billets. The "midstream" of steel industry chain refers to the manufacturing process of steel products through rolling of intermediate products.

2. Structure and Size of the Public Procurement Market for Steel Products

In 2021, the amount of steel products purchased through public procurement by public institutions was approximately 1.28 trillion KRW[13]. Applying the average price of each product[14] in 2021, this corresponded to approximately 1.09 million tons of product. Considering that domestic steel shipments in 2021 were estimated to be about 80 million tons[15], this estimate means that only 1.4% of steel was supplied through the public procurement market. Since the Korean steel industry exports nearly 40% of its products, its dependence on the domestic market is relatively low, and even within that context, the demand for construction is only around 30%. Therefore, the market share of public procurement is small.

Figure 5. Market Share of Steel Industry and Demand Share by Industry in Korea

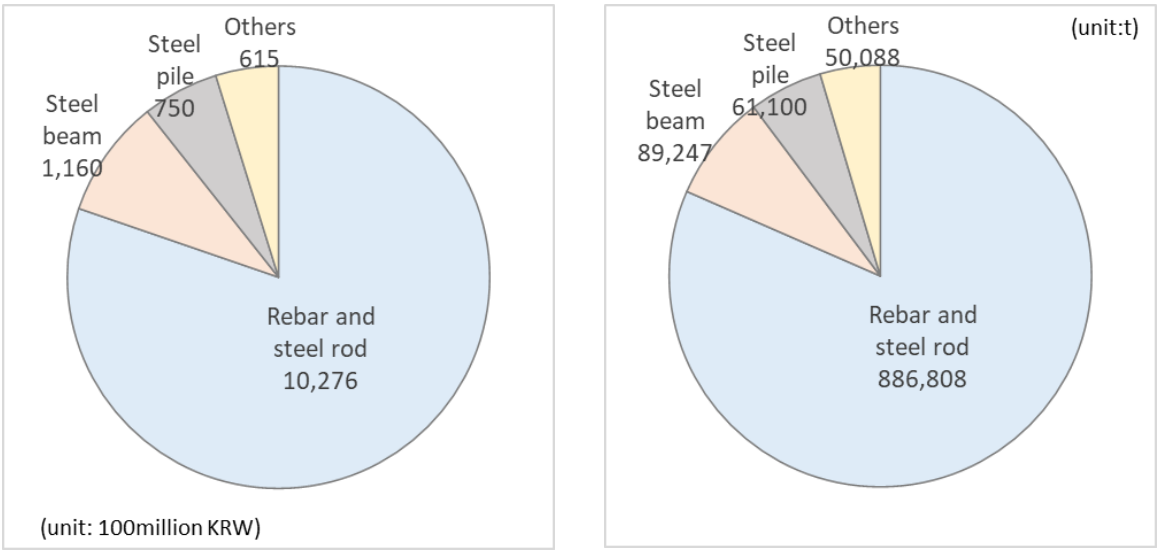


Note. The ratios of export and domestic demand are figures from 2021 (한국무역협회, 2021). The demand share by industry presents figures from 2020 (한국철강협회, 2021).

[13] **Only direct purchases by the public sector counted. Procurement made through service contracts or construction not counted in due to the lack of data.**
Items for which the purchase amount of money was aggregated are as follows: steel plates, stainless steel pipes (or hollow sections), stainless steel wires, stainless steel pipe joints, stainless steel gratings, steel piles, steel rails, steel slates, steel beams, steel angles, steel coils, rebar or steel rods, railroad guard rails, railroad rails, and carbon pipes (or hollow sections).
[14] Rebar or steel rod: 1,158,725 KRW/ton (arithmetic mean of monthly price of rebar, source: KIWOOM Securities, January to December 2021), steel beam: 1,300,000 KRW/ton (arithmetic mean of wholesale price of H-shaped structural steel sections based on end of month wholesale price of Hyundai Steel large-scale products, source: Steel and Metal News, January to December 2021), steel pile and others: 1,227,527 KRW/ton (arithmetic mean of monthly price of 89.1 x 1.8 steel pipe for general construction, source: Steel and Metal News, January to December 2021).
[15] Estimated from 70.42 million tons of crude steel production in 2021 by applying the shipment factor to crude steel production in 2020.

Considering the steel procurement market by items, rebar and steel rods accounted for the largest share (80%, 1.276 trillion KRW), followed by steel beam (structural steel sections) (9%) and steel piles (pipes) (6%). Most of these are steel materials used in construction and infrastructure.

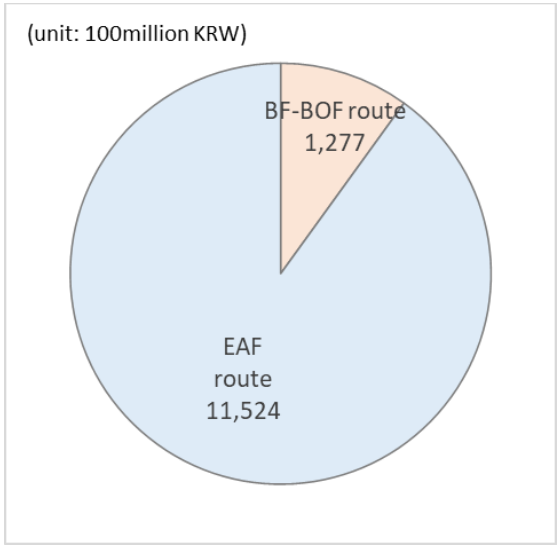
Figure 6. Share of Public Procurement Steel Market by Items In 2021 (Price, Quantity)

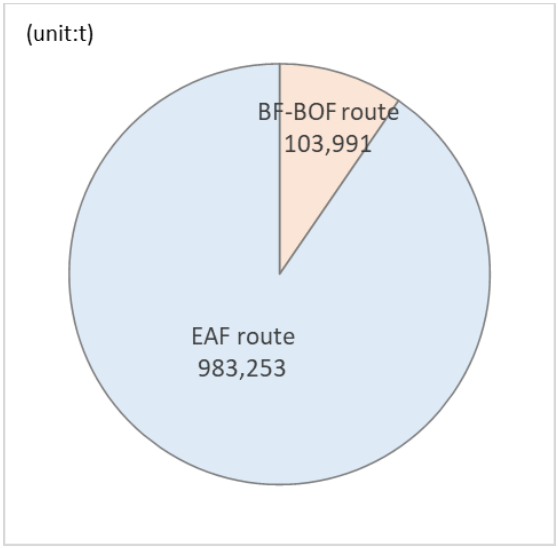


Steel products that are manufactured through BF-BOF route include hot-rolled steel plates and stainless-steel plates directly supplied by POSCO, pipe products that small and medium-sized steel companies produce from processing POSCO's hot-rolled steel, and steel wires and steel slates. According to national statistics, steel products produced using the BF-BOF route in the public procurement market are estimated to have accounted for KRW 127.7 billion in 2021. The products produced using the BF-BOF and EAF routes are estimated to have totaled 104,000 tons and 983,000 tons, respectively[16].

[16] Average price of products from the BF-BOF route applied corresponding to the price of steel piles.

Figure 7. Share of Public Procurement Steel Market by Manufacturing Technology in 2021 (Price, Quantity)





IV. Policy Recommendations to Promote Low-Carbon Steel Demand in Korea and Expected Effects

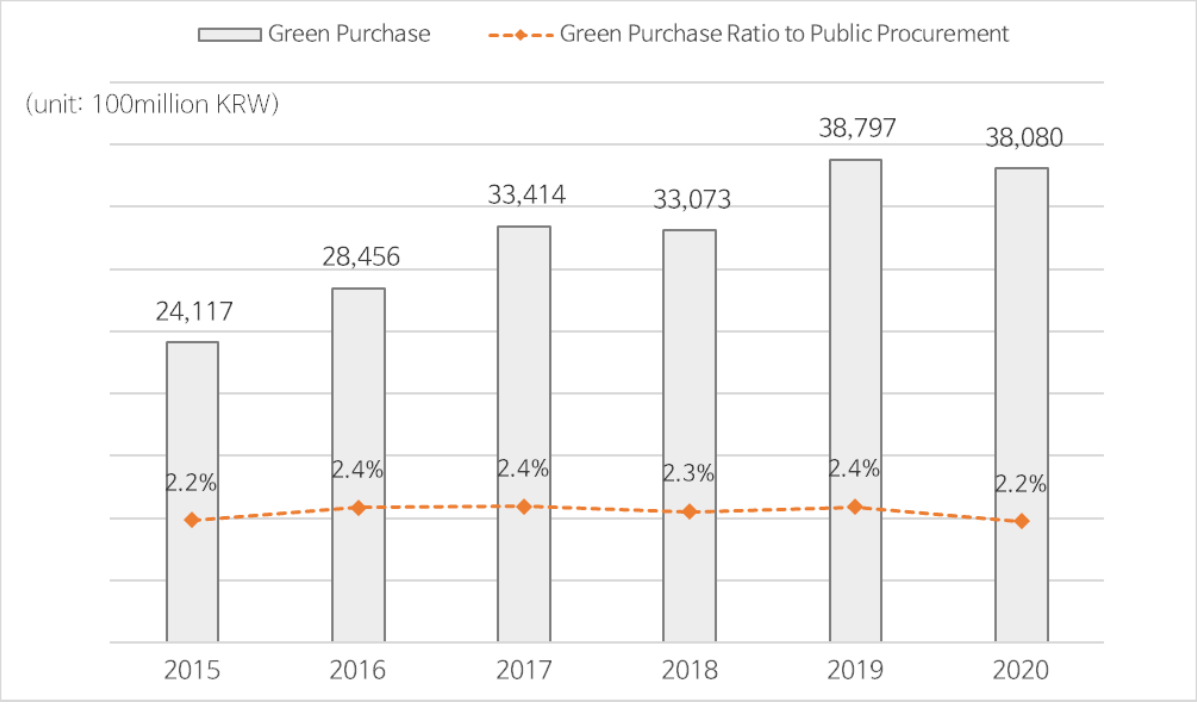
This section proposes systematic improvements to maximize the decarbonization incentives in the steel industry by reflecting the aspects of the Korean public procurement steel market described above. This section also proposes improvements in the MPG Program, MGS Program, and Low Carbon Product Program, and analyzes the expected effects of GHG reduction.

1. Revising Performance Indicators for the MPG Program

The current MPG Program monitors purchases of green products as a performance indicator, but it has two major limitations.

First, coupled with economic growth, inflation, and the increasing government purchasing power, it is difficult to measure the actual expansion of the green product market. This is supported by the evidence that the proportion of green product purchases relative to the total public procurement stagnated at 2%, even though the absolute purchases of green products steadily increased after the program was implemented (Figure 8).

Figure 8. Performance of Green Product Purchases and Proportions Relative to Total Public Procurement (2015-2020)



Source: 환경부(2021.7), 조달청(2021b)

Second, the purchase of green products, as an implementation indicator for the program, has a limited capability to identify the social and environmental effects. For example, impact indicators such as the recycling rate, energy consumption, and GHG emissions of products supplied to the public procurement market should be established and measured in order to improve the effectiveness of the program. The U.S. federal government aims to measure the effectiveness of its public procurement policy by setting goals for government and public institutions on energy efficiency, water consumption, waste reduction, and GHG emissions[17]. The Malaysian government monitors impact factors such as energy reduction, energy savings, and emission intensity for three products (computers, printers, and lighting apparatuses) with high numbers of purchases by public institutions[18].

The performance indicator of 'absolute purchases of green products' should be reformulated as the "percentage of green product purchases relative to the public purchase size," and GHG emissions should be added as an effect indicator, so the actual climatic effects of the program can be monitored.

2. Adding Steel Products and Emission Intensity Evaluation Criteria to MGS Program

A way of stimulating low-carbon steel demands while minimizing systematic overhaul would be to revise the Minimum Green Standard of the PPS. As of June 2022, the construction materials for which the PPS proposes minimum green standards are cement, flooring boards, and wood plastic composites, but steel materials are not included. Although energy consumption efficiency, high-efficiency energy certification, hazardous substance reduction, and the recycling rate are considered in the minimum green standards, GHG emissions are not.

The MGS Program failed to consider the responses to climate change and decarbonization. An example is the failure to include steel products in the items subject to the minimum green standards and greenhouse emissions in the assessment criteria in the minimum green standards. If 1) steel products are added to the subject products, and 2) emission intensity criteria are added to the minimum green standard and recommended green standard, public institutions will be unable to procure steel products that do not satisfy the minimum green standards; as a result, the steel products procured by public institutions will be all low carbon.

[17] Ganley (2013)
[18] World Bank (2021)

Table 4. Recommendations to Improve MGS Program

	MGS applicable products	MGS components
Current	109 items, inc. computers, washers, cooling towers, power generators, cement, flooring materials, flooring boards, and synthetic woods	Energy efficiency, high-efficiency energy certification, use of non-hazardous material, and recycling rate
Recommendations	**Adding steel products (e.g., rebars, beams, pipes, plates)**	**Adding carbon footprint as one of the components**

3. Adopting Maximum Carbon Limit in the Low-Carbon Product Certification Program[19]

The current program only applies the minimum carbon reduction rate to the certification of low-carbon steel products and does not apply the maximum carbon limit. Due to the oligopolistic structure of the steel industry in Korea, even if a maximum carbon limit is proposed based on the industrial average, it will only work as a standard that is customized for a particular company, failing to incentivize steelmakers to decarbonize. Therefore, this brief suggests that the government should set a new maximum carbon limit at a level that induces industrial transitions required to meet the NDC target.[20]

In the public procurement steel market, steel products from the EAF and BF-BOF routes account for about 90% and 10% of purchases, respectively. Thus, the maximum carbon limit should be applied as a standard for all steel products from the EAF and BF-BOF routes to receive an incentive for decarbonization. Similar to the benchmark set by the European Union Emissions Trading System, establishing a separate standard for products from the EAF route and products from the BF-BOF route may be considered.

It will be necessary to set the maximum carbon limit standard for steel products from the BF-BOF route to be enough to induce conversion to EAF or DRI. For steel products from the EAF route, the standard should be sufficient to induce the procurement of renewable electricity. In order to determine the level, this brief proposes the following steps that reflect the goals of EAF supply in the steel industry and electricity procurement specified in the NDC.

[19] The figures presented in this section are based on data disclosed by governments and companies. The data gaps were calculated through reasonable estimation. When the government actually calculates the GWP limit of low carbon steel, the classification and definition of items should be clarified more at the national level, and the emission intensity for each item should be completely reinvestigated and calculated by unifying the methodology of LCA analysis with the scope of the research.

[20] Setting the maximum carbon limit by designated items is introduced by the Buy Clean California Program of the California state government (refer to Appendix).

3.1. Maximum Carbon Limit for Steel Products from the BF-BOF Route

The NDC aims to convert 3 million tons to the EAF steel manufacturing process by 2030 in order to reduce GHG emissions in the steel industry. This figure is equivalent to 5% of BF-BOF production (52.3 million tons) in Korea. Considering that it takes about 2 years to build an EAF and less than 8 years are left until 2030, this is an urgent task. POSCO announced a plan to add 2 EAFs facilities of 2.5 million tons in 2025 and 2027 respectively, but continuous closure of existing BF-BOF facilities and conversion to EAF are necessary to achieve the NDC goal.

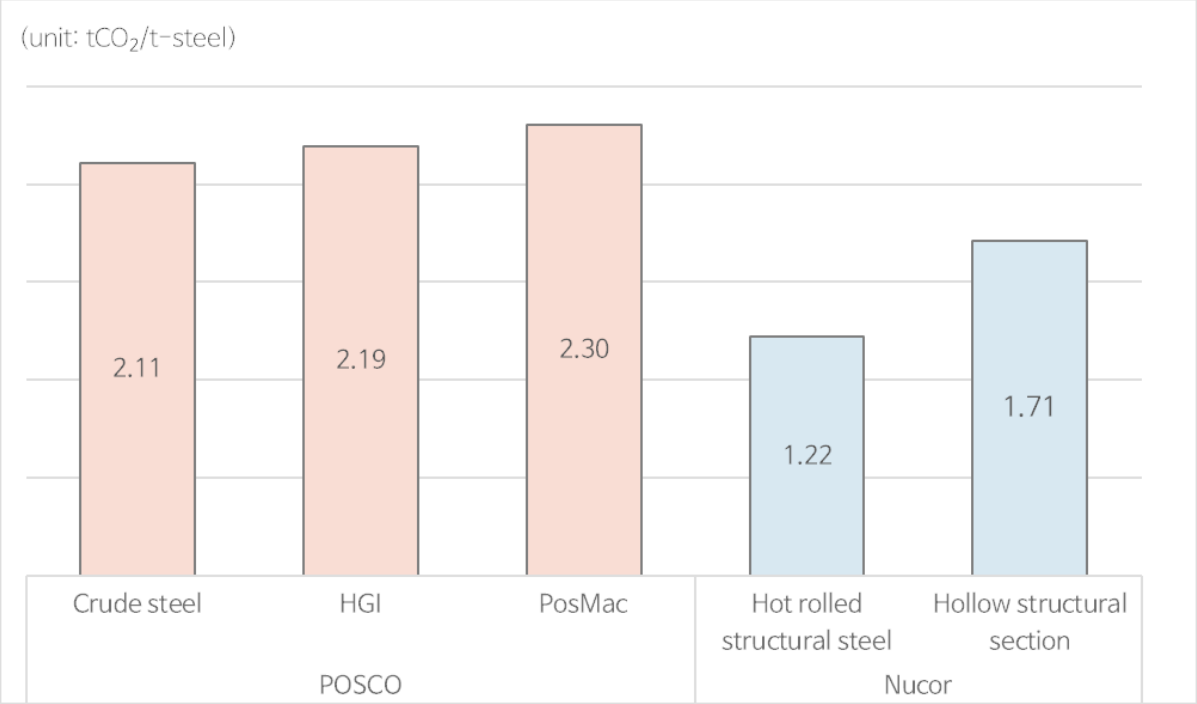
Basing the standard of low-carbon products on steel products produced from the EAF route would offset the uncertainty in the profitability of EAF investments for steel companies, thus providing a strong incentive for conversion to EAF. Therefore, this brief proposes to match the maximum carbon limit to steel products from the EAF route[21].

However, since hot-rolled steel products are manufactured only through the BF-BOF route in Korea, no case exists to benchmark carbon emission of hot-rolled steel products from the EAF route in the domestic conditions. Among global cases, Nucor from the U.S. is a representative steel company that produces hot-rolled steel without depending on BF-BOF. According to Nucor's disclosures, the GHG emission of hot-rolled structural steel is 1.22 tCO_2/t and 1.71 tCO_2/t in fabricated hollow structural sections[22]. Nucor's case is the almost sole benchmark case of hot-rolled steel products from the EAF route. Meanwhile, since Nucor manufactures all of its hot-rolled steel products by mixing natural gas DRI with scrap, the emission intensity is rather high compared to products manufactured solely by scrap.

Currently, the emission intensity of POSCO's hot-rolled steel products manufactured by the BF-BOF route is 2.11-2.30 tCO_2/t. If the manufacturing method is switched to scrap and natural gas DRI based EAF[23], emissions could be reduced by up to 26%. However, even if the same amount of fuel and material is input, the emissions may not be identical to those reported in the U.S. due to differences in the manufacturing environment (e.g., electricity emission factors and overall facility efficiency).

[21] The reason why the H_2 DRI technology is being actively pursued for the domestic steel industry is that commercialization of the H_2 DRI technology is aimed for after 2030 under the current domestic technology level, and this is not an effective goal level to induce realistic conversion to low carbon before 2030.
[22] Nucor (2021a, 2021b)
[23] Since natural gas DRI is not produced in Korea, natural gas DRI or H_2 DRI should be imported or DRI with reduced emission intensity must be produced by increasing the input rate of hydrogen in the domestic Pionex manufacturing process.

Figure 9. Emission Intensity of Hot-Rolled Structural Steel (POSCO, Nucor)



1) HGI: Hot-dip galvanized steel plate. Used as raw material of pipes.

2) PosMAC: POSCO Magnesium Aluminum alloy Coating Product. Corrosion-resistant galvanized steel plate used for interior and exterior materials in construction and solar structures.

Source: POSCO (2020), Korea Environmental Industry & Technology Institute (2022), Nucor (2021a, 2021b)

Source: 포스코(2020), 한국환경산업기술원(2022), Nucor(2021a, 2021b)

In other words, the maximum carbon limit of hot-rolled steel products from BF-BOF route should be set around 1.22-1.72tCO_2/t to establish a positive incentive for conversion from BF-BOF to EAF. This proposal is summarized in Table 5[24].

Table 5. Recommended Maximum Carbon Limit of BF-BOF Steel Products

Product category	Maximum carbon limit
Hot-rolled structural steel	1.22~1.71 tCO_2/t

[24] This figure was derived from a very limited data. In order to reflect the standard in reality, research must be conducted again to establish definitions of the range of items encompassing the types of products in the market and the carbon footprint simulation of domestic hot-rolled steel products when introducing EAF facilities.

3.2. Maximum Carbon Limit for Steel Products from the EAF Route

Most of the demand for steel products in the public procurement market is for construction applications, which comprise rebar and structural steel sections, which are manufactured from scrap-based EAF route. Thus, closing blast furnaces is not a sole remedy for decarbonizing steel production through public procurement. A low-carbon standard for EAF products is also necessary to ensure emission cuts in the steel public procurement market.

About 68% of GHG emissions of EAF steel products are indirect emissions from electricity consumption, while combustion emissions and process emissions accounting for about 32%[25]. Therefore, it is no exaggeration to say that the decarbonization of EAF steel products depends on the emission intensity of electricity.

According to the NDC, the power mix is envisaged as to reduce coal, expand new and renewable energy to 30.2%, and add carbon-free electricity sources like ammonia. Based on this plan, the calculated national electricity emission factor is 0.2448 $kgCO_2/kWh$[26], which is almost half of the current figure of 0.4781 $kgCO_2/kWh$[27].

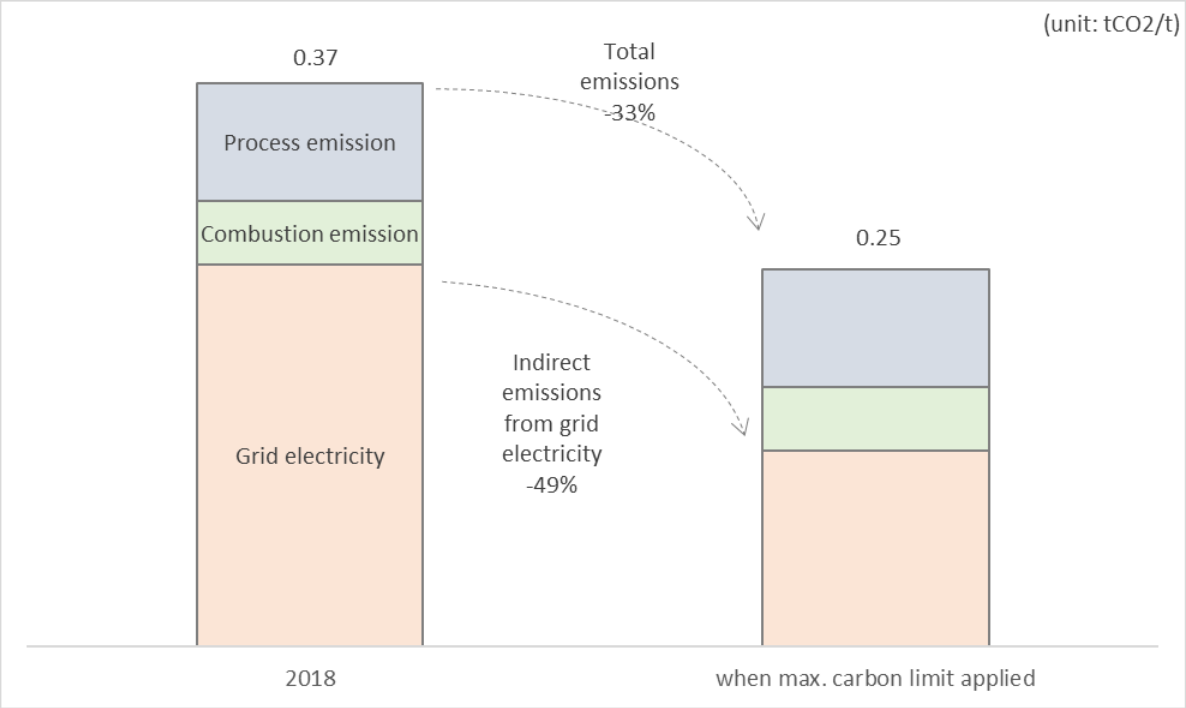
Table 6. The Goal of Power Source Conversion in 2030 Compared to the Current Status

Power mix (in terms of power generated)							Emission factor ($kgCO_2/kWh$)
Year	Nuclear	Coal	LNG	New and renewable	Ammonia	Hydro pumps and others	
2020	29.0%	35.6%	26.4%	6.6%	0%	2.4%	0.4781
2030	23.9%	21.8%	19.5%	30.2%	3.6%	1.0%	0.2448

When compared to the current emission intensity of steel products, if the maximum carbon limit of EAF steel is set to induce achievement of the target power mix of the NDC level, the emissions due to electricity will decrease by 51% and the total emissions will decrease by 67%. Table 8 shows the maximum carbon limit derived based on the emission intensity of current EAF steel.

[25] NEXT Group's own estimation. Based on Dongkuk Steel in 2018.
[26] NEXT Group's own estimation
[27] 국가기후기술정보시스템(2021)

Figure 10. The Estimated Emission Intensity of EAF Steel Products from When the NDC Target of Electricity Emission Factor is Achieved



Note. The figures in 2018 were derived based on manufacturing performance and GHG emissions of Sinpyeong, Incheon, and Pohang Steelworks of Dongkuk Steel, where structural steel sections and pipes are manufactured from steel scrap.

Table 7. Recommended Maximum Carbon Limit of EAF Steel Products

Product category	Maximum carbon limit
Rebars and structural steel sections	0.25 tCO_2 / t

4. Expected Effects

If steel items are included in the PPS's minimum green standards and the maximum carbon limit standard of low-carbon products is strengthened, all steel products purchased by the government and public institutions will be procured with low-carbon steel. In this case, all pipes based on hot-rolled steel from the EAF route are manufactured by BF-BOF using scrap and DRI as raw materials. Rebar, structural steel sections, and piles from the EAF route are manufactured through cleaner power sources.

At this time, 0.4-1.08 tCO_2/t for products from the BF-BOF route and 0.12 tCO_2/t for products from the EAF route will be reduced. When applied to the entire procurement market, about 160,000-

230,000 tCO_2 will be reduced. It is expected that GHG emissions in the public procurement steel market will be decreased by 38% in the future compared to the existing emissions.

Figure 11. Estimated Changes in GHG Emission in the Public Procurement Steel Market After Policy Amendment

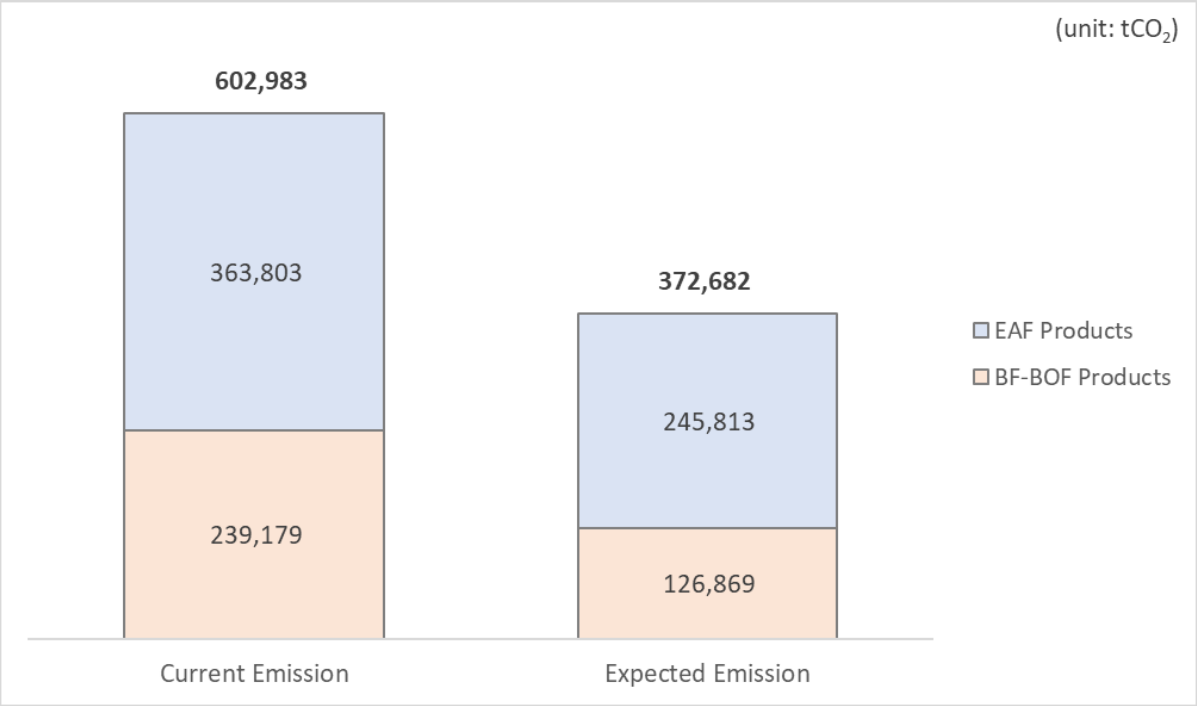


Table 8. Calculated Changes in GHG Emission in the Public Procurement Steel Market After Policy Amendment

Product category	Procured volume (ton)	Current GHG emissions (tCO_2)	Expected GHG emission reductions (tCO_2/t)	GHG emissions after policy amendment (tCO_2)
Steel from BF-BOF route	103,991	239,179[1)]	0.4~1.08[2)]	126,869
Steel from scrap-based EAF route	983,253	363,803	0.12[3)]	245,813
Total	**1,087,244**	**605,063**		**372,682**

1) POSCO's PosMAC emission intensity (2.30 tCO_2/t) is applied.

2) Maximum reduction, 2.3-1.22; minimum reduction, 2.11-1.71 (the difference in the emission intensity of POSCO and Nucor products)

3) 0.37-0.25 (the difference in emission intensity that can be achieved if Dongkuk Steel procures electricity at the NDC level)

VI. Conclusion

GPP can Prime the Pump

Although the steel public procurement market in Korea is small, only accounting for 1% of total domestic steel production, it is a stable market that can lead to the creation of continuous demand for low-carbon steel. The GPP policy is designed to make the public sector pay a price premium in an effort to guarantee the demand for low-carbon products, stimulating their usage even if they are less price competitive. The fact that demand for low-carbon steel is guaranteed by the government resolves partially the uncertainty of low carbon investments, thereby providing a strong incentive to business executives to make investment decisions.

Since investments in new technology usually start with a small-sized demo plant, the size of the public procurement market is sufficient to support decisions on initial facility investment. In the future, through strengthening or improving the additional regulations such as green building certifications, if the demand for low-carbon steel is further spread to the private sector, this could serve as a priming pump to accelerate the commercialization of demo plants and the transition away from BF-BOF.

Moreover, a reinforced GPP policy would send a signal to the market that the government is willing to expand the demand for low-carbon steel not only for public construction but also for other applications and private procurement. Carrying out such an action in public makes the industry realize the urgency of the low carbon transition and accelerates the climate actions from the market.

Currently there is no officially agreed definition for low carbon steel. By setting a maximum carbon limit, low-carbon steel can be defined clearly. The government is the right actor to define low-carbon steel considering the domestic manufacturing environment, export competitiveness, and compatibility with the national GHG reduction goals.

What to Do Next to Create Demand for Low-Carbon Steel in the Private Sector

Starting with revising GPP, the government should consider ways to promote the demand for low-carbon steel in the private sector in the long-term. Considering the product mix of the Korean steel, the government should focus on creating low-carbon steel demand in the automotive and shipbuilding industries as the next step, because these sectors procure BF-BOF steel products mainly. Amid intensifying international climate regulations, such as Carbon Border Adjustment Mechanism (CBAM), and strengthened Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII) by

the International Maritime Organization (IMO), the necessity for low-carbon steel in the private sector is increasing. Policy incentives and a testing ground that can preferentially use low-carbon products are critical to accelerate steel decarbonization and thus to minimize the potential loss of export competitiveness of the steel industry in the future. This brief is expected to ideally spark discussions on policy mechanisms to boost low-carbon steel demand starting from revisioning existing GPP policies.

References

- 국가기후기술정보시스템. (2021). 2021 년 승인 국가 온실가스 배출·흡수계수.
- 대한민국 정책브리핑. (2021.12.21). **혁신조달.** [2022 년 6 월 13 일 접속] https://www.korea.kr/news/policyNewsView.do?newsId=148897154 - :~:text=%EC%9A%B0%EB%A6%AC%EB%82%98%EB%9D%BC%20%EC%97%B0%EA%B0%84%20%EA%B3%B5%EA%B3%B5%EC%A1%B0%EB%8B%AC%20%EA%B7%9C%EB%AA%A8,%EC%A7%80%EC%9B%90%EC%97%90%EB%8A%94%20%ED%95%9C%EA%B3%84%EA%B0%80%20%EC%9E%88%EC%97%88%EB%8B%A4 https://www.korea.kr/news/policyNewsView.do?newsId=148897154
- 동국제강. (2021). **2021 환경경영 보고서.**
- 이동이. (2020.08). 국내 철강산업의 현황과 과제. **산은조사월보.** KDB 산업은행 미래전략연구소.
- 조달청. (2021a). 공공조달 녹색제품 공급실적 통계. **공공녹색구매 통합정보망.** [2022 년 6 월 13 일 접속] https://www.pps.go.kr/green/bbs/list.do;jsessionid=5nhclX5m2sol3cjCTrLeR16Ymg2X1fhbKQbP5VXkkxxzjlwYczDb!1322748488?key=01145#none
- 조달청. (2021b). 전체 공공조달 현황. **온통조달 공공조달통계시스템.** [2022 년 6 월 16 일 접속] https://data.g2b.go.kr:1443/pt/statdata/moveTotlPubPrcrmntStatsPop.do
- 조달청・한국조달연구원. (2021a). **미국 공공조달시장 입찰가이드북**
- 조달청・한국조달연구원. (2021b). **EU 공공조달시장 입찰가이드북**
- 철강금속신문. (2021.01~12). **강관류, 봉형강 가격표.**
- 키움증권. (2021.01~12). **Kiwoom Steel & Metal Weekly.**
- 포스코. (2020). **2020 기업시민 보고서.**
- 한국철강협회. (2022). 정보센터. **한국철강협회 홈페이지.** [2022 년 6 월 3 일 접속] https://www.kosa.or.kr/
- 한국환경산업기술원. (1999). **국가 LCI DB.**
- 한국환경산업기술원. (2019). **2020 친환경건설자재 정보.**
- 한국환경산업기술원. (2022). **환경성적표지 인증제품 유효현황.**
- 환경부. (2021.7). **공공기관 녹색제품 구매실적(2020 년도) 집계 결과.**
- European Commission. GPP Criteria-Background and approach. [Accessed on May 10, 2022]. https://ec.europa.eu/environment/gpp/gpp_criteria_en.htm
- European Commission. (2022). National GPP Action Plans (policies and guidelines.
- EU Public Procurement Directive 2004/18/EC.

- Ganley. (2013). Federal “Green” Product Procurement Policy in the United States.
- Hasanbeigi and Shi. (2021). Target Setting for Green Public Procurement Programmes.
- Hyundai Steel. (2020). Environmental Product Declaration In Accordance with ISO 14025 and EN 15804 + A1 : Hot Rolled Steel Coil.
- Nucor. (2021a). Environmental Production Declaration : Fabricated Hot-Rolled Structural Steel Sections.
- Nucor. (2021b). Environmental Production Declaration : Fabricated Hollow Structural Sections.
- OECD. Green Public Procurement. *OECD.org.* [Accessed on July 13, 2022] https://www.oecd.org/gov/public-procurement/green/
- Paulsson, Larse. (2021.11.9). How Steel Could Become Green, and What It Would Take. *Bloomberg*. [Accessed on June 9, 2022] https://www.bloomberg.com/news/articles/2021-11-09/how-steel-could-become-green-and-what-it-would-take-quicktake#:~:text=Will%20it%20be%20really%20expensive%3F&text=Green%20steel%20will%20be%20more,may%20have%20reduced%20that%20figure.
- Rijkswaterstaat. (2019). Towards Climate-Neutral and Circular Procurement.
- State of California. (2021). Buy Clean California Act. *ca.gov.* [Accessed on June 15, 2022] https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act
- Thiruvengadam et al. (2004). Cost Modeling of Reinforced Concrete Buildings Designed for Seismic Effects. *13th World Conference on Earthquake Engineering.* Paper No. 1956
- UNEP. (2017). Comparative Analysis of Green Public Procurement and Ecolabelling Programmes in China, Japan, Thailand and the Republic of Korea: Lessons Learned and Common Success Factors.
- UNEP. (2018). Policy Brief: Green Economy. Sustainable Public Procurement for an Inclusive Green Economy.
- UNEP. (2019). Green Public Procurement in the Republic of Korea: A Decade of Progress and Lessons Learned.
- World Bank. (2021). Green Public Procurement: An Overview of Green Reforms in Country Procurement Systems.

Contact Points	**Rachel Eun Ko,** NEXT Group / rachel.eun.ko@nextgroup.or.kr
	Geunha Kim, Solutions for Our Climate / geunha.kim@forourclimate.org

Appendix. GPP Policies of Major International Countries

U.S. Federal Government and California State Government

(Environmentally Preferable Purchase) According to Part 23.103 of the US Federal Procurement Regulations, the federal government agencies must engage in sustainable procurement. In particular, the Environmentally Preferable Purchase (EPP) recommends purchasing products that satisfy the product specification, standards, or labels determined by the U.S. Environmental Protection Agency.

(Buy Clean California Act) The Buy Clean California Act enacted in 2017 in California, U.S., designated products including steel and plate glass for construction. In order to participate in the bidding of procurement for those products, a manufacturing company should submit an Environment Product Declaration (EPD) certificate, and bidding by the state government for materials exceeding the GWP limit[28] is prohibited starting in 2021. In February 2022, the Biden Administration launched a task force to explore expanding the Buy Clean California Act into federal government and state government units and is actively promoting the formation of a low-carbon construction material market and the purchase of these materials at the federal government level.

Table 9. GWP limit by Products of Buy Clean California Act

Product category	GWP limit
Hot-rolled structural steel sections	1.01 tCO_2/t
Hollow structural sections	1.71 tCO_2/t
Steel plate	1.49 tCO_2/t
Concrete reinforcing steel	0.89 tCO_2/t
Flat glass	1.43 tCO_2/t
Light-density mineral wool board insulation	3.33 kg CO_2 /1 m^2
Heavy-density mineral wool board insulation	8.16 kg CO_2/1 m^2

EU

(Public Procurement Directives) EU Public Procurement Directives recommend contracts that can contribute to environmental sustainability such as the application of environmental standards to technology specifications for environment protection and sustainable development (Article 23(3)b),

[28] Based on the EPD information of participants in the bidding of the same materials, the average value was generated and the GWP limit was set to a range exceeding up to 20% of the average value (Ministry of Environment, 2019).

the use of ecological labels (Article 23(6)), the consideration of environmental requirements when contracting (Article 26), proof of environmental standard compliance of bidders (Article 27), and application of successful bid criteria considering environmental characteristics (Article 53)

Since 2008, the European Commission has developed more than 20 common GPP standards, and adopted them through a multi-criteria analysis including the scope of environmental improvement, impact on suppliers, political sensitivity, market availability, and economic efficiency.

Netherlands

(Sustainable Public Procurement) The Sustainable Public Procurement (SPP) in Netherlands is being developed and implemented according to the domestic situation based on EU Public Procurement Directives. The Netherlands government aims to achieve a completely circular economy and reduce the use of primary materials by 50% by 2050. To achieve these goals, the government aims to reduce CO_2 emissions by about 1 million tons through circular procurement in accordance with the circular economy principles.

(Items) The standard has been developed for 47 products and services including new construction, office building, roads, and heavy vehicles.

(Evaluation method) For the bidding projects, the overall environmental impact and CO_2 emission reduction are evaluated using DuboCalc[29] and the CO_2 Performance Ladder[30] developed by the Netherlands Public Infrastructure Authority (Rijkswaterstaat). According to the environmental cost index and CO_2 performance certification grade derived through those methods, a discount is applied to the bidding price.

[29] An LCA-based tool to calculate the environmental impacts of materials, construction, or construction methods.
[30] A 5-step certification system that consists of measures to limit CO_2 emissions within companies, projects, and supply chains.