

# The Journey Toward Greenwashing: Greenate

POSCO Profile No. 2



- ▶ On June 4, 2023, POSCO launched a series of carbon reduced steel brands, including Greenate certified steel™ adopting the mass balance methodology to calculate emissions reductions.
- ▶ The estimated amount of reduced carbon emission of Greenate certified steel™ is only equivalent to three days of POSCO's annual emissions, and its manufacturing methodology significantly lacks both carbon reduction capability and relevance to decarbonization technologies.
- ▶ The mass balance methodology, which is at the core of the sustainable credentials claimed by Greenate certified steel™, carries significant risk of greenwashing. This could be detrimental to the development of Korean and global green steel technologies and related markets.
- ▶ POSCO must establish transparent and environmentally friendly standards when utilizing the mass balance methodology, to strengthen the eco-friendliness of individual brands, and clearly present the volume of carbon reduction using basic units.

## POSCO's carbon reduced steel brands - a case of greenwashing?

In mid-2023, POSCO unveiled plans to launch several brands of carbon reduced steel products<sup>1</sup>, including Greenate certified steel™, with the goal of selling 10.5 million tons per year of its series of carbon reduced products by 2030.

- POSCO announced its plans to launch a series of carbon reduced steel brands, including Greenate certified steel™, as part of the product line under its carbon-neutral master brand, Greenate<sup>2</sup>, at a briefing on its carbon reduced product initiative held on June 1, 2023.
- During the Q2 2023 Earnings Presentation held in July, POSCO announced that it had already launched two products in the carbon reduced steel line unveiled in June and will continue to launch and advertise and market the remaining carbon reduced steel brands by 2030.
- **POSCO also announced its goal to sell 10.5 million tons of carbon reduced steel products annually by 2030, which accounts for approximately 25% of the combined annual production capacity of POSCO's Pohang and Gwangyang steel plants, which is 40.6 million tons.** This reveals that the carbon reduced steel brands are expected to account for a significant portion on the South Korean steelmaker's product line.
  - The first publicly announced buyer of Greenate certified steel™ was LG Electronics, which signed a supply contract for 200 tons of Greenate certified steel™ to produce dryer components.

1 For steel products, the certification schemes relying on a mass balance methodology, such as Greenate Certified steel™, allow steel to be 'deemed' low/no carbon through the allocation of recycled content. Due to the greenwashing risks associated with the mass balance methodology, this brief defines POSCO's low-carbon products as 'carbon reduced steel' as opposed to the 'low carbon based' terminology that may misrepresent conventional steel products with minimal emissions reductions, as green. Overall, steel product definitions should clearly and accurately categorize 'green steel' or 'fossil-free steel' products as those having significant emissions reductions through the use of green hydrogen or similar production pathways.

2 In November 2022, POSCO announced the launch of "Greenate," a 2050 carbon-neutral master brand that will oversee all eco-friendly products, as well as related technologies and processes.

[Figure 1] Launch Plan of POSCO's Carbon reduced Steel Product Line

**POSCO's Carbon reduced Steel Lineup (to 2030)**

Release schedule	product lineup	description
'23	Renewable energy steel	Procuring renewable energy (Green Premium, REC, etc.) such as solar power and wind power and providing it Renewable E certificate
	Greenate certified steel™	Allocating the amount of carbon emissions reduced through low-carbon processes/technologies to some designated products and reducing carbon emissions
'26	Greenate carbon reduced steel	EAF <sup>•</sup> TYPE Reducing carbon with hybrid low-carbon production using the latest large-scale electric and blast furnaces
		Type undecided Reducing carbon by applying technology to raise the conventional blast furnace-based scrap rate (reduction technology under review)
'30	Greenate carbon reduced steel (HyREX <sup>**</sup> Type)	Reducing carbon emissions by applying HyREX production technology to hydrogen reduction steelmaking

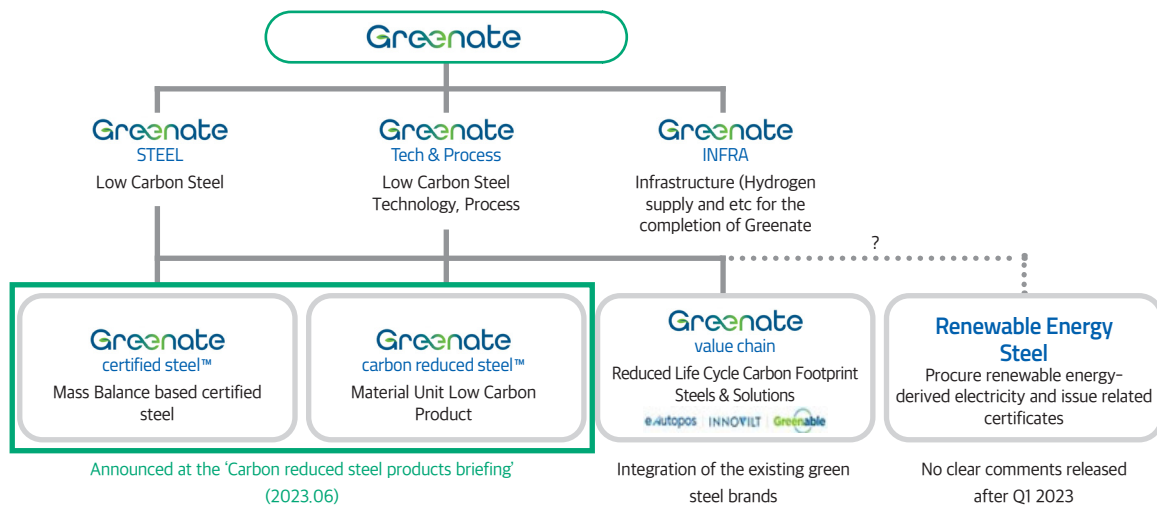
<sup>•</sup>EAF (Electric Arc Furnace): An electric furnace that melts metals or alloys with electrical energy  
<sup>\*\*</sup>HyREX (Hydrogen Reduction): Hydrogen reduction steelmaking to produce molten iron

Source: POSCO Holdings (July 24, 2023), 2023 2Q Earnings Presentation

The brand structure of Greenate to date (as of December 2023) is categorized by the following three pillars: Steel, Technology & Process, and Hydrogen & Infrastructure.

- Greenate Steel covers Greenate certified steel™; Greenate carbon reduced steel™; and Greenate Value Chain.
  - Greenate Value Chain aims to reduce carbon emissions in the product lifecycle by improving the lifespan of products and increasing their energy efficiency and product quality. It includes existing product lines, such as the so-called eco-friendly brands of e-Autopos, INNOVILT, and Greenable.
  - POSCO Renewable Energy Steel announced during the first quarter of 2023 is not included in the outline of Greenate on the POSCO website. As there is no specific mention of Renewable Energy Steel, it is assumed to belong to the Greenate Steel brand and analyzed accordingly.

[Figure 2] Overview of Greenate, POSCO's Carbon reduced Master Brand



Source: POSCO website data edited by SFOC

- POSCO’s Renewable Energy Steel refers to steel sourced from eco-friendly renewable power sources such as solar and wind power, while Greenate certified steel™ launched in Q2 2023 refers to carbon reduced steel classified using the mass balance method.
- Greenate carbon reduced steel™, which is expected to be launched after 2026, consists of ‘EAF Type’ products, which refer to products made by mixing molten steel produced in electric arc furnaces and molten wires produced in blast furnaces, and ‘Type undecided’<sup>3</sup> products, for which the carbon reduction method has not yet been specifically defined.
- Greenate carbon reduced steel™ (consisting solely of ‘HyREX Type’ products), which is expected to launch after 2030, is expected to employ POSCO’s authentic method of reducing carbon emissions by using a hydrogen-based direct reduced iron (DRI) production process, HyREX.

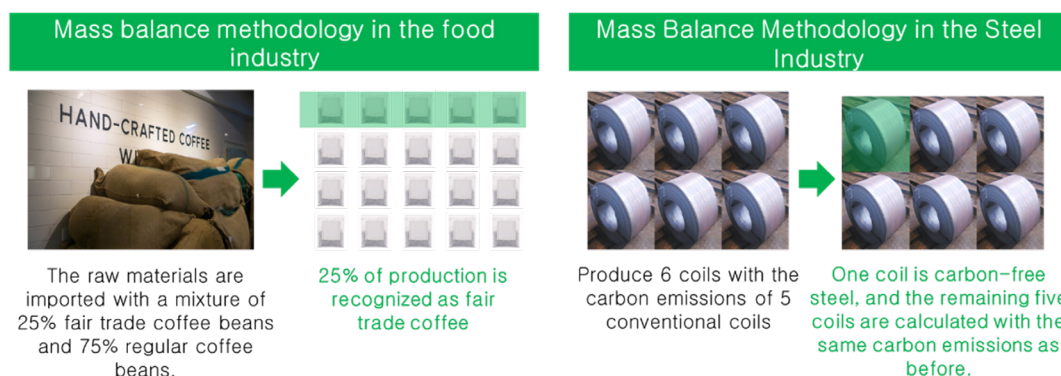
## The logic behind Greenate Steel’s carbon reduction: Mass Balance

The mass balance methodology of Greenate certified steel™ involves calculating reductions in carbon emissions, for instance through the use of steel scrap and pellets, and assigning the reduced amount of carbon to designated products.

- The mass balance methodology is a method of allocating a certain amount of reduced carbon to specific steel products, as so called ‘low carbon based’ which this brief categorizes as ‘carbon reduced steel’. While the rest of the steel produced is recognized as ordinary steel which has the same carbon emissions as products by normal production methods.

$$\begin{aligned} & \text{Total carbon emissions volume of steel produced} = \\ & \text{Total carbon emissions volume of carbon reduced steel} + \text{Total carbon emissions volume of the rest of the steel} \\ & (\text{Average CO}_2 \text{ emissions volume} * \text{Volume produced}) = (\text{CO}_2 \text{ emissions volume of the steel considered to be carbon reduced steel} * \\ & \text{Volume produced}) + (\text{CO}_2 \text{ emissions volume of the rest of the steel} * \text{Volume produced}) \end{aligned}$$

[Figure 3] Overview of Mass Balance Accounting



Source: SFOC data

- Before Greenate carbon reduced steel™ becomes available (2025), POSCO is expected to target the green steel market through Greenate certified steel™.
- Currently as there is no lack of a clear global standard for green steel, there is a risk that some steelmakers will push for the inclusion of mass balance accounting methods in the definition of green steel.

<sup>3</sup> At a briefing held in June 2023, POSCO presented its plan to significantly increase the input of steel scrap to the electric arc furnaces during the existing blast furnace-basic oxygen furnace (BF-BOF) production process as an illustration but explained that it had not yet finalized the specific methodology to be applied.

- ※POSCO senior executives participated in the '1st Korea-Japan Green Steel Joint Seminar' held on September 23, 2023, and discussed international standards for green steel with the Korean government and steel industry officials.
- In January 2023, POSCO received a certificate from DNV Business Assurance Services UK Limited to produce approximately 170,000 to 290,000 tons of steel with a carbon footprint of 590,756 tons CO<sub>2</sub>e.
- ※POSCO reduced carbon emissions by increasing the input of steel scrap and pellets in the blast furnace production process for about eight months, from January to the end of August.

### ThyssenKrupp AG's bluemint® pure: The first mass balance method-based carbon reduced steel

In October 2021, Germany's ThyssenKrupp introduced the industry's first mass balance-classified steel, BLUEMINT® PURE, which claimed to have 28% of the carbon footprint of conventional steel.

- ThyssenKrupp injected Hot Briquetted Iron (HBI) into its blast furnaces for 10 days in the second half of 2021, saving a total of 1,447.49 tons of carbon equivalent (CO<sub>2</sub>e), which was allocated in a mass balanced manner to produce 965 tons of bluemint® pure, which emitted 0.6 tons of carbon per ton of product.
- This represented a 1.5 tons CO<sub>2</sub>e reduction in carbon emissions compared to conventional steel. Meanwhile, the remaining steel with no allocated carbon reduction was calculated to have the same 2.1 tons CO<sub>2</sub>e per ton emissions intensity as conventional steel.

「Total volume of carbon emissions reduced by a business through a specific activity =  
Total volume of carbon reduction of carbon reduced steel produced by the business」

$$1447.49 \text{ tCO}_2\text{e} = 965 \text{ tons} * 1.5 \text{ tCO}_2\text{e}$$

Following the launch of ThyssenKrupp's bluemint® pure, global steelmakers, including Japanese blast furnace-reliant producers, began launching carbon reduced steel products actively adopting the mass balance approach.

- Despite its low production volume, bluemint® pure had a major impact on discussions that had previously centered on eco-friendly steel products based on LCA (Life Cycle Assessment), which sought to reduce carbon by increasing the lifespan of a company's products, and steel products with low carbon emissions, such as those made using electric arc furnaces.
- Unlike ThyssenKrupp, POSCO is certified to produce carbon reduced steel that is considered to have entirely offset all its carbon emissions, while also expanding the application of mass balance to steel grades other than hot-rolled steel.
  - POSCO's Greenate certified steel™ has a lower carbon footprint than ThyssenKrupp's bluemint® pure and can be sold in a wider range of steel grades, which increases the risk of greenwashing.
  - ※ Upon customer request, POSCO is also able to sell steel products that have partially offset their carbon footprint, similar to ThyssenKrupp's bluemint® pure. For example, if a customer wants electrical steel with 50% offset carbon emissions, POSCO can supply up to 332,820 tons of 50% carbon reduced electrical steel.

**[Table 1] Maximum Production Volumes by Type of Steel That Can Be Produced, Calculated Using the Mass Balance Accounting Method, as Suggested by DNV UK (Unit: tons)<sup>4</sup>**

	Maximum production volume with carbon reduction fully allocated to this type of steel	Carbon emissions volume per ton calculated by DNV UK (CO <sub>2</sub> e)
Hot rolled steel	approximately 286,775 tons	2.06
Cold rolled steel	approximately 254,636 tons	2.32
HGI structural	approximately 259,104 tons	2.28
Wire rod	approximately 252,460 tons	2.34
Steel Plate	approximately 251,386 tons	2.35
POSMAC3.0 (structural)	approximately 243,110 tons	2.43
Hot-dip galvanized steel	approximately 215,604 tons	2.74
Electrical steel	approximately 166,410 tons	3.55

Source: DNV UK (January 4, 2023), Independent Limited Assurance Report to the Management of POSCO, edited by SFOC

To prevent the continued application of the mass balance methodology in the future, including after the launch of Greenate carbon reduced steel™, it is necessary to establish clear parameters for mass balance accounting and set a deadline for its phase-out, which would have a significant impact on POSCO's future actions.

- Greenate carbon reduced steel™, which will be available after 2026, relies on a combination of blast furnaces and electric arc furnaces to produce steel. While it can reduce carbon emission, it cannot produce zero-carbon steel.
  - ※ Increasing the proportion of electric arc furnaces can reduce carbon emissions per ton of product, but EAFs also emit 0.6–0.8 tons of carbon per ton of product, so a certain amount of carbon emissions is unavoidable.
- The transition of South Korea's power structure from coal-fired to renewable energy is expected to take place after 2033, which is also the period for the commercialization of HyREX. The hydrogen reduction-based steel products that POSCO aims to produce will also take considerable time to reach zero carbon emissions.
- Furthermore, Carbon Capture, Storage, and Utilization (CCUS), which is gaining traction as a potential solution for hard-to-abate industries, will take time to prove its economic viability and reliability. Given these trends, strict deadlines are required, in order to limit the use for a limited application of the mass balance accounting during this technology-transition period.

## Greenate Steel: Why is it Greenwashing?

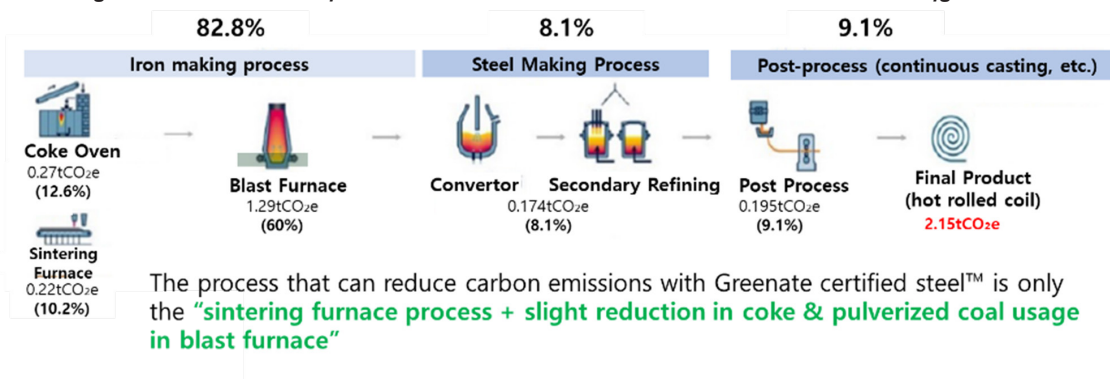
**When comparing the brand image with the actual carbon emissions reductions of POSCO's line of carbon reduced steel products disclosed as of December 2023, a high risk of greenwashing can be identified, due to the low emissions reduction volume and limited contribution to the development of low carbon basedmaking technologies, such as HyREX.**

**[Greenate certified steel™ - Limited carbon emissions reduction]** Greenate certified steel™ reduces carbon emissions by increasing the input of steel scrap in the basic oxygen furnaces and pellets in the blast furnaces and reducing the production and use of sintered ore. The problem is that **the input of pellets in the blast furnaces increases, resulting in limited carbon reduction**, and that this process does not realize the eco-friendliness that POSCO directly or indirectly promotes.

- Pellets are more environmentally friendly than sintered ore since they can reduce carbon emissions by 0.191 tCO<sub>2</sub>e per ton of steel product (more if the sintered ore is replaced with pellets). However, sintered ore accounts for only around 10% of the carbon footprint of steel production, and using pellets alone **does little to reduce coal use in blast furnaces (coke + blast furnace), which contributes more than 70% of the carbon footprint.**

<sup>4</sup> Shows the production volume of steel that is considered to have a zero-carbon footprint.

[Figure 4] Carbon Emissions by Process and Per Ton of Steel Produced in Blast Furnaces and Basic Oxygen Furnaces



Source: Wimmer et al. (2022), POSCO (2014), CARBON REPORT 2013, and other data analyzed and edited by SFOC

- Additionally, since pellets are the raw material for DRI/HBI<sup>5</sup>, which is used as a substitute for quality steel scrap in EAFs, it is difficult to realize the full carbon reduction potential of pellets if they are fed directly into the blast furnace.
  - ※ By 2030, a global shortage of quality iron ore for pellet manufacturing is expected. Therefore, it is important to achieve the maximum carbon reduction through pellets, which are becoming a scarce resource.
- For Greenate certified steel™ to live up to its green credentials, a clear technology transition roadmap and rapid transition from simply feeding pellets to BFs to using DRI/HBI, are needed.
  - ※ If POSCO switches to using HBI like Kobe Steel Plant in Japan, where HBI manufactured with MIDREX technology is loaded into the blast furnace and reduces carbon by about 0.78 tons CO<sub>2</sub>e per ton of HBI input, POSCO could further reduce carbon by about 0.5 tons CO<sub>2</sub>e per ton of crude steel.

**[Greenate certified steel™ - Potential to delay the transition to green steelmaking technology]** Mass balance-reliant carbon reduced steel, such as Greenate certified steel™, risks reducing the incentive to switch to green facilities by extending the life of blast furnaces, which may delay the development of HyREX, POSCO's innovative low-carbon technology.

- Relatively less expensive than green steel made from renewable energy and green hydrogen, mass balance based steel products "could serve" as a stopgap measure for reducing Scope 3 emissions for all but a few leading companies that are active in securing genuinely low carbon based throughout their supply chains (such as Orsted and Mercedes Benz).
- In the case of the BMW 5 Series 520i and i5 sedans, the use of green steel using hydrogen-reduced steel will incur an additional cost of approximately USD 503 thousand (KRW 900,000-1.8 million) per vehicle. Since few customers can afford the green steel premiums bringing genuine carbon emissions reductions, steelmakers might be tempted to continue to supply mass balanced, carbon reduced steel made using blast furnaces for as long as possible. POSCO, which has highlighted HyREX as its proprietary hydrogen reduced steel production method, is at high risk of being caught in **a dilemma where Greenate certified steel™ delays the development of HyREX**. This is because Greenate certified steel™ not only reduces the momentum for developing HyREX technology, but also undermines the core rationale for applying for approximately USD 601 million (KRW 800 billion) in government funding to aim HyREX commercialization.
- One of POSCO's key arguments for requiring government support to develop HyREX is that the availability of high-grade iron ore with 67% iron or higher, which is essential to produce the pellets needed for the shaft furnace-based hydrogen reduction steel being developed by EU-based steelmakers such as SSAB, is very low, particularly in Asia. However, **the**

<sup>5</sup> Short for Hot Briquetted Iron, these pellets are made from DRI (Direct Reduced Iron) that have been reduced by direct contact with reduction gases, such as natural gas or hydrogen, in an easily transportable form. DRI and HBI are similar in composition to pig iron made in blast furnaces, with an iron content of over 94%.

**fact that POSCO is feeding pellets into its blast furnaces to produce steel based on mass balance accounting may undermine POSCO's argument.**

- ※ Greenate certified steel™, which produces carbon reduced steel by feeding pellets into a blast furnace, contradicts POSCO's claimed need to accelerate the development of HyREX, and may be an excuse to delay the development of HyREX, a technology essential to achieving carbon neutrality by 2050.
- If the pace of HyREX development and commercialization proceeds slower than planned, POSCO's eco-competitiveness could fall significantly behind its rivals. To prevent Greenate certified steel™ and the mass balance methodology from becoming an alternative to carbon reduction technologies, the company needs to take rapid action while paying attention to key stakeholders.

**[Greenate certified steel™ - Excuse for retrofitting old blast furnaces]** Despite the various criteria surrounding mass balance, there are no cases of taking countermeasures for producing carbon reduced steel by retrofitting old blast furnaces as of December 2023. This poses a high risk of greenwashing, as Asian steelmakers with strong steelmaking industries dominated by BF-BOF assets, could retrofit their existing blast furnaces, and still sell their steel under a 'carbon reduced' label based on the mass balance accounting method.

- Reducing carbon emissions by retrofitting old equipment and improving inefficient operations should not be used nor accepted as a solution to carbon reduction.
    - ※ The world's most efficient steel mills emit about 2.1 tons CO<sub>2</sub>e of carbon to produce a ton of hot-rolled coil, while older mills emit more than 2.6 tons CO<sub>2</sub>e per ton of hot-rolled coil.
- The mass balance approach risks providing an incentive for steelmakers with a large number of blast furnaces to retrofit older BFs, which, given that blast furnaces typically have a lifespan of around 15-20 years, suggests that retrofitted blast furnaces are expected to operate until 2050 or beyond.
- Carbon reduced steel from blast furnace reforming is likely to dominate the initial green steel market due to its lower manufacturing costs compared to green steel produced with green hydrogen and renewable energy, which may further delay the development of innovative green steelmaking technologies.

**[Greenate certified steel™ - High risks of carbon leakage issues]** In the worst case scenario, the mass balance accounting method may lead to both greenwashing and 'actual carbon leakage' issues, associated with producing carbon reduced steel by 'replacing aged blast furnace facilities in developing countries with modern blast furnace facilities,' i.e., producing carbon reduced steel through moderate reductions in carbon emissions rather than moving towards 'carbon neutrality in 2050.'

- Carbon leakage from building new blast furnace facilities in less regulated developing countries to avoid stricter environmental regulations in major industrialized countries.
  - ※ In September 2022, Nippon Steel and ArcelorMittal announced that they will build two new large blast furnaces by 2026 at the Hajira Steel Plant, owned by AM/NS India, the companies' joint venture in India. Carbon emissions from the new blast furnaces are expected to be around 2.2 tons CO<sub>2</sub>e per ton of crude steel, more than 30% less than existing blast furnaces in India.
- Blast furnaces are operated for at least 15 years once built and typically undergo retrofitting one to several times, so the blast furnaces to be newly built in India are likely to operate after 2050. If the mass balance approach is abused, **there is a high risk of greenwashing, whereby blast furnaces that emit a large volume of carbon remain in operation after 2050 and produce carbon reduced steel based reliant on the mass balance approach.**
  - ※ If abused, the mass balance methodology risks "greenwashing" the production of carbon reduced steel grounded on keeping blast furnaces that emit significant carbon in operation beyond 2050, significantly slowing the global steel



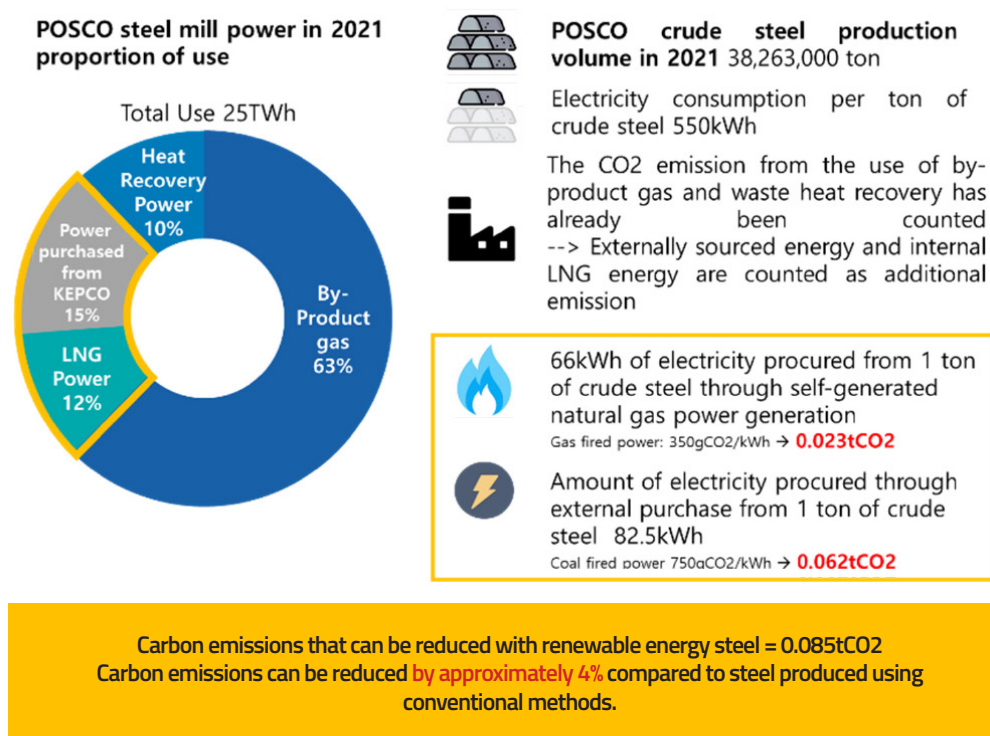
industry’s decarbonization transition, as well as eroding the profitability of developing innovative green technologies.

**[Renewable Energy Steel - Carbon reduction of less than 0.1 ton]** POSCO Renewable Energy Steel has a low carbon footprint of about 0.085 tons CO<sub>2</sub>e per ton of crude steel, but it is green-washed to promote steel as eco-friendly by using the clean image of renewable energy.

- According to the data presented by POSCO, the amount of electricity required to produce one ton of crude steel is 550 kWh. For **by-product gas power generation and heat recovery power generation, which accounts for 73% of this 550 kWh**, when used to produce electricity, carbon emissions are calculated as zero since they have already been calculated in the process of by-product gas and heat recovery power generation. For coke oven gas (COG), which is mainly used to generate by-product gas, carbon emissions are already calculated in the coke manufacturing process, so carbon emissions are not calculated additionally to avoid redundant calculations, even if it is utilized. This indicates **that POSCO is likely to use electricity from by-product gas and heat recovery power generation, which have zero carbon emissions.**

※ The volume of carbon emissions reduction that POSCO could achieve by procuring renewable energy-derived electricity is **148.5 kWh, which is only 27% of the 550 kWh**. Assuming that the externally-sourced electricity is purchased from a coal-fired power plant and that the carbon emissions of the company’s LNG plant are similar to those of a typical gas-fired power plant, **the carbon emissions required to generate 148.5 kWh of electricity are only 0.085 tCO<sub>2</sub>e.**

[Figure 5] POSCO’s Power Use (left) and Estimated Carbon Emissions Per Ton of Crude Steel That Renewable Energy Steel Can Reduce (right)



Source: POSCO Newsroom (June 30, 2022), POSCO’s Challenges and Commitment to Energy Transition, edited by SFOC

**[Renewable Energy Steel – Adding RE100<sup>6</sup> label to blast furnace-based steel is Greenwashing]** POSCO is giving a boost to its Renewable Energy Steel brand by revealing plans to launch so-called 'RE100 products' (products created with 100% renewable energy). To avoid accusations of greenwashing, Renewable Energy Steel and RE100 labels should strictly be used for electric furnace-centric products.

- At the 'Breakthrough Technology Conference 2023', POSCO announced plans to supply RE100 stainless steel to the IT industry in 2023 and RE100 galvanized steel to the automotive industry in 2030, along with a plan to increase the company's renewable energy procurement from 0.1 GWh in 2022 to 848 GWh by 2030.
- However, estimates show that only about 0.41 tons of CO<sub>2</sub>e can be saved per ton of crude steel, which is around 18% of emissions from blast furnace and electric arc furnace methods. Marketing blast furnace steel as RE100 while maintaining a coal-based blast furnace-based production system risks being deceptive to consumers.
  - ※ The RE100+ blast furnace method that POSCO proposed is estimated to reduce about 0.41 tons of CO<sub>2</sub>e per ton of crude steel, which is only about 18% of the existing emissions. To significantly increase the eco-friendliness, electric arc furnace steelmaking should be applied in conjunction with renewable energy procurement to justify the RE100 label.
  - ※ 'Mixing blast furnace molten steel with electric furnace molten steel', which will be rolled out in earnest in 2026, also poses greenwashing issues as the greater the proportion of blast furnace molten steel, the greater the greenwashing.
- POSCO should apply the Renewable Energy Steel branding and RE100 label only to steel products produced by EAFs, excluding BF-based production.

**[Greenate Value Chain - Different perspectives on the effect of the product lifecycle]** The carbon reduction may be insignificant compared to POSCO's promotion of extending product life in the Greenate Value Chain or reducing carbon emissions by improving the quality of steel

- POSCO's claim 1: "By providing high-quality steel, we can significantly increase the lifespan of steel products such as buildings, thereby reducing carbon emissions by 'discouraging the manufacture of additional products because they last longer, even though they produce the same amount of carbon emissions.'"
  - ※ Even if the potential life of a building is significantly extended by using higher quality steel, estimates of the exact carbon savings are dependent on many variables, such as the client's decision on whether to use the building for the duration of the entire extended lifespan.
  - ※ For passenger cars, half of the buyers replace their vehicles within 1-5 years, which is less than half of their lifespan. The logic of the Greenate Value Chain's eco-friendliness claims does not hold if products are not used for their entire lifetime.
- POSCO's claim 2: "We can reduce carbon emissions by reducing energy consumption when using our products, such as by improving the efficiency of steel or developing high-quality steel to achieve lightweight automobile bodies."
  - ※ It can be assumed that high quality steel does not have much room for further improvement, already being at the top

<sup>6</sup> As of December 2023, POSCO has not announced an RE100 commitment. It is therefore assumed that 'RE100 steel' used by POSCO refers to the use of renewable energy for steel production - namely the procurement of 100% renewable energy to supply the external\* electricity procurement needs of steel production of certain steel products (steel produced with 100% renewable energy).

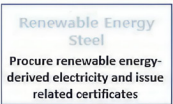



\*Self-generation, including byproduct gas-generated electricity, accounted for 85% of POSCO's energy consumption in 2021 and a small portion is supplied externally from the grid. The renewable energy supply and associated carbon emissions reductions are dependent on the overall electricity consumption division in the integrated steel plants in the future.

of the product range. Furthermore, calculating potential savings in carbon emissions by estimating how much longer a product is used (for which there is no baseline), is highly complex and comparative, particularly given that estimates in carbon savings vary depending on which steel grades are compared.

Product lifecycle-based emissions reduction is not a clear-cut method of reducing emissions because its effect can be drastically reduced if a product is not used for a long period of time. Therefore, reducing emissions through quality improvement is at risk of being falsely marketed as greenwashing.

Based on the above, the actual carbon reduction and greenwashing of POSCO’s low carbon steel brands can be illustrated as shown in the figure below.

[Figure 6] Evaluation of POSCO Carbon Reduction Steel Brands<sup>7</sup>

	Real amount of CO2 emission reduction	Level of Greenwashing
	Very Low	Very High
	Very Low	Very High
	Low	High
	High	Low

Source: Made by SFOC

## How can Greenate truly become green steel?

**[Setting standards for mass balance to facilitate the low-carbon transition and strengthening the link to the green transition]** To ensure that the mass balance approach is not a greenwashing scheme to compromise on carbon reductions, but a genuine green scheme that can progressively reduce emissions to 2050 carbon neutrality, the following actions should be taken:

- Prohibiting the use of the mass balance accounting method for carbon reduction that is not related to a genuine green transition, such as the retrofitting of old blast furnaces

<sup>7</sup> For Greenate carbon reduced steel™, the actual carbon emissions can be significantly reduced by blending electric furnaces or utilizing HyREX, yet carbon emission issues still exist due to the use of coal-based electricity and the burning of natural gas to heat the steel and the combustion of natural gas for heating steel. As POSCO has introduced HyREX as ‘carbon neutral HyREX’ without a clear explanation (as of December 19, 2023), the brief has labeled it as “Low”.

- When using resources with large CO2 emission reductive abilities, such as pellets, the correlation between itself and the eco-friendly steel making process has to be demonstrated.
  - ※ Greenate certified steel™ is not environmentally friendly as it is simply a blast furnace feedstock for DRI/HBI pellets, which can significantly reduce carbon emissions, wasting the carbon reduction potential of the pellets and not contributing to POSCO's carbon neutrality roadmap.
- Through discussions with stakeholders including the government, the phase out of mass balance could be a matter of policy, requiring a regulation to ensure that only steel produced by genuinely eco-friendly steelmaking processes such as hydrogen reduction steelmaking will be recognized after a certain period of time.

**[Early commercialization of green steelmaking technologies such as HyREX]** Being more proactive in developing innovative eco-friendly HyREX technology to reduce the risks of mass balance accounting method prolonging reliance on carbon-intensive steel production.

- Currently, companies such as SSAB and H2Green Steel plan to complete the development of green steel technology using 100% hydrogen and renewable energy by 2026, and EU-based steelmakers such as ArcelorMittal and ThyssenKrupp are actively working on technology development for hydrogen-based steel processes and the sourcing of hydrogen in cooperation with their governments. The US is also actively expanding its renewable energy generation capacity, which is expected to significantly strengthen the eco-competitiveness of US steelmakers with an industrial structure centered on electric blast furnaces.
  - Blast furnace-based steel production reliant on mass balance methodologies is unlikely to be a competitive interim technology in EU and the North American markets where there is a growing demand for greener technologies.
- As the EU and US steel industries develop eco-friendly capabilities, they are likely to impose trade restrictions such as tariffs on mass balance certified steel in the future. POSCO needs to reduce its reliance on the mass balance accounting method by setting a clear deadline for its application under its carbon neutrality roadmap.
- As the domestic steel industry needs to expand the share of renewable energy to reduce carbon emissions through the introduction of large scale electric arc furnaces and hydrogen reduction steel technology, POSCO should strive to promote renewable energy such as offshore wind power through cooperation with the government and related industries.

**[Presenting the actual carbon reduction per ton and effectiveness of carbon reduced products]** POSCO must clearly indicate the reduced amount of carbon within its steel brands in order to emphasize its eco-friendliness. Otherwise, this may mislead the end consumers to overestimate the effect and degree of the product's carbon reduction.

- If POSCO does not address the greenwashing risks associated with its carbon reduced steel, it could be left behind in the green steel market, which is expected to grow in demand.
  - ※ In June, Bloomberg New Energy Finance (BNEF) found that the demand for green steel is growing rapidly, mainly in the automotive and parts sectors and the energy industry, and that demand is expected to outpace globally supply for the foreseeable future. In August 2023, the Global Wind Energy Council predicted that annual global offshore wind installations will reach 60,200 MW by 2022, more than 6.9 times the level in 2012. Offshore wind is a prime example of an industry with heavy pressure for carbon neutrality in the supply chain, and the steel products used in the industry are also expected to face increasing demands to reduce their carbon emissions.
- If POSCO continues with its current branding of so-called 'low carbon based', it risks greenwashing not only itself but also its customers.
  - ※ If genuine green products such as green steel based on renewables and green hydrogen is launched in regions where

renewable energy capacity is rapidly growing, such as China and the Middle East, POSCO would not be able to avoid issues of greenwashing.

- POSCO should enhance the eco-friendliness of its carbon-reducing steel brands to eliminate the suspicion of greenwashing of Greenate products and implement proactive strategies to capture the future green steel market, such as clearly stating the amount of carbon emission reduction per ton of product to enhance transparency and product reputation.

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