

Coal Tomorrow with POSCO: Doubts Rising on Korean Steelmaker's Net-Zero Future

POSCO Profile No. 1



- ▶ Despite POSCO's commitment to greening the business announced during the company's public events such as the Vision Declaration Ceremony and Corporate Citizen Day held in July 2023, POSCO plans to spend a total of KRW 299 billion (USD 226 million¹) to reline a mega-sized coal-powered blast furnace steel production facility, the Pohang Blast Furnace No. 4, which has an annual steel production capacity of 5.3 million tons.
- ▶ Back in 2019, POSCO set aside a budget of KRW 220 billion (USD 166 million) announcing intentions to reline the Gwangyang Blast Furnace No. 2, which boasts an annual steel production capacity of 3.15 million tons. Despite persistent delays in the relining, which has been paused since its announcement, POSCO has not provided a definitive stance on this issue.
- ▶ To establish the credibility of POSCO's Carbon Neutrality Roadmap and validate the request for government subsidies totaling approximately KRW 800 billion (USD 606 million), aimed at developing hydrogen reduction ironmaking technology and constructing a pilot plant, POSCO should clearly state its position on these matters.

POSCO, owner of 40% of the world's mega-sized coal powered blast furnaces

As of 2023, POSCO, the largest steelmaker in South Korea, boasts an annual steel production capacity of 17.71 million tons at its Pohang steel plant and 22.97 million tons at its Gwangyang steel plant. Additionally, the company owns 40% of the world's 15 mega-sized coal powered blast furnaces, defined as those with a volume of 5,500 cubic meters or more.

- POSCO possesses three blast furnaces in Pohang and five in Gwangyang. These have only been in operation for an average of 8.25 years since their last renovation and also possess the most latest facilities.

Table 1. Facility overview and production capacity of Pohang Steelworks and Gwangyang Steelworks (in tens of thousands of tons and year, mega-sized blast furnaces marked in red)²

Pohang ³	BF #2	BF #3	BF #4	FINEX #2 ⁴	FINEX #3
1st operation	1976	1978	1981	2007	2014
Prior Relining	2015	2017	2010	-	-
Annual production	230	530	530	150	250
Gwangyang	BF #1	BF #2	BF #3	BF #4	BF #5
1st operation	1987	1988	1990	1992	1999
Prior Relining	2013	2005	2020	2022	2016
Annual production	570	315	460	460	460

Source: Table created by SFOC using open-source data

1 The values used in this brief were converted from local currency (KRW) and are approximations of the equivalent USD value using the exchange rate of 1320 KRW = approx. 1 USD

2 POSCO has electric furnace facilities with annual stainless steel production capacity of 42 tons and 60 tons in Pohang. However, these facilities are not included in this document.

3 Pohang Blast Furnace No. 1 (BF #1) ceased operation in December 2021 and is no longer in operation.

4 FINEX is a steelmaking technology developed by POSCO. It produces molten iron from cheap powdered iron ore and bituminous coal without the need for preliminary processing.

Ranked 7th in global crude steel production in 2022, POSCO has several facilities overseas, of which the following locations are directly involved in crude steel production:

- PT.KRAKATAU POSCO in Indonesia has a blast furnace with an annual production capacity of 3 million tons of steel.⁵
- POSCO (Zhangjiagang) Stainless Steel Co., Ltd in China has an electric arc furnace with an annual production capacity of 1.1 million tons of stainless steel.
- POSCO YAMATO VINA STEEL JOINT STOCK COMPANY in Vietnam has an electric arc furnace with an annual production capacity of 1.1 million tons of steel.⁶

Pohang Blast Furnace No. 4 is silently undergoing relining, while Gwangyang Blast Furnace No. 2 is also planned for relining

In its 2022 Half-Yearly Report posted on the Financial Supervisory Service Electronic Disclosure System (DART) in August 2022, POSCO announced that a third renovation of Pohang Blast Furnace No. 4⁷ was being considered. In the subsequent 2023 Q1 Report published in May in the following year, it confirmed that renovation work was underway.

- In its 2022 Half-Yearly Report, which mentioned the third renovation of Pohang Blast Furnace No. 4 for the first time, the company announced that POSCO Construction⁸ landed the project for KRW 200 billion (USD 151 million), with the start and end dates yet to be determined.
- According to the 2022 Business Report, disclosed in March 2023, the contract start and end dates for the third relining of the Pohang Blast Furnace No. 4 remained undetermined. However, it was announced that POSCO ICT⁹ had secured two related projects on September 15, 2022 (both projects have a contract start date of September 15, 2022, and a contract end date of September 30, 2024). By adding these projects, the total cost increased to 214 billion KRW (USD 162 million).
- The 2023 Q1 Report announced in May 2023 detailed that the contract for relining the Pohang Blast Furnace No. 4 commenced in February 2023 and was scheduled to conclude by October 2024. The project was also scaled up, with a budget totaling to KRW 299 billion (USD 226 million¹⁰). The 2023 Q1 Report released in August 2023 indicated that approximately KRW 12.68 billion (USD 9.6 million), equivalent to roughly 4.24% of the total budget, had been executed by June 30, 2023.¹¹

5 At its inception in 2010, the ownership structure was 70% POSCO and 30% Krakatau Steel. However, in May 2022, POSCO divested a 20% stake to Krakatau Steel, resulting in both companies having equal ownership stakes. Nevertheless, POSCO retains 50% of the common shares, while Krakatau Steel holds 21% of common shares and 29% of preferred shares. This ownership structure affects the calculation of annual production, with three million tons being attributed to POSCO.

6 However, because POSCO holds a majority ownership stake of 51%, the statistical annual production capacity is calculated at 550,000 tons.

7 The Pohang Blast Furnace No. 4 relining project involves the participation of both POSCO E&C (POSCO Construction), responsible for the renovation, and POSCO DX (POSCO ICT), responsible for ICT technology related to blast furnaces.

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The company name of POSCO Construction was changed to POSCO E&C on March 20, 2023. However, for consistency with past disclosure records, this profile maintains the former name of POSCO Construction.

9 The company name of POSCO ICT was also changed to POSCO DX on March 20, 2023. However, for consistency with past disclosure records, this profile maintains the former name of POSCO ICT.

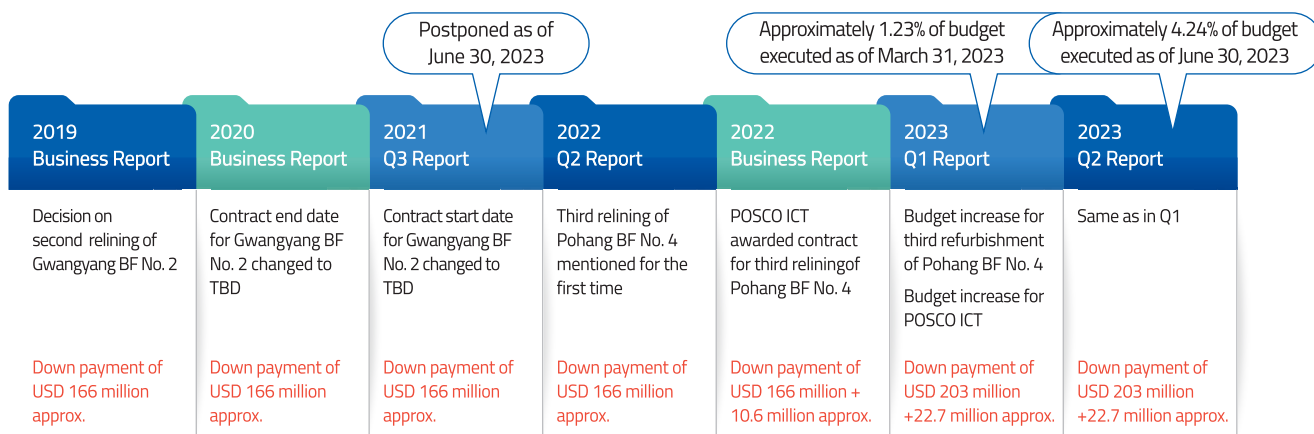
10 The contract amount for POSCO E&C was increased to 269 billion KRW, while the contract amount for POSCO ICT was increased to 30 billion KRW.

11 As of March 31, 2023, which marks the end of the first quarter, a total of 3.67 billion KRW has been executed.

Furthermore, concerning the second renovation of the Gwangyang Blast Furnace No. 2, which was initially reported on DART in March 2020, the report did not provide detailed information regarding the progress or project timeline. According to the 2019 Business Plan revealed in March 2020, POSCO Construction acquired the project for a total of KRW 220 billion (USD 166 million), with the initial contract commencement date set as October 2021 and the contract termination date as July 2022. However, in May 2020, the contract’s start date was modified to December 2019.

- Nevertheless, in the 2020 Business Report announced in March 2021, the contract end date was changed to undetermined; in the 2021 Q3 Report released eight months later in November 2021, the contract start date was also marked as undetermined. Currently, the contract for the second renovation of the Gwangyang Blast Furnace No. 2 totals KRW 220 billion (USD 166 million), but the contract start and end dates remain undetermined.

[Picture 1] Timeline of disclosure related to POSCO blast furnace relining



Budget changes for the blast furnace relining project indicated in POSCO's reports (as of 30 June 2023)



Source: Created by SFOC based on disclosed POSCO Holdings materials

Concerns about POSCO’s credibility and the feasibility of achieving its 10% emission reduction target by 2030

[Blast furnace relining confronting POSCO's Carbon Neutrality Roadmap] POSCO has unveiled a plan to attain carbon neutrality by 2050, which includes interim targets of cutting carbon emissions by 10% by 2030 and by 50% by 2040.¹² These targets are built upon a baseline carbon emission level of 78 million tons, averaged from 2017 to 2019. However, if POSCO

12 As of September 21, 2023, the target of '10% reduction by 2030' that was previously available on POSCO's official website in Korean and English has been changed to '30% reduction by 2035.' Currently, POSCO is not distributing any official press releases on this subject, and even the same "Carbon Neutrality Strategy" page is providing both the 10% reduction target by 2030 and the 30% reduction target by 2035. POSCO's '2022 Corporate Citizenship Report' also provided a 10% reduction target by 2030 as of July 7, but as of September 21, 2023, it had changed to a 30% reduction by 2035.

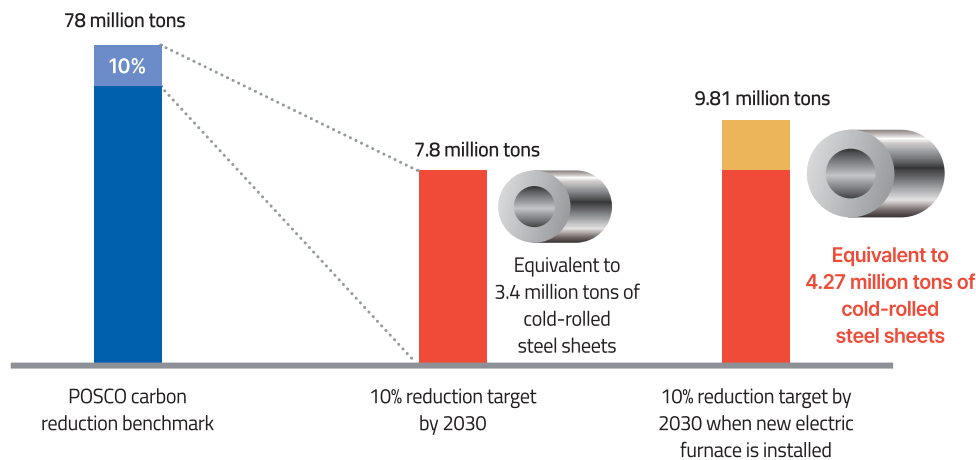
proceeds with the relining of both blast furnaces, achieving the 10% emission reduction target by 2030 becomes extremely challenging.

- To meet its 2030 goal, POSCO would have to cut carbon emissions by 7.8 million tons, roughly equivalent to reducing steel production by approximately 3.4 million tons, based on cold-rolled steel product standards. Given that POSCO currently possesses world-leading blast furnace technology and that its facilities are exceptionally well-maintained, with an average operating period of only 8.25 years since the last renovation, achieving the 10% carbon emission reduction target by 2030 without retiring blast furnace facilities would prove to be a formidable challenge
- Additionally, for both Pohang No. 4 and Gwangyang No. 2 blast furnaces, POSCO has not disclosed any carbon emission reduction technologies, such as enhancing the use of iron scrap in converters or increasing hydrogen injection into the furnaces. Without these technological advancements, it is unlikely that any significant reduction in carbon emissions will be attained, as emission levels are expected to remain similar to current levels even after the relining.
- Moreover, the planned addition of a mega-sized electric arc furnace with an annual steel production capacity of 2.5 million tons at the Gwangyang integrated steel mill starting in 2026 would result in additional carbon emissions. Considering that the carbon emission per unit of an electric arc furnace product is about 0.8 tons per ton of product, this expansion could lead to an estimated 2.01 million tons of additional carbon emissions. Given POSCO's existing carbon emission reduction target of 7.8 million tons, if the electric arc furnace expansion proceeds as intended, POSCO will need to reduce approximately 9.81 million tons of carbon emissions to meet its 2030 goal.
- One of the key emission-reduction strategies, particularly when it comes to reaching the 2030 interim target, outlined in POSCO's Carbon Neutrality Roadmap is the increased use of low-carbon materials like iron scrap.¹³ The company has disclosed plans to establish a supply chain capable of procuring 500,000 tons of iron scrap annually within South Korea by 2025 as part of its efforts to secure low-carbon materials. However, to achieve the targeted reduction of 9.81 million tons of carbon emissions through the use of iron scrap in the blast furnace-converter process, an additional 5.51 million tons of iron scrap will be required.¹⁴ This represents approximately 34% more than South Korea's total annual iron scrap imports, which amounted to 4.128 million tons in 2021. Given the increasing global focus on carbon neutrality, along with the competition among global steel producers to secure iron scrap, procuring such a high quantity is expected to be a challenging task even for POSCO, Korea's largest steelmaker. In other words, it is anticipated that POSCO is unlikely to achieve its 2030 carbon emissions reduction target of 10% solely by increasing its use of recycled iron scrap and other low-carbon iron sources, such as Hot Briquetted Iron.

13 Specific methods under consideration to lower carbon emissions include: (1) Reducing the proportion of sintered ore, which accounts for nearly 70% of the raw materials fed into the blast furnace, in favor of materials like pellets and HBI (Hot Briquetted Iron) with lower carbon emissions; (2) Increasing the quantity of iron scrap introduced into converters from the existing range of 10-15% to 30% or more; and (3) Combining molten iron generated in the blast furnace with molten steel produced in the electric furnace to reduce carbon emissions in the final product

14 Typically, the process of charging processed raw materials into the blast furnace to produce molten iron results in the emission of approximately 1.78 tons of CO₂ equivalent per ton of crude steel produced. However, when one ton of scrap iron is used in the blast furnace-converter process, it can reduce carbon emissions by exactly the same amount since scrap iron is introduced after this stage in the process.

[Picture 2] Carbon emission reductions needed to meet POSCO's 2030 carbon neutrality milestone



[Blast furnace relining amidst substantial government funding requests] POSCO has sought substantial government funding for the development of carbon emission reduction technologies within its existing facilities and the development of the eco-friendly hydrogen reduction ironmaking technology, HyREX. However, there are concerns regarding the justification of this funding request, particularly because the company has allocated a substantial amount of KRW 519 billion (USD 393 million) towards the life-extension of coal-based steel production, as opposed to focusing on new technology development.

- During the 'Transition to Carbon-Neutral Era and the Shift to Hydrogen Reduction Ironmaking' seminar held at the National Assembly in June 2023, a POSCO executive in charge of carbon neutrality stated that out of the approximately KRW 800 billion (USD 606 million) in government funding requested for the construction of a hydrogen reduction ironmaking facility, POSCO had only received KRW 12.68 billion (USD 9.6 million).
- The KRW 519 billion (USD 393 million) that POSCO allocated for blast furnace relining is approximately 65% of the government funding requested by POSCO. This allocation has raised questions because it suggests that the company may prioritize renovating existing facilities over developing eco-friendly technologies, despite seeking substantial government support for its technology transition.
- Furthermore, in February 2023, just two months after POSCO's decision to reline its blast furnaces in 2022,¹⁵ the Ministry of Trade, Industry, and Energy (MOTIE) announced the 'Steel Industry Development Strategy for Transition to Low-Carbon Steel Production,' which laid out various policies aimed at supporting the steel industry's transition from high-carbon emissions to become more eco-friendly. However, as of June 30, 2023,¹⁶ POSCO has continued to invest in relining Pohang Blast Furnace No. 4 and has budgeted funds for relining Gwangyang Blast Furnace No. 2.
- By 2030, POSCO intends to invest KRW 21.175 trillion (USD 16,041 million) in the maintenance and relining of blast furnaces and other existing facilities. However, it plans to allocate only around KRW 8.47 trillion (USD 6,416 million) in eco-friendly investments. This allocation raises concerns about whether the company's decisions prioritize short-term gains while relying on government support to mitigate significant risks in investments.

¹⁵ The Pohang Blast Furnace No. 4 relining project was initially mentioned in POSCO Holdings' 2022 Business Report. This report was made public on March 9, 2023, through the Financial Supervisory Service's electronic disclosure system. However, this report covers corporate activities from January 1, 2022, to December 31, 2022. Consequently, in this profile, it is indicated that the decision to reline the Pohang Blast Furnace No. 4 was taken in 2022.

¹⁶ The latest available disclosure is found in POSCO Holdings' 2023 Half-Year Report, which was officially released on August 14, 2023. This report provides information on corporate activities up to June 30, 2023.

[Statement of intent to maintain blast furnaces] Considering POSCO's ownership of some of the world's most advanced blast furnaces, its decision to reline its blast furnace capacity may signal an implicit commitment to maintaining the operations of coal-based steel production facilities.

- The relining of Pohang Blast Furnace No. 4, which has a substantial annual steel production capacity of 5.3 million tons, strongly implies POSCO's intention to continue using the blast furnace for an extended period. Given the extended relining cycle for blast furnaces, which now spans over 20 years, this decision may indicate a commitment to operating the facility until approximately 2045.
- The fact that POSCO is currently considering both the utilization of Carbon Capture, Utilization, and Storage (CCUS) technology to potentially maintain some blast furnaces beyond 2050 and the complete phase-out of blast furnaces by 2050—raises suspicions about whether the relining decision at this time signifies a choice to maintain blast furnaces rather than phase them out.
- Considering the potential need for further blast furnace relining around 2030, based on the current relining cycle, the ongoing relining of Pohang Blast Furnace No. 4 strongly suggests that POSCO may continue to reline its blast furnace capacity in the future. This projection contradicts the company's previous emphasis on environmental sustainability through big corporate events in July, raising questions about the credibility of its commitment to ESG (Environmental, Social and Governance) principles.

[Picture 3] Pohang Blast Furnace No. 4 (left) and Gwangyang Blast Furnace No. 2 (right)



Source: Yonhap News (Sep. 12, 2022), "POSCO restarts Pohang Blast Furnace No. 4...to be fully operational tomorrow at the earliest";
Newsis (Aug. 19, 2011), [Compiled for second release] Two injured in explosion at Gwangyang Steelworks

Key issues requiring clarification

[Transparent stance on blast furnace relining] POSCO must provide a clear position regarding the ongoing relining of Pohang No. 4 and Gwangyang No. 2 blast furnaces. If these relinings cannot be canceled, POSCO should provide a detailed explanation as to why they cannot be halted and an outline on their strategy to minimize carbon emissions associated to these relining.

- As previously mentioned, taking into account the anticipated carbon emissions from the proposed 2.5-million-ton mega-sized electric arc furnace in Gwangyang, POSCO must reduce its annual carbon emissions by nearly 9.8 million tons by 2030. This goal cannot be achieved without the decommissioning of currently operational blast furnaces.
- In the long term, relining blast furnaces poses a challenge to POSCO's carbon neutrality objectives. Moreover, in light

of the progressively stricter global regulations related to carbon neutrality, relining blast furnaces presents a high-risk investment scenario. While such renovations may yield short-term profits, they could potentially turn into stranded assets over the long term.

- Given these considerations, if the relining of blast furnaces is deemed necessary, POSCO should provide an explanation of its rationale, outline the emissions-reduction technologies to be incorporated in the relining, and present a clear vision for achieving its carbon emissions reduction targets by 2030.

[Clarity on carbon intensity of steel and emission reduction progress] Since declaring its commitment to carbon neutrality on December 13, 2020, as the first steel company in Asia, POSCO has unveiled numerous technology development initiatives and corporate strategies aimed at achieving this objective. Nevertheless, when evaluating POSCO's annual carbon emission per ton of steel, there has been no substantial reduction evident over the past six years.

- To gain international recognition for its various carbon emission reduction initiatives, POSCO should report on its carbon emissions reduction for each stage of the production process. Furthermore, the company should disclose the extent to which its carbon footprint has decreased in comparison to the baseline year. This transparency will facilitate the effective evaluation of POSCO's progress towards carbon neutrality and its concrete carbon reduction efforts by government agencies, investors, and other stakeholders, enabling them to provide appropriate support.

Table 2. POSCO's carbon emissions per ton of steel

	2017	2018	2019	2020	2021	2022
Carbon emissions per ton of steel (tCO ₂ e/t-steel produced)	2.06	2.08	2.11	2.11	2.05	2.05

Source: Reprocessed by SFOC using POSCO's Corporate Citizen Reports from 2020 to 2022

[Acting credibly to justify government support] In seeking government assistance, POSCO must provide a clear rationale for the importance of its eco-friendly technology development and show its commitment to realizing this objective.

- In February of this year, the Ministry of Trade, Industry, and Energy (MOTIE) announced the 'Steel Industry Development Strategy for Transition to Low Carbon Steel Production.' According to this strategy, a total of KRW 268 billion (USD 203 million) is earmarked for research and development (R&D). Out of this amount, KRW 162.6 billion (USD 123 million) is designated for carbon emission reduction initiatives in existing blast furnace and converter-based facilities, while KRW 51.1 billion (USD 39 million) is allocated to enhance the efficiency of electric arc furnace processes.
- In response to this announcement, the steel industry raised concerns about the limited funding, emphasizing that it falls significantly short in comparison to allocations in other countries. There has been a call for more extensive government support and focus, especially considering that only KRW 26.9 billion (USD 20 million) is set aside for the development of HyREX technology, a pivotal technology in achieving carbon neutrality within the steel industry.
- The achievement of carbon neutrality that involves the development of HyREX technology is critically important as it has far-reaching ripple effects not only on the steel industry itself but also on related sectors. However, without a clearly disclosed budget execution roadmap and budget allocation for the development in support of hydrogen reduced iron making HyREX technology, POSCO's current budget allocation of around 65% of the amount requested to the government not for technology development but for the company's profit gain significantly undermines its credibility.

- Currently steel experts foresee that as POSCO sees an increase in requests for low carbon steel from various consumers, it will be difficult for them to continue its traditional method of emissions-intensive blast furnace based steel making. Consumers expect low carbon steel to include a concrete indication of emissions reductions. Considering that it takes approximately 20 years to develop hydrogen reduction steelmaking facilities and establish necessary operations, such a delay will increase the Korean steel industry's dependence on blast furnaces, creating a vicious cycle that will eventually slow down the transition toward low-carbon steelmaking. If POSCO maintains its current stance and does not mainstream issues related to blast furnace relining with stakeholders, it will end up as a trigger for Korea to fail to achieve its Nationally Determined Contributions (NDC) goals and will bring a decline in not only POSCO but also the competitiveness of the entire Korean industry.

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