

# Environmental Product Declaration



THE INTERNATIONAL EPD SYSTEM



In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

## Cold rolled steel

from

**POSCO CO., LTD**



Programme:	The International EPD® System, <a href="http://www.environdec.com">www.environdec.com</a>
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*An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at [www.environdec.com](http://www.environdec.com)*



## General information

### Programme information

<b>Programme:</b>	The International EPD® System
<b>Address:</b>	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
<b>Website:</b>	<a href="http://www.environdec.com">www.environdec.com</a>
<b>E-mail:</b>	<a href="mailto:info@environdec.com">info@environdec.com</a>

<b>Accountabilities for PCR, LCA and independent, third-party verification</b>
<b>Product Category Rules (PCR)</b>
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): Product Category Rules for Construction Products (PCR 2019:14) version 1.3.4 and UN CPC code: 41221(flat-rolled products of non-alloy steel, not further worked than cold-rolled, of a width of 600 mm or more)
PCR review was conducted by: The Technical Committee of the International EPD System. See <a href="http://www.environdec.com">www.environdec.com</a> for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat <a href="http://www.environdec.com/contact">www.environdec.com/contact</a> .
<b>Life Cycle Assessment (LCA)</b>
LCA accountability: <i>Yoosung Park, H.I.Pathway Co.,Ltd. <a href="mailto:yoosung.park@hipathway.com">yoosung.park@hipathway.com</a></i> EPD owner's contact person: Sung Hyun Choo, POSCO, <a href="mailto:sh.choo@posco.com">sh.choo@posco.com</a>
<b>Third-party verification</b>
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:
<input checked="" type="checkbox"/> EPD verification by accredited certification body
Third-party verification: <i>Noh-hyun Lim, Certiquality Srl</i> is an approved certification body accountable for the third-party verification
The certification body is accredited by: <i>Accredia</i>
Procedure for follow-up of data during EPD validity involves third party verifier:
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation



factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

## Company information

Owner of the EPD: POSCO CO., LTD

Contact: Sung-Hyun Choo, e-mail: sh.choo@posco.com, tel: +82 61 790 1325

Description of the organisation:

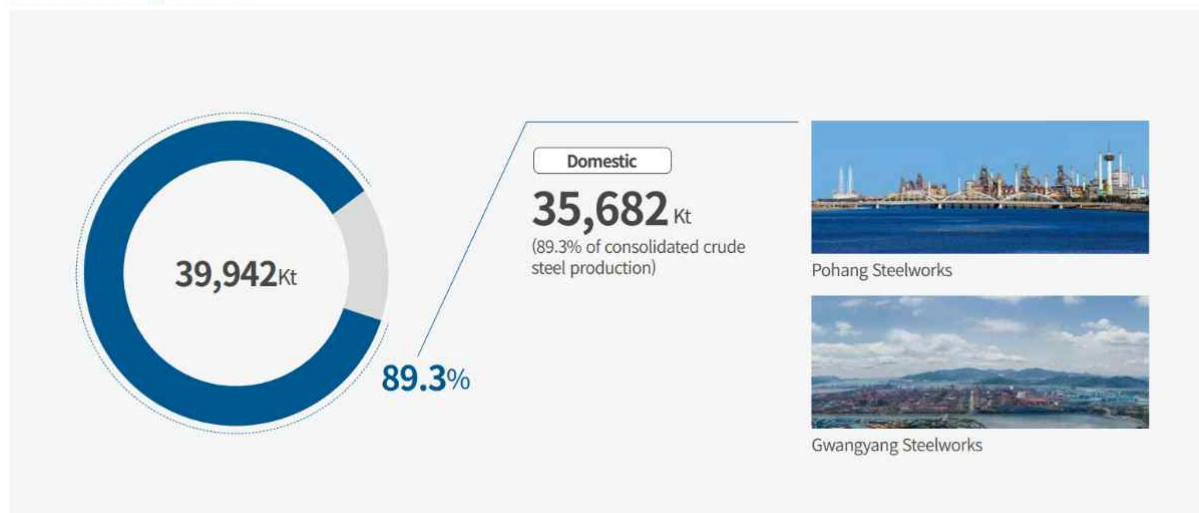
**Steel is an essential element of modern life. Backed by industry-leading competitiveness, POSCO Group steers the transition to low-emission steelmaking.**

### Domestic Operations

By shifting to decarbonized processes and reinforcing the sustainable product portfolio, we are positioned for future market leadership.

- Install electric arc furnaces (EAF) and develop bridge technologies to reduce carbon emissions in existing facilities
- Promote sales growth for sustainable products and make forward-looking investments
- Integrate digital and innovative process to enhance operational efficiency

### Crude Steel Output (2023)

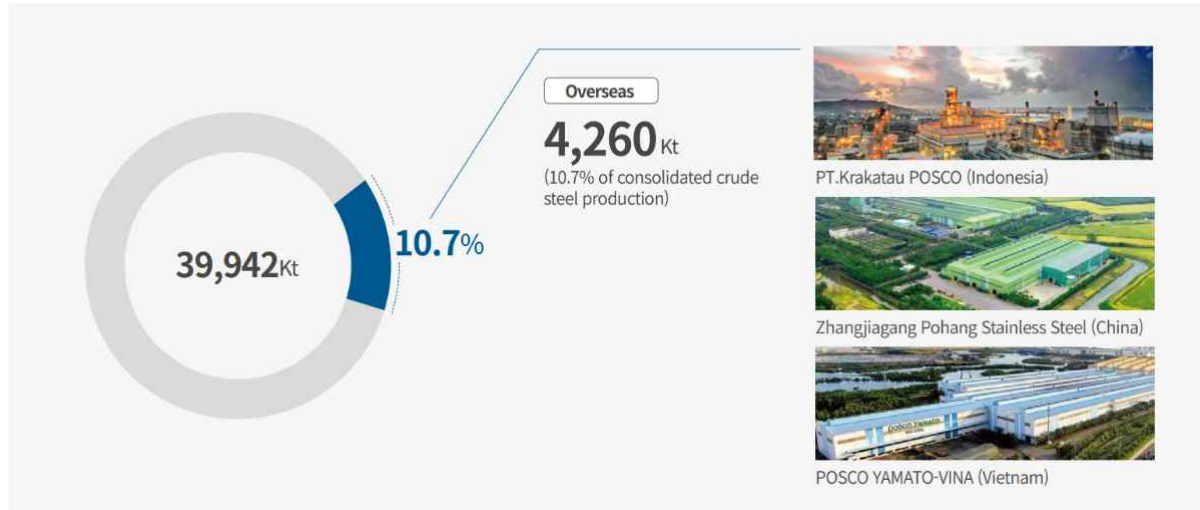


### Overseas Operations

Across the world, we oversee multiple operations including steel mills, processing centers, and raw materials sourcing subsidiaries. Investments in Indonesia, India, and the Americas, the three fast-growing steel markets, are considered to scale our global business.

- Invest in growth markets via diverse avenues, e.g., JV, local manufacturing capacity building and eco-friendly process application
- Seek partnerships with raw materials and energy suppliers, e.g. Australia

### Crude Steel Output (2023)



### POSCO's Carbon Neutrality Roadmap

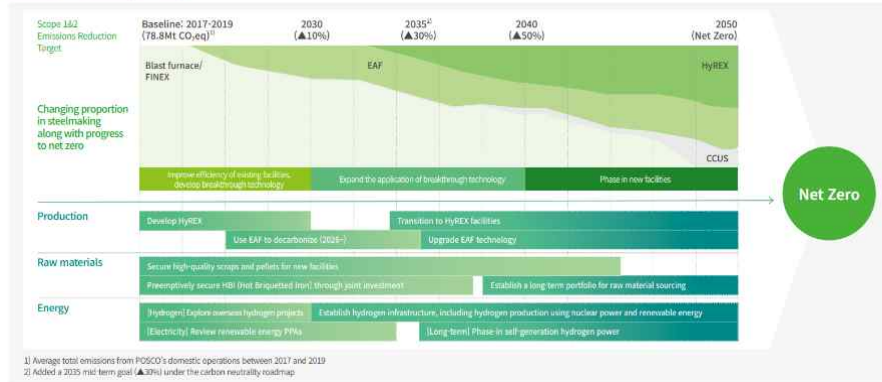
POSCO established its 2050 Carbon Neutrality Roadmap encompassing its overarching mid/long-term strategies for raw materials, investment, energy, and technology development to reach net zero by 2050.

POSCO plans to reduce its carbon emissions by 10% by 2030, 30% by 2035, and 50% by 2040 against the baseline of 78.8 million tons, its three-year average carbon emissions between 2017 and 2019, and become net zero by 2050.

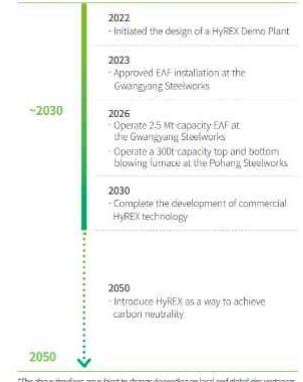
Journeying towards its 2050 net zero goal, POSCO will shift to low-carbon fuels and raw materials for its currently-operating facilities and develop low-HMR (Hot Metal Ratio) technology along with improving the efficiency of existing facilities in the short term while introducing highly feasible bridge technologies such as Electric Arc Furnace (EAF) and CCUS in the mid term.

Ultimately, POSCO aims to develop HyREX (Hydrogen Reduction) technology to ensure its steelmaking process does not generate GHG emissions.

POSCO's Carbon Neutrality Roadmap



Carbon Neutrality Investment Plan\*



## Water Resources

POSCO commits to minimizing the risk of water shortages by optimizing its water management and increasing water recycling. To keep the environmental impact of its steelworks on the surrounding waters to a minimum, POSCO applies stringent standards to managing the quality of effluents. POSCO implements the MES (Manufacturing Execution System) for its steelworks operations to keep track of energy supply/demand in real time, including water consumption by water source, and monitors water consumption of each plant on a monthly basis.

POSCO has received water security assessments under CDP's water disclosure project since 2016. In 2023, POSCO was rated Leadership A- in the leadership band.



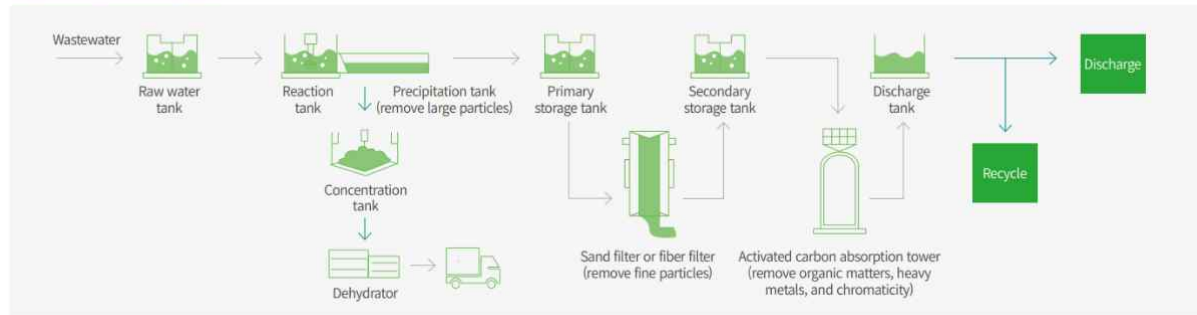
## Water Conservation and Wastewater Recycling

POSCO Group committed to minimizing environmental footprint in our environmental policy by reducing the consumption of water and other resources as much as possible and ensuring proper wastewater management. In August 2023, Gwangyang where our key production site is located was ranked Water Stress High, indicating its water stress level is in the 40~80% range according to WRI (World Resources Institute)'s water stress criteria. As the location of the Gwangyang Steelworks was classified as Water Stress High, we are seeking out ways to conserve water and maximize the use of available water resources. These include recycling wastewater discharged at appropriate quality levels from the water treatment facilities of unit plants, and research projects are ongoing to recycle final effluents such as end-of-pipe treated drainage water through reverse osmosis to use them as industrial water rather than for road or yard sprinkling. Such efforts to reduce water withdrawal while increasing water recycling represents our commitment to bracing for water stress concerns.

POSCO, which accounts for 80% and more of Group-wide domestic water withdrawal, is securing alternative industrial water sources to reduce its use of surface and ground water. The Pohang Steelworks has been reusing treated wastewater to avoid the use of 80,000 tons of fresh water a day since 2015, and the Gwangyang Steelworks has been producing desalinated water with its seawater desalination plant since 2014 to replace the use of up to 30,000 tons of freshwater a day. Such efforts enabled POSCO to recycle 26% of its total water withdrawal in 2023, doing its part in addressing the risk of water shortage facing local communities.

While minimizing the generation of wastewater at the steelworks and maximizing the recycling of wastewater, POSCO also ensures that unrecyclable wastewater undergoes rigorous end-of-pipe treatment before released into the environment. Wastewater receives primary treatment (physical/chemical) at each plant within the steelworks and wastewater containing organic matters receives additional secondary treatment (biological) before their final treatment at the wastewater treatment plant. Final effluents are controlled for their discharge concentrations of SS, TOC, T-N and other key pollutants, and POSCO's internal criteria are set at 80% of the legal threshold. Consuming large quantities of water is unavoidable due to the inherent characteristics of integrated still mill operations. Still, POSCO recycles as much water withdrawn as possible to reduce its water consumption. For instance, water use is minimized through wastewater circulation within the process, and stormwater and yard/road spraying water is collected through stormwater treatment facilities for treatment and is recycled afterwards.

### Wastewater Treatment System



## Chemical Substances

POSCO's steelworks respectively operate a rigorous monitoring system throughout the entire process of safely transporting, using and discarding chemical substances. The location tracking system has been introduced since 2016 for vehicles transporting chemicals according to the conditions of steelworks to ensure prompt response in the event of an accident. POSCO also abides by safety standards for chemical handling facilities, and makes facility improvements including leak detection systems to further raise the bar on safety.

POSCO works on multiple fronts to prevent chemical spills. To this end, the company established an emergency response system to ensure the safety of facilities handling hazardous chemicals and minimize the damage should any accidents occur. The company provides employees with chemical spill response training and safety training to help them strengthen response capabilities. Both steelworks set up departments responsible for chemicals management and appointed over 50 chemicals\ managers to ensure management accountability. POSCO operates the safety disaster prevention center equipped with special vehicles and professionals to enhance its early response capabilities, and conducts regular public-private joint drills and self-defense fire drills for increased response capabilities. Serving as the representative of the chemical safety community organized for local chemical safety, POSCO supports small/mid-sized companies with chemical safety while also joining the chemical safety committee of local governments.

POSCO raises the bar on chemicals management through supply chain partnerships and focuses on the safe distribution and handling of chemicals. The company embraces innovative technology and approaches for the sustainable development of chemical handling practices, fully adheres to applicable laws and regulations, and works to strike the right balance between environmental protection and economic growth.

POSCO's chemical management system verifies the content of hazardous chemicals designated by the government for their significant hazards/risks within the materials it introduces for the first time through the use of the MSDS. When unauthorized hazardous chemicals are contained, the concerned



materials are prevented from entering its operations, and they are replaced with non-hazardous alternatives through collaboration with the supplier. If such a switch is not viable, POSCO makes sure these materials are handled with appropriate protection facilities and equipment, including improved facilities and protective gear, under the approval of the government.

POSCO applies standards more stringent than government regulations to the management of its working environment to minimize the exposure of workers to any hazardous substances. Since 2022, the company has adopted its internal policy specifying prohibited chemicals to shift to low-toxicity alternatives and reduce the chemical exposure for both workers and the environment. POSCO also issues material-specific environmentally hazardous substances reports for respective manufactured products and discloses them on the electronic transaction system (E-Sales) for external stakeholders.

### **Byproducts**

POSCO is progressing toward a circular economy by maximizing the recycling of byproducts generated from its steel production process such as slag, dust, and sludge. Since designated as an enterprise subject to resource recycling performance management in 2018, POSCO has been setting annual recycling targets and tracking its performance. To minimize the landfill and incineration of waste that is not readily recyclable, POSCO works to increase the recycling of byproducts by discovering potential consumers and developing recycling technology with a goal of maintaining its byproduct recycling rate at 98% and above.

Slag accounts for over 75% of total byproducts generated at the steelworks, and is classified into blast furnace slag and steelmaking slag. Blast furnace slag, a rock-like byproduct generated when molten iron is produced at the blast furnace, morphs into sand-like granulated slag by spraying high-pressure water for rapid cooling. Over 90% of blast furnace saag exists in this granulated form. Granulated slag, mostly composed of calcium oxide and silicon dioxide, is able to substitute for cement clinker and is noted for its environmental benefits for reducing GHG emissions that are normally generated during limestone calcination as part of the conventional cement manufacturing process. In partnership with RIST and POSCO E&C, POSCO is distributing PosMent it developed to raise the content of granulated slag to up to 58% compared to traditional slag cement, contributing to mitigating GHG emissions and recycling byproducts in so doing. Furthermore, granulated slag can be used as feedstock for silicate fertilizers and contains a large amount of silicate which is an essential nutrient for the growth of rice. Silicate serves to more than triple the strength of the rice stem to increase the crop yield and enhance the overall quality of rice with improved taste and texture. It was also discovered through joint efforts with professional research institutes that iron ions (Fe<sup>3+</sup>) that exist in trace amounts in slag inhibit the activity of methanogens and produce the effect of lowering GHG (methane) emissions by nearly 14% in the rice cultivation process. Steelmaking slag is generated when impurities are removed from molten iron in the converter during the steelmaking process.

Steelmaking slag undergoes magnetic separation to reclaim the iron content: magnetic slag is repurposed into scrap iron substitutes and non-magnetic slag, which is mainly composed of limestone, silica and other natural rock substances, is used as natural aggregate substitutes. In particular, civil engineering sites using slag aggregates comply with the slag management guidelines published by the Korean Iron and Steel Association to manage potential leachate that may occur when slag aggregates come into contact with water during construction. Meanwhile, dust and sludge are generated when operating duct collectors, water treatment facilities and other environmental facilities: dust and sludge with high iron content are reused in their original form, or processed into pellets or briquettes and are fed back into the ironmaking and steelmaking processes as raw materials.

### **Initiative Participation**

POSCO is enhancing its interactions and collaborations with various stakeholders via active involvement in diverse global initiatives. We are publicly affirming our commitment to achieving carbon neutrality by 2050 and reinforcing our capacity to execute this commitment. Our aim is to showcase leadership in sustainability management through pioneering and proactive engagement.

### **Selected as a UNGC LEAD Group**

POSCO has been a member of the United Nations Global Compact (UNGC) since 2012. The UNGC represents the world's largest voluntary initiative for corporate citizenship, advocating for sustainability management practices through its 10 principles that encompass human rights, labor rights, environmental stewardship, and anti-corruption measures. POSCO is actively working towards contributing to the United Nations' Sustainable Development Goals (SDGs), a set of international commitments expected of every global stakeholder in our pursuit of a better future. In recognition of these endeavors, POSCO was selected for the 'UNGC Network Korea LEAD Group' for four years in a row, beginning with 2020.

### **The World Steel Association's Sustainability Champion**

The World Steel Association has recognized Sustainability Champions from among its 140 member companies since 2018. These companies exemplify leadership in the steel industry's commitment to sustainability. To qualify for this title, companies must adhere to the nine principles laid out in the Sustainability Charter, provide data on their carbon emissions, broken down by materials and processes used, and actively participate in sustainability programs. Recognized for its dedication and remarkable accomplishments in ESG management, POSCO has been selected as a Sustainability Champion for two consecutive years since 2022.

### **ResponsibleSteel Site Certification**

POSCO, as a leading global steelmaker, is dedicated to fulfilling its social responsibilities and exerting strong leadership, especially in light of the recent emergence of ESG as the new normal in corporate governance. As a part of its efforts, in 2022 POSCO joined ResponsibleSteel, a global ESG initiative for the steel industry, to assess and enhance its ESG performance, obtaining certification for its business sites. To achieve this certification from ResponsibleSteel, companies need to meet all 370 stringent requirements that align with global ESG benchmarks. These requirements encompass a wide range of areas, such as climate change, greenhouse gases, environmental management, health and safety, human rights, labor rights, community engagement, and biodiversity. To meet these requirements, successful completion of written and on-site audits conducted by a third-party certification body is necessary. In addition, certification requires successful validation from an expert panel comprising external professionals, as well as interviews with various external stakeholders such as civil societies, environmental organizations, and academia. Thanks to our commitment to ESG management activities and results based on our philosophy of corporate citizenship, which are embedded in our entire company processes and systems, POSCO was able to seamlessly handle the assessment. As a result, in October 2022, POSCO's Pohang and Gwangyang steelworks, which are ranked first and second globally in terms of single-site capacity, became the first steel facilities in Asia to obtain ResponsibleSteel site certification.

### Company Overview

<b>Company Name</b>	POSCO CO., LTD	<b>Business Description</b>	Ironmaking, steelmaking, and the production and sales of rolled steel products
<b>CEO</b>	Si-Woo Lee	<b>Product</b>	Hot rolled steel, thick plates, wire rods, cold rolled steel, hot-dip galvanized steel, electro-galvanized steel, electrical steel sheets, stainless steel, titanium, and more
<b>Headquarters</b>	6261, Donghaean-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do (Goedong-dong), Republic of Korea		
<b>Founded</b>	March 2, 2022(Corporate spin-off, Unlisted new company)	<b>Website</b>	www.posco.co.kr

### POSCO Overseas Subsidiaries



**13** production subsidiaries and **26** processing centers across **13** countries

\* Based on steel corporations where we have obtained management control

Product-related or management system-related certifications: ISO 9001- and 14001-certificates

Name and location of production site(s):

- Pohang Steelworks, 6262, Donghaean-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do, the Republic of Korea
- Gwangyang Steelworks, 20-26, Pokposarang-gil, Gwangyang-si, Jeollanam-do, the Republic of Korea

[Overview]

Name: POSCO CO., LTD, Establishment April 1, 1956

President Si-woo Lee

Website <https://www.posco.co.kr/>

Head office 6261, Donghaean-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do, the Republic of Korea

## Product information

Product name: Cold Rolled Steel

Product identification:

We operate two plants in Pohang and four in Gwangyang to produce cold rolled steel. Cold rolled steel's applications range from structural steel, home appliances including motor vehicles, washing machines and fridges to industrial uses.

- Structural Cold Rolled Steel: This material is particularly suitable for steel components that do not require further processing, such as drawing, but require high strength. Structural CR steel is widely used as a structural building material.

- **Weather Resistant Steel:** This type of steel with enhanced corrosion and atmospheric corrosion resistant properties through the addition of such special elements as P, Cu, and Cr is used in manufacturing containers, special automobiles and construction structures.
- **Sulfate Resistant Cold Rolled Steel:** Gases emitted by thermal power plants and boilers, where fossil fuels such as heavy oil and bituminous coal are used, contain Sulfur Oxides (SOx). Sulfur oxides encounter condensed moisture during recovery of waste heat from exhaust gases, creating a highly corrosive environment. Sulfate resistant steel is an excellent choice for desulfurization and smoke elimination facilities where sulfate corrosion is a real concern. Through the use of this steel, maintenance and repair costs can be controlled making compliance with environmental regulations.
- **Commercial Cold Rolled Steel:** This type of steel is appropriate for manufacturing ordinary objects like refrigerator doors, drum containers and furniture as well as automobile parts such as oil filters.
- **HSS (High Strength Cold Rolled Steel) (up to 60kg class):** High strength steel is used in products requiring a material with higher strength than traditional cold rolled steel can provide. If machinability is also required along with strength, HSS is the right choice.
- **Cold Rolled Steel for Welding Rod:** Cold rolled steel for welding rod is used to produce welding rod for ordinary applications, also for ultra-low temperature applications such as LNG and LPG tanks, high Mn content thick plates, and marine structural components.
- **Cold Rolled Steel for Porcelain Enameling:** This product features desirable properties for enameled porcelain manufacturing such as heat resistance, corrosion resistance, and gloss surface, as well as traditional steel virtues (impact resistance, high ductility and formability). It is used for components of home appliances, construction materials, kitchen appliances and bathtubs, etc.

Grade	POSCO	National Standards			
		KS	JIS	ASTM	EN
Commercial Quality	CSP1 CSP1D	KS-SPCC	JS-SPCC	A1008 CS	EN-DC01, EN-DC03
Drawing Quality	CSP2	KS-SPCD	JS-SPCD	A1008 DS	EN-DC04
Deep Drawing Quality	CSP3(N)	KS-SPCE	JS-SPCE	A1008 DDS	EN-DC05
Extra Deep Drawing Quality	CSP3E, CSP3X, CSP3Z	KS-SPCF, KS-SPCG	JS-SPCF, JS-SPCG	A1008 EDDS	EN-DC06, EN-DC07
Test piece	Rolling direction KS 5	Rolling direction KS 5	Rolling direction JIS 5	Rolling direction ASTM	Perpendicular to Rolling direction EN

**Product description:**

Cold rolled steel sheet (CR) features a fine surface and excellent workability. It is used for a variety of products ranging from home appliances such as refrigerators and washing machines to industrial

machinery, architectural components and automobiles. Cold rolled steel is an indispensable material in our modern society.

UN CPC code: 41221

Geographical scope: The product is produced at the Pohang Steelworks (6262, Donghaean-ro, Nam-gu, Pohang-si, Gyeongsangbuk-do, the Republic of Korea) and Gwangyang Steelworks(20-26, Pokposarang-gil, Gwangyang-si, Jeollanam-do, the Republic of Korea) located in Rep. of Korea. Product use was excluded from the scope of environmental impact calculations in this study. For the end of life stage, the environmental impact was calculated based on product disposal statistics from the World Steel Association, 2020.

## **LCA information**

Functional unit / declared unit: 1 metric ton (1,000 kg)

Reference service life: Not applicable

Time representativeness: The production data are from 2023, and the database data are from 2024 i.e., no data is older than 10 years.

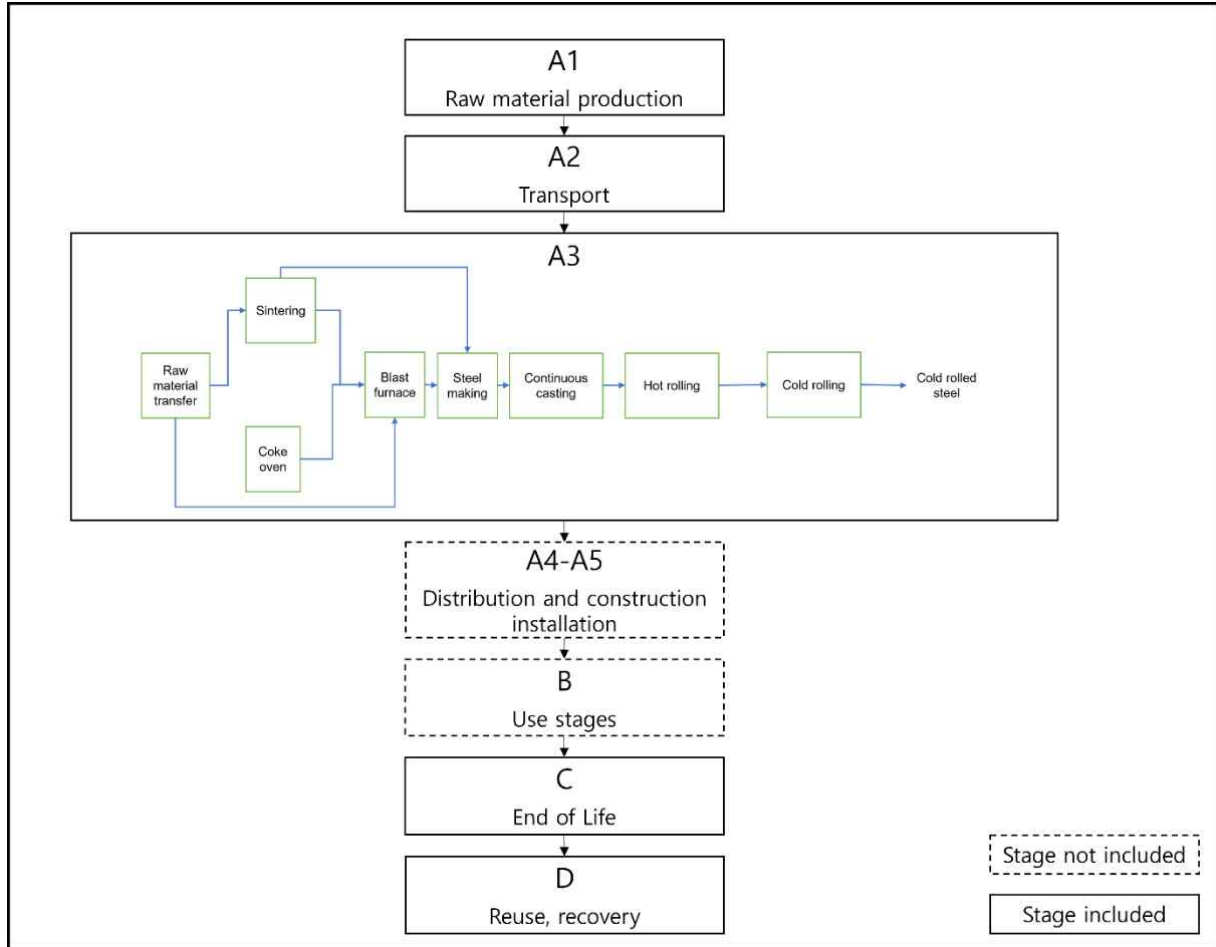
Database(s) and LCA software used: Database used is mainly Ecoinvent 3.10. The LCA software used is SimaPro 9.6.0.1

Description of system boundaries:

EPD scope: a (Cradle to gate with modules C1-C4 and module D(A1-A3+C+D))

LCA is made in "Cradle to gate (A1–A3)" form. All major materials, production energy use and waste are included for product stages A1, A2 and A3. The product is a hot rolled steel. After the customer purchases the product, it is manufactured as a construction product and then applied to the construction site, so, POSCO does not have control over subsequent processes, and the usage data for each sector to which certified products are applied is not managed. Therefore, the installation (A4-A5) and use(B1-B7) are not the responsibility of POSCO. All life cycle impacts are included, see flowchart below. The following information describes the scenarios in the different modules of the EPD. All major raw materials and all the essential energy are included. All raw material and energy flows were included in the environmental impact assessment.

System diagram:



**More information:** Electricity, waste and ancillary materials in production are calculated as an average weight per produced tonne of all products using yearly production data and the rate for 2023. For manufacturing processes, the specific country mix of electricity is considered. For secondary data on materials' flow information has been gathered from the Ecoinvent 3.10 database. In addition, the allocation is made following the provisions of PCR 2019:14 Construction products (EN 15804:A2) (1.3.4). The transportation of the material is considered in this analysis. The polluter pays and modularity principles are followed. The processes excluded from analysis are environmental impacts from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process and personnel-related impacts.

In this study, environmental impacts were calculated for all inputs of steel plate. In other words, 100% of inflow was considered, and proxy data was not used.

	Product stage			Construction process stage		Use stage						End of life stage			Resource recovery stage	
	Material supply	Manufacturing	Finishing	Construction	Installation	Transport	Storage	Use	Maintenance	Repair	Energy use	Water use	Demolition	Processing		
																Recovery-Recycling

Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	RoW	RoW	KR	ND	ND	ND	ND	ND	ND	ND	ND	ND	GLO	RER	RoW	RoW	RoW
Specific data used	> 90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Relevant*			-	-	-	-	-	-	-	-	-	-	-	-	-	-

\* The reported environmental impact is a weighted average based on product production by factory. (the difference of 3.46% between the two steelworks)

- From Pohang steelwork: 2.60E+03 kgCO<sub>2</sub>-eq./ton
- From Gwangyang steelwork: 2.51E+03 kgCO<sub>2</sub>-eq./ton

X = declared stage, ND = Not Declared

#### - Raw material supply (A1)

The materials that are needed to produce 'Cold rolled steel' products are iron ore and cokes from lignite. Since Pohang and Gwangyang factories operate a steel making process.

#### - Transport (A2)

Iron ore, lignite and limestone are transported from Australia, Brazil, Canada, Republic of South Africa, Kingdom of Bahrain, Chile, Russia, Republic of Mozambique, U.S.A, Indonesia, Peru, China and Rep. of Korea.

#### - Manufacturing (A3)

The processes that are included in the manufacturing phase are the pig iron process, , of which energy consumption, auxiliary material consumption, waste and gaseous emissions have been modeled.

The manufacturing process of module A3 is Rep. of Korea, and the environmental impact of electricity consumption from national electricity grid was calculated using the "Electricity, medium voltage {KR} | market for electricity, medium voltage | Cut-off" LCI database of Ecoinvent v3.10. Its climate impact is 6.53E-01 kgCO<sub>2</sub>-eq./kWh of GWP<sub>total</sub>. (GWP<sub>fossil</sub> = 6.52E-01 kgCO<sub>2</sub>-eq./kWh, GWP<sub>biogenic</sub> = 2.75E-04 kgCO<sub>2</sub>-eq./kWh, GWP<sub>luluc</sub> = 3.76E-04 kgCO<sub>2</sub>-eq./kWh)

The environmental impact of electricity from off-gas power plant in each steelwork was assessed using primary data of the off-gas power plants.

Climate change impact of electricity from off-gas power plant of Pohang steelwork is 2.04E+00 kgCO<sub>2</sub>-eq./kWh of GWP<sub>total</sub>. (GWP<sub>fossil</sub> = 2.04E+00 kgCO<sub>2</sub>-eq./kWh, GWP<sub>biogenic</sub> = 6.33E-06 kgCO<sub>2</sub>-eq./kWh, GWP<sub>luluc</sub> = 6.24E-06 kgCO<sub>2</sub>-eq./kWh)



Climate change impact of electricity from off-gas power plant of Gwangyang steelwork is  $1.73E+00$  kgCO<sub>2</sub>-eq./kWh of GWP<sub>total</sub>. (GWP<sub>fossil</sub> =  $1.73E+00$  kgCO<sub>2</sub>-eq./kWh, GWP<sub>biogenic</sub> =  $1.07E-05$  kgCO<sub>2</sub>-eq./kWh, GWP<sub>luluc</sub> =  $1.03E-05$  kgCO<sub>2</sub>-eq./kWh)

#### - De-construction demolition (C1)

Energy consumption of a demolition process is on average 10kWh/m<sup>2</sup> (Bozdag, Ö & Seçer, M. 2007). The average mass of a reinforced concrete building is about 1000 kg/m<sup>2</sup>. Therefore, energy consumption during demolition is 0,01 kWh/kg. A conservative assumption has been made that the energy consumed during demolition of a steel building is the same as that of a concrete building. The source of energy is diesel fuel used by work machines. It is assumed that 100% of the waste is collected and transported to the waste treatment centre.

#### - Transport (C2)

Transportation distance to treatment is assumed as 300 km and the transportation method is assumed to be lorry.

#### - Waste processing (C3)

Approximately 95% of steel is assumed to be recycled based on World Steel Association, 2020.

#### - Disposal (C4)

It is assumed that the remaining 5 % of steel is taken to landfill for final disposal.

#### - Reuse-Recovery-Recycling-potential (D)

Due to the recycling process, the end-of-life product is converted into recycled steel. In module C, it is assumed that 95% of the product is recycled, so 0.950 tons per declared unit is recycled. The target product of this report has a secondary material input of 0 tons at module A. Therefore, the net recycling amount of 0.95 tons.

## Content information

Product components	Weight, %	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Iron ore	62.4%		
Lignite	19.9%		
Limestone	6.9%		
Iron scrap	3.3%	100%	
Lime	2.8%		
Processing raw material(Steelmake)	2.4%		
Dolomite	0.8%		
Others	1.5%		
TOTAL	100%		
Packaging materials	Weight, %	Weight-% (versus the product)	Weight biogenic carbon, kg C/kg
OPP(Package)	0.7%		
Steel(Package)	87.2%		
Corrugated board(Package)	8.9%		
HDPE(Package)	0.9%		
LDPE(Package)	0.7%		
Rubber(Package)	0.4%		
PET(Package)	0.0%		
PP(Package)	1.1%		
TOTAL	100%		

## Results of the environmental performance indicators

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Results per functional or declared unit							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
GWP-fossil	kg CO <sub>2</sub> eq.	2.52E+03	6.21E+01	3.05E+01	5.90E+01	3.58E+00	-1.59E+03
GWP-biogenic	kg CO <sub>2</sub> eq.	2.04E+00	1.43E-02	1.16E-02	1.35E-02	4.32E-03	6.90E-01
GWP-luluc	kg CO <sub>2</sub> eq.	3.15E-01	6.99E-03	1.56E-02	6.64E-03	1.00E-03	-3.40E-02
GWP-total	kg CO <sub>2</sub> eq.	2.52E+03	6.21E+01	3.05E+01	5.90E+01	3.59E+00	-1.58E+03
ODP	kg CFC 11 eq.	8.20E-06	9.88E-07	5.18E-07	9.39E-07	6.13E-08	-3.60E-12
AP	mol H <sup>+</sup> eq.	7.25E+00	5.76E-01	8.35E-02	5.47E-01	3.20E-02	-3.53E+00
EP-freshwater	kg P eq.	1.41E+00	1.91E-03	2.56E-03	1.81E-03	1.43E-04	-2.99E-04
EP-marine	kg N eq.	2.32E+00	2.67E-01	2.20E-02	2.54E-01	1.46E-02	-6.22E-01
EP-terrestrial	mol N eq.	1.76E+01	2.90E+00	2.27E-01	2.76E+00	1.58E-01	-5.46E+00
POCP	kg NMVOC eq.	4.95E+00	8.59E-01	1.20E-01	8.16E-01	4.75E-02	-2.52E+00
ADP-minerals&metals*	kg Sb eq.	1.64E-03	2.17E-05	8.54E-05	2.06E-05	2.03E-06	-4.10E-03
ADP-fossil*	MJ	1.45E+04	8.14E+02	4.60E+02	7.73E+02	5.07E+01	-1.51E+04
WDP*	m <sup>3</sup>	6.69E+01	1.75E+00	2.34E+00	1.67E+00	4.30E-01	-1.97E+04
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption						

\* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

## Additional mandatory and voluntary impact category indicators

Results per functional or declared unit							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
GWP-GHG <sup>1</sup>	kg CO <sub>2</sub> eq.	2.52E+03	6.21E+01	3.05E+01	5.90E+01	3.58E+00	-1.59E+03

*Additional voluntary indicators e.g. the voluntary indicators from EN 15804 or the global indicators according to ISO 21930:2017*

## Resource use indicators

Results per functional or declared unit							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	1.55E+02	3.70E+00	4.39E+00	3.51E+00	2.68E-01	4.86E+01
PERM	MJ	1.02E+02	9.30E-01	1.44E+00	8.83E-01	7.81E-02	-5.08E-01
PERT	MJ	2.58E+02	4.63E+00	5.82E+00	4.40E+00	3.46E-01	4.80E+01
PENRE	MJ	1.54E+04	8.65E+02	4.89E+02	8.22E+02	5.39E+01	-1.58E+04
PENRM	MJ	4.55E-01	6.78E-03	1.50E-02	6.44E-03	3.70E-03	0.00E+00
PENRT	MJ	1.54E+04	8.65E+02	4.89E+02	8.22E+02	5.39E+01	-1.58E+04
SM	kg	7.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m <sup>3</sup>	1.83E+00	6.39E-02	7.34E-02	6.07E-02	1.17E-02	-6.90E+00
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

<sup>1</sup> This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO<sub>2</sub> is set to zero.

## Waste indicators

Results per functional or declared unit							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.44E-02	5.47E-03	2.90E-03	5.20E-03	3.29E-04	0.00E+00
Non-hazardous waste disposed	kg	2.04E+01	1.16E+00	4.00E+01	1.11E+00	4.99E+01	0.00E+00
Radioactive waste disposed	kg	6.49E-03	8.91E-05	1.00E-04	8.47E-05	6.53E-06	0.00E+00

## Output flow indicators

Results per functional or declared unit							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	0.00E+00	9.50E+02	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

## Additional environmental information

### Regulated Hazardous Substance

- The base material of the steel plate is iron. No substances required to be reported as hazardous are associated with the production of this product.

### Dangerous Substance

- All chemicals used in the Pohang and Gwangyang steelworks are managed in accordance with the Korean Toxic Chemicals Control Act. Substances listed on the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemicals Agency (ECHA) are not contained in the steel in declarable quantities.

## **Additional social and economic information**

Not applicable

## **Information related to Sector EPD**

This is an individual EPD.

## References

General Programme Instructions of the International EPD® System. Version 4.0.

PCR 2019:14 Construction products (EN 15804:A2) (1.3.4)

EN 15804:2012+A2:2019. Sustainability of construction works – Environmental product declarations –

ISO 14025:2006. Environmental labels and declarations — Type III environmental declarations —

Principles and procedures

ISO 14040:2006. Environmental management – Life cycle assessment – Principles and framework

ISO 14044:2006. Environmental management – Life cycle assessment – Requirements and guidelines

LCA software SimaPro 9.6.0.1

