Green Tomorrow begins with POSCO
- POSCO's Carbon Neutral Strategy -

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### World · Government

123 countries declare 2050 carbon neutrality, accelerate 2030 carbon emission reduction

- **Governments** (123 countries), including Korea, EU and the US, declared 2050 carbon neutrality in accordance with UN IPCC* 1.5℃ recommendation
  - * Intergovernmental Panel on Climate Change
- **Emphasis on corporate participation and role in carbon neutrality such as COP26**
  - ** Conference Of the Parties 26**
- **Korea, raised the 2030 reduction target** (Nov. 2021)
  - Compared to 2018, △26.3% → △40.0%

### Investor · Customer

Investors and customers directly request to produce and supply low-carbon steel products

- **TCFD**, establishment of long-term reduction target and demand for implementation plan according to 1.5℃ scenario
  - * Taskforce on Climate-related Financial Disclosures
- **BlackRock**, one of the boards recognizes climate change risks and emphasizes reflection in management strategies
- **Customers urged us to reduce CO₂ much rapidly**
  - 12 → 39 Companies

Climate change became a key dimension of ESG considerations for businesses.

POSCO believe that “a company must grow in harmony with society to be sustainable”.

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*POSCO 2050 Carbon Neutrality Declaration (11th Dec. 2020)*
POSCO’s Carbon Neutral Strategy

History of establishing and rolling of POSCO carbon neutral strategy

2021 Roadmap Establishment toward Carbon Neutrality
- Scenario planning for facility improvement and transition to achieve 2030 NDC and carbon neutrality by 2050

2022 Rolling
- Detailed measures to achieve 2030 NDC
- Production system of low carbon steel up to 10Mt/yr
- Two track route for carbon neutral
  ① HyREX, hydrogen steelmaking
  ② EAF with scrap and DRI produced overseas

2023 Rolling
- Targeting 2035 carbon emission reduction to 30%
  - Strengthening bridge technologies & Commercialization of HyREX
- 2050 carbon neutrality with CCUS

POSCO Group CEO Jeong-Woo Choi announced challenging carbon emission reduction target during keynote speech
[Global Steel Dynamics Forum, 27th June 2023]
POS CO’s Carbon Neutral Roadmap

2017-2019  2030  2035  2040  2050
(Base) △10%+α  △30%  △50%  Net-Zero

Strengthening competency of CO₂ reduction by 2035

- CO₂ reduction in conventional BF-BOF
- Optimized EAF operation with BF-BOF route
- Completion of HyREX commercialization
- Commencement of replacement of BF with HyREX

Achieving economical and sustainable Carbon Neutrality by 2050

Route 1  HyREX
Route 2  EAF + HBI/Scrap
Route 3  Low carbon BF/FINEX + CCUS

Building Infrastructure for Carbon Neutrality

- Raw materials supply for low carbon steel production
- Economical electrical energy supply
- Massive hydrogen supply with low price
- Leverage of POSCO’s own eco-friendly brand in marketing
02 Low-carbon & Carbon-free Ironmaking Process

**BF-based Low-carbon Technology**

- Bridge technology is required to reduce CO\(_2\) emission with existing BF-based steelmaking process

- High Reducibility, Low Gangue compared to other ores (Basic Pellets, Semi-basic Pellets, etc)

- Energy saving for iron ore reduction in BF (HBI, DRI, LRI, Scrap, etc)

- Replacement of reduction agent from C to H\(_2\) (LNG, COG, H\(_2\), etc)

- AI-based operation process (Data-based operation prediction and automatic control, etc.)

※ selected as Lighthouse factory(2019)
Low-carbon & Carbon-free Ironmaking Process

Basic Oxygen Furnace

‘Oxygen Top & Bottom Blowing Converter’ can secure additional heat sources and increase scrap usage

Top and Bottom Blowing Converter

<table>
<thead>
<tr>
<th>Oxygen blowing location</th>
<th>Top blowing converter</th>
<th>Top and bottom blowing converter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post combustion ratio(%)</td>
<td>5~10</td>
<td>25~30</td>
</tr>
</tbody>
</table>

* [Primary combustion]  
[C] + ½ O$_2$ → CO : + 2,200 kcal/kg$_C$

[Post combustion]    
CO + ½ O$_2$ → CO$_2$ : + 5,630 kcal/kg$_C$

[Comparison between Top Blowing Converter and Top & Bottom Blowing Converter]
Low-carbon Steel Production using Electric Arc Furnace

- **EAF Steelmaking Process:** Mixing with Hot Metal (①) or Transferring directly to Secondary Refining (②)

Diagram:
- BF-BOF
- EAF
- BF
- BOF
- HMPS
- Secondary Refining

Steps:
1. Mixing with Hot Metal
2. Molten Steel
CCUS (Carbon Capture Utilization & Storage)

FINEX®

Fine ore → Off-gas CO, CO₂, H₂ → PSA → CO₂ → Power

CCU

Cryogenic
Liquefied carbonic acid
CO₂+H₂ Chemical
Recycled in Coke oven
Reused in BOF

CCS

Domestic CCS
Oversea CCS

Pure O₂

Oversea CCS
Pohang
Ulsan
Busan
58km
HyREX Process using 100% Hydrogen

*HyREX: Hydrogen Reduction

Fe₂O₃ + 3H₂ → 2Fe + 3H₂O

H₂ Recycling

Sinter feed

Multi-stage Fluidized Bed Reactor

H₂

Hydrogen

Hydrogen Heating

Hot DRI

ESF

LD Converter

Molten Steel

Product

Molten Metal

Slag

Cement Industry

HyREX: Process using 100% Hydrogen

Low-carbon & Carbon-free Ironmaking Process
Roadmap of HyREX Development

Demonstration by 2030, hereafter Stepwise Replacement of BF with HyREX

- **2022:** Lab Scale Test
- **2024:** Demonstration Scale Engineering
- **2026:** Demonstration Scale Construction
- **2028:** Demonstration Scale Test Operation
- **2030:** Commercial Plant Construction

**Present:**
- Fluidized Bed Reactor: 50 kg/batch
- Electric Smelting Furnace: 1.0 t/hr (Test will start in 2024)

**Future:**
- Demonstration Plant: 0.3 Mt/y (Engineering in progress)
- Commercial Plant: 1.0 Mt/y (Transition of FINEX to HyREX)
HyREX Demo Plant Engineering
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Launching Eco-friendly and High-performance Brand

Carbon Neutral Master Brand, 『Greenate』 (Nov. 2022)
- Represents POSCO's strategic direction, efforts and achievements

Greenate is a portmanteau of ‘green’ and ‘-ate’

※ POSCO Eco-friendly brands (Steel sub-brand)
  2019 INNOVILT  2020 eAutopos  2021 Greenable

- Greenate STEEL
  Low carbon steel products

- Greenate TECH&PROCESS
  Low carbon steel technology/process

- Greenate INFRA
  Infrastructure for realization of steel products/technology/process

Launching a mass-balanced carbon reduction brand, 『Green Certified Steel』 (Jun. 2023)
- The most widely used international standard and verification came from DNV UK, one of the world's top three certification bodies
- POSCO was recognized for cutting certain amount of CO₂ emissions from January to August last year by raising the use of pellets in its blast furnaces and scrap metal in its converters.
Response to Customer's Low-carbon Demand

☑️ Low-carbon requirements of major customers
   ☑️ IT industry: all STS products with 100% renewable energy (’23), and increased scrap usage ratio
   ☑️ Automobile industry: Produced with 100% renewable energy GI products (’30)
   ☑️ Energy industry: 50% reduction in CO₂ emissions (’32), carbon neutrality (’40)

☑️ Operation of production system that meets customer needs (~’30)

<table>
<thead>
<tr>
<th></th>
<th>2022</th>
<th>2030</th>
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<tbody>
<tr>
<td>I</td>
<td>Increased scrap usage ratio (%)</td>
<td>-</td>
</tr>
<tr>
<td>II</td>
<td>Reduction of carbon unit (tCO₂/t-s)</td>
<td>2.0</td>
</tr>
<tr>
<td>III</td>
<td>RE100 product production (GWh)</td>
<td>0.1</td>
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* Hot Metal Ratio
** Renewable Energy Certificate

[~2050] Green steel production will be achieved via expansion of investment in renewable energy, and 7 million tons of hydrogen will be secured through domestic/overseas production and purchase.

POSCO will continue to respond actively to meet market needs for eco-friendly product.
Eco-friendly Industries utilizing Steel as a Core Material

7 Major Industries and Representative Products

- **Automobile**: Drive Motor NO, Battery Case, Giga Steel
- **Offshore Wind Power**: Structure (Tower, Substructure)
- **Solar Energy**: High Corrosion-Resistance Steel Sheet (PosMAC)
- **LNG**: High Pressure Vessel Piping
- **Hydrogen**: High Mn Steel for LNG Storage Tank
- **Construction**: Structural Steel
- **Home Appliance**: Graphitic Steel (PosGRAM)
POSCO's Eco-friendly Brands and Sales Target

- Steel for Eco-friendly Vehicle
- Eco-friendly Steel Building Materials
- Steel for Eco-friendly Energy

Sales Target:
- 2022: 6.4 Mt
- 2025: 8.5 Mt
- 2030: 12.0 Mt
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Establish and redeem business and technological strategies to keep commitment to carbon neutrality by 2050. And recently announced a goal of increasing the pace of CO$_2$ emission reduction.

30% reduction by 2035, 50% reduction by 2040, and carbon neutrality by 2050

Introduce low carbon BF-BOF and EAF, and develop hydrogen base steelmaking, HyREX. Simultaneously build supply chain of iron carriers and infrastructure of hydrogen and energy.

Response to customers' low carbon demand, POSCO moves to supply 10Mt steel of 30% lower carbon intensity by 2030.

Launch of carbon neutral master brand, Greenate™ to represent the strategic direction, efforts and achievements, and will supply high grade steel to the environmentally friendly Industry utilizing steel as a core material.

POSCO is operating the eco-friendly product brands such as INNOVILT®, eAutopos®, and Greenable®. POSCO aims to increase the eco-friendly product sales from 6.4Mt to 12Mt by 2030.
Thank you for your kind attention