



# Nippon Steel's Environmental Initiatives

Dec, 2019

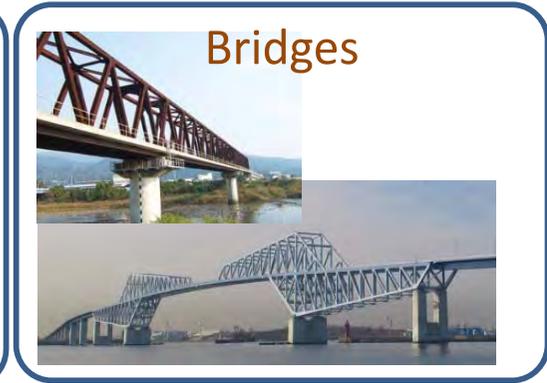
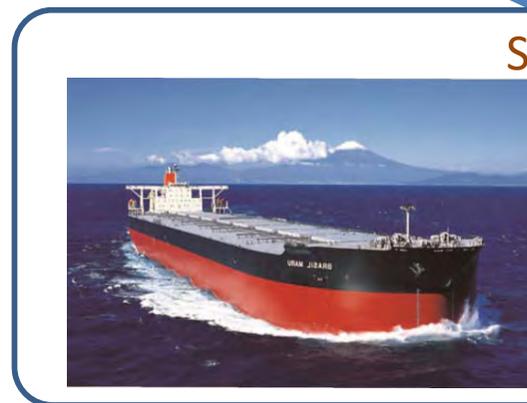
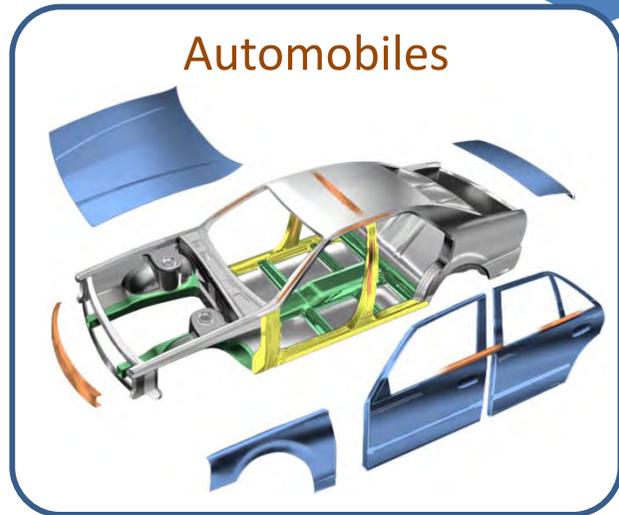
**NIPPON STEEL CORPORATION**

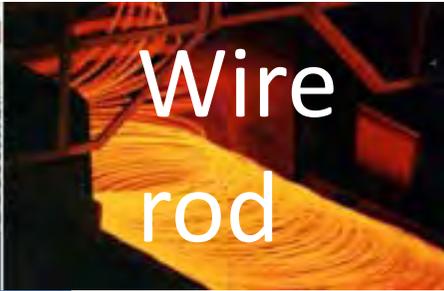
# Agenda

- **Steel and Human Society** p.3
- **Environmental Management** p.10
- **Coping with Climate Change** p.15
- **Contributing to a Circular Economy** p.33
- **Promotion of Environmental Risk Management** p.39
- **Initiatives on Conservation of Biodiversity** p.43
- **Innovative Technology Development** p.48
- **Disclosure under TCFD** p.56
- **Life Cycle Assessment** p.61
- **ESG Topics** p.68

# Steel and Human Society

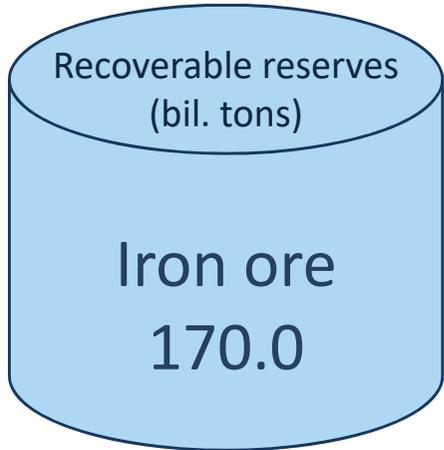
# Steel Products and Application





# Steel is an Essential Material

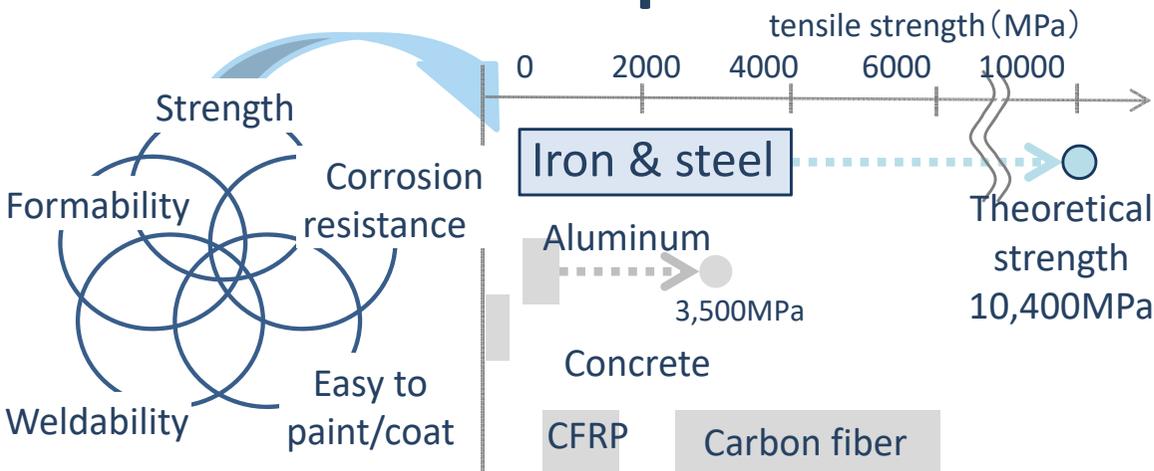
## Abundant resource



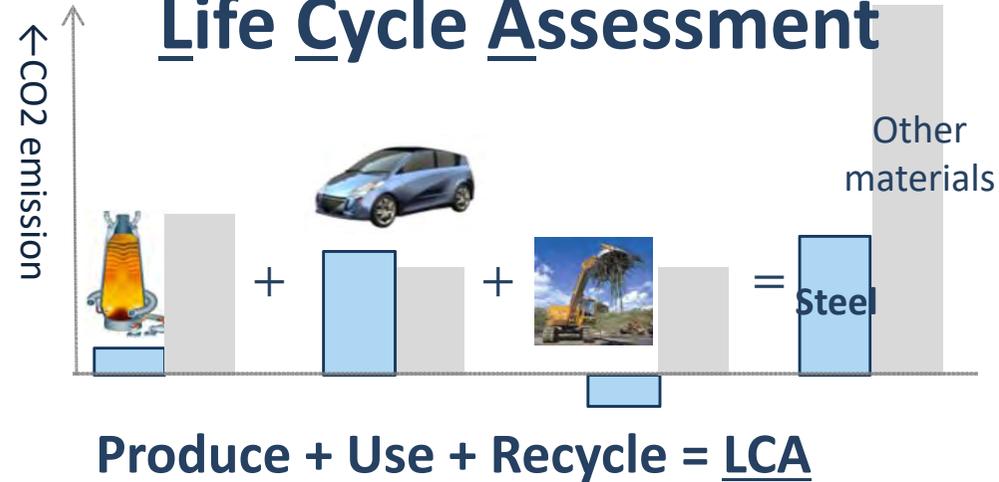
## Endless recyclability into all kinds of steel products



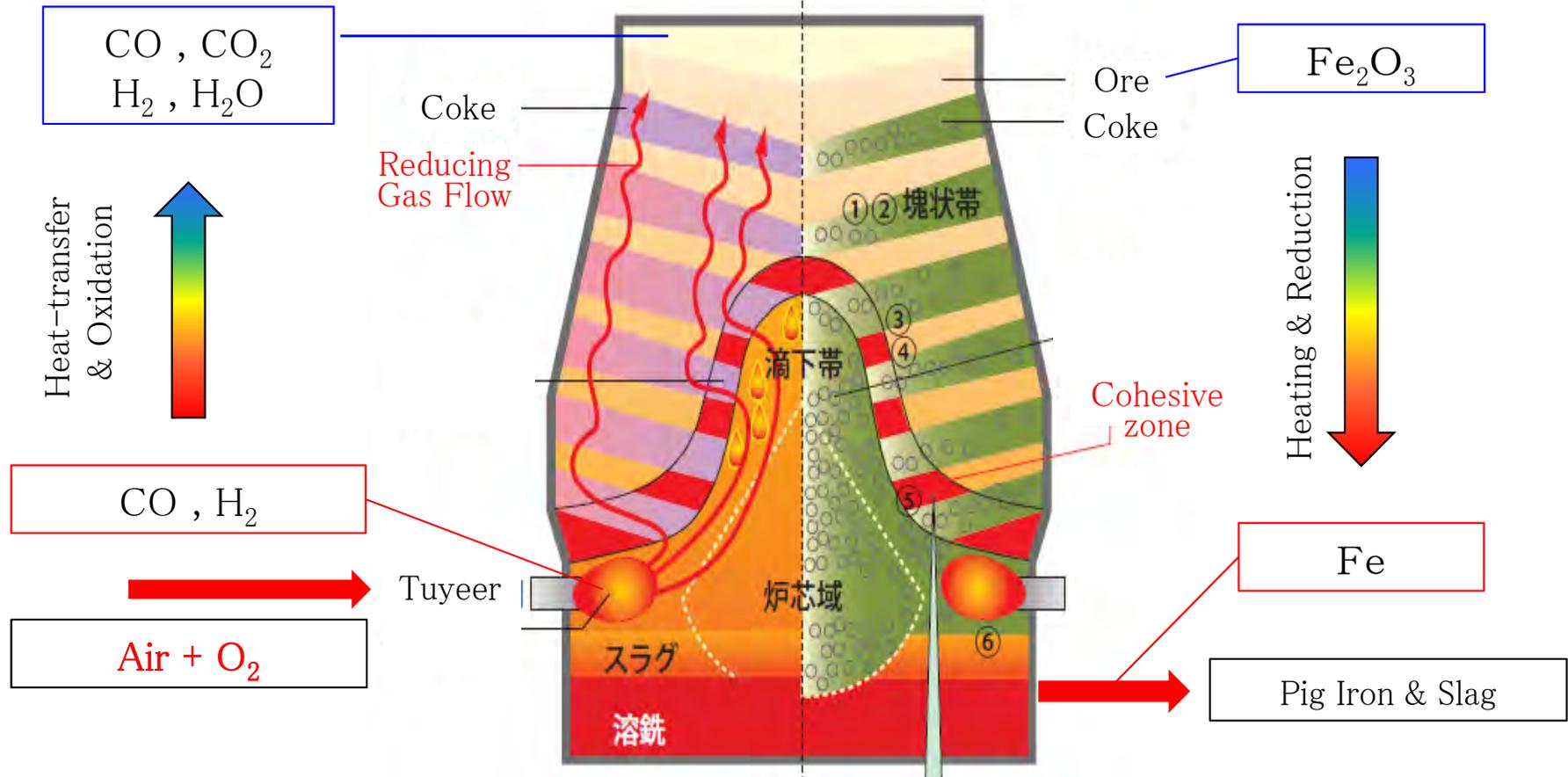
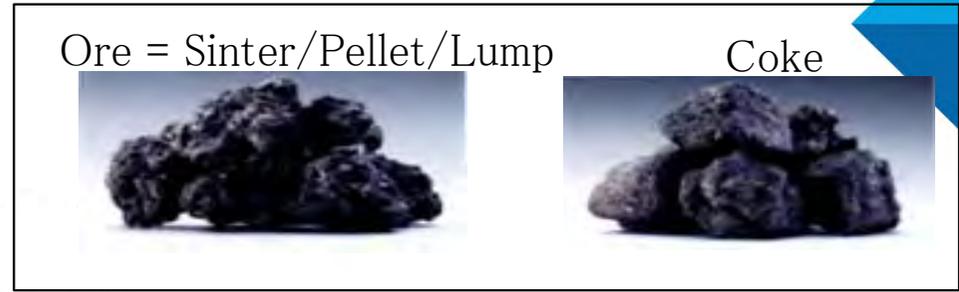
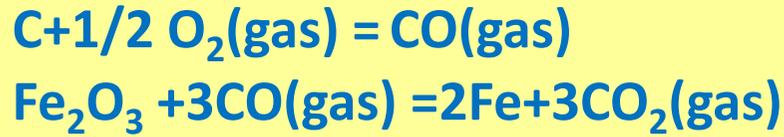
## Diverse properties and further potential



## Eco-friendly in Life Cycle Assessment



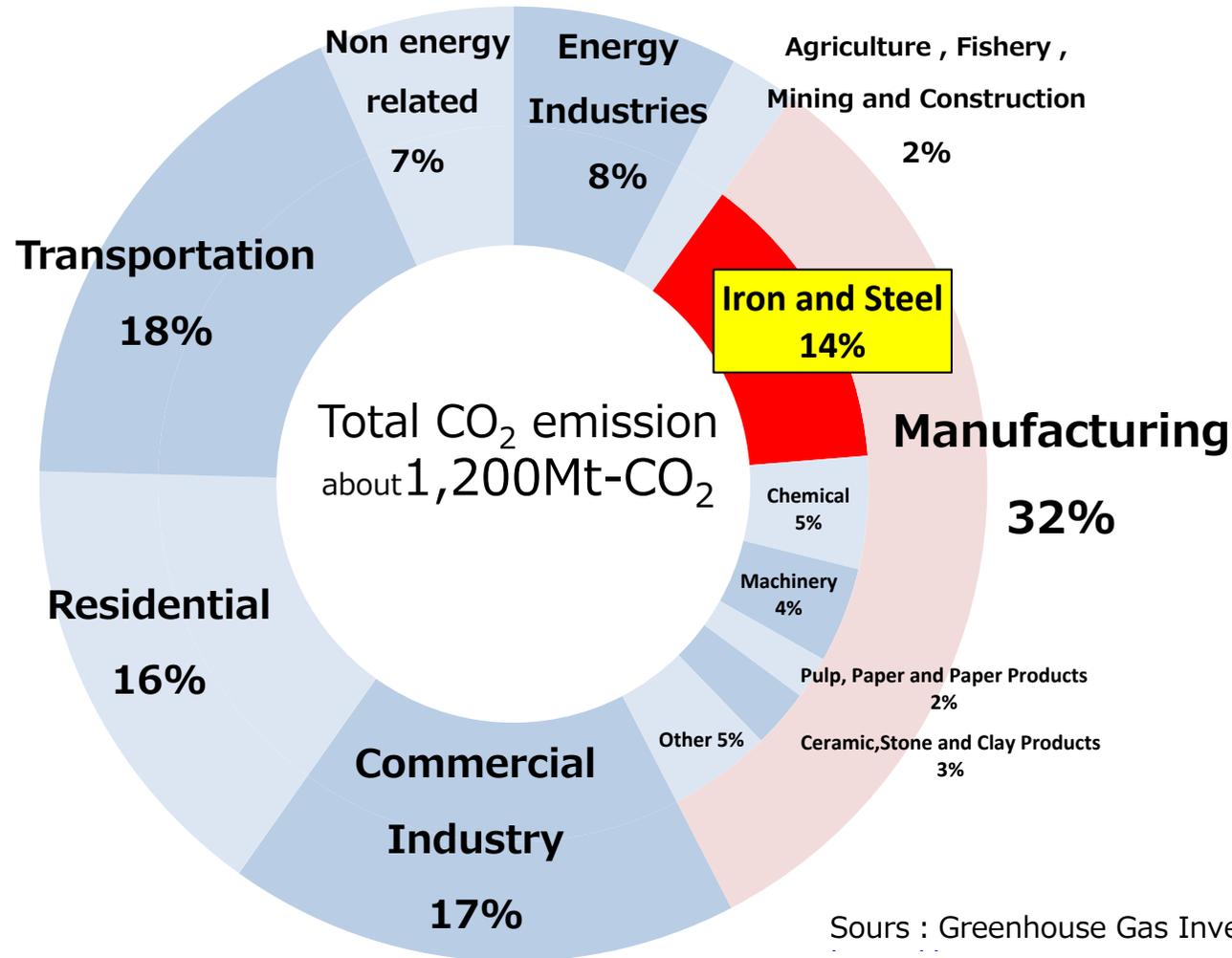
# Manufacturing process of steel (Blast furnace)



Coke is essential material as reducing agent to produce steel .

# CO<sub>2</sub> emissions in Japan in 2017

- Steel industry accounts for 14% of CO<sub>2</sub> emissions in Japan.
- CO<sub>2</sub> emission from industrial sector has been decreasing, while that of commercial and residential sector is increasing year by year.



# Steel and SDGs

## NIPPON STEEL contributes SDGs through Steelmaking



Paris Agreement

Factors promoting steel demand

# Environmental Management

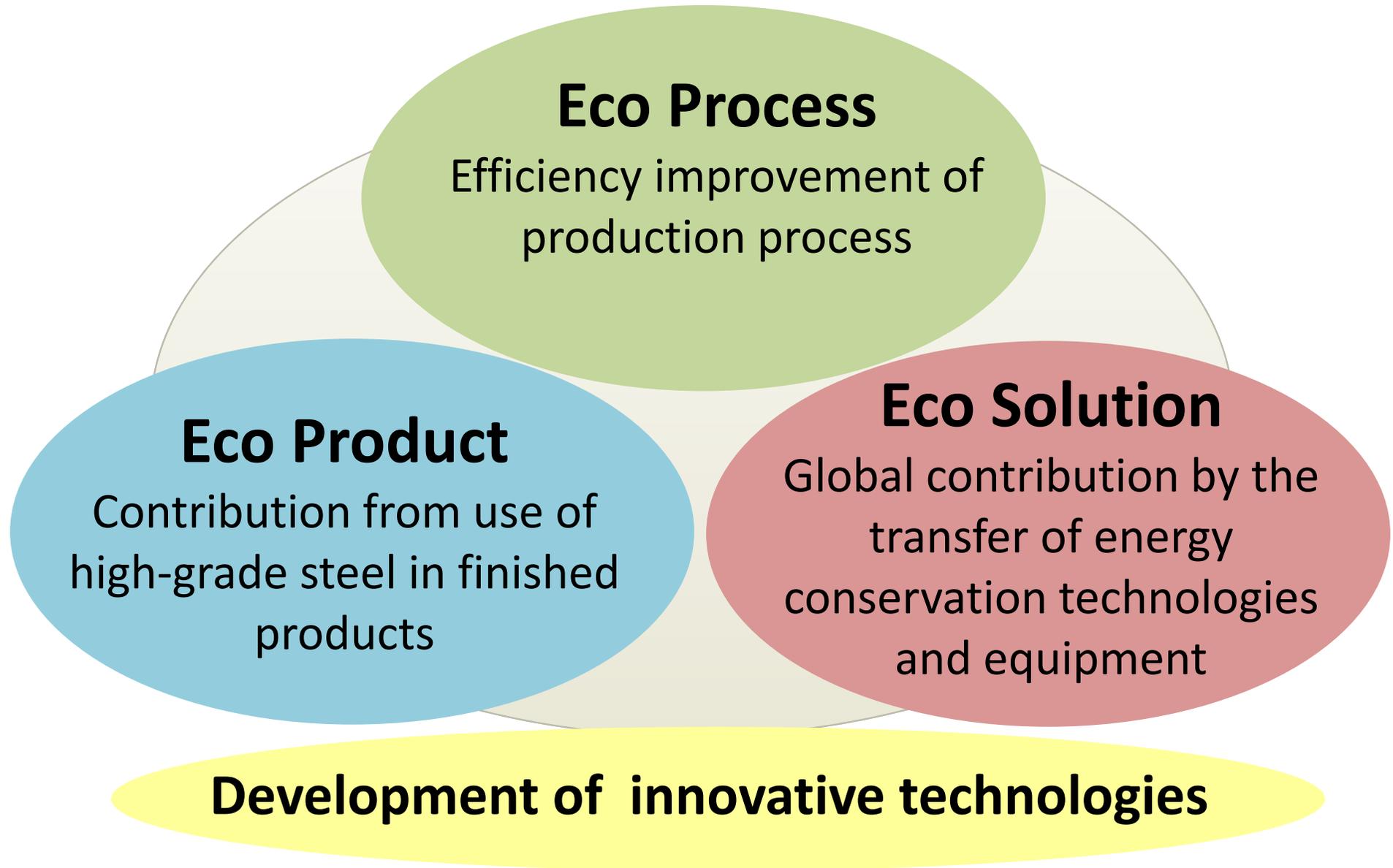
# Basic Environmental Policy

Nippon Steel is a corporation whose business activities exert a large influence on the environment. For this reason, we see comprehensive “environmental management” throughout the group companies as an integral part of our mission, and we establish “Basic Environmental Policy”.

## Basic Environmental Policy

Under the principle of “Ecological Management,” Nippon Steel is committed to contributing to the creation of an environmental-preservation oriented society with lower environmental impact. For this purpose, the company will conduct business activities based on the viewpoint of **environmental preservation in local communities**, which includes the maintenance and improvement of good living environments and the promotion of reduction and recycling of waste. The company will also **address challenges on a global scale** including response to issues of global warming as well as the maintenance and improvement of biological diversity.

- 1.Reducing environmental impacts at every stage of operations (Eco Process)
- 2.Offering of environment-oriented products (Eco Products)
- 3.Proposing environmental preservation solutions from a global perspective (Eco Solution)
- 4.Development of innovative technologies
- 5.Development of a rich environment
- 6.Promotion of environmental relations activities



# Three ecos to contribute to SDGs

Three ecos and innovative technology development

Raising challenges from the viewpoint of SDGs

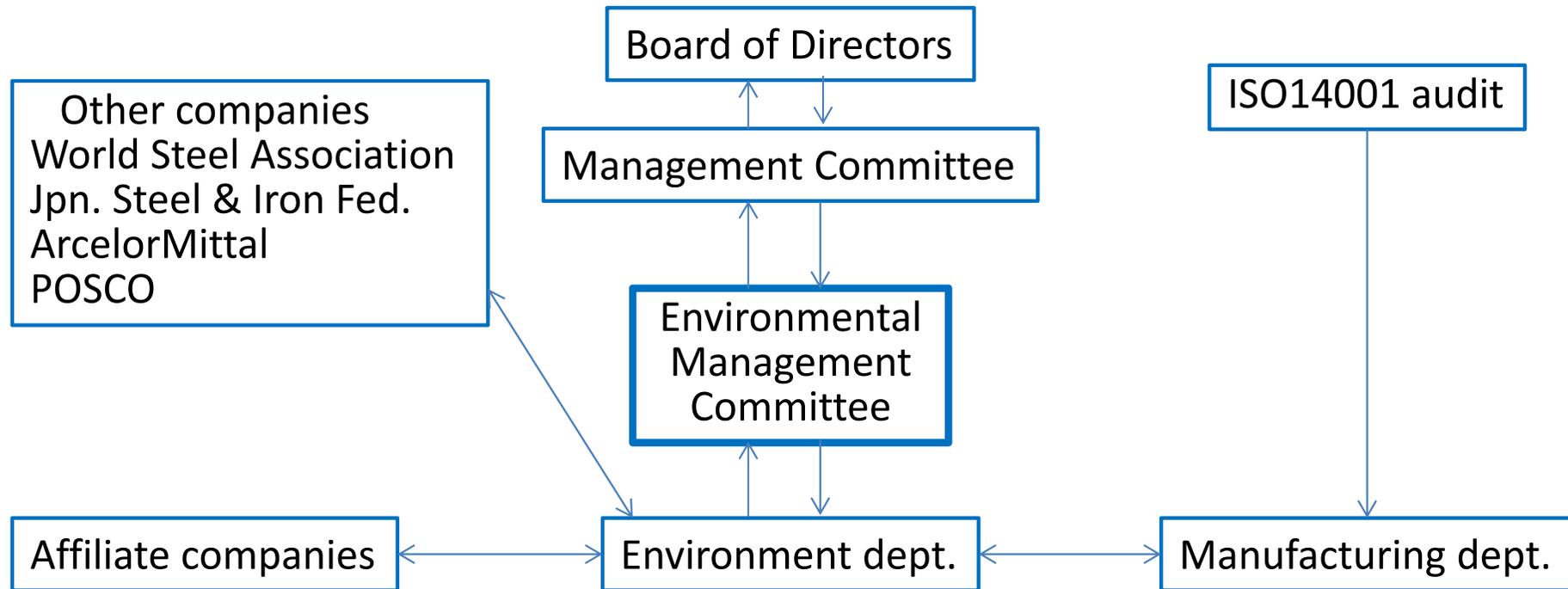


2020 Mid-Term Environmental Management Plan

Sustainable Development Goals (SDGs)



# Corporate governance and internal control system 14

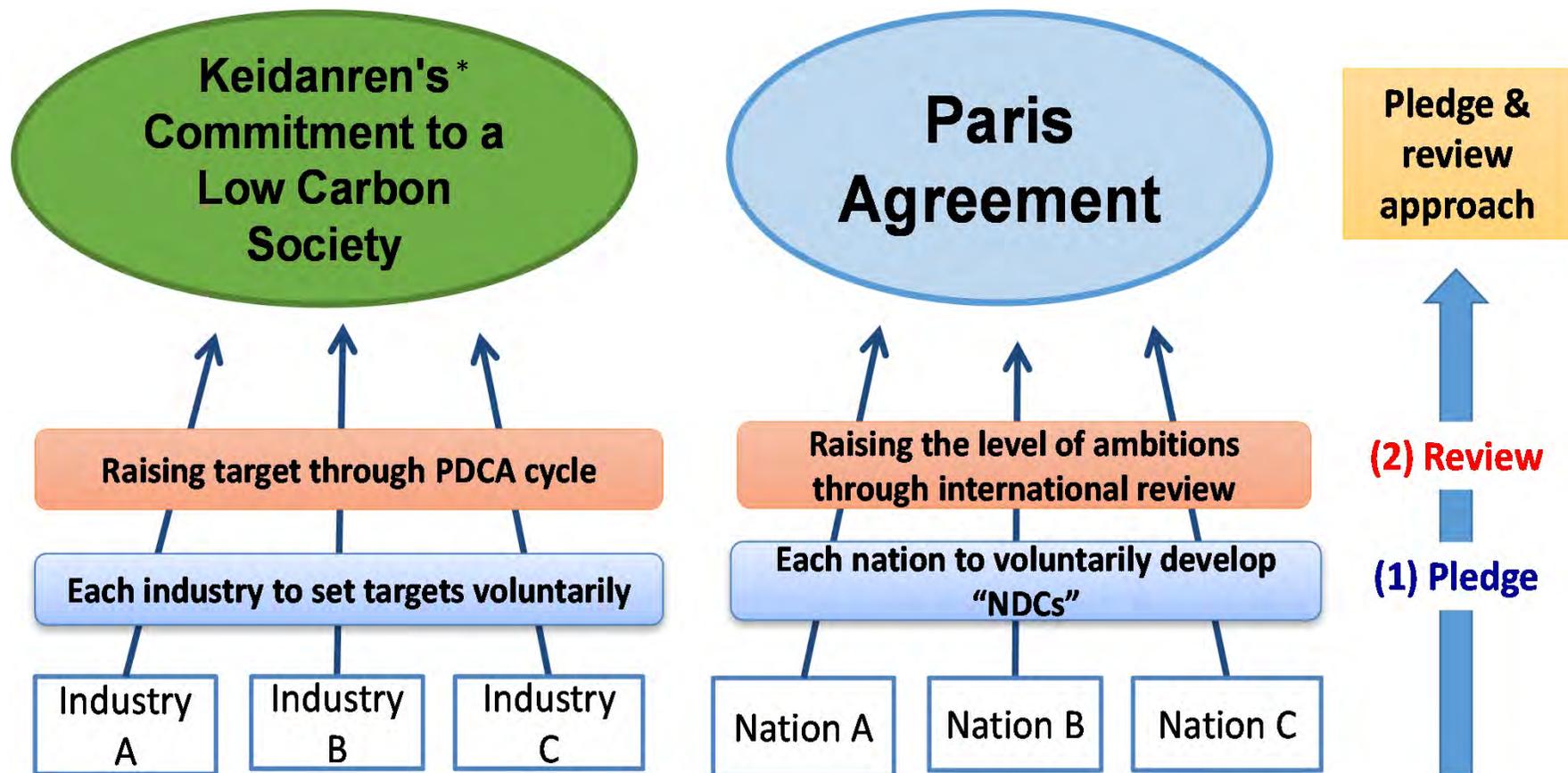


- ✓ We hold an “Environmental Management Committee” hosted by top management including 4 of 5 vice presidents every six months.
- ✓ The committee manages environmental risks such as climate change and air / water / waste, etc., and reports to the Board of Directors and Management Committee.
- ✓ The steel industry requires huge investments, so long-term perspectives are essential for the management. The climate change issue is one of the most important issues that is directly linked to our business performance in the long term.
- ✓ Our officers and directors are 100% performance-linked.

# Coping with Climate Change

# Voluntary CO<sub>2</sub> reduction actions by Japanese industrial sector 16

- 60 industries including steel have pledged to the voluntary CO<sub>2</sub> reduction targets towards 2020 and 2030 under “Commitment to a Low-Carbon Society”
- “Commitment to a Low-Carbon Society” and “Paris Agreement” have the same framework
  - ✓ **Pledge** to a voluntary target and enhance actions through **review** by third party



\*Keidanren: Japan Business Federation

The Japanese steel industry has adopted a sectoral approach to reduce CO2 emission both domestically and worldwide.

## Effectiveness of the Sectoral Approach

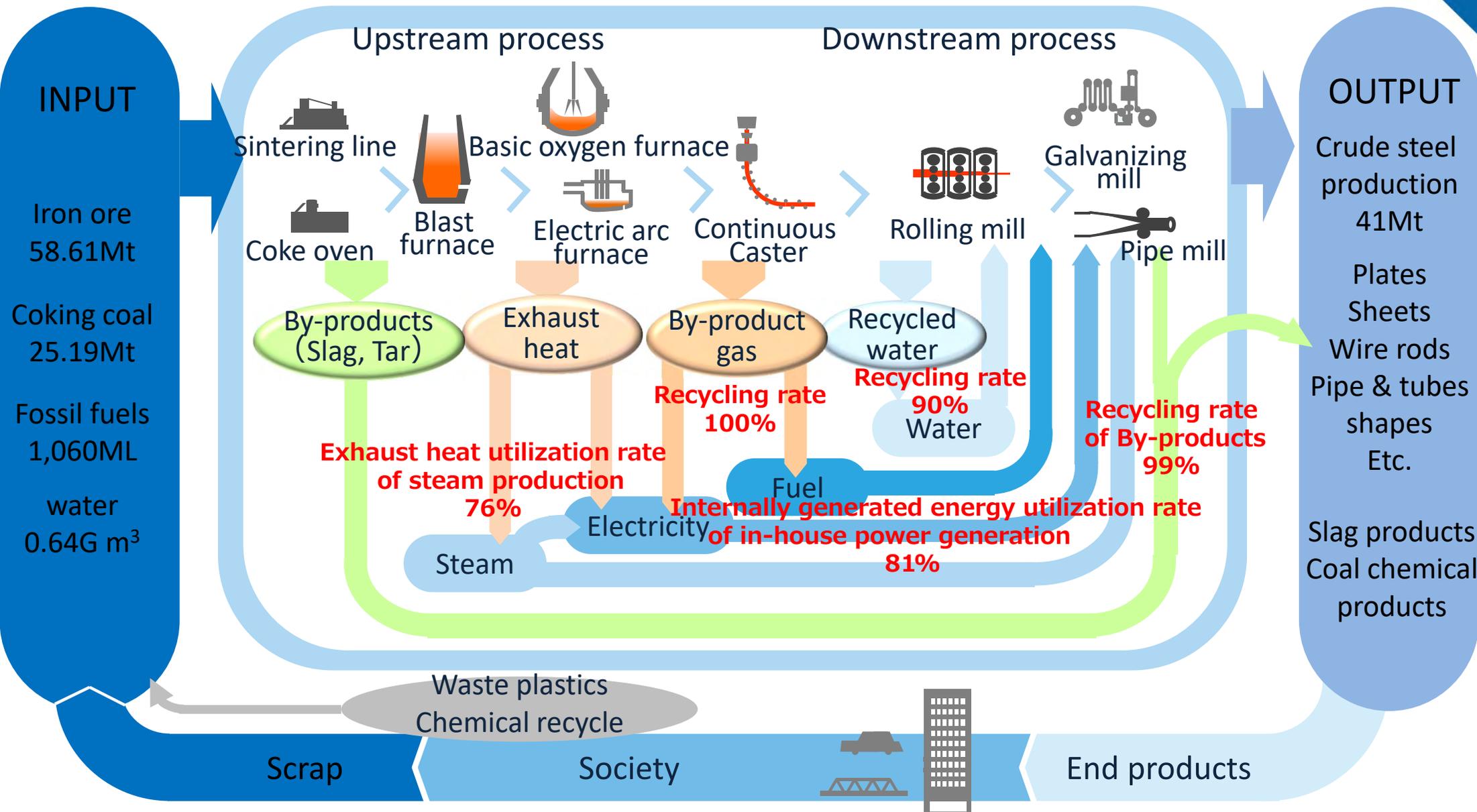
- ✓ Since the Japanese steel industry has matured technically, we have been working on CO2 reduction with ambitious goals while sharing the best practice across the industry.
- ✓ On the other hand, emerging countries have great CO2 reduction potential. Since the steel making processes are basically similar, it is effective to reduce the world's CO2 emission by transferring the world's best energy-saving technology in Japan.
- ✓ Switching to an innovative process is a huge challenge, so it is effective to create a national project with subsidies from the government and develop innovative technologies in all Japan.

**As a leader in the Japanese steel sector, we are driving this activity.**



# Eco Process

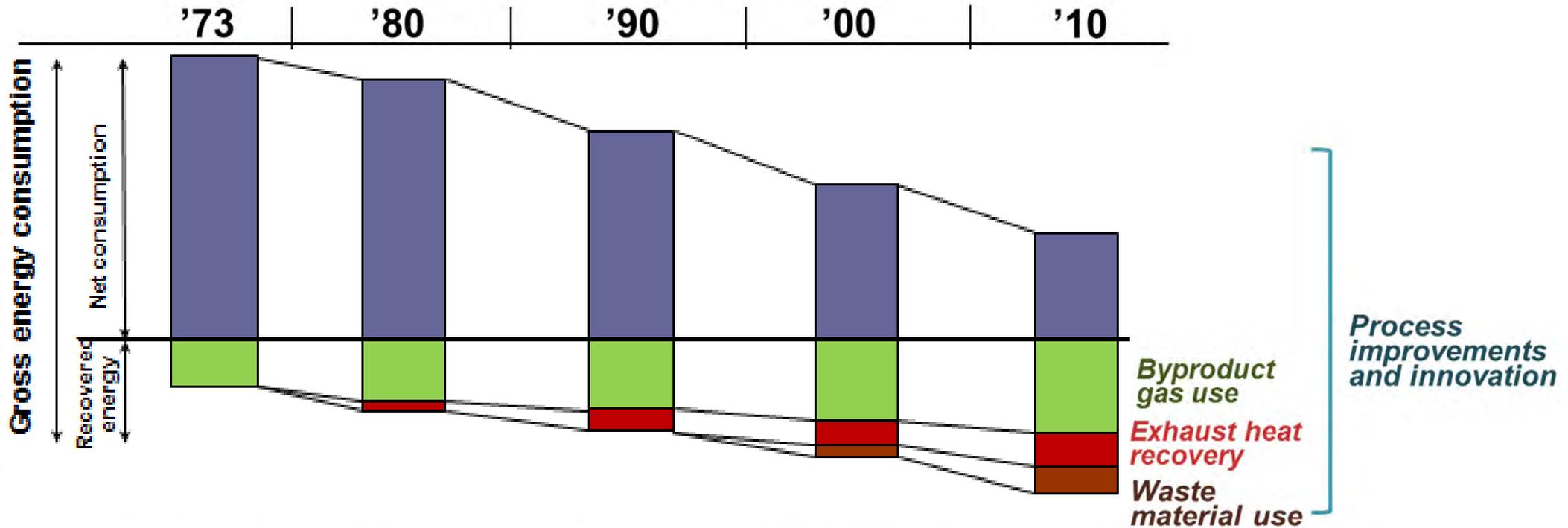
The steel manufacturing process efficiently recycles all raw materials.





# Implementation of energy saving technologies in Japanese steel industry

- Japanese steel industry reduced gross consumption by process improvements.
- Energy recovery has been contributing to reduction of net consumption in recent years.



### Process improvements and innovation

continuous casting, PCI, coal moisture control, optimization of logistics, SCOPE21

### Byproduct gas use

gas holder, high-efficiency gas turbine combined cycle generation, hydrogen amplification, CO<sub>2</sub> recovery

### Exhaust heat recovery

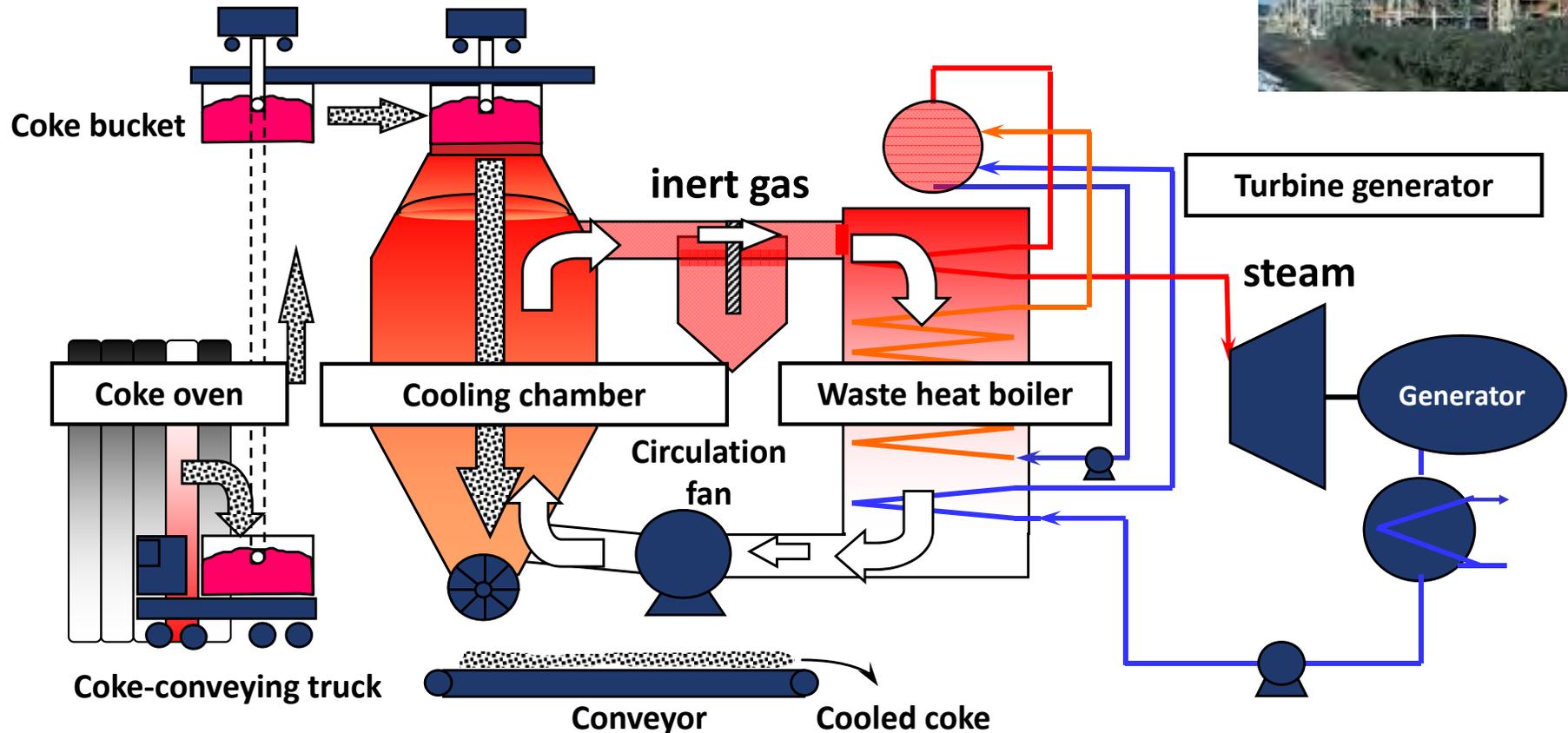
TRT, CDQ, regenerative burners, mid-low temp. heat recovery

### Waste material use

waste plastics and tires

Source: The Japan Iron and Steel Federation

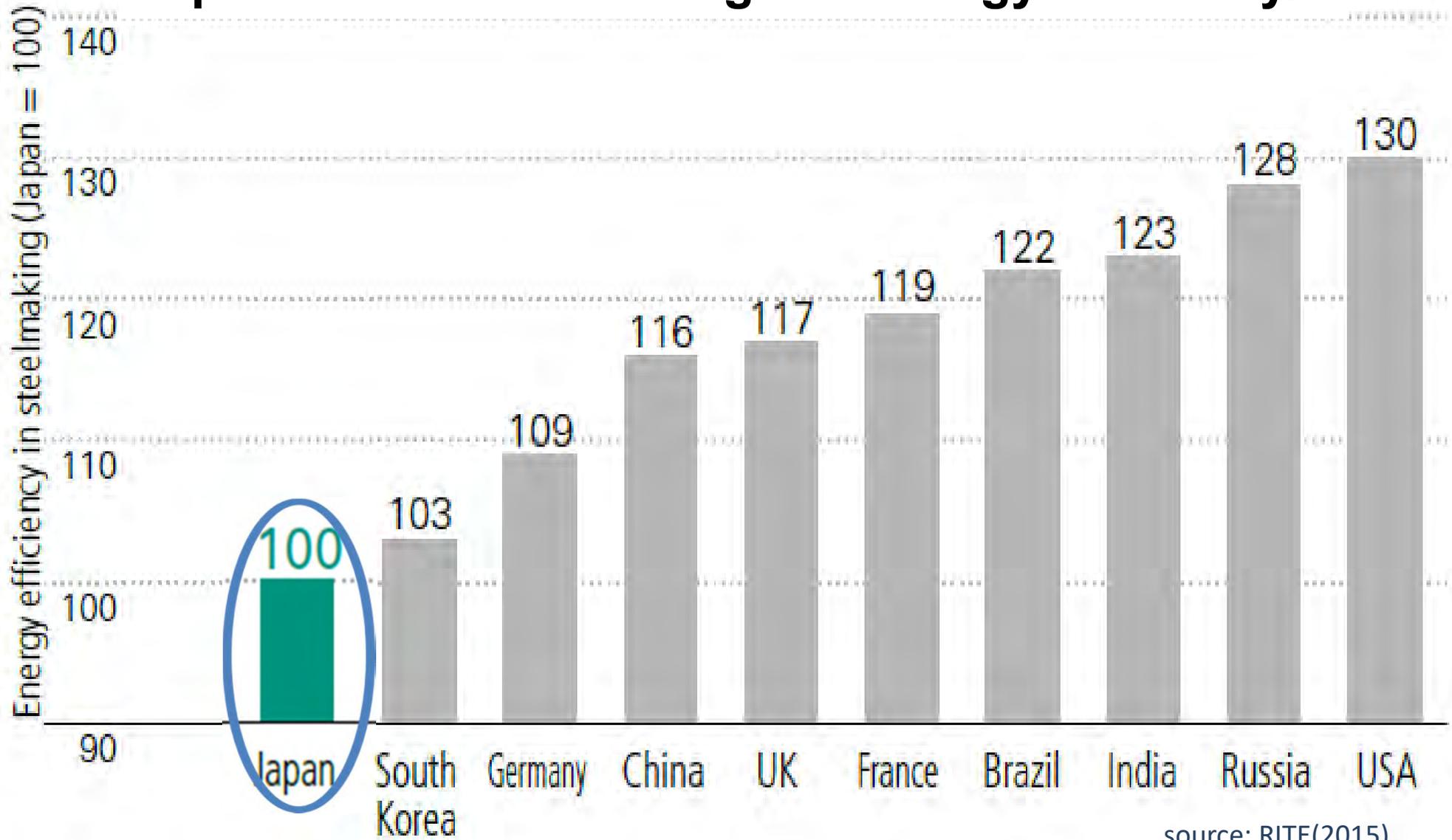
- Instead of water used conventionally, CDQ uses inert gas to quench hot coke and recovers the heat to generate power.
- CDQ contributes to an improvement of coke quality and reduction of environmental pollution.
- CDQ has been installed at all the working coke ovens of steel manufacturers in Japan.





# Energy Efficiency in Steelmaking(BOF)

Japan has the world's highest energy efficiency.



source: RITE(2015)



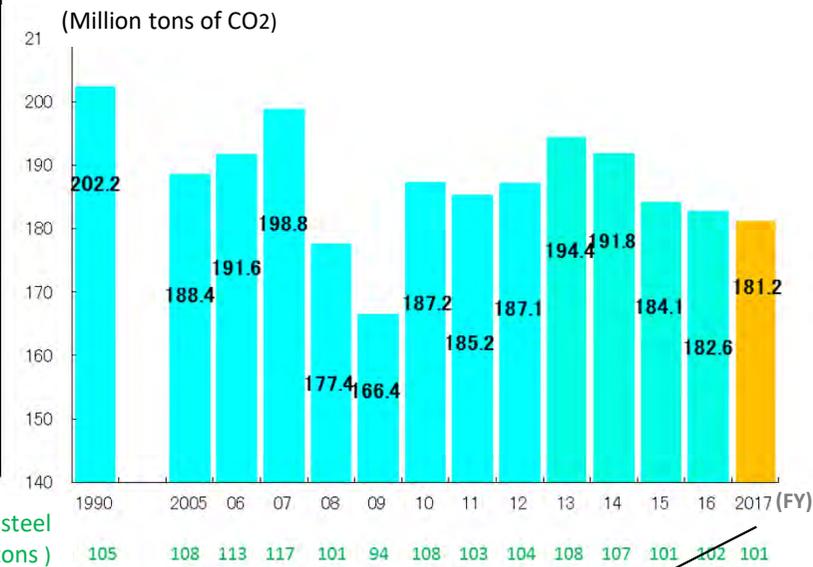
# CO2 reduction targets and results in the steel manufacturing process

- The Japan Iron and Steel Federation's "Low Carbon Society Action Plan" sets CO2 reduction targets for 2020 and 2030 in the steel manufacturing process.
- Aiming for a reduction of 3 million tons in FY2020 and 9 million tons in FY2030 as a reduction in CO2 emissions (BAU emissions) that are assumed based on FY2005 and based on certain production assumptions.

Countermeasure menu	Phase I 2020	Phase II 2030
1. Efficiency improvement of coke oven	0.9Million t-co <sub>2</sub>	1.3Million t-co <sub>2</sub>
2. Efficiency improvement of power generation facilities	1.1Million t-co <sub>2</sub>	1.6Million t-co <sub>2</sub>
3. Strengthen energy saving	1.0Million t-co <sub>2</sub>	1.5Million t-co <sub>2</sub>
4. Waste plastic recycling	—	2.0Million t-co <sub>2</sub>
5. Development and introduction of innovative technologies	—	2.6Million t-co <sub>2</sub>
total	3.0Million t-co <sub>2</sub> +Waste plastic recycling	9.0Million t-co <sub>2</sub>

<reference>

**Energy-related CO2 emissions**  
(Reflects the power coefficient after the credit for each fiscal year)



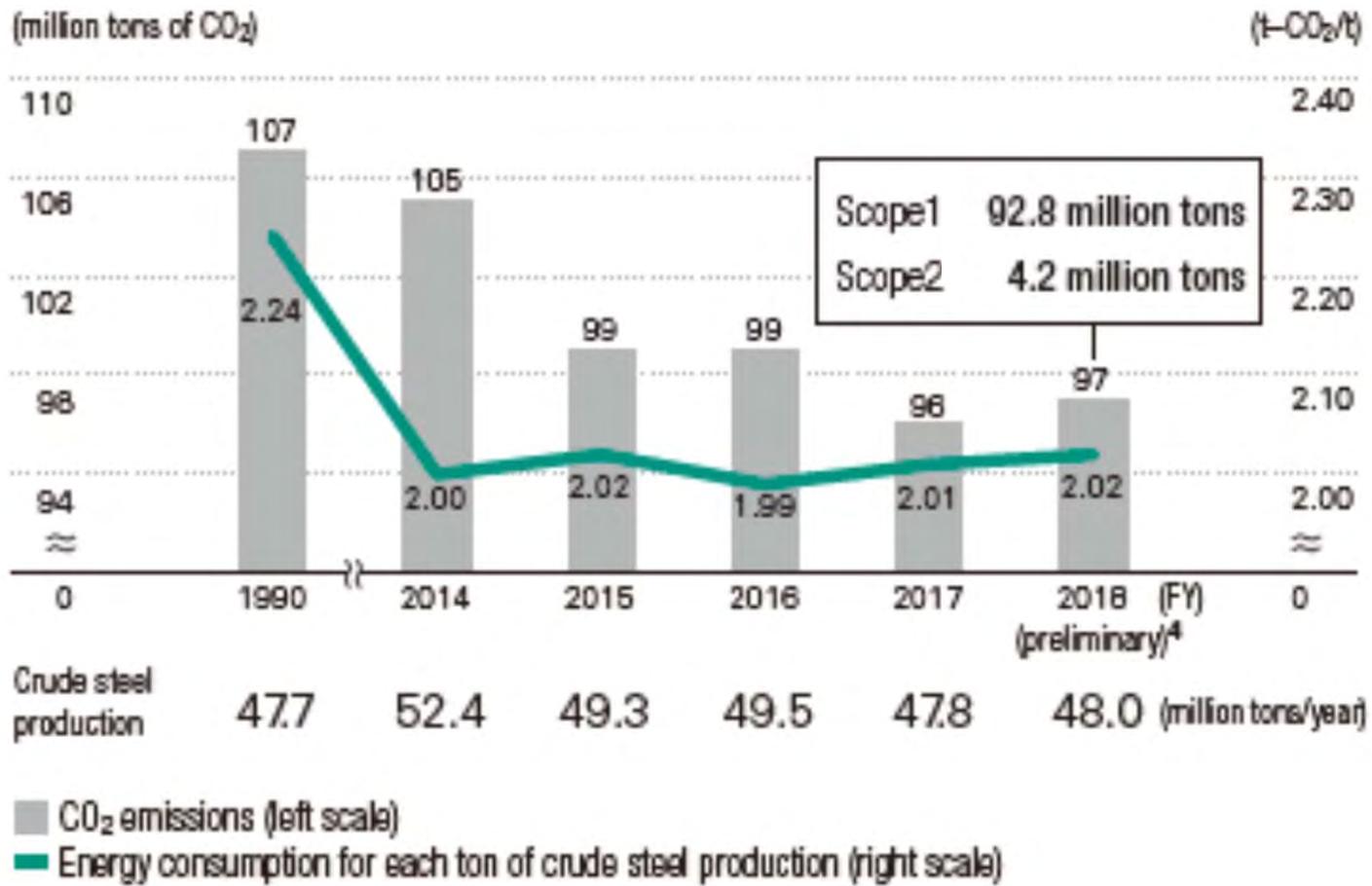
- **FY2017 CO2 reduction results:**  
**Down 2.29 million t-CO<sub>2</sub> from BAU**

<reference>

- **CO2 emissions** (use of electric power coefficient after reflecting credits in FY2017): **181.2 million t-CO<sub>2</sub>**  
**(-3.8% compared to FY2005)**



# Nippon Steel Group's energy-related CO2 emissions



<included companies>  
 NIPPON STEEL NIPPON STEEL NISSIN  
 Osaka Steel  
 Sanyo Special Steel  
 NIPPON STEEL Stainless Steel  
 OJI STEEL  
 NIPPON COKE & ENGINEERING  
 5 CO-OPERATIVE THERMAL POWER companies  
 2 SANSO (O<sub>2</sub>) centers etc.

- We are working to save energy through effective use of energy, operational improvements in each process, replacement of aging equipment, and introduction of high-efficiency power generation facilities.



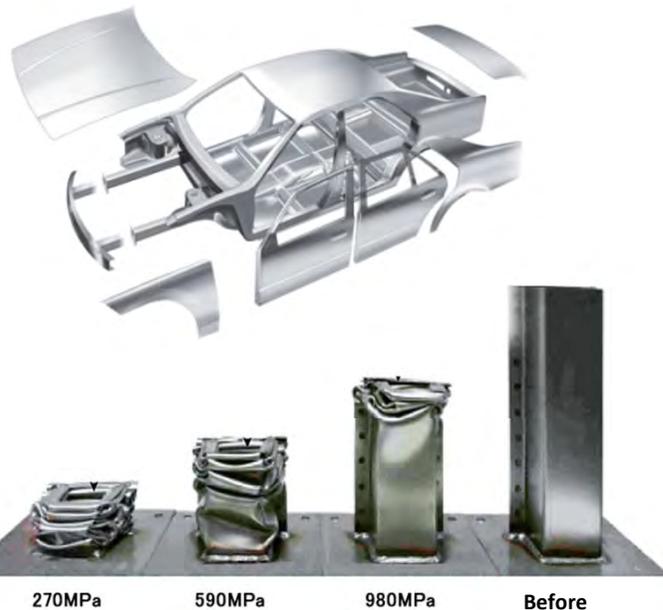
- We are working to improve the efficiency of logistics, such as maintaining and improving the modal shift rate, improving transportation efficiency, and improving fuel efficiency.
- In addition, we have implemented initiatives such as the introduction of Japan’s first lithium-ion battery-equipped hybrid cargo ship (launched in February 2019).

Items of Improvement		
Reduction in frequency of transportation	Shift to larger transportation means	Further modal shift (from motor vehicles to vessels and railways)
		Use of larger vessels and vehicles
	Improvement in transportation efficiency	Improvement in load capacity
		Improvement in actual loading rate
Reduction in transportation volume	Reduction for cycle times	
Improvement in fuel efficiency	Improvement in engine efficiency	Shortening of transportation distance
		Shift to fuel-efficient vessels and vehicles
	Improvement in operation procedure plans	Adoption of ways to improve fuel efficiency (eco-friendly tires, etc.)
		Turning off of engine when the vessel or vehicle is stopped
	Promotion of economic operation (eco-friendly way of driving, etc.)	
	Improvement in productivity in shipment (adoption of two-hanging coil lifters, etc.)	



Our high-performance steel products contribute greatly to reducing CO<sub>2</sub> emissions throughout the supply chain.

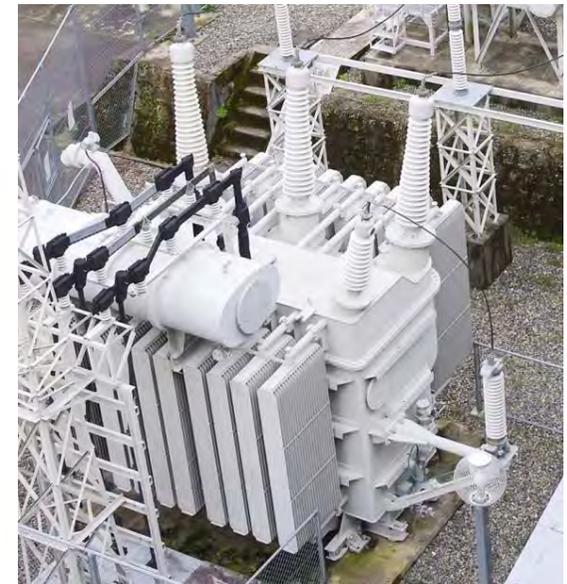
➤ **High strength steel sheet**  
Our high-strength steel sheet contributes to improving the fuel efficiency of automobiles by simultaneously improving collision safety and weight reduction of automobile bodies.



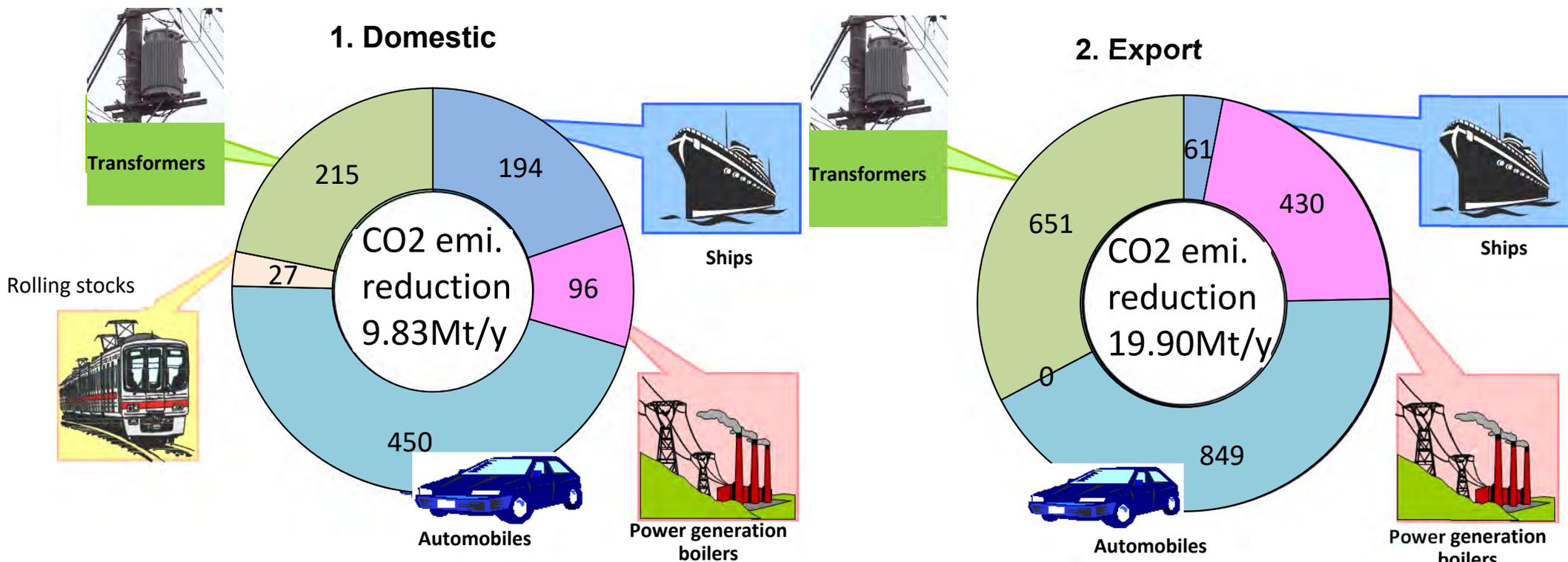
➤ **High strength steel plate**  
Our FCA-W plate has excellent fatigue fracture resistance in bulk and welds, contributing to improved fuel efficiency by making the LNG carrier hull thinner.



➤ **Steel for transformer**  
Our grain-oriented electrical steel sheet significantly reduces power loss during power conversion.



Statistics are for the five major types of high-performance steel for which quantitative data are available (FY2017 production of 6.95 million tons, 6.6% of Japan's total crude steel output). Use of finished products made of high-performance steel cut FY2017 CO<sub>2</sub> emissions by 9.83 million tons for steel used in Japan and 19.90 million tons for exported steel, a total of 29.73 million tons of CO<sub>2</sub>.

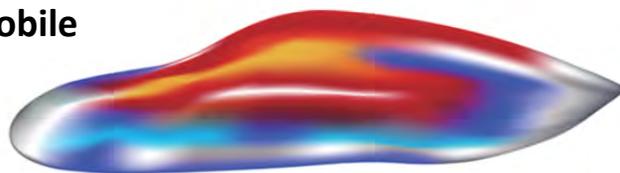


**CO<sub>2</sub> Emission Reductions: 29.73 million tons CO<sub>2</sub> in total  
(6.95million tons of high-performance steel)**

Source: The Institute of Energy Economics, Japan

## Nippon Steel as the best partner to help materialize potentials of automobile

**Mission:**  
Design the future  
of automobile



**Realizing 30% weight reduction  
by a vehicle made of steel (equal to aluminum)**

- Solutions in the ratio of high-tensile steel, structural/process designs, etc. → Achieved both less weight and collision safety

**Solutions includes structural design conditions of components**

- Select materials up to steel of 2.0GPa in tensile strength, on required performance ⇒ Help reduce thickness in sheet and integrate components
- Developed a structure concept using a battery made of steel for EVs, HVs, etc.
- Use of advanced electro-magnetic sheet and analysis solutions in the development of high-efficiency, small, light, quiet motors

**Using the group's comprehensive power**

- Delivery of materials and services with know-how in all major materials: from gasoline-vehicle parts to batteries and motors for EVs

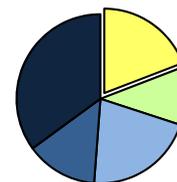
## *Nsafe™-AutoConcept*

The Nsafe™-AutoConcept is a concept of future automobile designed by Nippon Steel by using its advanced material and solution technologies and processing original products.

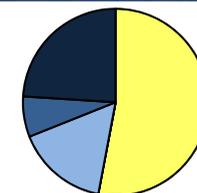


Breakdown of use of high-tensile steel by strength

**Current vehicle**

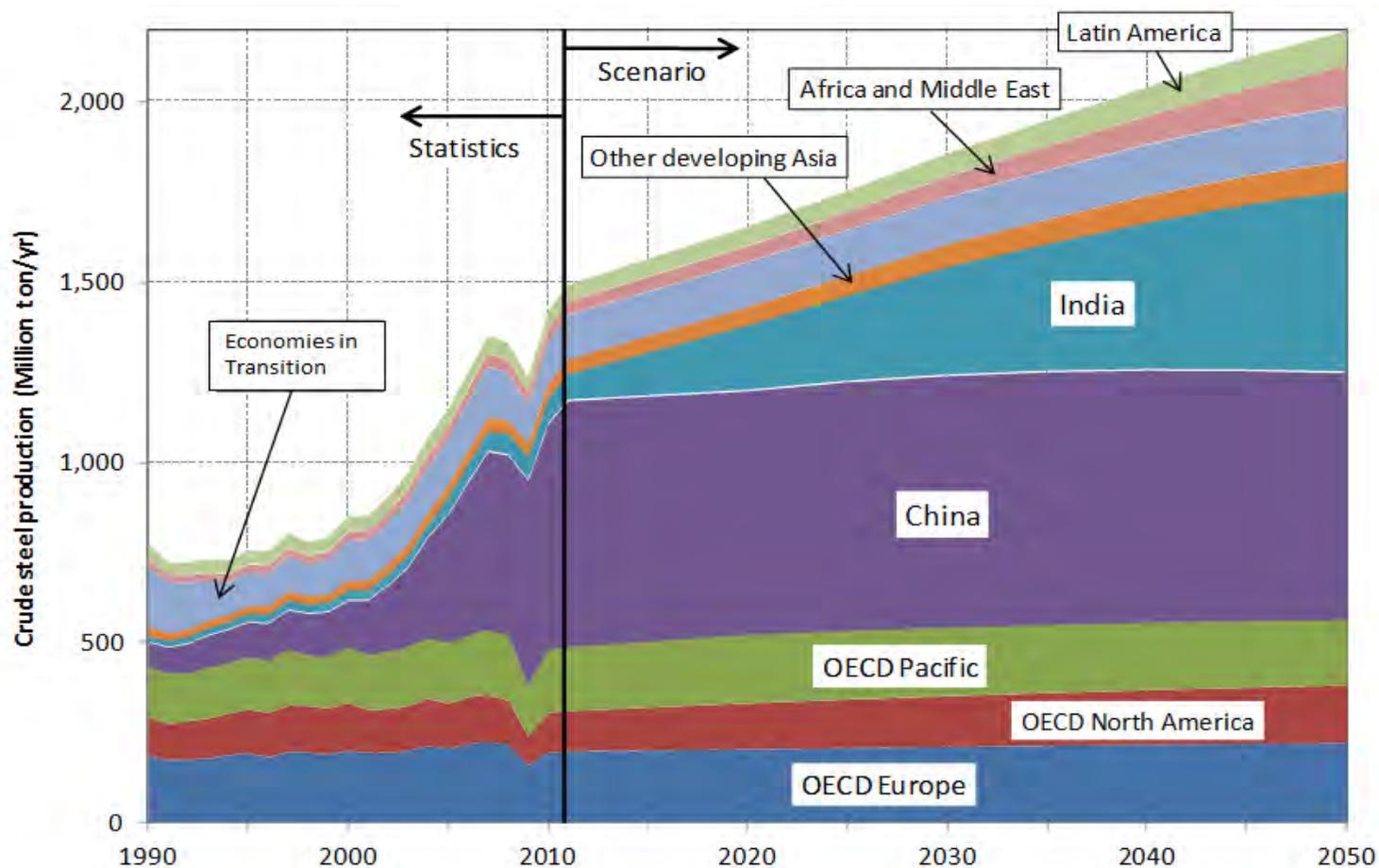


***Nsafe™-AutoConcept***



- Technologies are the only way to minimize CO<sub>2</sub> emissions as demand for steel increases. Japan's steel industry is the most energy-efficient in the world. Worldwide transfer of Japanese energy conservation technologies will become even more important as an effective means of fighting global warming.

Forecast for Global Crude Steel Production



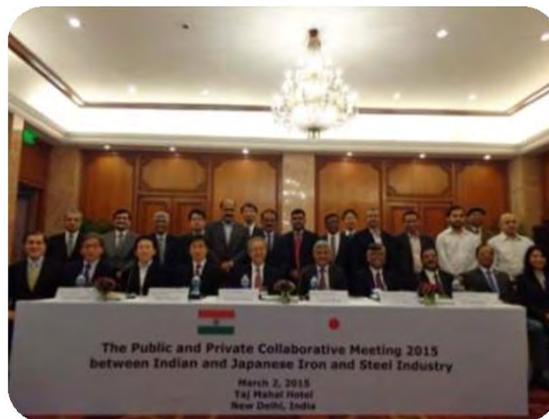
Source: RITE

In addition to the domestic energy saving actions, Japanese steel industry promotes contribution to global energy saving.



## China since 2005

Japan-China Steel Industry Environmental Protection and Energy Conservation Technology Conference



## India since 2011

The Public and Private Collaborative Meeting between Indian and Japanese steel industries



## ASEAN since 2014

ASEAN: ASEAN-Japan Steel Initiative

## Purpose

- Exchange knowledge and experiences and thereby contribute to the energy saving and environmental protection in ASEAN
- Encourage technology transfer from Japan to ASEAN steel industry

## Participants

### Public Sector

Ministries and governmental institutions related to steel industry and energy saving in ASEAN countries and Japan

Cooperation

### Private Sector

AISC, national association in ASEAN, JISF and their member companies

## Main Activities

1

### Technologies Customized List



2

### Steel Plant Diagnosis



3

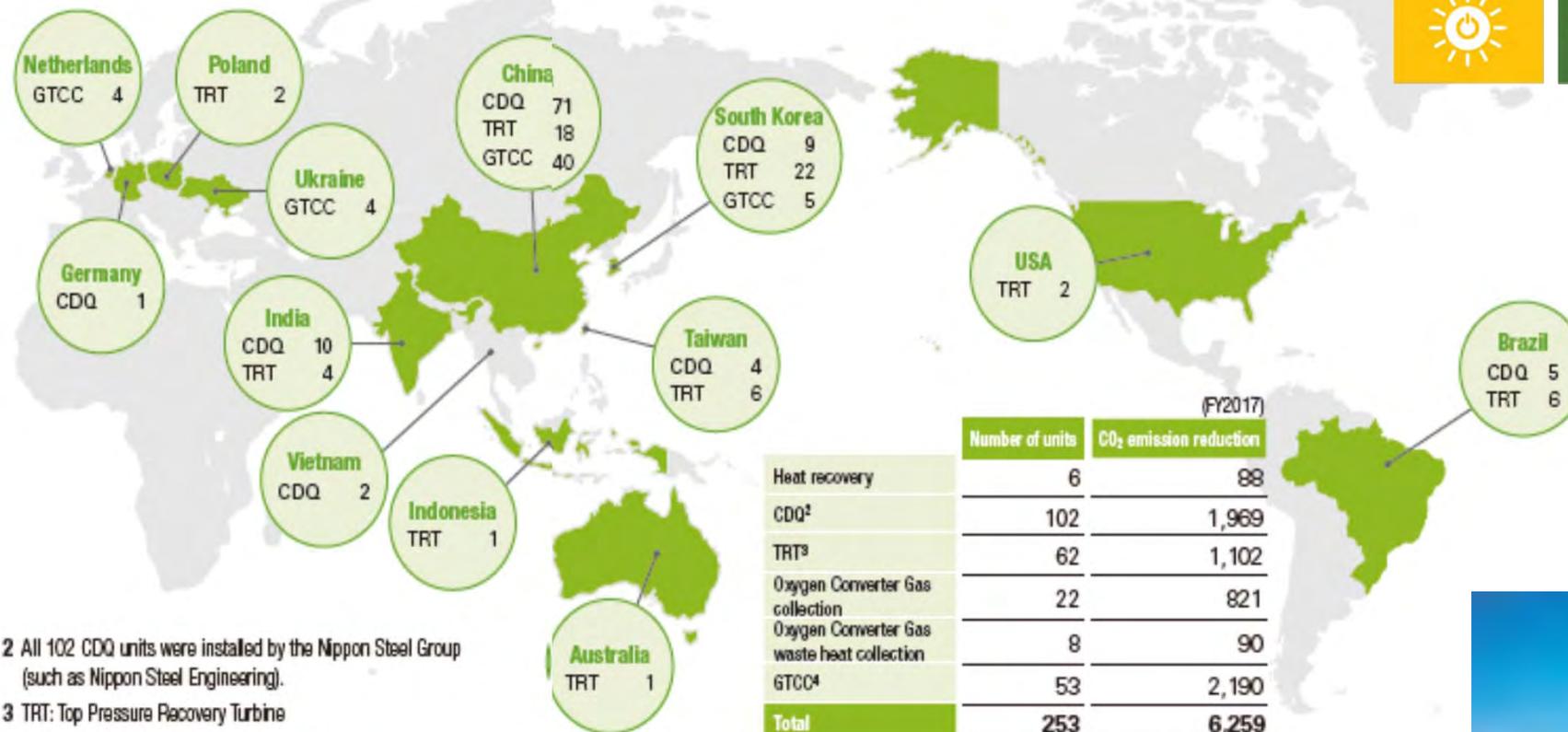
### Public and Private Meeting/Workshop







# Japanese steel industry's energy-saving technologies<sup>32</sup> are spreading globally



	Number of units	CO <sub>2</sub> emission reduction (FY2017) 10,000 t-CO <sub>2</sub> /year
Heat recovery	6	88
CDQ <sup>2</sup>	102	1,969
TRT <sup>3</sup>	62	1,102
Oxygen Converter Gas collection	22	821
Oxygen Converter Gas waste heat collection	8	90
GTCC <sup>4</sup>	53	2,190
<b>Total</b>	<b>253</b>	<b>6,259</b>

2 All 102 CDQ units were installed by the Nippon Steel Group (such as Nippon Steel Engineering).  
 3 TRT: Top Pressure Recovery Turbine  
 4 GTCC: Highly-efficient GTCC power generation



## CDQ = Coke Dry Quenching

- <efficacy1> **Reduction of CO2 emissions** through power generation using steam
  - <efficacy2> **Suppressing dust generation** when cooling coke
  - <efficacy3> **Improved coke quality** suitable for blast furnace use
- CDQ102 unit: All are the results of NIPPON STEEL ENGINEERING

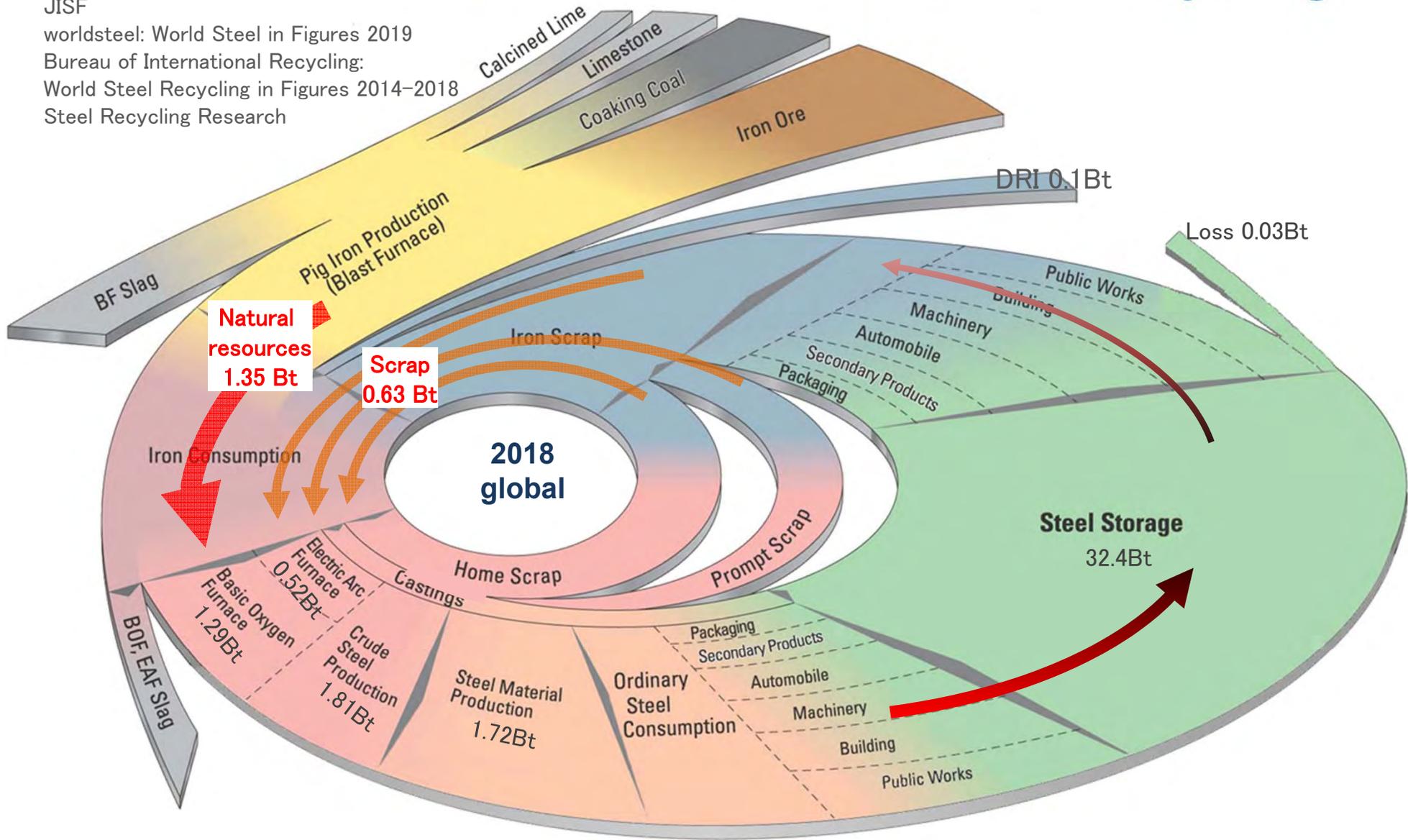


**We received orders for two large CDQs in India / Tata Steel in March 2019**

# Contributing to a Circular Economy

# Steel is a flexible material that can sustain resource recycling

JISF  
worldsteel: World Steel in Figures 2019  
Bureau of International Recycling:  
World Steel Recycling in Figures 2014–2018  
Steel Recycling Research



**The steel industry has the equipment and technology necessary to build a Circular Economy**

## Steel industry

**We accept and effectively use by-products / waste generated by society and other industries**



**We effectively use by-products generated in the steel industry**

# Recycling of waste plastics

## (Chemical recycling without residues)



About **30%** of the plastic containers and packaging generated in households nationwide are **recycled at our steelworks.**



Sorted waste plastic



Shredding



Pelletizing



Pyrolysis in coke oven

**Oil** ca. **40%**  
Used by chemical manufacturers in our group as raw materials for plastics



**Coke** ca. **20%**  
Used as reducing agent in blast furnace

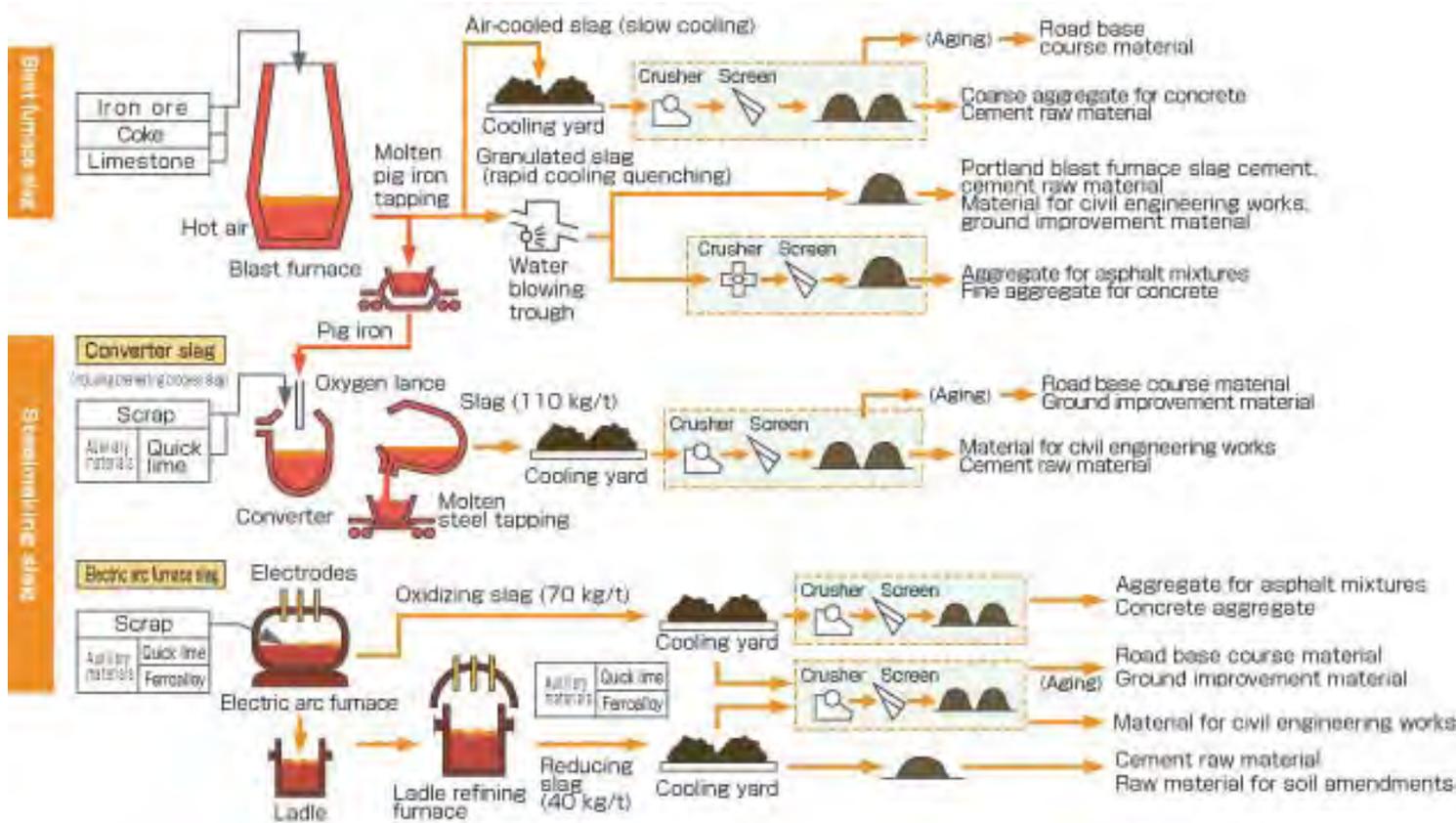


**Gas** ca. **40%**  
Used as fuel for power generation etc. at steelworks



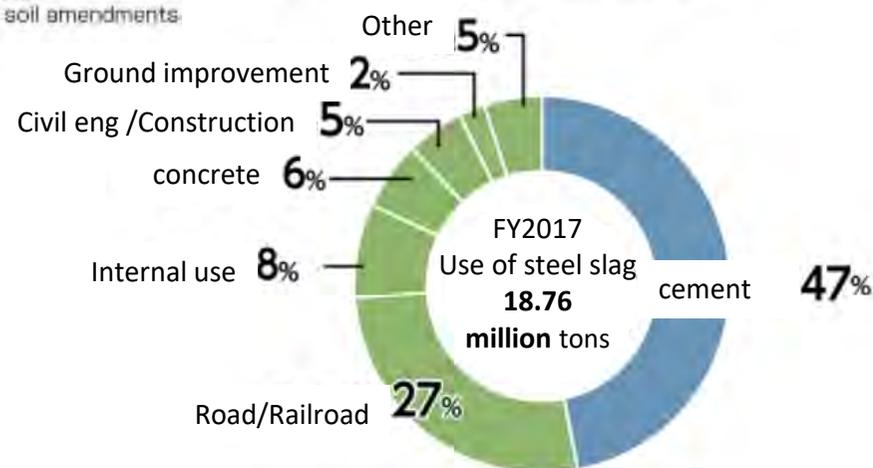
# Material recycling of by-products produced in steel works (steel slag)

## Schematic diagram of slag recycling



Source: Nippon Slag Association

Application of slag produced by Nippon Steel



# By-products and recycling (FY2018)

By-product	Amount generated (wet weight – million tons)	Recycling application	Recycling rate
Blast furnace slag	12.16	Blast furnace cement, fine aggregate, road base, etc.	100%
Steelmaking slag	5.40	Road base, civil engineering materials, fertilizer, etc.	99%
Dust	3.17	Raw materials for use in-house and also zinc refining	100%
Sludge	0.48	Raw materials for in-house use	88%
Coal ash	0.50	Cement raw materials, construction materials	100%
Waste furnace materials	0.35	Reuse, road base, etc.	81%
Others	2.30	In-house use, others	99%
<b>Total</b>	<b>24.35</b>	<b>Total recycling rate</b>	<b>99%</b>

1 Fine dust collected with a dust collector

2 Semi-solid slurry recovered from industrial wastewater or sewage treatment

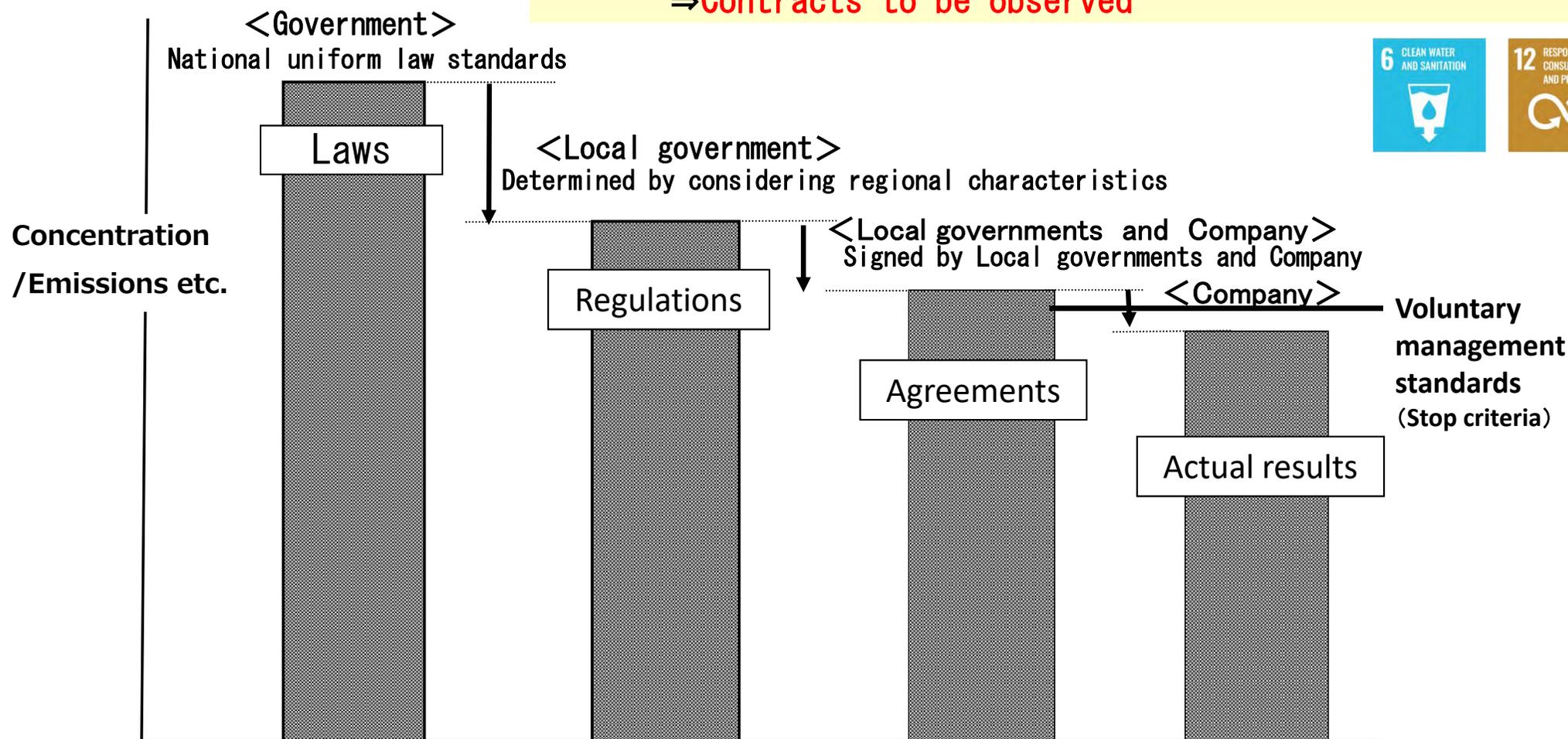
Recycling rate of by-products **99%**

# Promotion of Environmental Risk Management

# Environmental Agreements with Local governments

- We manage by entering into agreements with local governments at levels that are more stringent than laws and regulations
- In order to comply with the agreed levels, we set voluntary management standards and manage results

Agreement : Gentlemen agreement between Local governments and Company  
 ⇒ **Contracts to be observed**





**Dry desulfurization  
denitration  
equipment**



**Low NOx  
regeneration burner**



**Emergency  
drainage  
cutoff facility**

- From the perspective of environmental conservation in the steelworks area, we not only comply with laws and regulations, but also enter into more stringent agreements with local governments on our environmental impacts such as air and water pollution.
- Aiming to continually improve environmental conservation, PDCA is steadily implemented every year to promote environmental risk management, which is a corporate social responsibility.

# Overcoming pollution

**1960's**

**Dirty Dokai Bay**



**Sky covered with smoke**



**Current**

**Revived Dokai Bay**



**Sky regained the blue**



# Initiatives on Conservation of Biodiversity

# Initiatives for “Creation of Hometown Forests” at each steelworks

## Muroran

Tree planting in 1972



Current



## Oita

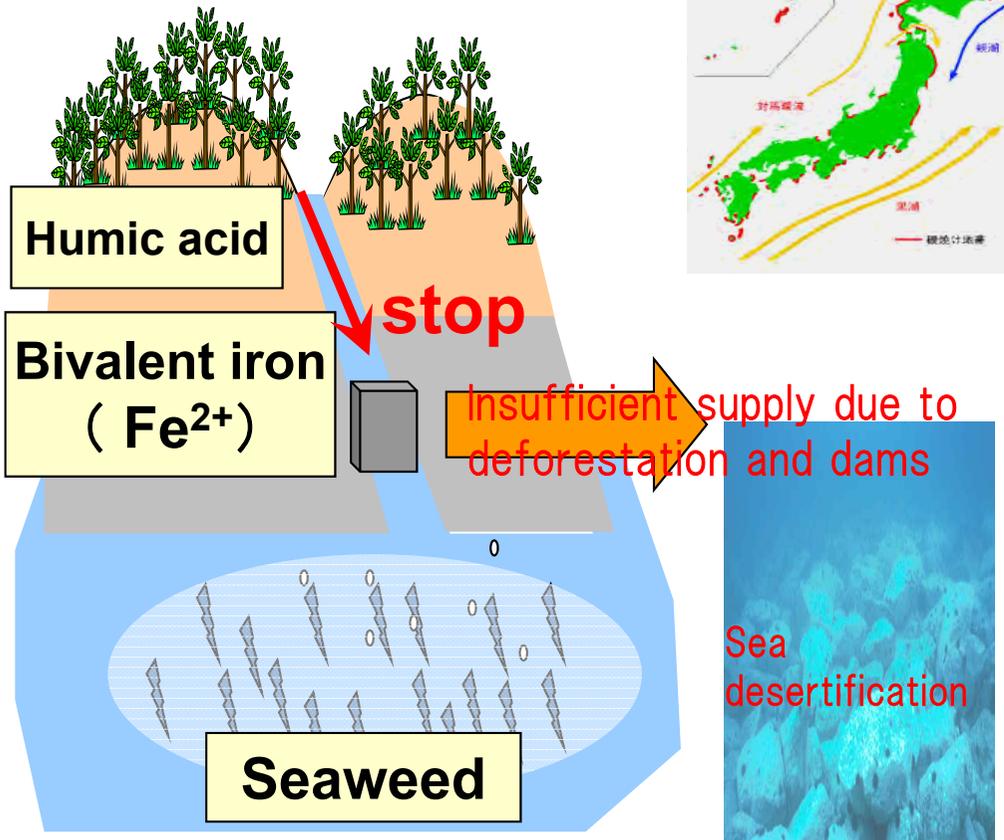
Greenery in 1973



Current



The “hometown forest” raised by NIPPON STEEL is currently about 830 hectares. Equivalent to 180 Tokyo Domes.



Bivalent  $Fe^{2+}$  binds humic acid to form soluble humic acid iron salt and is supplied to seaweed through the river

## Development of divalent iron fertilization technology



**Steel slag ( $Fe^{2+}$ )**



**Fermented waste wood**



**Beverly™ Unit**

(Divalent iron fertilization unit)

# Contributing to the Creation of Sea Forests

- Utilizing steel slag, a byproduct of steelmaking, contributes to the regeneration of seaweed beds
- Currently working in 38 waters near Japan
- Received 2nd Eco Pro Award for Excellence in the Beverly™ series



EcoPro Awards



Sea desertification



Installation of Beverly™ Unit

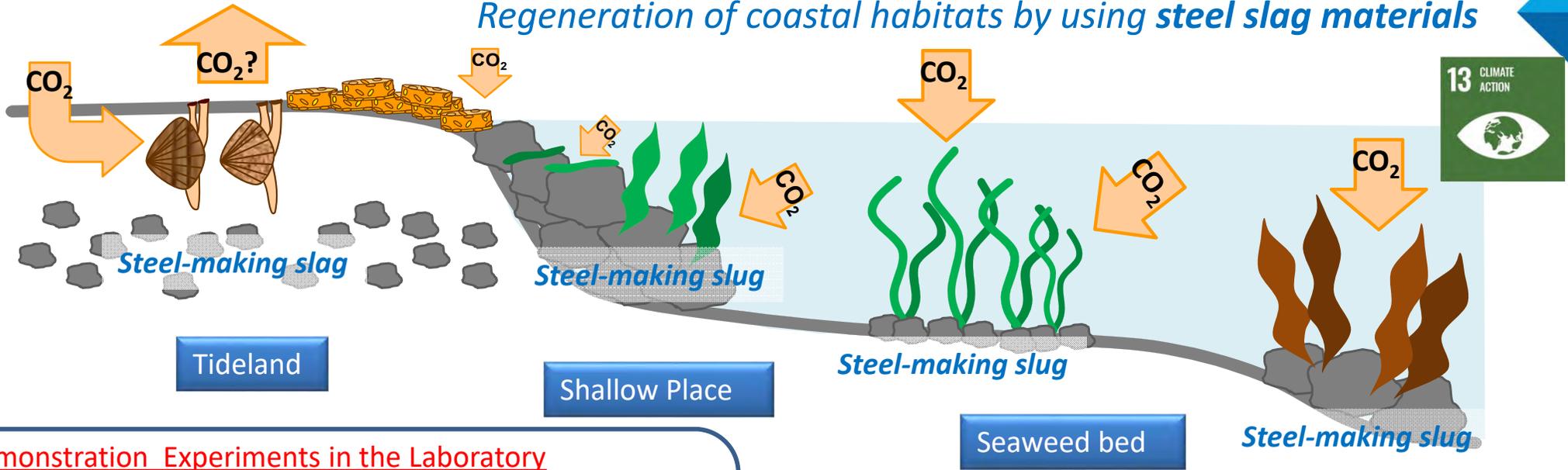


A community of sea kelp regenerated one year later (Hokkaido, Mashike Town)



# Blue Carbon : CO<sub>2</sub> fixation in coastal and marine ecosystem

Regeneration of coastal habitats by using steel slag materials



## Demonstration Experiments in the Laboratory

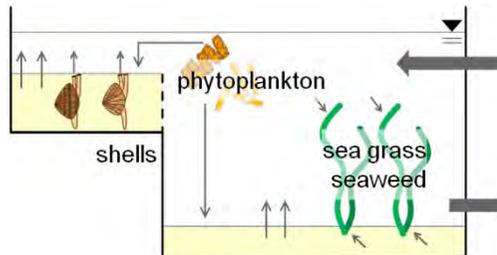
### SeaLab I



### SeaLab II



### Seaweed Growing



### Material Balance

## CO<sub>2</sub> Fixation & Biomass Production in the Actual Coast



### Sea grass

Hayama in Kanagawa  
[CaO-improved soil]



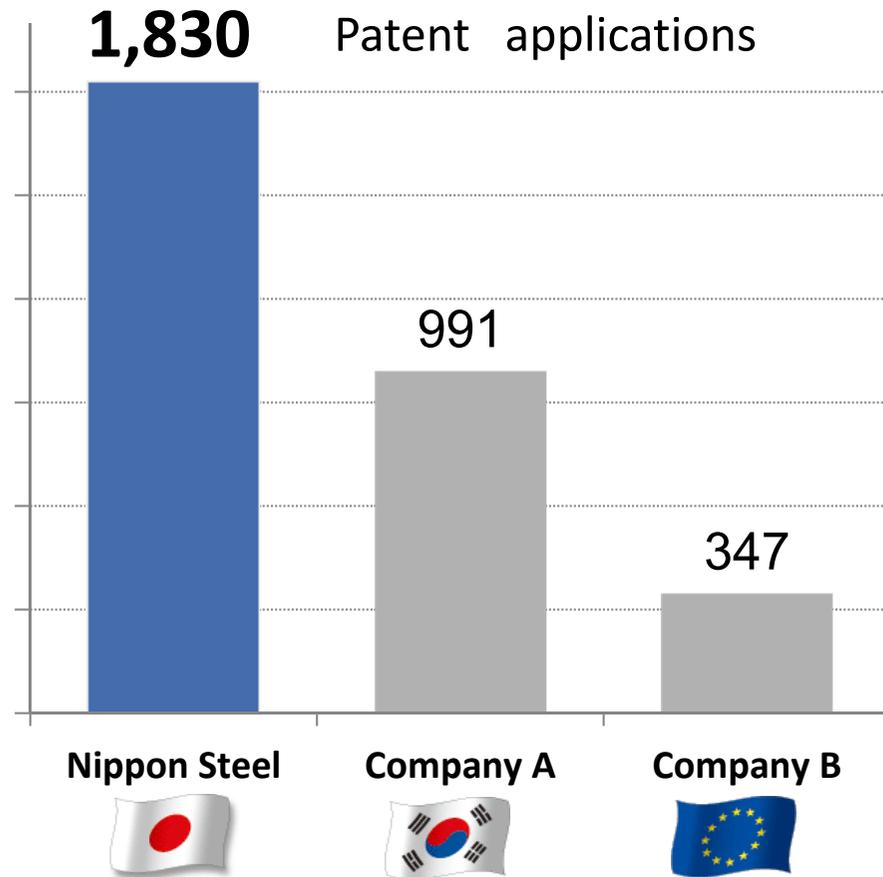
### Seaweed

Mashike in Hokkaido  
[Ferrous fertilizer]

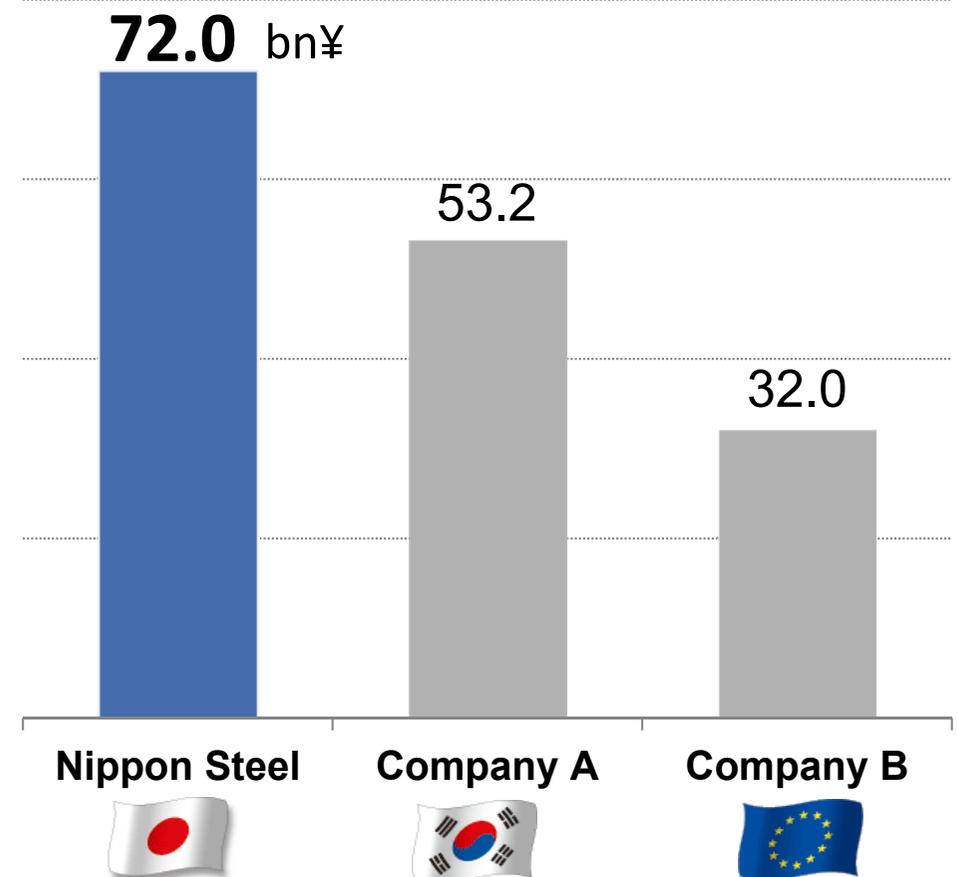
# Innovative Technology Development

The Japan Iron and Steel Federation's  
“A challenge towards zero-carbon steel”

## International Patent Application Published : CY2012-2018



## R&D Expenditure FY2018

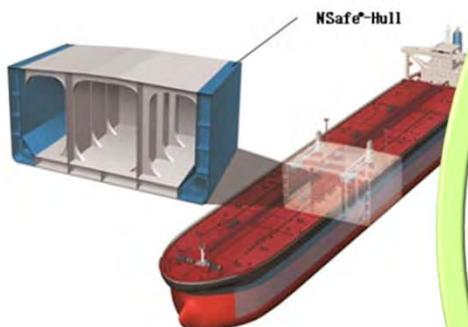


We received “Derwent Top 100 Global Innovators\*” for 7 consecutive years (2012-18).

\* IP research firm Clarivate Analytics (Thomson Reuter) selects from companies and institutions.

## The Ichimura Prize in Industry for Distinguished Achievement

Improvement of crashworthiness for ship collision by development of highly ductile steel plates



## The Okochi Prize in Production

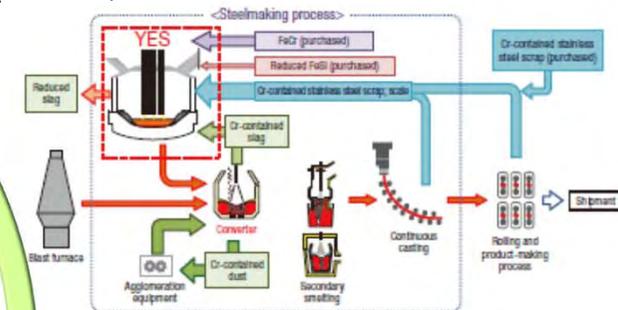
Development eco-friendly type steel wire for super-high-tensile strength bridge cables

## The Commendation for Science and Technology (Prize for Science and Technology: Development Category) by the Minister of Education, Culture, Sports, Science and Technology

Development of steelmaking process achieving minimum chromium emission  
(YES: Yawata Environment-friendly Smelter)

## Derwent Top 100 Global Innovator 2018-19

Prized 7 consecutive years  
on high evaluation of  
constantly high patent success rate

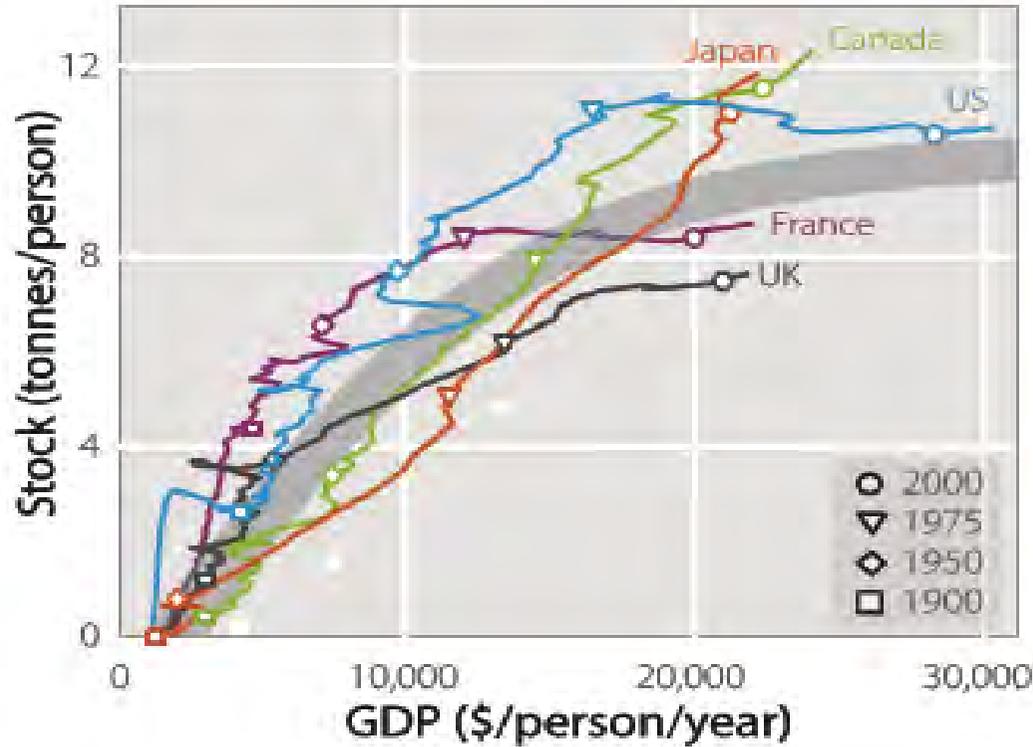


## The Ichimura Prize in Industry against Global Warming for Distinguished Achievement

Development of high strengthened stainless steel for high pressure hydrogen environment to accelerate hydrogen-based society

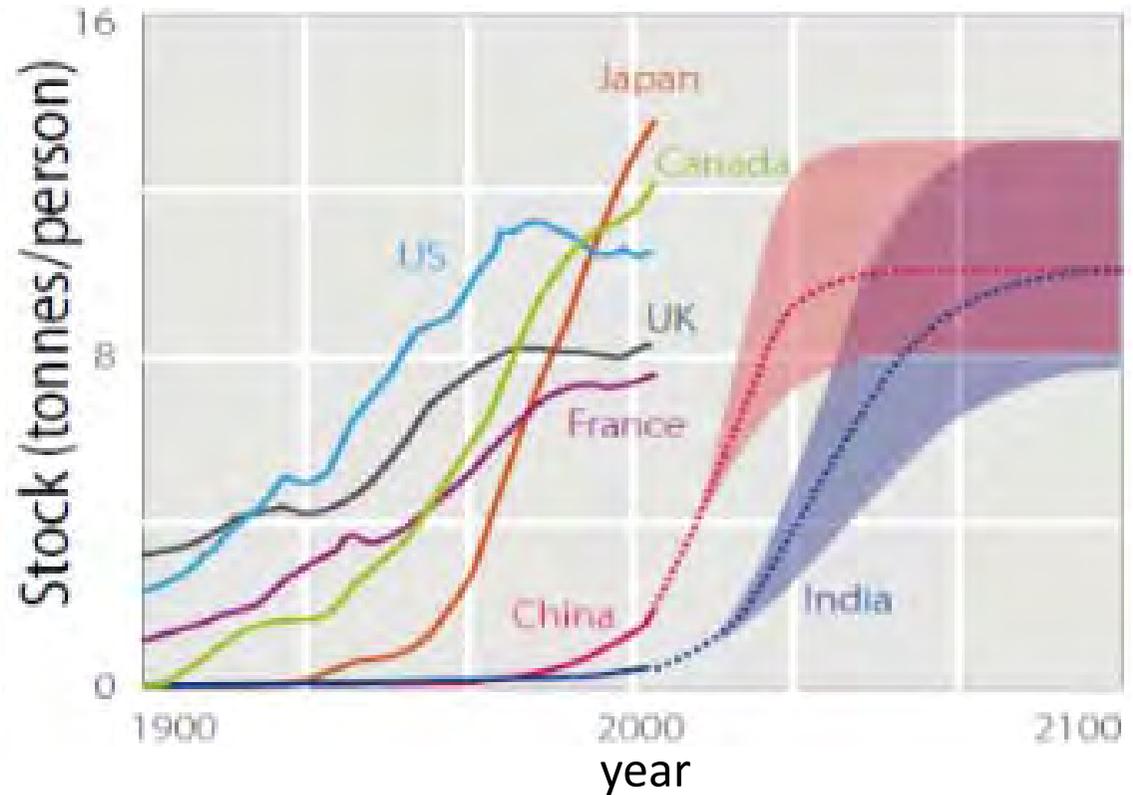


Relationship between GDP per capita and steel stock per capita



Muller, et.al, "Patterns of Iron Use in Societal Evolution", Environ. Sci. Technol. 2011, 45

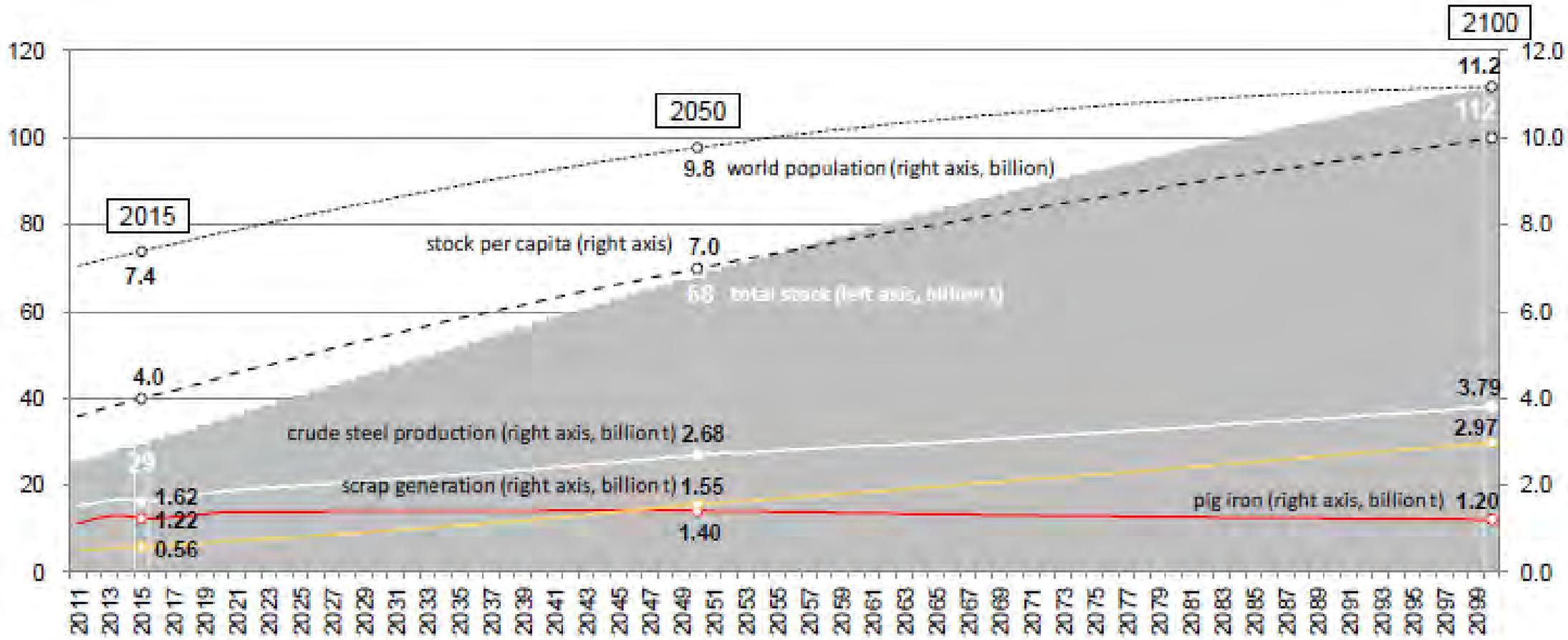
Transition of steel stock per capita



"Sustainable steel: at the core of a green economy", World Steel Association, 2012

Steel stock saturates at about 10 t/capita in developed countries.

# Steel demand and production

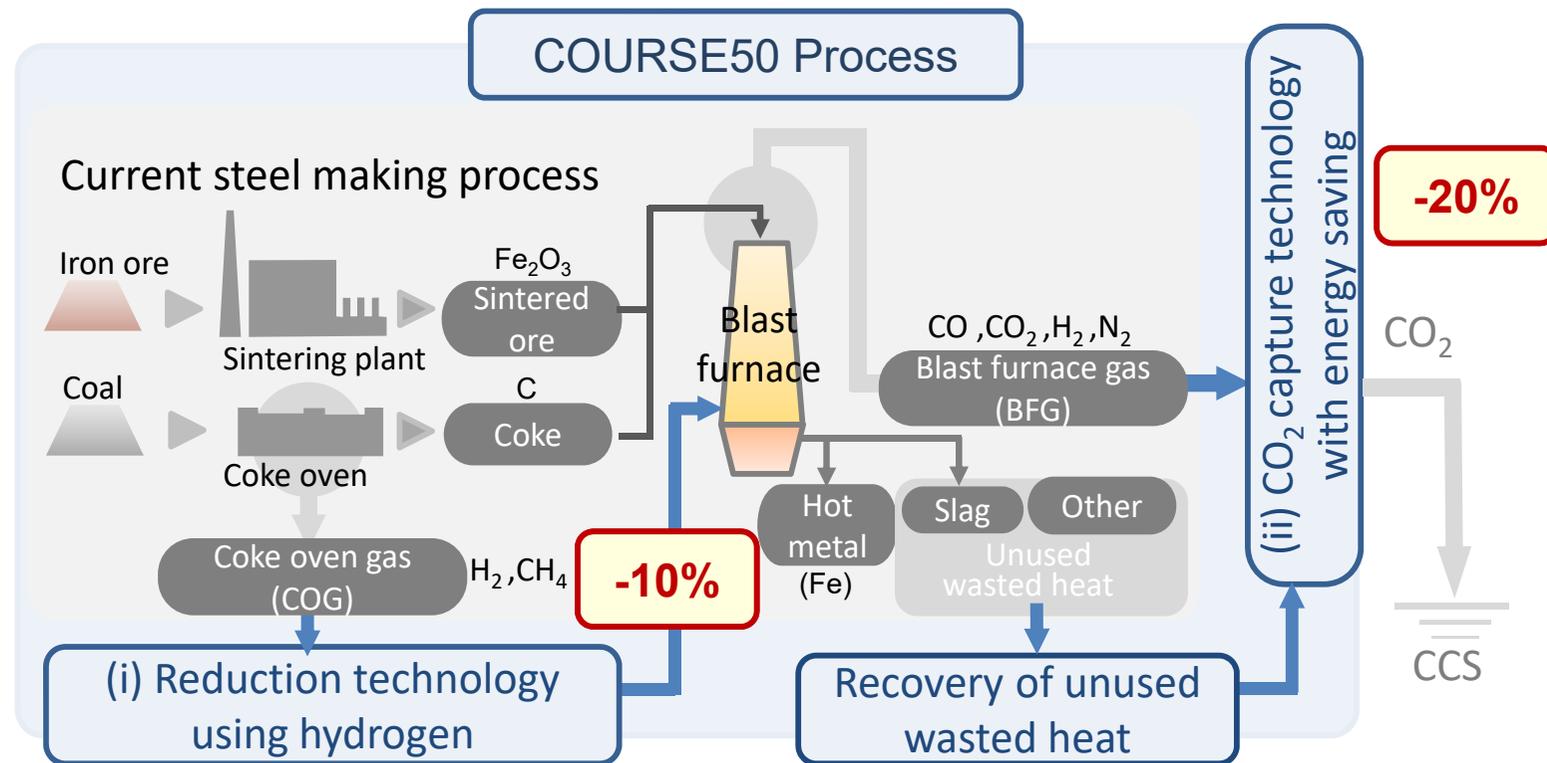


Japan Iron and Steel Federation

Steel production from iron ore is still necessary in the future.

# The First Step to the future; COURSE50

- (i) Development of **reduction technology using hydrogen** in coke oven gas
  - (ii) Development of **CO<sub>2</sub> capture technology from blast furnace gases**
- Project target : Mitigation of CO<sub>2</sub> emissions from steelworks by 30%**



100%-sponsored research by NEDO (New Energy and Industrial Technology Development Organization)

# JISF Long-term vision for climate change mitigation <sup>54</sup>

- ✓ JISF has decided to develop super innovative technologies to realize zero-carbon steel on Nov 2018.
- ✓ Hydrogen-based steel making and CO<sub>2</sub> capture are main measures.
- ✓ COURSE50 is the first step to the future.
- ✓ For hydrogen-reduction, massive and stable supply of carbon-free hydrogen with rational cost is essential.

## Challenges specific in iron & steel sector

		2020	2030	2040	2050	2100
COURSE50	Raising ratio of H <sub>2</sub> -reduction in blast furnace using internal H <sub>2</sub> (COG) Capturing CO <sub>2</sub> from blast furnace gas for storage	R&D		Implementation		
Super COURSE50	Further H <sub>2</sub> -reduction in blast furnace by adding H <sub>2</sub> from outside (assuming massive carbon-free H <sub>2</sub> supply becomes available)	Stepping up	R&D	Implementation		
H <sub>2</sub> -reduction ironmaking	Reduction with H <sub>2</sub> ironmaking without using coal	Stepping up	R&D	Implementation		

## Challenges common in social fundamental

		2020	2030	2040	2050	2100
Carbon-free H <sub>2</sub>	Technical development of low cost and massive amount of hydrogen production, transfer and storage	R&D		Implementati		
CCS/CCU	Technical development on CO <sub>2</sub> capture and strage/usage Solving social issues (location, PA, etc.)	R&D		Implementatio		

- ✓ In November 2018, the Japan Iron and Steel Federation announced the “Challenge to Zero Carbon Steel” (hereinafter referred to as the JISF Long-Term Vision). In order to reach the long-term target level sought by the Paris Agreement, it is necessary to use “super-innovation technology” that goes beyond the innovative steelmaking technology currently being developed. Based on the knowledge gained from the COURSE50 currently being developed, etc. Clarified that we will challenge to develop zero carbon steel.
- ✓ In June 2019, the government decided on the “Long-term strategy as a growth strategy based on the Paris Agreement” that reflects the JISF long-term vision. In response to this, the Ministry of Economy, Trade and Industry is scheduled to start an open call for research for leading zero carbon steel in January 2020 through the New Energy and Industrial Technology Development Organization (NEDO).
- ✓ In response to this situation, the JISF will set up the “Zero Carbon Steel Liaison Committee” and prepare for the commissioned lead research.

# Disclosure under TCFD

(Task Force on Climate-related Financial Disclosures)

- In May 2019, Nippon Steel signed a support of the information disclosure recommendations compiled by TCFD.
- Chairman Shindo was on stage at the TCFD Summit held in October this year.
- We participated in the creation of “TCFD guidance for companies (announced in October 2018)” and “TCFD guidance for investors (announced in October 2019)” and actively exchanged opinions with domestic companies and investors.
- We will continue to participate as a member of the TCFD Consortium Planning Committee.
- In the Sustainability Report 2019 and Integrated Report 2019, information is disclosed according to the TCFD disclosure recommendations.  
⇒ This year's TCFD disclosure is the first stage. We will work on improving the level .

Scenario	Factor	Events	Impact to Nippon Steel	Nippon Steel's strategy	
2°C	Transition factor 1 Advance in electric vehicles (EVs); decline in powertrain-related steel demand	Estimates for 2050: 1 EV: 342mn units (17% of total) Internal combustion engine vehicles (ICEVs): 1656mn units (83%)	 Opportunities in demand growth of steel	<ul style="list-style-type: none"> <li>■ Potential decline in the ratio of powertrain-related steel demand, but potential increase in demand for the global cumulative number of vehicles (ICEVs incl. HVs, PHVs).</li> <li>■ Increase in demand for high-performance steel for EVs.</li> </ul>	<ul style="list-style-type: none"> <li>■ Capturing growing demand by providing high-performance steel products (high-tensile steel, electric steel sheet), using its global supply network, and total solutions (NSafe™-AutoConcept).</li> </ul>
	Transition factor 2 Shift to other lightweight materials, prompted by tighter fuel efficiency regulations, etc. (multi materials)	Shift to other lightweight materials, prompted by tighter fuel efficiency regulations, etc.	 Opportunities in demand growth of high-strength steel; capturing demand for other materials	<ul style="list-style-type: none"> <li>■ Switch to other lightweight materials is possible but should not be significant as steel remains superior in environmental impact from the LCA viewpoint.</li> <li>■ Increase in demand for high-strength steel, carbon fiber reinforced plastics (CFRP), titanium steel, etc.</li> </ul>	<ul style="list-style-type: none"> <li>■ Penetration of the LCA concept</li> <li>■ Advance in strength of high-strength steel and provision of total solutions (NSafe™-AutoConcept) to compete with other lightweight materials</li> <li>■ Cooperation with Group companies (Nippon Steel Chemical &amp; Material) to capture demand for CFRP, etc.</li> </ul>
	Transition factor 3 Shift to the electric arc furnace (EAF) route	Progress in shift from the blast furnace (BF) route to the EAF route, which has lower environmental impact in manufacturing	 Opportunities in demand growth of steel	<ul style="list-style-type: none"> <li>■ Increase in the ratio of use of scrap (25% to 47%), due to more accumulation and generation of scrap; an increase in blast furnace steel production to continue up to 2050 to satisfy steel demand not satisfied by steel made of scrap</li> </ul>	<ul style="list-style-type: none"> <li>■ Penetration of the LCA concept (the same LCA-based evaluation including the recycling impact for steel products made by the BF route and by the EAF route)</li> <li>■ Outstanding low-carbon operating technology to help capture the BF steel demand (promotion of innovative technology development including top-level energy efficiency; COURSE50 aimed at commercial application by 2030, CCU, and hydrogen reduction steelmaking)</li> <li>■ High-grade steel made by the EAF route by the Group companies to capture demand</li> </ul>

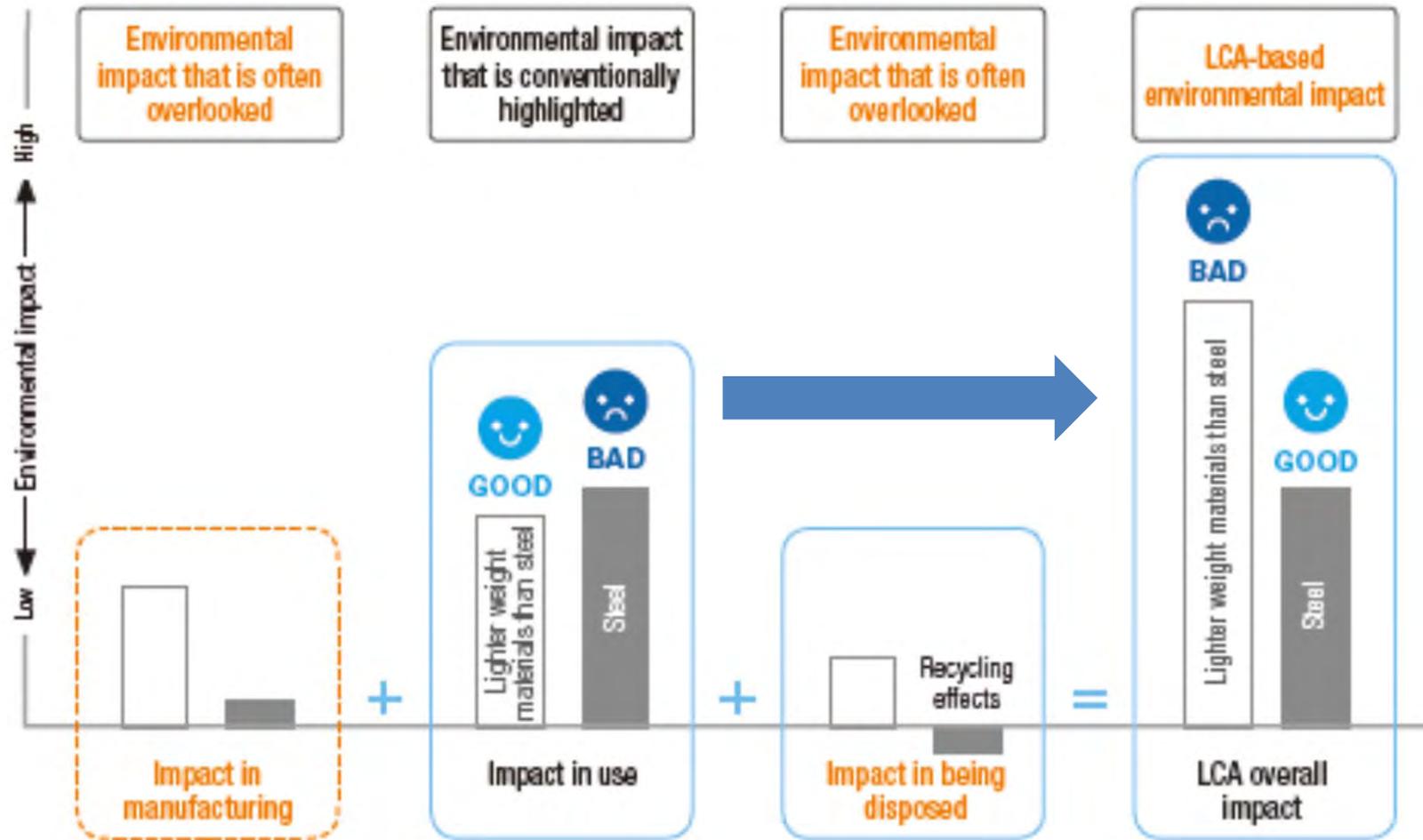
\*For data on EV vehicles, see IEA ETP2017. EV cars are only BEV without internal combustion engine. Vehicles equipped with internal combustion engines include PHV.

Scenario	Factor	Events	Impact to Nippon Steel		Nippon Steel's strategy
2°C	<p>Transition factor 4</p> <p>Increase in operating cost caused by adoption of carbon pricing</p>	<p>Adoption of carbon pricing</p>	<p></p> <p>Possibility of loss of competitiveness if an increase in cost cannot be passed on to product price</p>	<ul style="list-style-type: none"> <li>■ Significant impact for steel being an international product if carbon pricing is adopted.</li> </ul>	<ul style="list-style-type: none"> <li>■ Hydrogen reduction steelmaking and use of scrap to reduce CO2 emission</li> <li>■ Carbon pricing impact to be alleviated by securing pricing advantages, realized by our higher value-added product strategy, based on our technological strength and solution proposals</li> <li>■ Need to discuss with customers on passing cost increase on product price</li> </ul>
	<p>Transition factor 5</p> <p>Heightened needs for products and solutions associated with a hydrogen-oriented society</p>	<p>Increase in demand for hydrogen-related infrastructure and facilities</p>	<p></p> <p>Opportunities in demand growth for products of the Group</p>	<ul style="list-style-type: none"> <li>■ Profit growth by provision of the Group's products and solutions that support a hydrogen-oriented society [Ex] Stainless steel for high-pressure hydrogen (HRX19™); hydrogen station (Nippon Steel Engineering)</li> </ul>	<ul style="list-style-type: none"> <li>■ Enhancement of the Group's product menu and expanding sales in Japan and overseas</li> </ul>
	<p>Transition factor 6</p> <p>Higher needs for energy-efficient products and technology in the world</p>	<p>Eco-friendly technology solution to boost demand</p>	<p></p> <p>Opportunities in demand growth for eco-friendly technology</p>	<p>Profit growth, driven by our Group's long-proven technology solutions [Ex] Dissemination of CDQs, all of which are handled by Nippon Steel Engineering, into emerging countries</p>	<ul style="list-style-type: none"> <li>■ Expansion in provision of Eco Products in the world Government-private cooperation; Technologies customized list; and steel plant diagnosis to provide energy-saving technologies to emerging countries (contribution to the global value chain)</li> </ul>

Scenario	Factor	Events	Impact to Nippon Steel	Nippon Steel's strategy
4°C	<p>Physical factor 1</p> <p>Suspension of operation by raw material suppliers, due to abnormal weather</p>	<p>Difficulty to procure raw materials, caused by abnormal weather</p>	<p>↓</p> <p>Limited impact by taking measures on risk of suspended operation by raw material suppliers</p> <ul style="list-style-type: none"> <li>■ Limited assumed risk in securing stable procurement of raw materials by taking the following measures, despite some possibility in temporary procurement cost increase caused by a deterioration in supply/demand balance                             <ul style="list-style-type: none"> <li>• Material sourcing from multiple regions in the world</li> <li>• Keeping raw material inventories in steelworks and ships</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ Continual procurement from multiple sources</li> <li>■ Appropriate days of inventory; risk management</li> </ul>
	<p>Physical factor 2</p> <p>Suspension of operation and shipment, due to abnormal weather</p>	<p>Difficulty in operation caused by a natural disaster</p>	<p>↓</p> <p>Limited impact by taking appropriate measures</p> <ul style="list-style-type: none"> <li>■ BCP measures have been adopted. Limited risks in production disruption caused by natural disaster. Excessively abnormal weather may result in suspension of operation, etc.</li> </ul>	<ul style="list-style-type: none"> <li>■ Continual implementation of adaptation measures, with consideration of long-term trends: Measures against typhoons and heavy rain; measures to prevent crane overturns; measures against earthquakes and tsunami (securing emergency evacuation places, embankment reinforcement, etc.)</li> </ul>
	<p>Physical factor 3</p> <p>Heightened needs for solutions for "National Resilience" against natural disasters</p>	<p>Natural disaster caused by abnormal weather</p>	<p>↑</p> <p>Opportunities in demand growth of steel for national land resilience</p> <ul style="list-style-type: none"> <li>■ Profit growth by providing products and solutions for National Resilience against earth-quakes, tsunamis, heavy rain, typhoons, etc.</li> </ul>	<ul style="list-style-type: none"> <li>■ Enhancement of the Group's product menu and expanding sales in Japan and overseas</li> </ul>

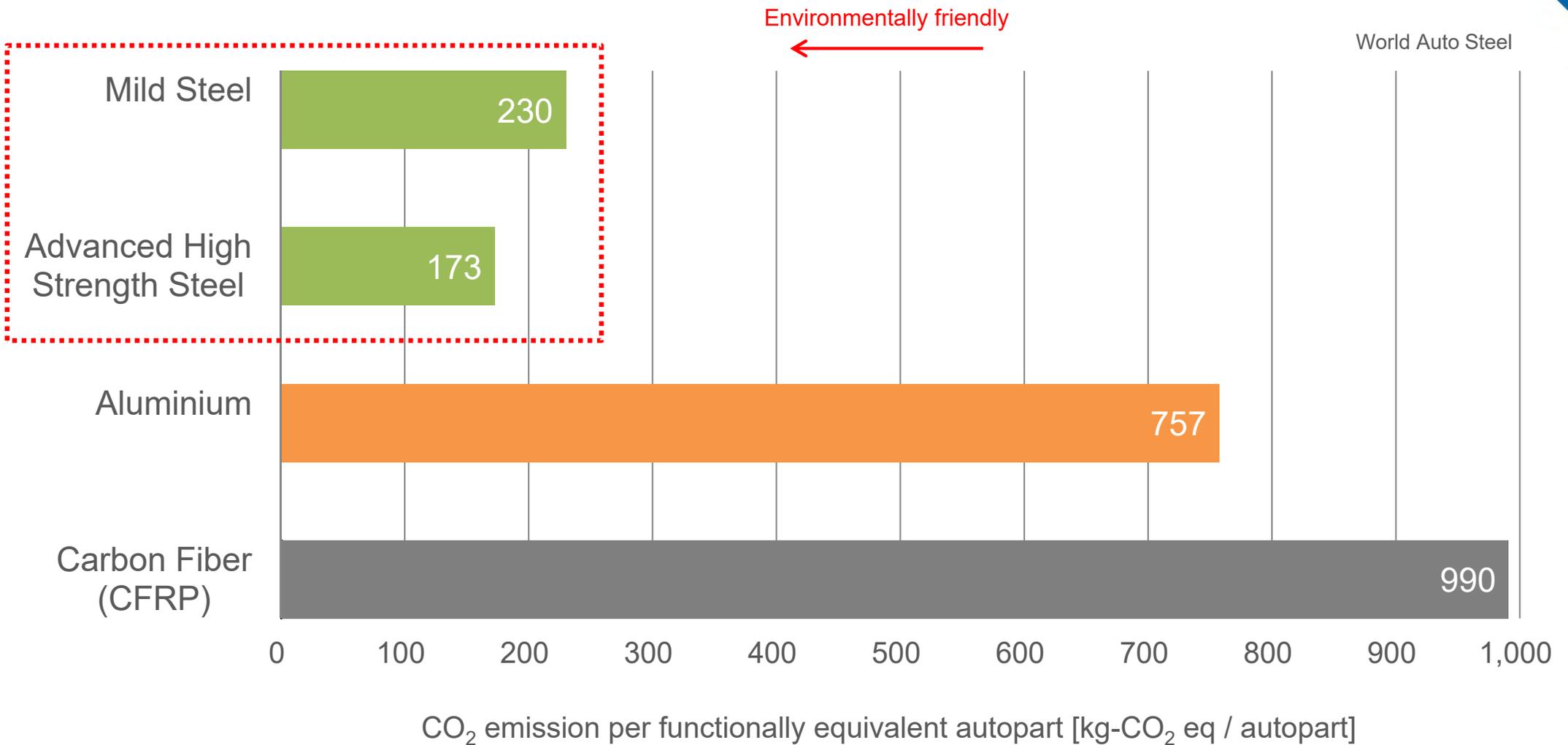
# LCA : Life Cycle Assessment

# Life Cycle Assessment (LCA)



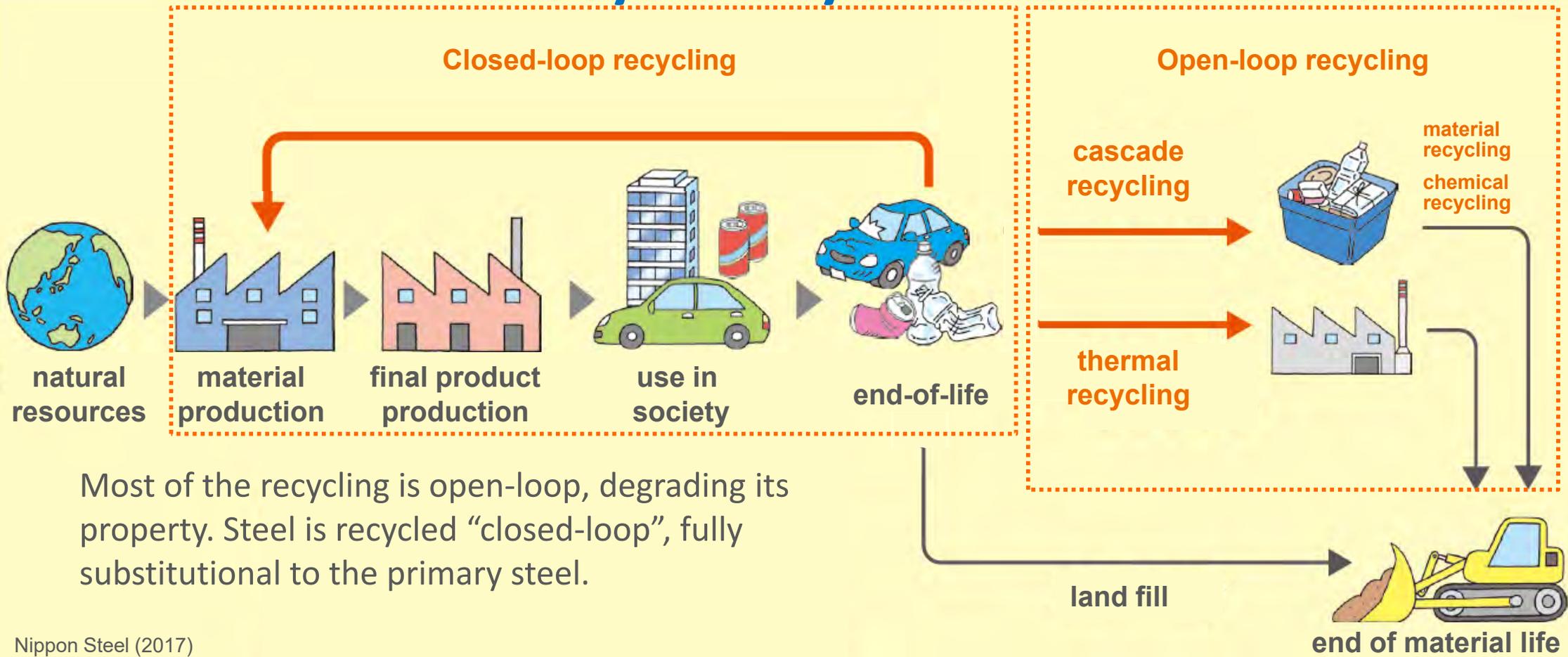
It is important to consider the environmental impact not only during product use, but also throughout the product life cycle, including disposal and recycling.

# CO<sub>2</sub> emission in production



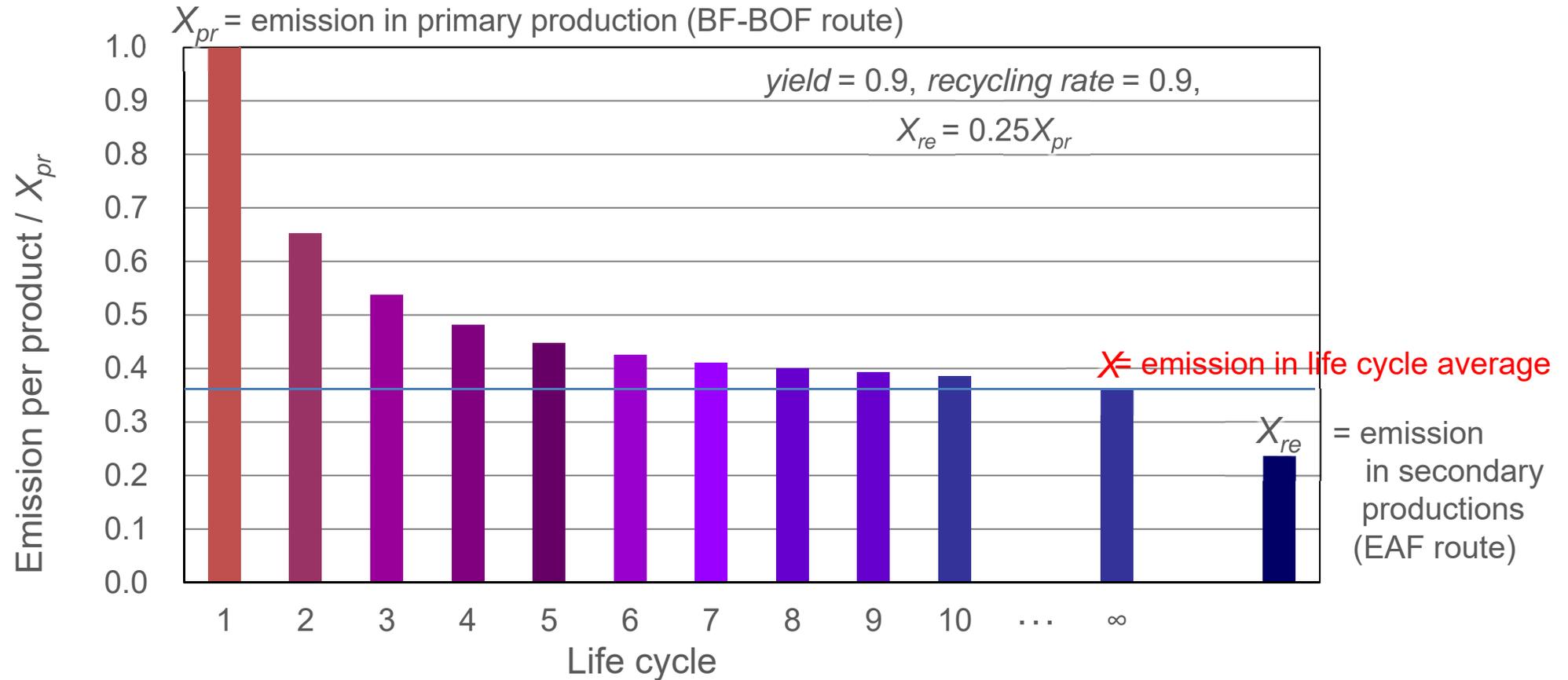
CO<sub>2</sub> emission in production per same performance component is low in steel compared to other light-weight materials.

# Recyclability of steel



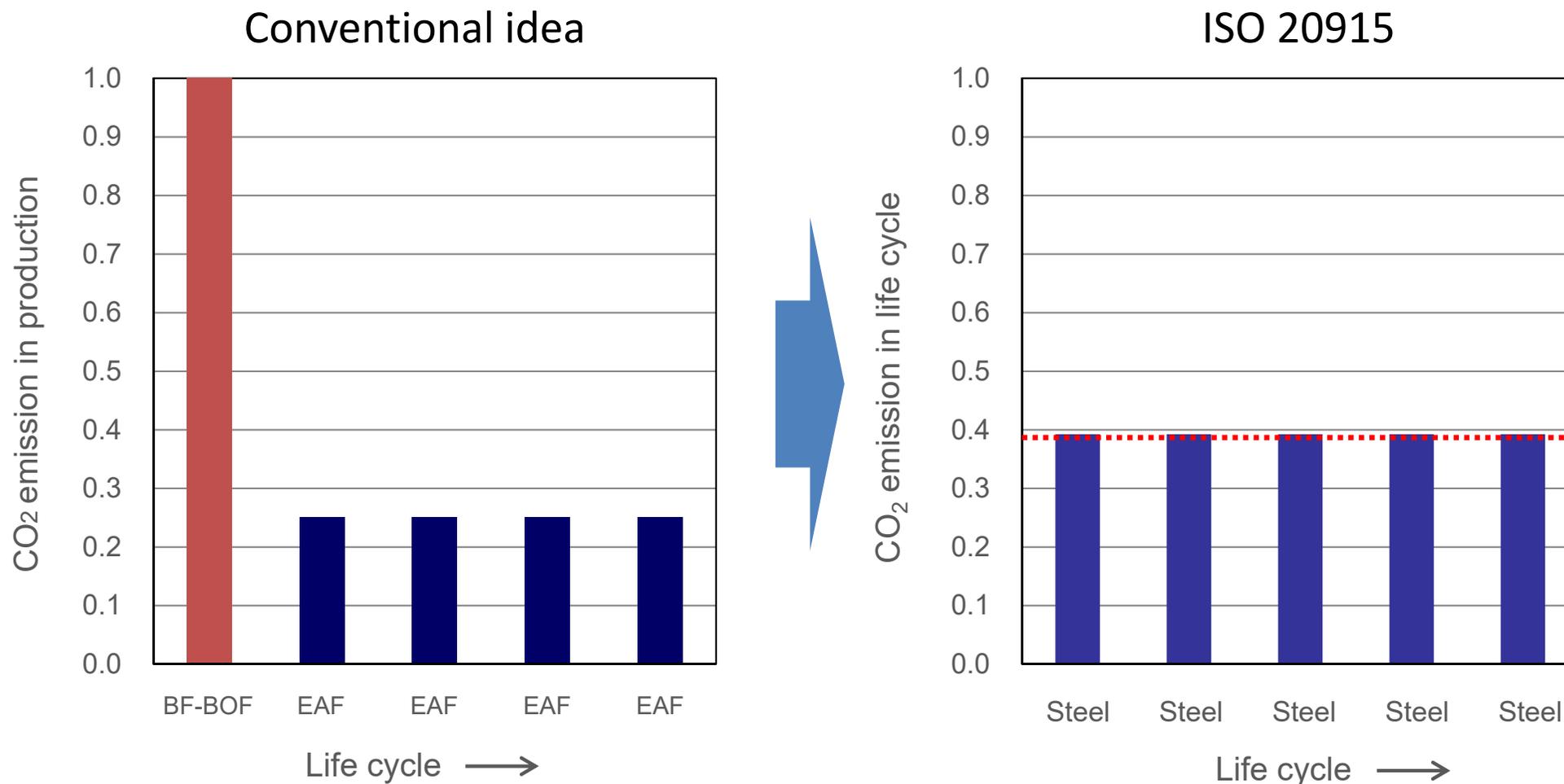
	Steel	Aluminum	Polymer
1. Easy sorting	Good	Fair	Fair
2. Low environmental impact in recycling process	Good	Average	Good
3. Existence of economical recycling system	Good	Good	Average
4. Refinable in recycling	Good	Average	Fair

# CO2 emission in multiple recycling



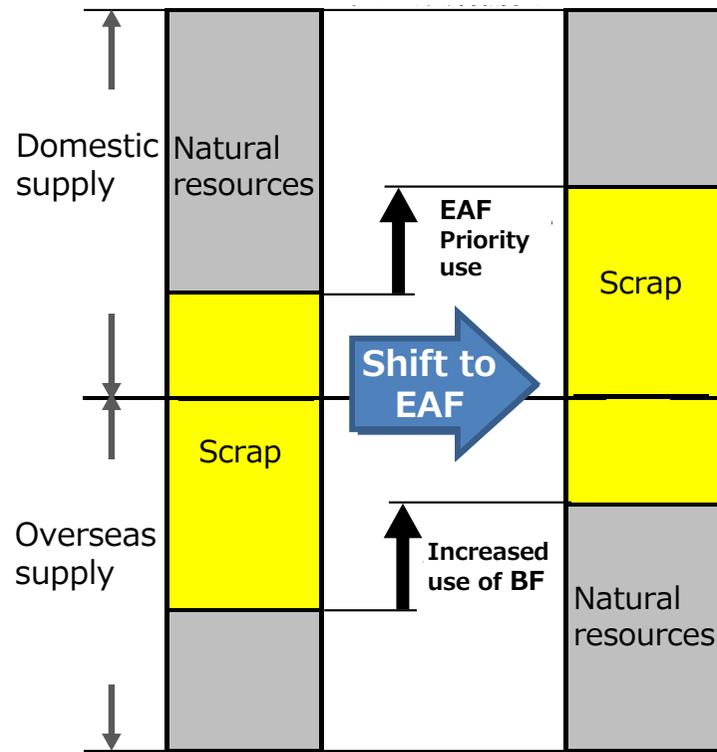
Emission in multiple recycling converges to a value.

# CO2 emission in multiple recycling

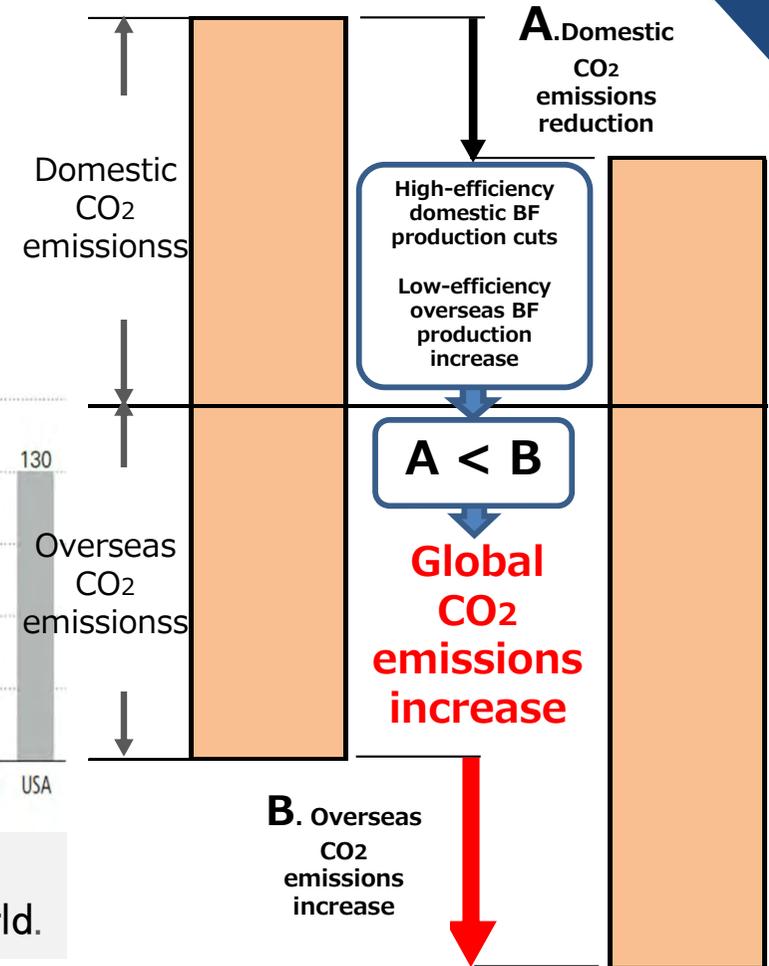
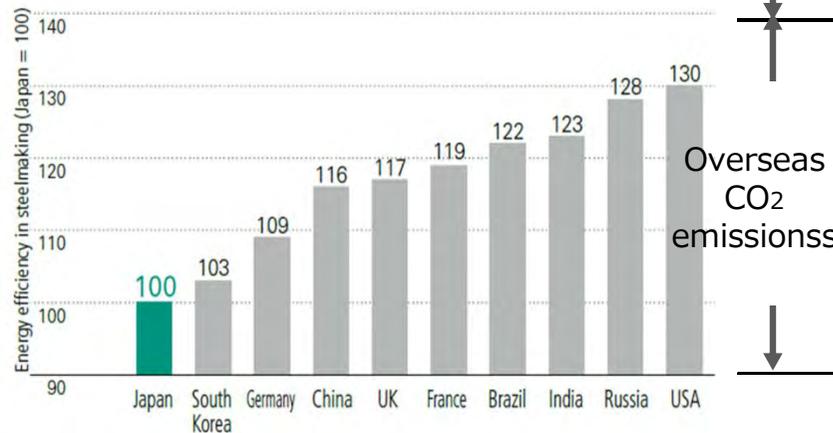


- ✓ In closed-loop recycling, there is no difference CO<sub>2</sub> emission between BF-BOF and EAF steels.
- ✓ This methodology was published as ISO 20915 on Nov. 2018.

# Distorted promotion of EAF steel may create global CO<sub>2</sub> increase



EAF: Electric Arc Furnace  
BF: Blast Furnace



Scrap is a finite resource.

Japan's blast furnace is the most efficient in the world.

Attempting to use scrap forcibly in Japan → leading to a CO<sub>2</sub> emissions increase in global

If we try to promote the use of electric furnace steel forcibly in the region, it will cause adverse effects.

- (1) There is a limit to the demand for electric furnace steel (almost construction materials).
- (2) Increased CO<sub>2</sub> in other areas.

# ESG Topics

## (Contributing to SDGs)



## ***NSSMC & Mazda Co-Develops World's First Cold-Stamped Parts Using 1,310 MPa-Class High-Strength Steel*** (Jan. 2019)

- By de-bottlenecking the formability and dimensional accuracy problems after processing, application of 1,310 MPa-Class High-Strength Steel has been expanded to car structural parts with more complexed configuration
- This results in a lighter and strong vehicle body that ensures improved fuel economy and crash safety performance



## ***ECO·VC Gold Award from Panasonic for 9 consecutive years*** (Jan. 2019)

“Development of new Electrical steel series for better motor performance”  
→Realized significant CO2 emission reduction



## ***Expanded 24-hour in-house nurseries in Hirohata Works*** (Feb. 2019)

The 5th nursery opened in Apr. 2019.  
Oita, Kimitsu, Yawata, Nagoya and Hirohata (New open)



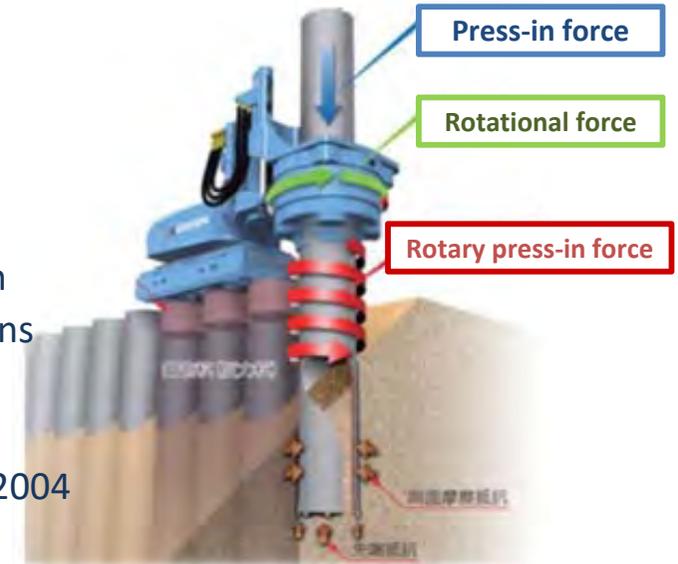


## ***Gyro-Press Method™ (Rotary Cutting Press-in Method), Co-development of GIKEN Ltd. & Nippon Steel, Has Been Adopted in Construction of Sea Embankment against Large-scale Tsunami***

~Gyro-Press Method™, GIKEN LTD. and our joint development method~

### <Advantages of Gyro-Press Method™>

- Clean emission : Restricted soil displacement
- Ultra low noise : Reduced skin friction
- Minimum affect on surrounding traffic : Compact operation in sites with narrow access or overhead obstructions
- Realize eco-friendliness, cost reduction & work efficiency
- Many achievements in various different infrastructure project such as river bulkhead & road retaining structure reinforcement since 2004
- Contribution for disaster prevention/reduction & early recovery



## ***New order for two large-scale CDQ systems from Tata Steel***

### < Benefits of CDQ = Coke Dry Quenching >

CDQ systems use an inert gas inside a cooling tower to cool red-hot coke that has been dry distilled in a coke oven. The sensible heat of red-hot coke, which previously has been dissipated, is recovered as steam with a boiler.

- 1) Reduced CO2 emissions through power generation by steam
- 2) Less amount of dust generated when cooling coke
- 3) Improved quality of coke suited to use in blast furnace



**thank you for your attention**