# EU Japan Sustainable Finance Policy Seminar
# Activities of Japanese steel industry for climate change

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Mr. Hiroyuki Tezuka
Chairman
Energy Technology Committee
The Japan Iron and Steel Federation

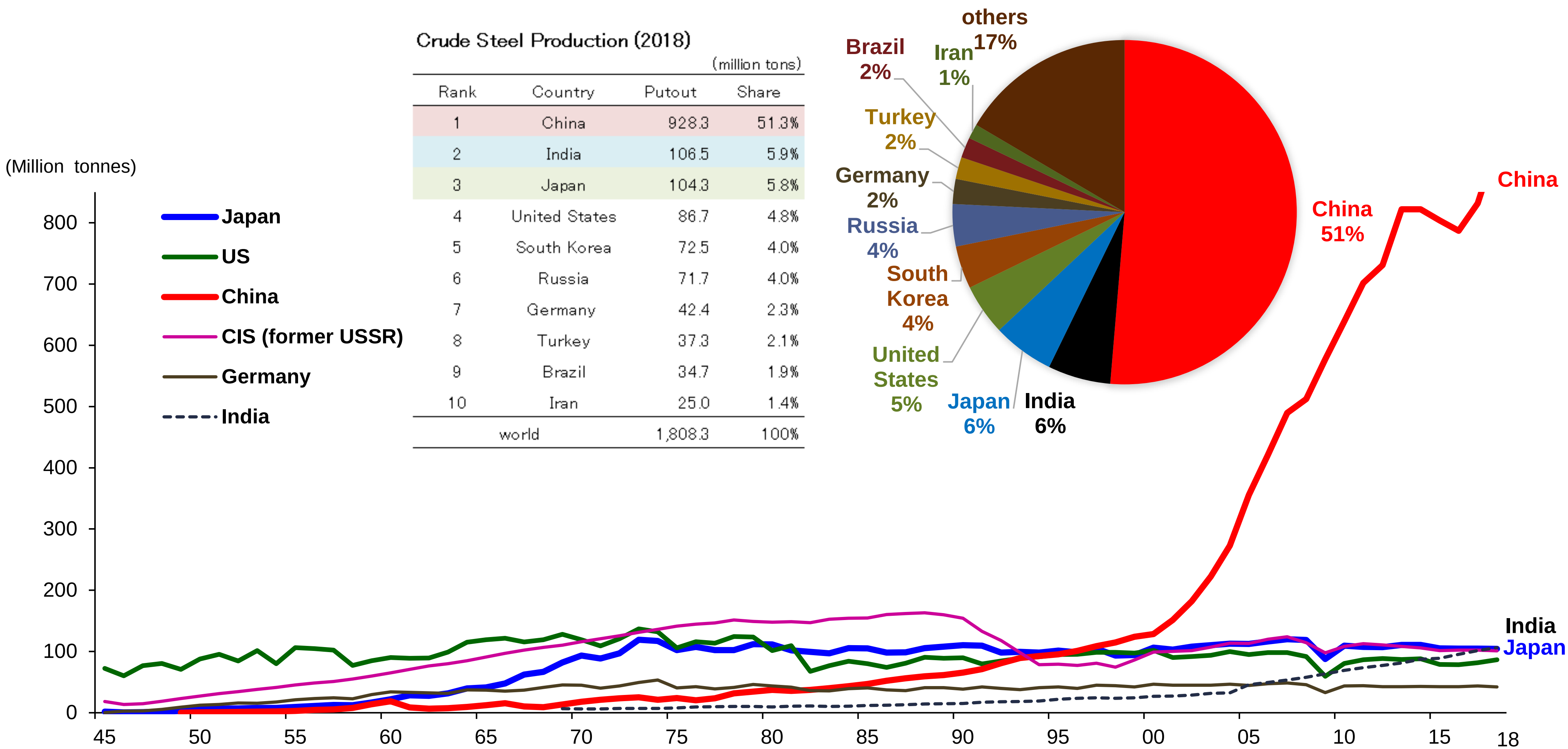
Fellow and
General Manager, Climate Change Policy Group
Technology Planning Dept.
JFE Steel Corporation

# Global Crude Steel Production (2018)

Crude Steel Production (2018)

(million tons)

| Rank | Country | Putout | Share |
|---|---|---|---|
| 1 | China | 928.3 | 51.3% |
| 2 | India | 106.5 | 5.9% |
| 3 | Japan | 104.3 | 5.8% |
| 4 | United States | 86.7 | 4.8% |
| 5 | South Korea | 72.5 | 4.0% |
| 6 | Russia | 71.7 | 4.0% |
| 7 | Germany | 42.4 | 2.3% |
| 8 | Turkey | 37.3 | 2.1% |
| 9 | Brazil | 34.7 | 1.9% |
| 10 | Iran | 25.0 | 1.4% |
| | world | 1,808.3 | 100% |




Source：worldsteel

# Steel Demand and Supply in the Future

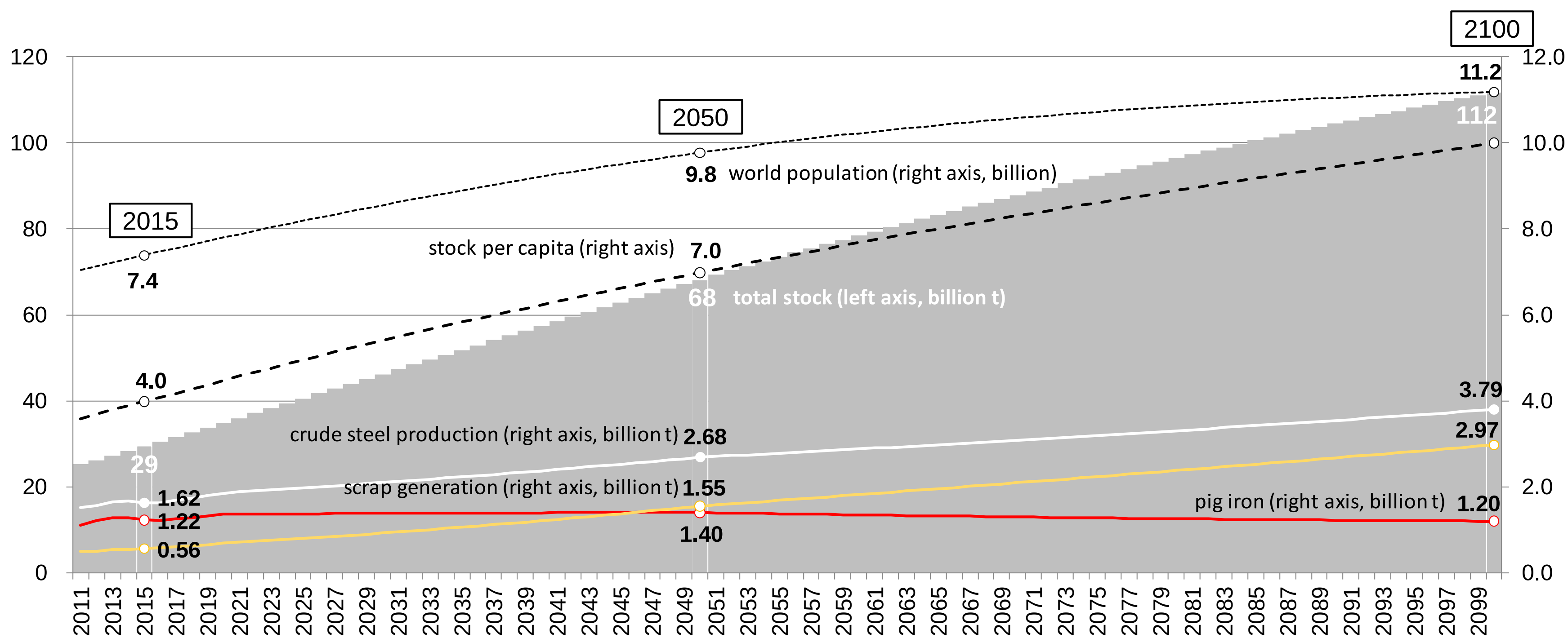
[crude steel production] increase as the steel demand increases

[scrap] its use increases mainly as a result of increased generation of end-of-life scrap due to expansion of the amount of total steel stock.

[pig iron production] As scrap alone can not meet steel demand and production from the natural resource route is essential for the expansion of steel stock, almost the same level of pig iron production as currently required will be required at the end of this century

(billion ton)

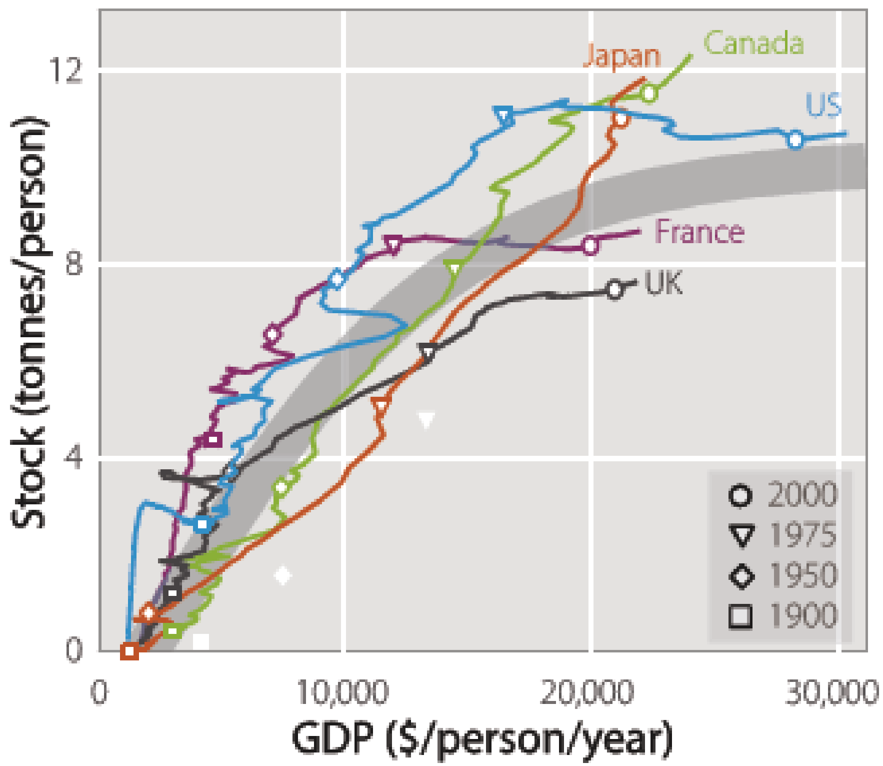
| | 2015 | 2050 | 2100 |
|---|---|---|---|
| Amount of steel in final products | 1.29 | 2.13 | 3.01 |
| Crude steel production | 1.62 | 2.68 | 3.79 |
| Pig iron production | 1.22 | 1.4 | 1.2 |
| Scrap consumption | 0.56 | 1.55 | 2.97 |



# Performance Trend of Steel Stock in the World

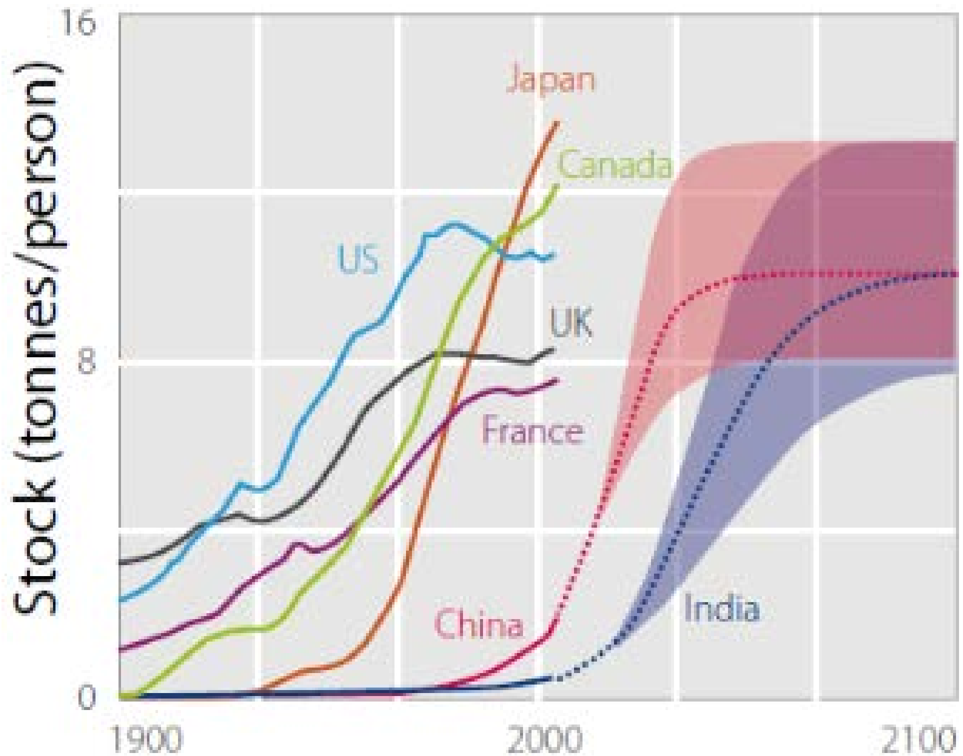


There is a certain correlation between economic growth and the amount of steel stock per capita, and as the population increases, the total stock amount expands. The steel stocks in developed countries are estimated to be in the range of 8 to 12 t/person, and it is estimated that the steel stock will reach 10 tons per person in China in the first half of this century and in India during this century.




**Relationship between GDP per capita and steel stock**

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

# How to tackle the climate change for the future (short term and long term)

- Considering the generation rates of scrap, only the scrap cannot meet the shortfall of steel sources. Therefore, the usage of primary resources are inevitable in the long term
- Based on existing technologies, $CO_2$ emissions will significantly increase with increasing crude steel production in 2050

**There is two choice for tackle the climate change for the future (short term and long term)**

## Short term

- Japanese steel industry is going to continually working for the energy saving their plant as they have been.
- In addition to the activity in Japan, disseminate Best Available Technologies to the countries where there are energy saving potential such as India and ASEAN countries for further $CO_2$ reduction and energy saving

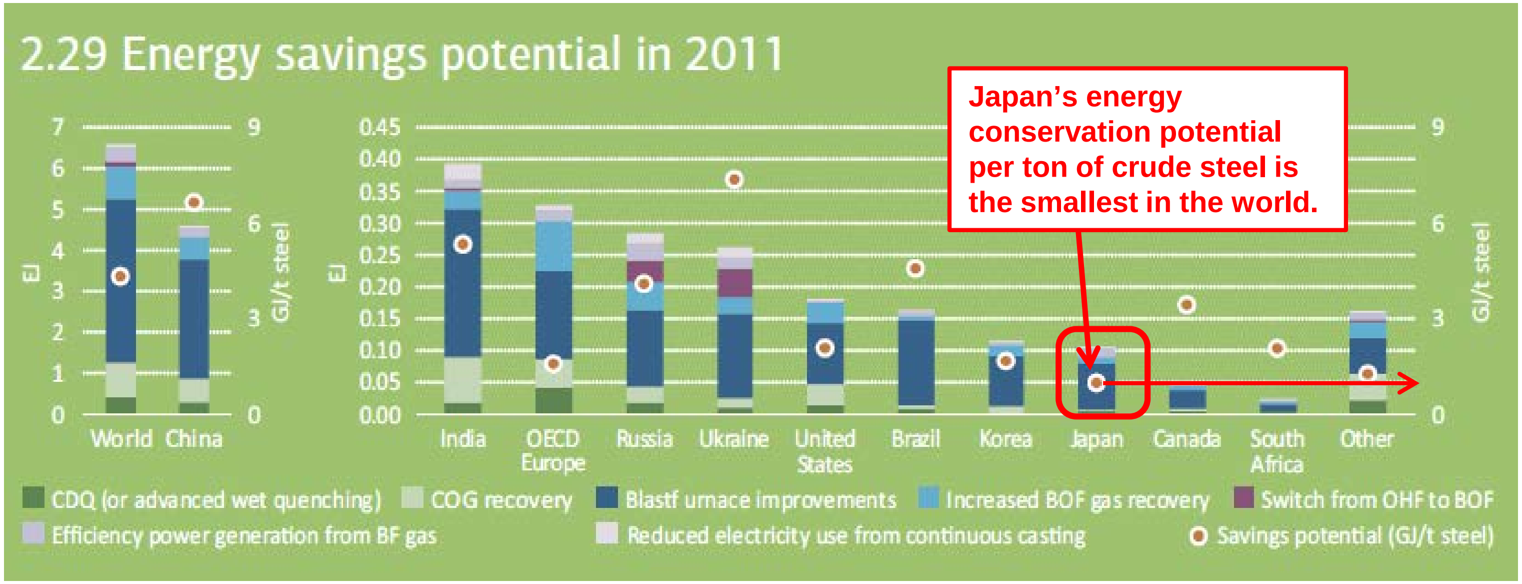
## Long term

- Development of innovative ironmaking technologies

# International Comparison of Energy Efficiency in the Steel Industry

- The International Energy Agency (IEA) estimates that if most of energy saving technologies available as of 2011 are applied world widely, the total energy saving potential would reach 6.6 EJ
- Virtually all steel mills in Japan use existing technologies and that there is very little potential for further energy-conservation measures
- Therefore, it is crucially important to disseminate these technologies to achieve further $CO_2$ reduction and energy saving

**Energy Saving Potential from Transferring and Promoting Energy Conservation Technologies (2011)**




Source: IEA "Energy Technology Perspective 2014"

# JISF's global energy saving activities

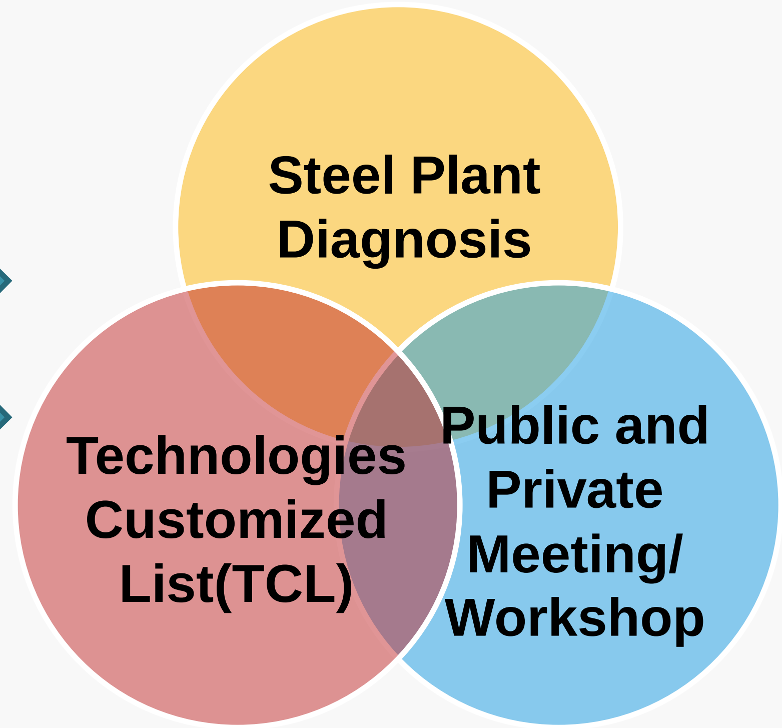
## Collaborative Country & Region

China (2005～)

India (2011～)

ASEAN (2014～)

## 3 main activities



# What are the advantages of Technologies Customized List?

1. The benefit of technology implementation is clearly demonstrated
   - Indicate $CO_2$ reduction effect and payback time for the collaborative country or region, based on country-based energy prices, plant installation cost and $CO_2$ emission factor

2. Technologies listed on TCL are reliable
   - Effects of the technologies are proven through Japanese steelmakers' operating experiences

3. Easy to reach out to further information when necessary
   - Include in contact detail of supplier companies which have the best available technologies


The 9th India-Japan Public and Private Collaborative Meeting on Iron and Steel Industry Mumbai, India
23 January, 2019.

**India side's thanked the updating of TCL and they mentioned that they would like to diffuse it to stakeholders in India and also expect to continually have a Public and Private Collaborative Meeting.**

# Technology Transfer of Energy Saving Technologies

CDQ, TRT and other major types of equipment alone are already lowering annual aggregate $CO_2$ emissions in China, Korea, India, Russia, Ukraine, Brazil and other countries by approximately 60 million tons in 2017.

(Mt/year)

| Energy Saving Rechnology | No. of units | CO2 Reduction |
|---|---|---|
| Coke dry quenching (CDQ) | 96 | 19.69 |
| Top-pressure recovery turbines (TRT) | 62 | 11.02 |
| Byproduct gas combustion (GTCC) | 52 | 21.90 |
| Basic oxygen furnace OG gas recovery | 21 | 8.21 |
| Basic oxygen furnace sensible heat recovery | 7 | 0.90 |
| Sintering exhaust heat recovery | 6 | 0.88 |
| **Total emission reduction** | | **62.59Mt** |

GTCC：Gas Turbine Combined Cycle system

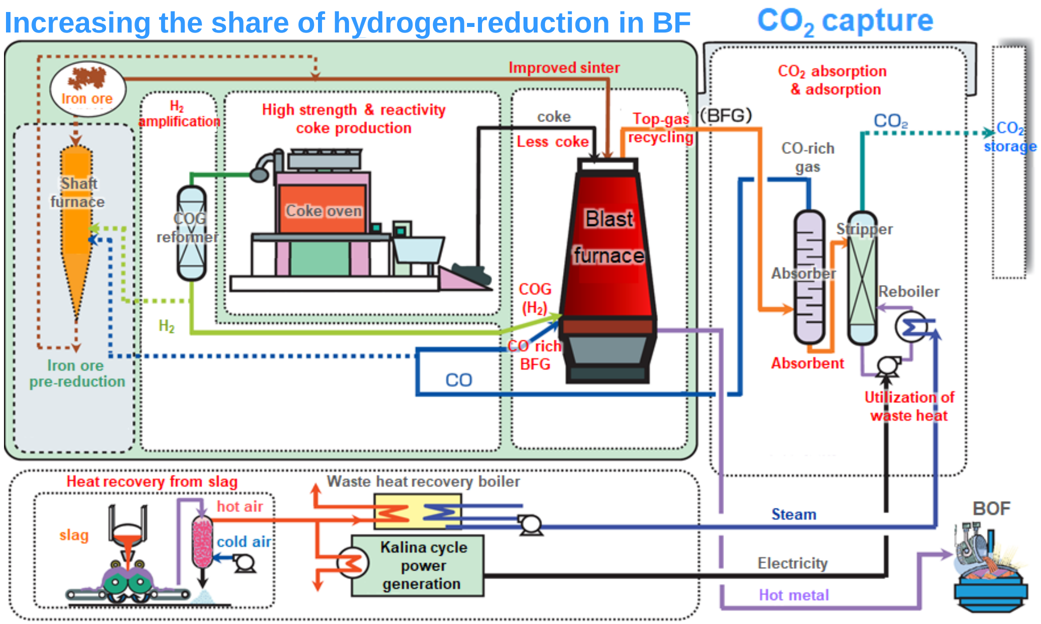
***5 major energy saving equippments, commercialized and sold by Japanese companies by 2017***

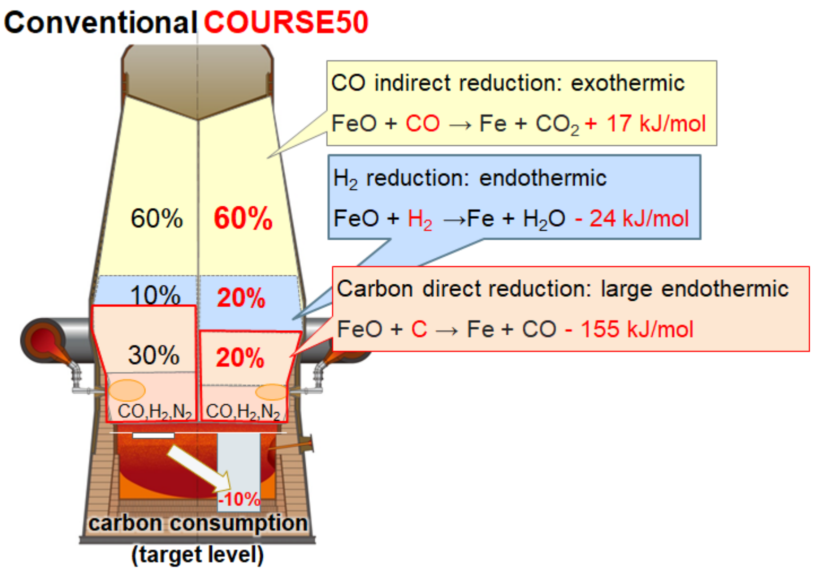
# The First Step to the future; COURSE50

**COURSE50 project is the national project for drastic $CO_2$ reduction from iron-making process, consisting of increasing the share of hydrogen-reduction in blast furnace and $CO_2$ capture from BFG**

NEDO COURSE50

**COURSE50 test blast furnace**



# Roadmap for Zero-carbon STEEL

The Japanese Iron and Steel Industry is diligently pursuing the development of innovative ironmaking technologies such as COURSE50 and ferro coke to realize practical application by 2030. When these technologies are put to practical use, they are expected to reduce $CO_2$ emissions of natural resource routes by 10% (excluding CCS effect). It is necessary to advance the establishment of low carbon technologies on the premise of blast furnace use, since the blast furnace method is considered to be the mainstream of the steel manufacturing method in the meantime, both technically and economically.

However, these efforts alone cannot reach the long-term target level of the Paris, and "super innovation technologies" beyond them are necessary. The Japanese Iron and Steel Industry will, using the knowledge gained from the development of COURSE50 and ferro coke as a foothold, challenge to develop technologies that will ultimately achieves zero emissions from ironmaking process, including iron reduction technologies using hydrogen, CCS and CCU.

The practical application of hydrogen-reduction ironmaking process is premised that hydrogen is developed and maintained as a common energy carrier for the society, as it is widely used not only in steel production but also in various sectors such as automobiles and consumer use. Especially, an important requirement for hydrogen to be used for the production of steel, which is a basic material, is stable supply at low cost, in addition to being carbon free. Moreover, the implementation of CCS requires, in addition to the development of cheap transportation and storage technologies for large quantities of $CO_2$, solving issues beyond technical aspects, such as securing $CO_2$ storage sites, acceptance from society, implementing entities, and distribution of the economic burdens.

Development of technologies specific to iron & steel sector

| | | 2020 / 2030 / 2040 / 2050 / 2100 |
|---|---|---|
| COURSE50 | Raising ratio of H2 reduction in blast furnace using internal H2 (COG)<br>Capturing CO2 from blast furnace gas for storage | R&D → Implementation |
| Super COURSE50 | Further H2 reduction in blast furnace by adding H2 from outside<br>(assuming massive carbon-free H2 supply becomes available) | Stepping up → R&D |
| H2 reduction iron making | H2 reduction iron making without using coal | Stepping up → R&D → Implementation |
| CCS | Recovery of CO2 from byproduct gases. | R&D → Implementation |
| CCU | Carbon recycling from byproduct gases | R&D → Implementation |

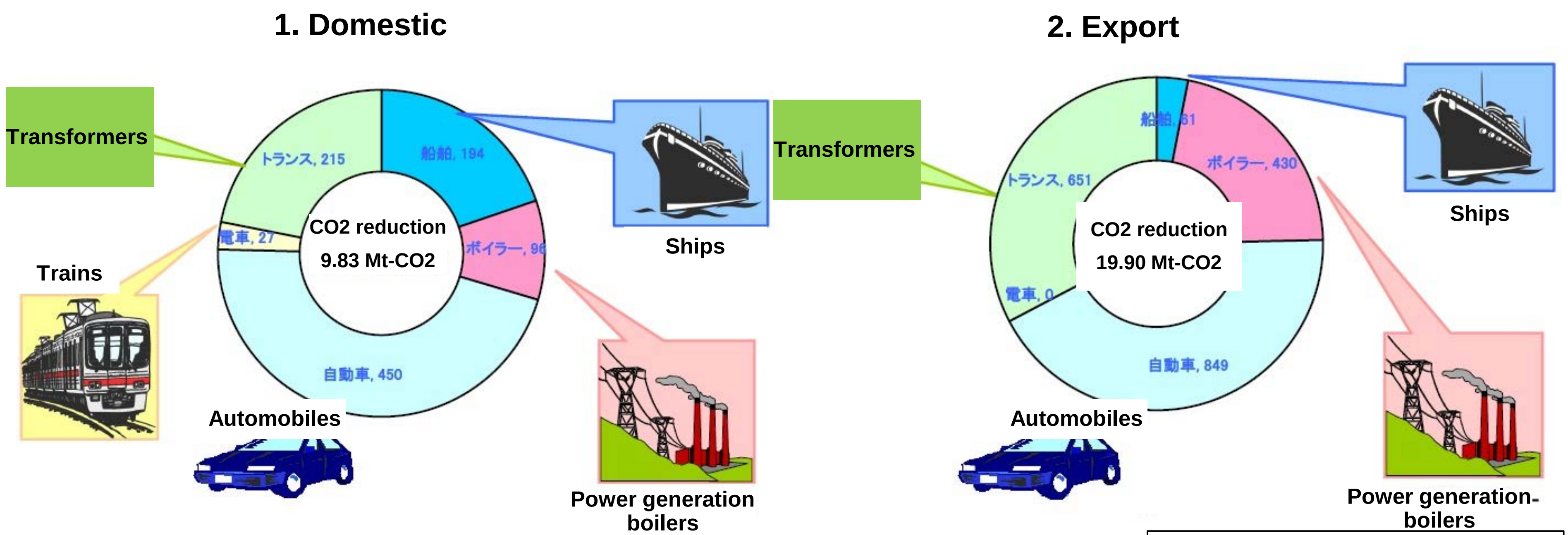
Development of common fundamental technologies for society

| | | 2020 / 2030 / 2040 / 2050 / 2100 |
|---|---|---|
| Carbon-free Power | Carbon-free power sources (nuclear, renewables, fossil+CCS)<br>Advanced transmission, power storage, etc. | R&D → Implementation |
| Carbon-free H2 | Technical development of low cost and massive amount of hydrogen production, transfer and storage | R&D → Implementation |
| CCS/CCU | Technical development on CO2 capture and strage/usage<br>Solving social issues (location, PA, etc.) | R&D → Implementation |

# Eco Product Contribution: Quantitative Evaluations – Contributions of Major High-performance Steel Products

- To establish a method to determine the quantitative contribution of high-performance steel, JISF established in FY2001 a committee with the participation of associations of steel-consuming industries, The Institute of Energy Economics, Japan and the Japanese government. The committee has been monitoring contributions every year since then.
- 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). The use of finished products made of high-performance steel cut FY2017 $CO_2$ 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 $CO_2$.

## $CO_2$ Emission Reductions by the five major types of high-performance steel (FY2017)



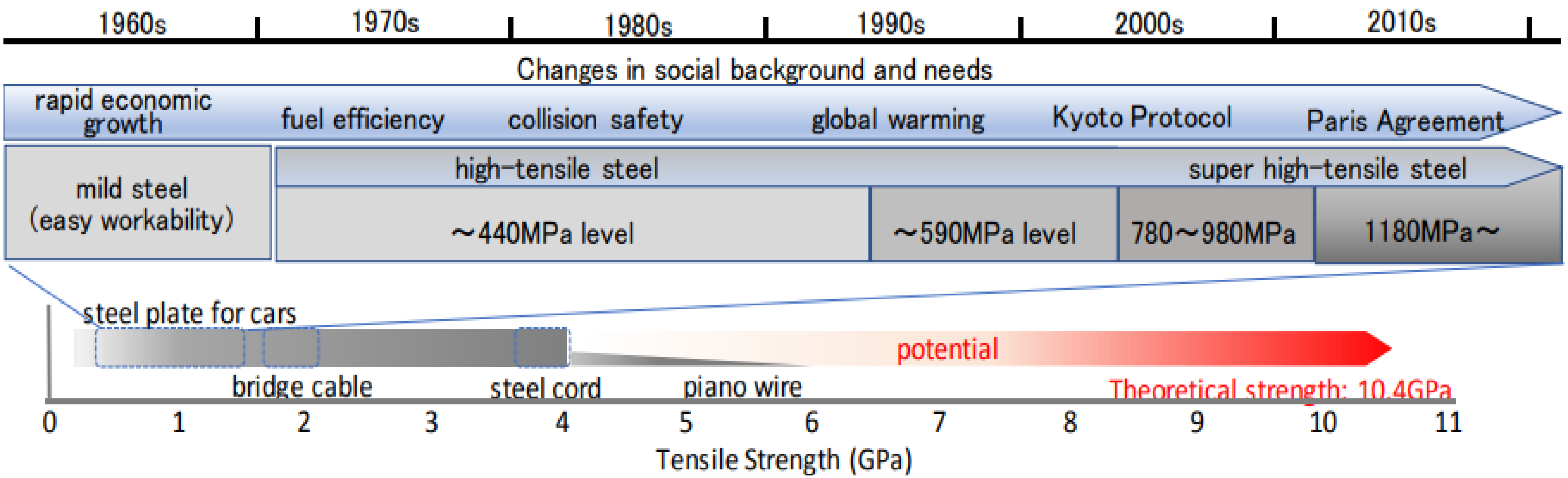

**$CO_2$ Emission Reductions: 29.73 million tons $CO_2$ in total (6.95 million tons of high-performance steel)**

Ref:
$CO_2$ Emission Reductions: 28.47 million tons $CO_2$ by the end of FY2016
(7.36 million tons of high-performance steel)

Source: The Institute of Energy Economics, Japan
*The five categories are automotive sheets, oriented electrical sheets, heavy plates for shipbuilding, boiler tubes and stainless steel sheets. In FY2017, use of the five categories of steel products in Japan was 3.18 million tons and exports were 3.77 million tons for a total of 6.95 million tons.
*Assessments in Japan started in FY1990 and for exports assessments started in FY2003 for automobiles and shipbuilding, in FY1998 for boiler tubes, and in FY1996 for electrical sheets.

# Eco Product Contribution: Future Potential of Iron and Steel Materials

- Iron and steel materials have greatly improved their mechanical and electromagnetic properties. However, , the characteristic level we put into practical use is only 1/10-1/3 (in the case of strength) with respect to the theoretical limit value.
- Japan Iron and Steel Industry will contribute to the reduction of CO2 in the entire life cycle, while supporting the foundation of the future society, through not only further strengthening steel products but also developing next-generation steel products for hydrogen infrastructure to be expected in the future.



# India-Japan Public and Private Collaborative Meeting on iron and steel industry (1/2)

## Purpose

To encourage technology transfer from Japanese to Indian steel industry and thereby contribute to the energy saving in India and in the world.

## Members – Public and Private sectors of India and Japan

Public and Private Partnership

### India

**Public members and observers**

Ministry of Steel
Bureau of Energy Efficiency etc.

**Private members and observers**

Indian steel companies
(SAIL, RINL, TSL, JSW, JSPL, BSPL, BSL, Essar, MECON etc.)

### Japan

**Public members and observers**

Ministry of Economy, Trade and Industry/ NEDO / JBIC / JETRO

**Private members and observers**

The Japan Iron and Steel Federation
(Nippon Steel & Sumitomo Metal, JFE steel, Kobe steel, Nisshin Steel etc.)

# India-Japan Public and Private Collaborative Meeting on iron and steel industry (2/2)

**Meetings – since 2011**

## Cooperative Approach

| 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2017 | 2019 |
|---|---|---|---|---|---|---|---|---|
| 1st meeting (New Delhi) | 2nd meeting (New Delhi) | 3rd meeting (Tokyo) | 4th meeting (Tokyo) | 5th meeting (New Delhi) | 6th meeting (Tokyo) | 7th meeting (Jaipur) | 8th meeting (Kitakyushu) | 9th meeting (Mumbai) |









**Three pillars of the energy management in the steel plant**

### ISO14404

**Steel Plant Diagnosis using ISO14404**
**(2013-2018)**

### Technologies Customized List

**Technology reference of energy saving technologies suitable for each country/region**

### Energy Management System


**Help steel plants to establish a framework to plan, do, check and act for the energy saving activities**

# Technologies Customized List (TCL)

TCL is a technology reference covering recommended technology for individual countries and regions. India version and ASEAN version are available now.

## ASEAN


Version 1
(Nov 2014)

Included tech items
30→33


Version 2
(Sep 2016)

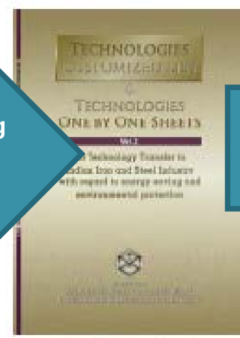
Adding 32 BF-BOF techs


Version 3
(Feb 2019)

## India


TCL version I (2013)
- 17 energy saving techs

Energy Saving tech items
17→19




TCL version II (2014)
- 19 energy saving techs

Adding 16 items of environmental protection tech

TCL version III (2017)
- 19 energy saving techs
- 16 environmental protection techs

Adding 34 EAF techs


Version 4
(Feb 2019)

TCL has been updated according to requests from the collaborative country/region and the circumstance of the country/region.

# Thank you