Decarbonization Efforts by Japan's Steel Industry and NEDO

June 17th, 2021

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Overview of NEDO
（New Energy and Industrial Technology Development Organization）

Mission ： **Innovation Accelerator**

- **Addressing energy and global environmental problems**
- **Enhancing industrial technology**

Organization: Established in 1980
Reorganized in 2015 as a National Research and Development Agency, under the Ministry of Economy, Trade and Industry (METI) of the Japanese government

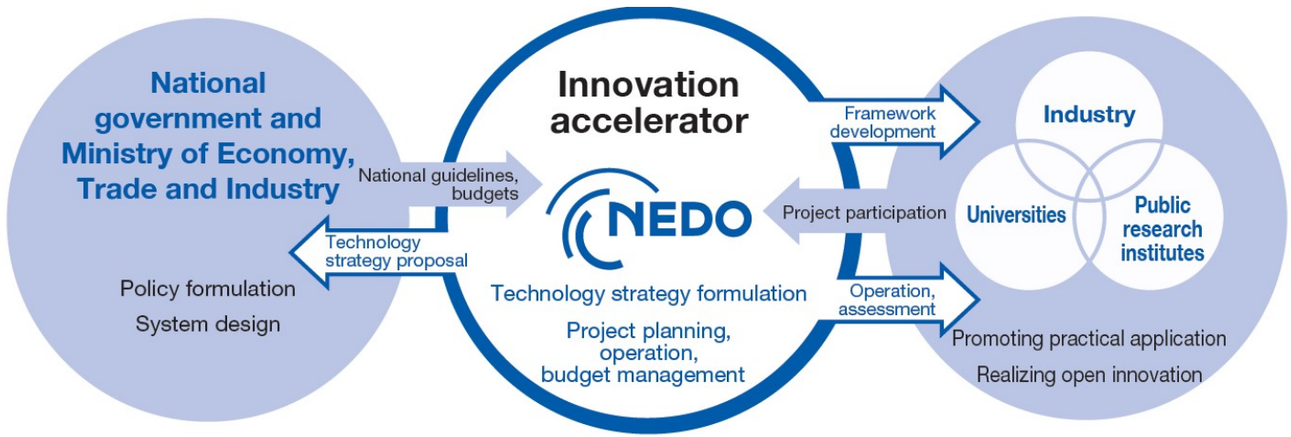
Head Office: Kawasaki City, Japan

Chairman: Mr. Hiroaki Ishizuka

Personnel: 1,256 (as of 1st April,2021)

Budget: Approx.$1.47 billion (2021FY)

*Fund: Green Innovation $18.36 billion
Post 5G $1.84 billion
Moonshot $19.9 million



NEDO's Core Technologies

Renewables

Energy Conservation

Electronics / ICT

Materials/Nanotech

Hydrogen /Battery

Water Treatment

Smart Community

Environment/ Clean Coal

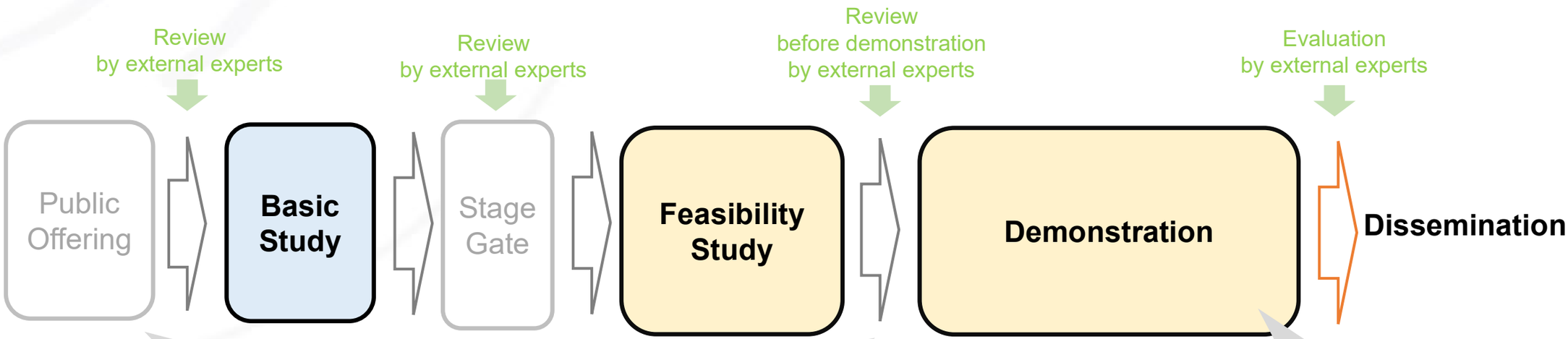
Robotics/AI

International Energy Demonstration Project

Purpose

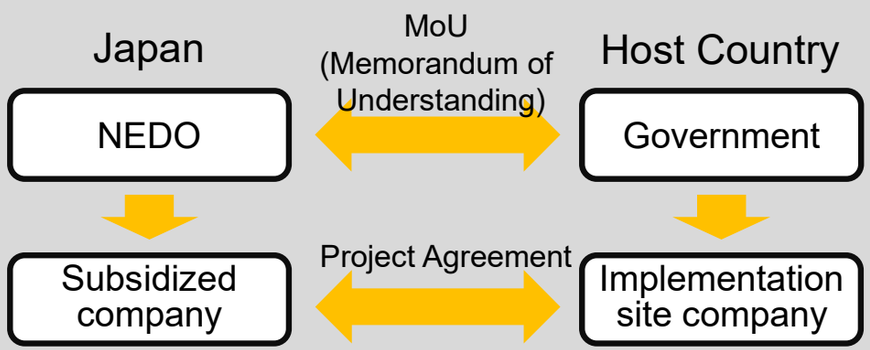
- ✓ Contribute to solving foreign energy problems through a demonstration of Japanese technology and systems for energy conservation.
- ✓ Contribute to obtaining energy security by reducing energy consumption through the dissemination of technology.

Scheme



Next public offerings are planned in **Summer in 2021**

※ Indian companies or universities may participate in the projects, together with Japanese companies which are supposed to apply for the offering.



Maximum for each project is around **3 Billion Rupees**

Implemented Demonstration Projects in India

Current Projects

1. EMS for Multiple Energy Sources at Steel Plant

Completed Projects (FY)

2. Sinter Cooler Waste Heat Recovery (2014)
3. Coke Dry Quenching System (2011)
4. Utilization of Sensible Heat from Blast Furnace Hot Stove Waste Gas (2004)
5. Green Telecom Tower Project (2016)
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12. Waste Heat Recovery System of Cement Plant (2004)

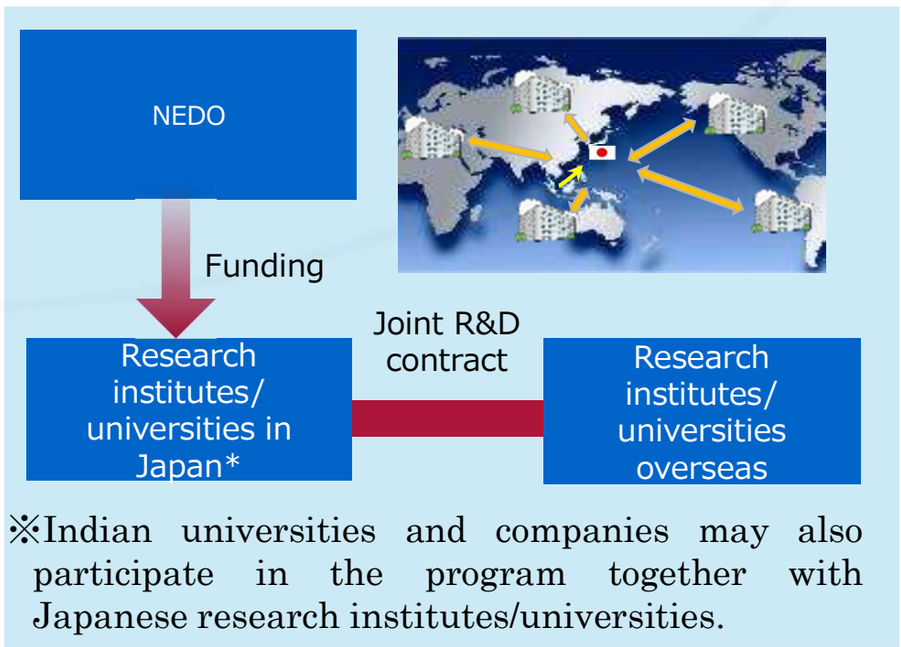
R&D Program for Promoting Innovative Clean Energy Technologies Through International Collaboration

● Program Outline

✓The aim of this program is to develop and strengthen international joint Research and Development between Japan and other countries in order to create new and innovative clean energy technologies that will have practical use after 2030.

✓This program supports Japanese research institutes and universities conducting joint international R&D projects with institutions from G20 member and other countries.

● Program Scheme



※Indian universities and companies may also participate in the program together with Japanese research institutes/universities.

● Project Details

NEDO calls for proposals from Japanese research institutes/universities that conduct innovative projects through international collaboration.

Project scheme	International collaboration between Japanese research institutes/universities and research institutes/universities overseas. Private companies may participate but only when research institutes/universities also participate.
Project budget	Maximum of almost **INR 3.5 crores** per project/per year. Note: NEDO will only fund the Japanese side of the international collaboration.
Project term	**Maximum of 3 years.**
Target technologies	Clean energy technologies, including renewable energy and energy-saving and environmental technologies that will have practical application after 2030. 4 R&D themes have been selected for FY2021.

NEDO New Delhi Office Webinar (Launched in 2021)

(1) 4th of February 2021

Theme : *Energy transition in post COVID-19 period and recovery of power sector in India Electricity situation and Renewable energy*

Speakers : CEA, SECI, Avaada, Toshiba JSW Power Systems Pvt.

(2) 10th of March 2021

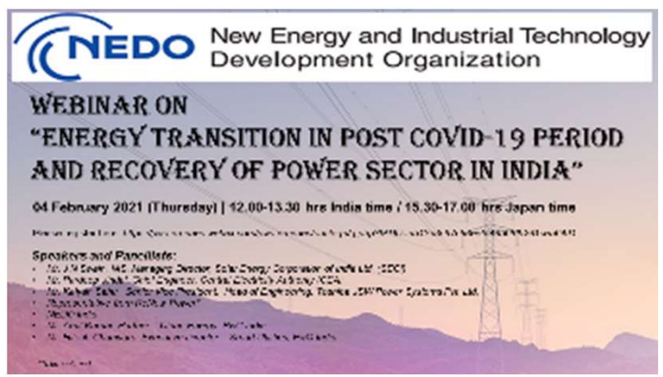
Theme : *Post COVID recovery of Power Sector in India & Investment Opportunities in Power distribution, Grid management & Energy Storage Distribution Management and Energy Storage*

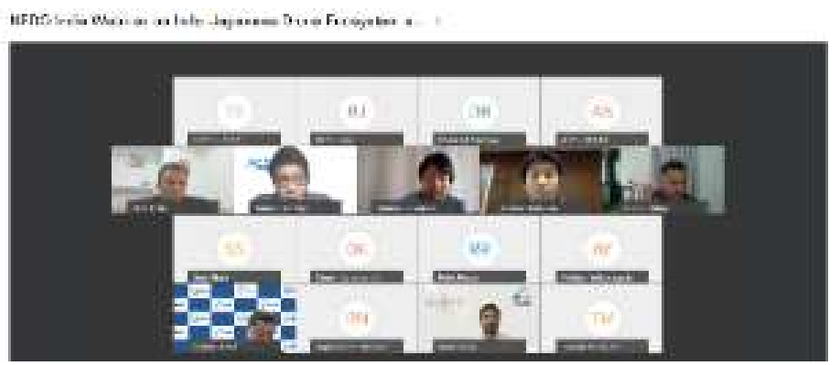
Speakers : NITI Aayog, POSOCO, Tata Power Delhi, Sumitomo Electric, etc.

(3) 24th of March 2021

Theme : *Indo-Japanese Drone Ecosystem and Potential Collaborations*

Speakers : MOCA, DFI, Government of Japan(Cabinet Secretariat, METI), ACSL





Japan’s Initiative for Carbon Neutrality 2050

- In Oct 2020, Prime Minister Suga declared Japan’s intention to aim for **Carbon Neutrality 2050**. This challenge has become the very essence of Japan's growth strategy.

  Also, in April 2021,PM Suga said Japan aims to reduce greenhouse gas emissions **46% by 2030** compared with fiscal 2013 levels. It is a significant increase from its previous commitment for a 26% cut.

- Gov. of Japan published **The Green Growth Strategy,** an industrial policy which aims to create a **positive cycle of economic growth and environmental protection**, together with the business community.

- The aim is to fully support the private sector’s efforts toward carbon neutrality, setting specific targets that enable the private sector to set and achieve ambitious goals.

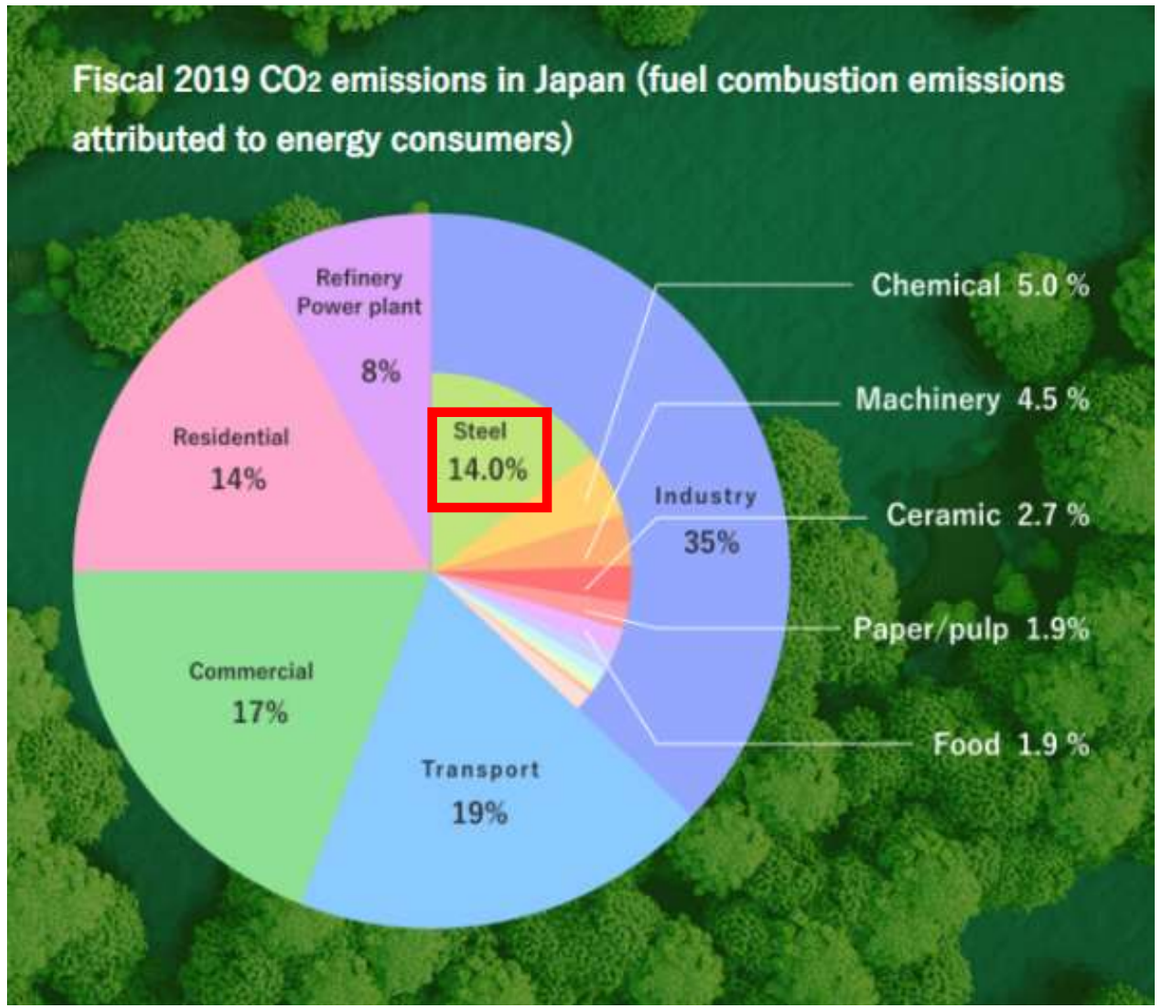
- The strategy includes 5 cross sectoral policy tools (support measures) and action plans for 14 sectors, and will be updated continuously.

The Green Growth Strategy (5 Policy tools)

Grant funding	✓ ***Green Innovation Fund*: 2 trillion yen** over 10 years ✓ Stimulate **15 trillion yen** worth of private R&D and investment.
Tax incentive	✓ Tax incentives to stimulate **1.7 trillion yen** worth of private investment over 10 years.
Guidance policy on Finance	✓ Formulate guidelines for transition finance and establish a scheme for **long-term funds with an interest subsidy (1trillion yen in 3 years** in business scale basis) to attract global ESG investment.
Regulatory Reform	✓ Consider regulatory reform in areas such as **hydrogen, offshore wind power, and mobility/batteries**. ✓ Discuss issues concerning carbon border adjustment and related policies with a view to ensuring global level playing field
International Collaboration	✓ Cooperation with various players, including both developed and emerging countries, on **innovation policy**, **joint projects** including third countries, **standardization and rule-making,** and providing wide variety of **solutions toward de-carbonization** ✓ World wide promotion efforts through "**Tokyo Beyond-Zero Week**"

CO2 Emissions in Japan's Steel Sector

- The steel industry is one of the largest emitters of CO2 (14%) among Japan's industrial sectors, due to its large manufacturing volume, and reducing its emissions is an important issue.



Source : https://www.zero-carbon-steel.com/en/

Basic Policy of the Japan steel industry on 2050 Carbon Neutrality
(Feb. 2021, Japan Iron and Steel Federation(JISF))

1. The Japanese steel industry supports Japan's ambitious policy of achieving carbon neutrality by 2050 and it will aggressively take on the challenge to realize zero-carbon steel with the aim of contributing to the Japanese government policy. Our challenge includes (1) contribution through our technologies and products and (2) initiatives to **reduce CO2 emissions in steel production process** (i.e., **zero-carbon steel**).

2. **Realization of zero-carbon steel is an extremely difficult challenge** and **that is unlikely to be realized in a straight line**. Therefore, the Japanese steel industry will **explore multiple pathways** to the challenge by employing every possible means including, our actively ongoing efforts for the drastic reduction of CO2 emissions from blast furnace through **COURSE 50 and ferro coke technologies plus CCUS** (carbon capture, utilization, and storage), development of super innovative technologies such as **hydrogen-based iron making**, **expanded use of scrap**, **recovery of low- to medium-temperature waste heat**, and **use of biomass**.

(Emphasis added)
Source: https://www.jisf.or.jp/en/activity/climate/documents/CN2050_eng_201210215.pdf

Basic Policy of the Japan steel industry on 2050 Carbon Neutrality
(Feb. 2021, Japan Iron and Steel Federation(JISF))

3. Challenges to develop super innovative technologies - To realize decarbonization in iron making process and zero-carbon steel, it is necessary to endeavor to develop advanced technologies, such as **CCUS, under a blast furnace (reduction with carbon) method** with an improved reduction ratio with hydrogen. In addition, we need to spend additional huge costs to neutralize unavoidable remaining CO2 emissions or implement **the hydrogen-based iron making** which does not generate CO2. **There is no other solution**.

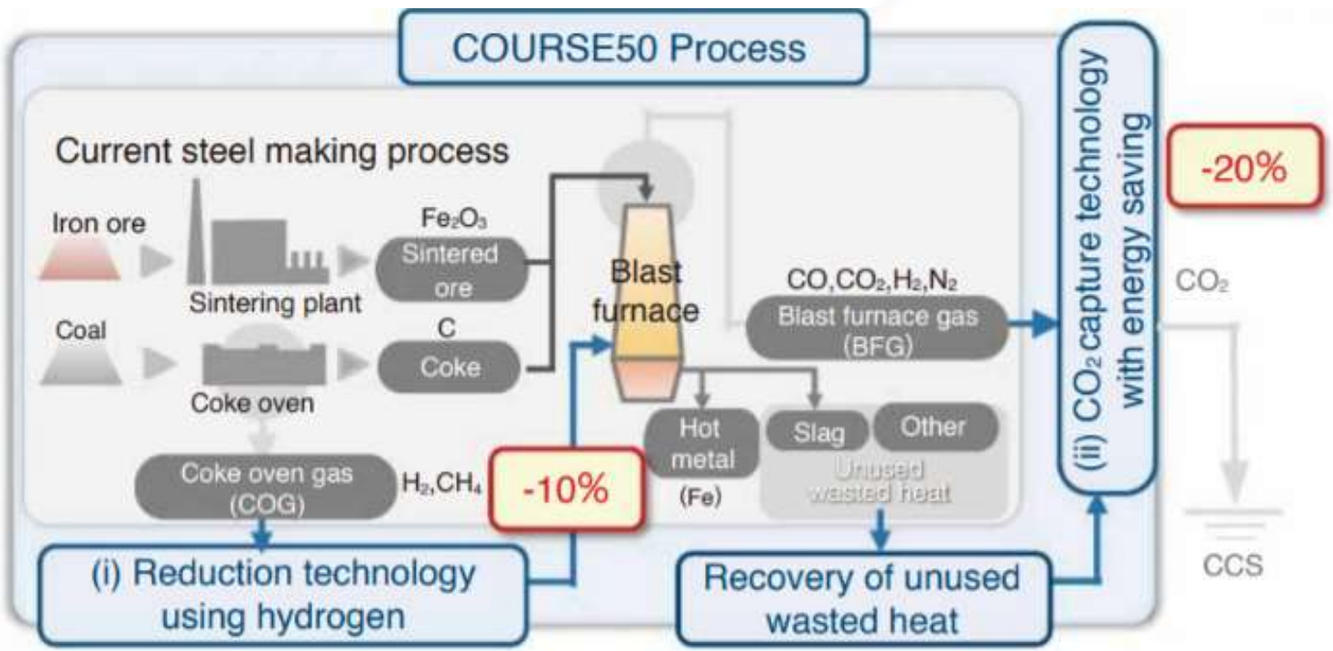
Hydrogen-based iron making is an iron making process that is totally different from the existing blast furnace process which we have reached over several thousand years in history. The detail of hydrogen-based iron making is still unknown, and it is a major hurdle for us. Some countries have just begun to develop such new technologies, thus this is an extremely ambitious and challenging project.

Furthermore, replacing the existing process with the new one at the stage of implementation will **require a huge amount of capital investment**, resulting in large capital and operating costs. But these additional costs are only for decarbonization and contribute neither to improving the performance of steel nor to increasing productivity of the steel.

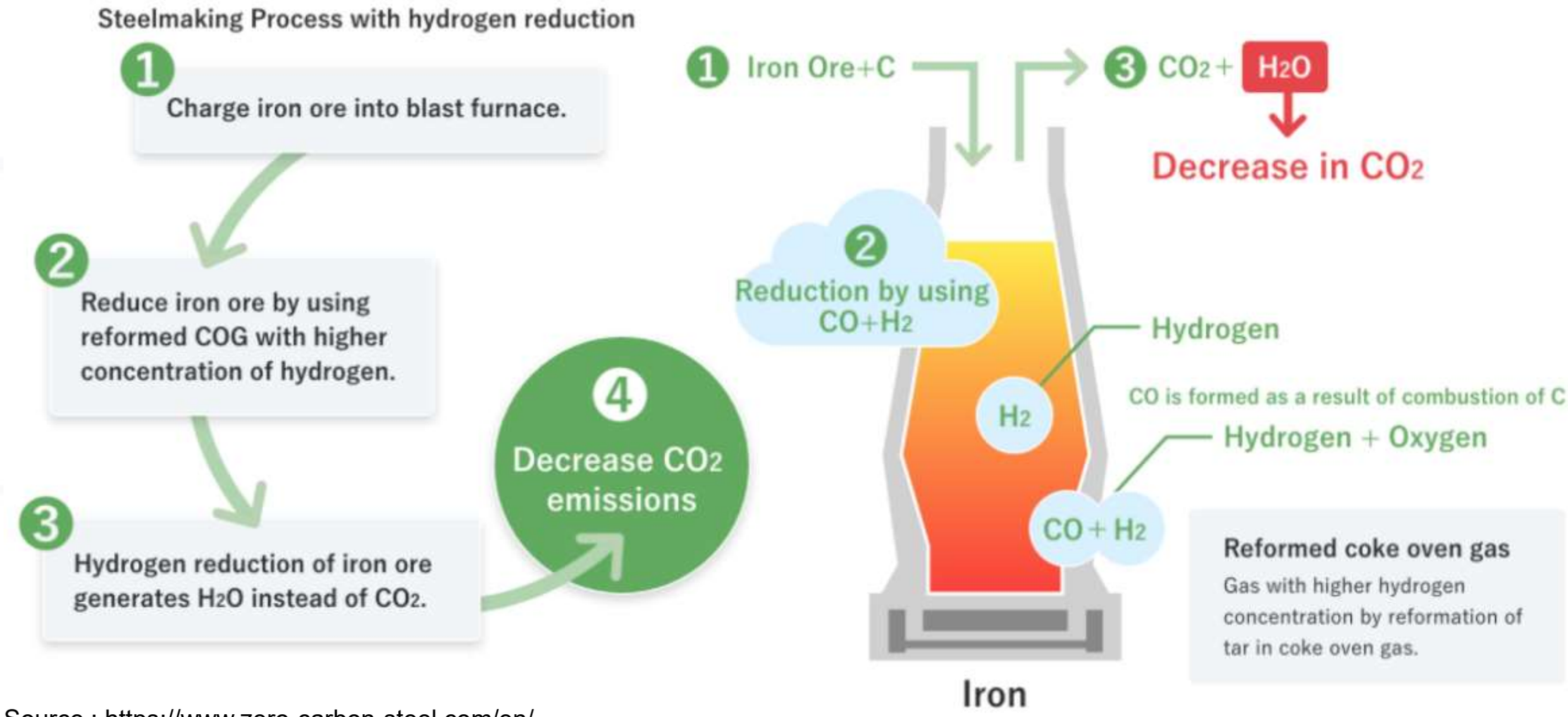
(The rest omitted)

COURSE50 (CO2 Ultimate Reduction System for Cool Earth 50)

1. **Development of technologies to decrease CO2 emissions**
   - Reduction of iron ore using hydrogen as a partial substitute for coke to decrease CO2 emissions **by 10%**
2. **Development of CO2 separation and recovery technologies**
   - Separation and recovery of CO2 from blast furnace gas decreases CO2 **by 20%**

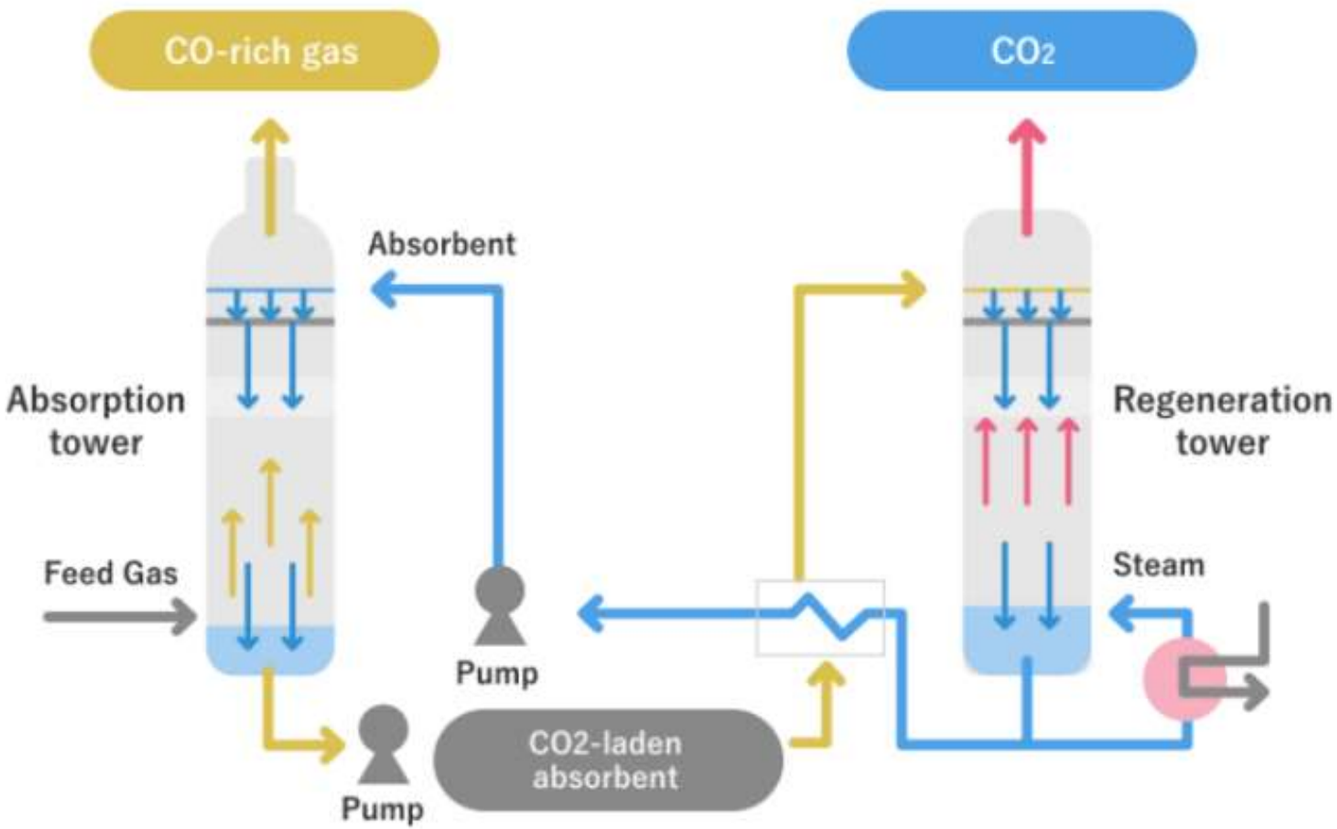


COURSE 50 (Technologies to decrease CO2 emissions)



Source : https://www.zero-carbon-steel.com/en/

COURSE 50 (CO2 separation and recovery technologies)



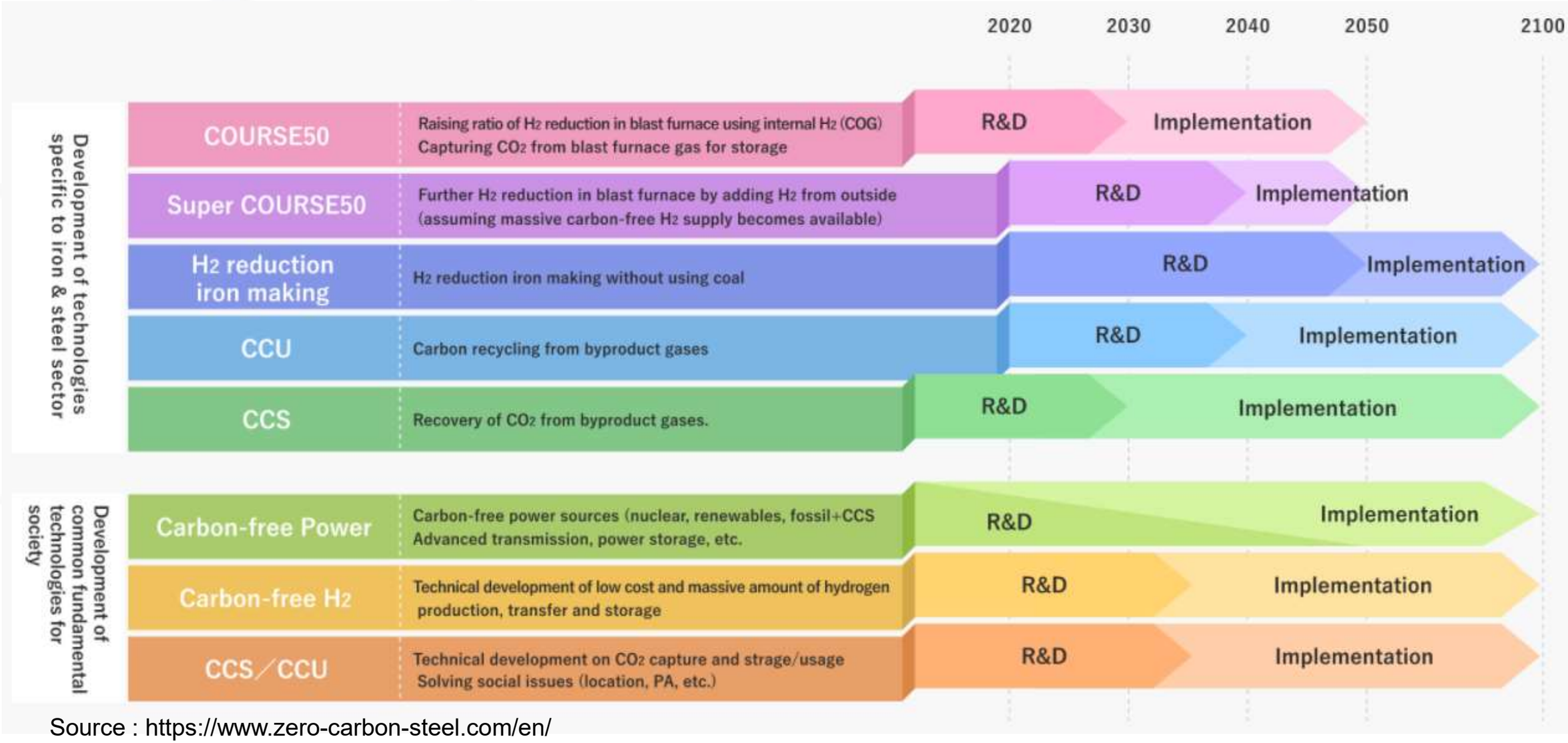
Source : https://www.zero-carbon-steel.com/en/

Energy-Saving CO_2 Absorption Process (ESCAP™)

(By Nippon Steel Engineering Co. Ltd.)

ESCAP™ achieves a greater than 40% reduction in the level of heat consumption required for the separation and recovery of CO_2 compared to conventional technology. This enables the production of high-purity CO_2 from source gases with high levels of impurities, for applications including food use.

The Roadmap for the Challenge of Zero Carbon Steel
(by Japan Iron and Steel Federation(JISF))



Source : https://www.zero-carbon-steel.com/en/

Green Steel Summit 2021: Virtual Conference
Theme: Towards an Energy Efficient and sustainable Steel Industry
17 th June 2021

NEDO's Activities

on Iron and Steel Industry in India

Presented by
A. M. Siddiqui, PhD
Representative, New Delhi Office

What is NEDO ?

Mission:

As Japan's largest public management organization promoting research and development as well as the dissemination of energy, environmental and industrial technologies, NEDO has a crucial mission to carry out.

- ✓ **Addressing energy and global environmental problems**
- ✓ **Enhancing industrial technology**

Chairman: Mr. Hiroaki Ishizuka

Organization: -National Research and Development Agency under the Ministry of Economy, Trade and Industry (METI), Government of Japan
- Established in 1980

Head Office: Kawasaki City, Japan

Personnel: 1256(as of April, FY 2021)

Budget: Approximately 1.47 billion US$ (FY2021)

Role of NEDO

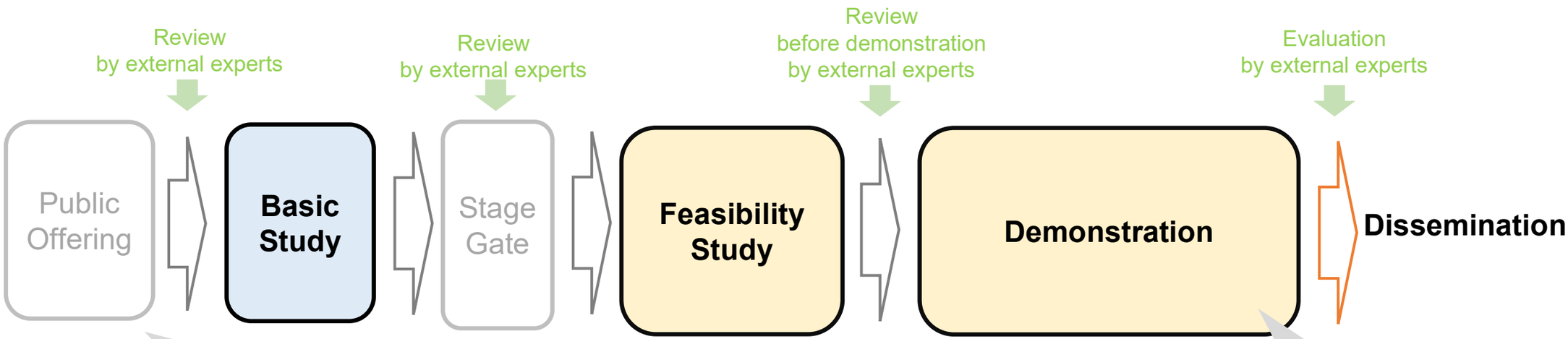
NEDO establishes project implementation frameworks by combining the capabilities of industry, academia, and government, including public solicitations of project participants. NEDO carries out research and development projects and set targets based on changes in social conditions in order to realize maximum results.

International Demonstration Project Scheme

Purpose

- ✓ Contribute to solving foreign energy problems through a demonstration of Japanese technology and systems for energy conservation.
- ✓ Contribute to obtaining energy security by reducing energy consumption through the dissemination of technology.

Scheme



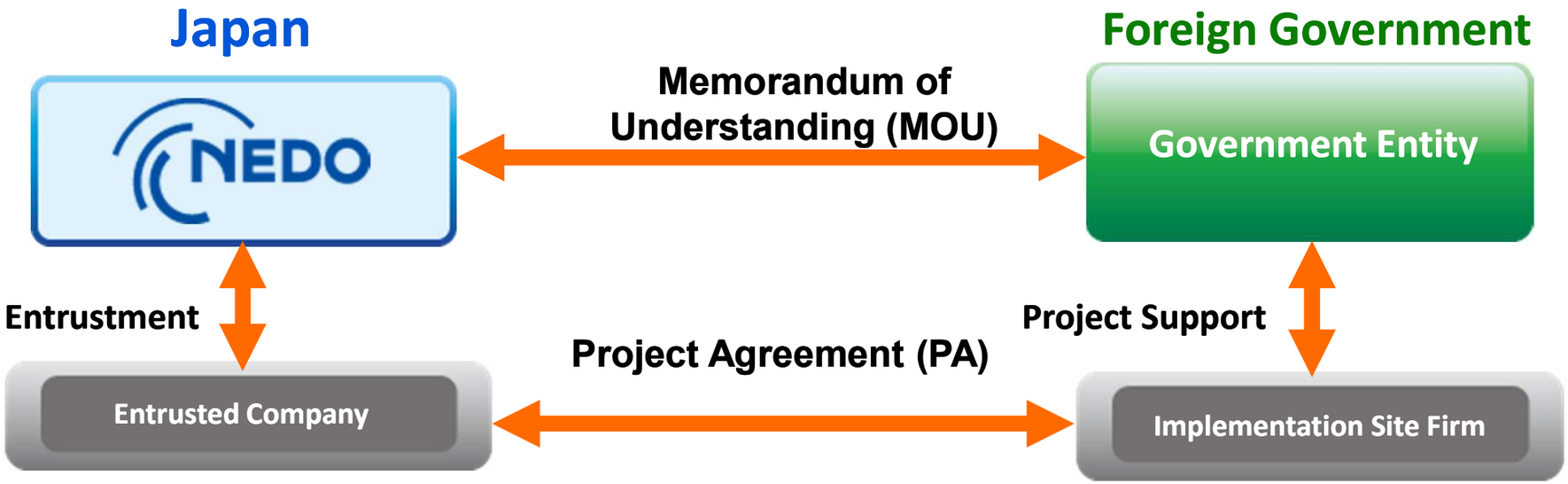
Next public offerings are planned in **Summer in 2021**

※ Indian companies or universities may participate in the projects, together with Japanese companies which are supposed to apply for the offering.

MoU (Memorandum of Understanding)

Maximum for each project is around **3 Billion Rupees**

International Demonstration Project Scheme



NEDO, MOF and SAIL signed a MOU for demonstration project on Energy Management System for Multiple Energy Sources at Steel Plant on 2 May, 2016

NEDO`s All Activities in India

Current Projects

1. EMS for Multiple Energy Sources at Steel Plant

Completed Projects (FY)

2. Sinter Cooler Waste Heat Recovery (2014)
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PAT Scheme and Iron and Steel Industry

PAT cycle – I

- **67 Iron and Steel plants in India were notified as Designated Consumers.**
- **Against a total saving target of 1.486 million TOE the sector achieved 2.10 million TOE of energy savings, thereby saving 6.51 million tonnes of CO2.**

PAT cycle – II

- **71 DCs achieved emission reduction amounting 12.13 MTOE amounting to 5360 crore INR.**
- **The total investment made was 4396 Cr. INR by 38 DCs out of 71.**

- **PAT experience shows that investment in energy saving has good returns.**
- **NEDO technology demonstration in Steel Sector will help Indian Steel Industry to achieve targets**

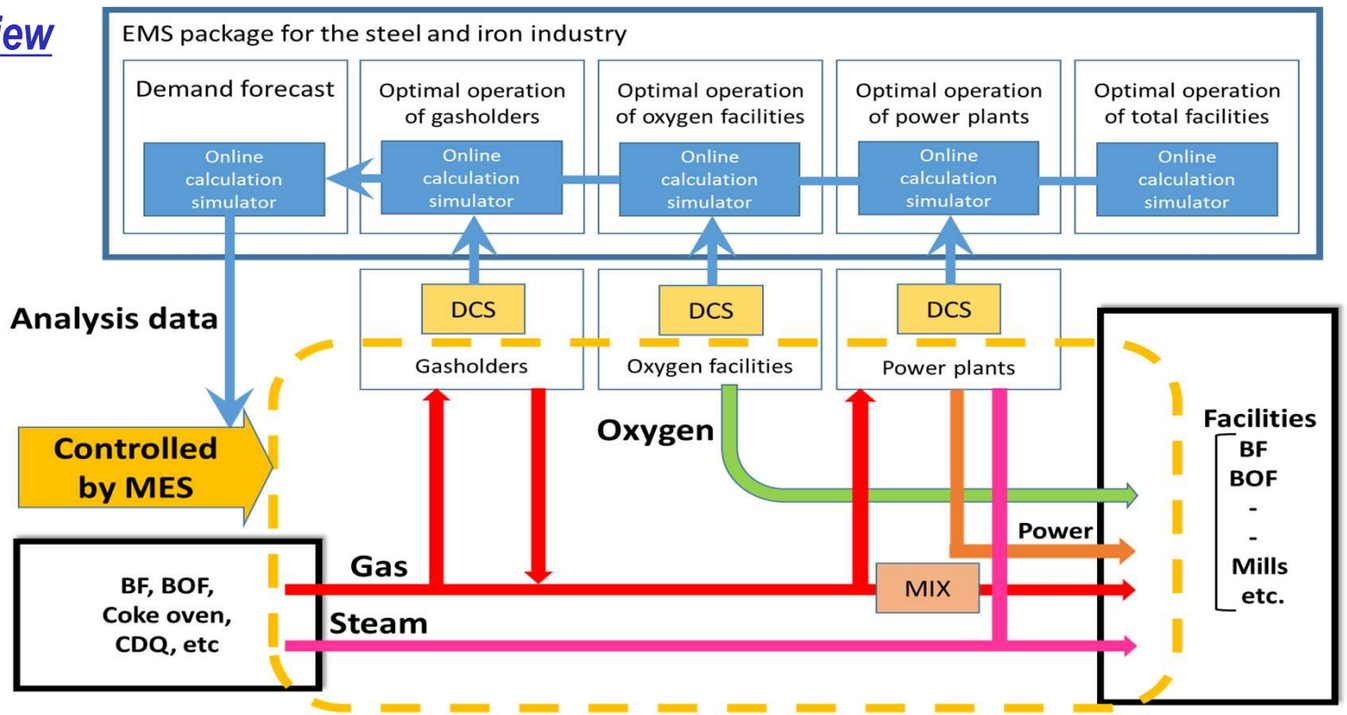
EMS for Multiple Energy Sources at Steel Plant

- The **purpose** of this project is to demonstrate an advanced energy management system (EMS) which can simultaneously monitor and control many different types of energy sources (electricity, byproduct gas, steam, oxygen) to meet demand of each facility at the IISCO Steel Plant, SAIL.

Key Information

- Period: 2014-
- Cost: US$ 7 M
- MOU signatories : DEA, MOS, SAIL
- Tech provider: Fuji Electric
- Energy Saving: 35%
- CO_2 Reduction: 35%

System Overview

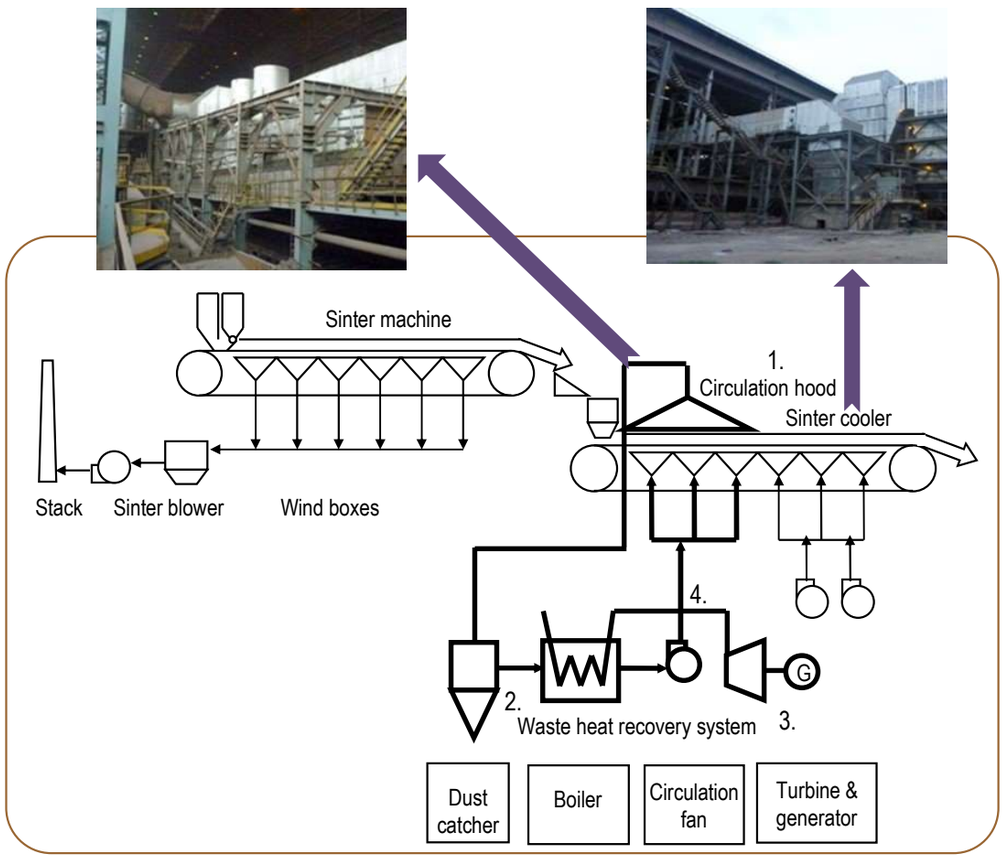


DCS: Distributed Control System, MES: Manufacturing Execution System

Sinter Cooler Waste Heat Recovery

- Sinter cooler waste gas previously emitted into the atmosphere in India can now be captured and routed to a waste heat recovery boiler. The heat can then be used to drive a steam turbine generator and produce electric power.

System Overview



Key Information

- Period: 2009-2014
- Cost: US$ 50 M
- MOU signatories :
  DEA, MOS
- Tech provider:
  JP Steel Plantech Co.
- Site : RINL VIZAG Steel Works
- Energy conservation effect :
  34,000 toe/Y
- CO_2 Reduction: 104,000 t/Y

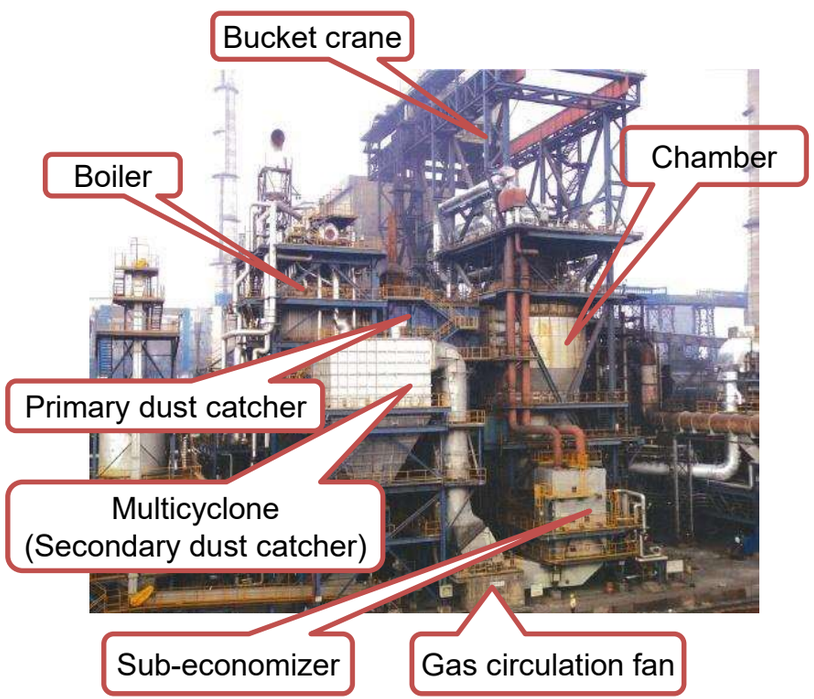
The Model Project for Coke Dry Quenching

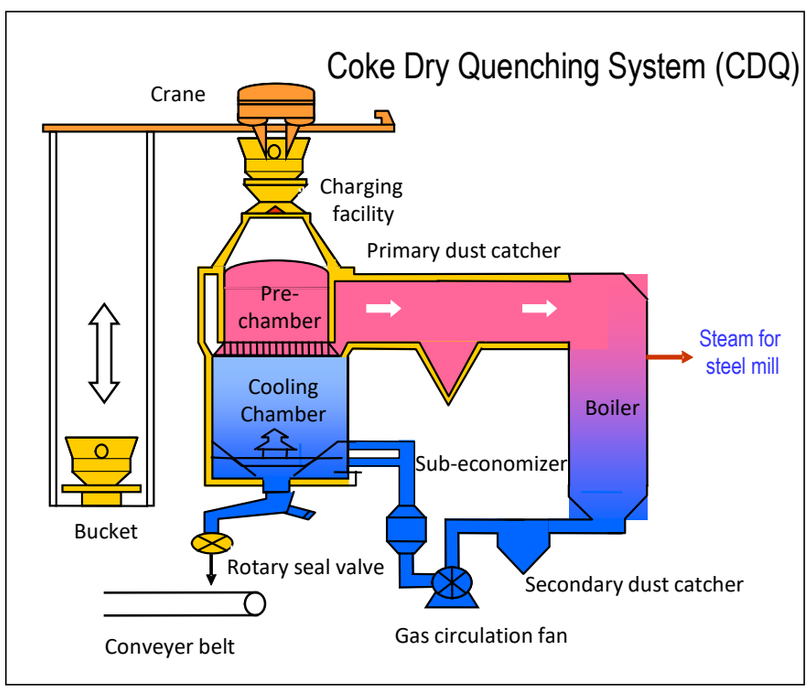
Purpose

- ✓ Reduce energy consumption by using nitrogen gas instead of the conventional wet cooling process using water.
- ✓ Waste heat is recovered and used in the steel manufacturing process.
- ✓ This reduces energy consumption, CO2 emissions and the spread of atmospheric pollutants, such as coal dust.

Key Information

- Period: 2006-2011
- Cost: US$3.2M
- MOU signatories : DEA,MOS
- Tech provider: Hitachi
- Energy saving: 50,000t/yr（Crude Oil equivalent)
- CO2 reduction volume: Approx. 137,000t/yr



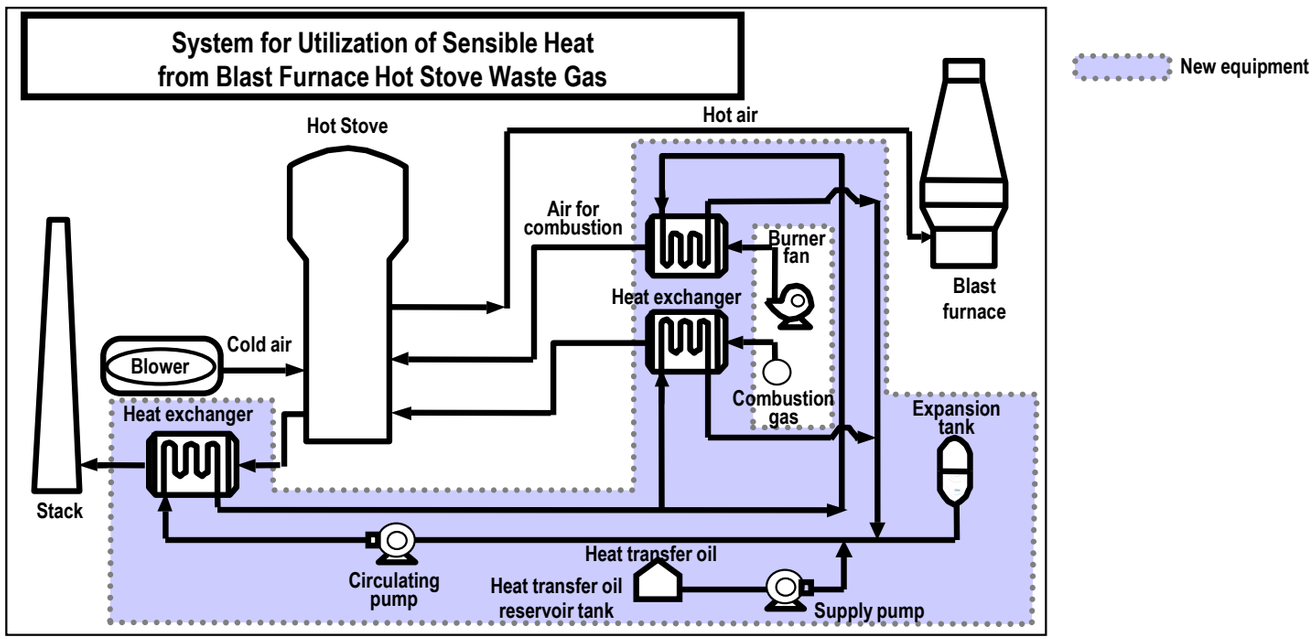


The Model Project for Sensible Heat from Blast Furnace Hot Stove Waste Gas

- **Purpose**
  - ✓Waste heat recovered from stove stack's exhaust gas is used to preheat the blast furnace gas combusted in the stoves, thereby reducing the amount of energy normally required for the hot stove and blast furnace.

Key Information

- Period: 2001-2003
- Cost: US$0.5M
- MOU signatories：DEA,MOS
- Tech provider: Nippon Steel Engineering Co., Ltd.
- Energy saving: Approx. 8,110 t/yr （Crude Oil equivalent)
- CO2 reduction volume: Approx. 25,090 t/yr



Conclusion

- **NEDO has been introducing Japanese advanced industrial technology in Indian steel sector through its model projects in order to cut down GHG emissions and conserve energy.**

- **NEDO's activity can contribute to:**
  a. strengthen the competitiveness of Indian steel industry
  b. solve environmental problems such as air pollution
  c. reduce the import of natural resources

Thank you for your attention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