Steel Industry Measures to Combat Global Warming

Voluntary Action Plan Progress Report

December 2012

The Japan Iron and Steel Federation

INDEX

1. FY2011 Report for Voluntary Action Program

Highlights of this year's report

- As FY11 crude steel production declined to the 102 million-ton level, partly because of the impact of the earthquake, energy consumption was 9.3% less than in FY1990.
- The steel industry will continue to focus on energy conservation (investments to conserve energy leading up to FY2012 (equivalent to ▲0.2%)) and use the Kyoto Mechanism as required (current contract volume is 27 million tons, equivalent to ▲2.7%) to increase the probability of reaching the target.

Voluntary Action Program of Steel Industry

1. Conserve energy with more efficient steel production processes

- Assuming annual crude steel production of about 100 million tons, the goal is to achieve a 10% reduction in energy consumption used by steel production processes by fiscal 2010 compared with fiscal 1990, the reference year.
- However, even if crude steel output exceeds 100 million tons, the steel industry is determined to do what is needed, including use of the Kyoto Protocol mechanisms, to reach this target.
- The 10% reduction is to be achieved based on average energy consumption for the five-year period ending in fiscal 2012

*A 10% cut in energy consumption is viewed as equivalent to a 9% cut in CO_2 emissions.

2. Contribute to energy conservation outside the steel industry

(1) Reuse one million tons of waste plastics and other materials, assuming that the required collection system can be established.

(2) Use steel products and byproducts to contribute to energy conservation

(3) Use international technical cooperation to contribute to energy conservation

(4) Utilize unused energy at steel mills in neighboring areas

(5) Increase activities involving consumers, businesses and transportation

3. Development of revolutionary technologies

- Technology to separate CO_2 from blast furnace gas for recovery
- Iron ore reduction technology using modified hydrogen from coke oven gas

Voluntary Action Plan Progress Toward Reduction Targets (Fiscal 2011 Performance)

- FY2011 crude steel production of 102,377 thousand tons was decreased 2.2% compare to fiscal 1990 (90 participating companies).
- In this environment;

  Energy consumption was 9.3% less than in FY1990

  CO_2 emissions were 8.5% less than in FY1990
- Unit energy consumption was down 7.2% from FY1990 and unit CO_2 emissions were down 6.4%.

*CO_2 emissions in this presentation are calculated by using electric power coefficients after reflecting emission credits.

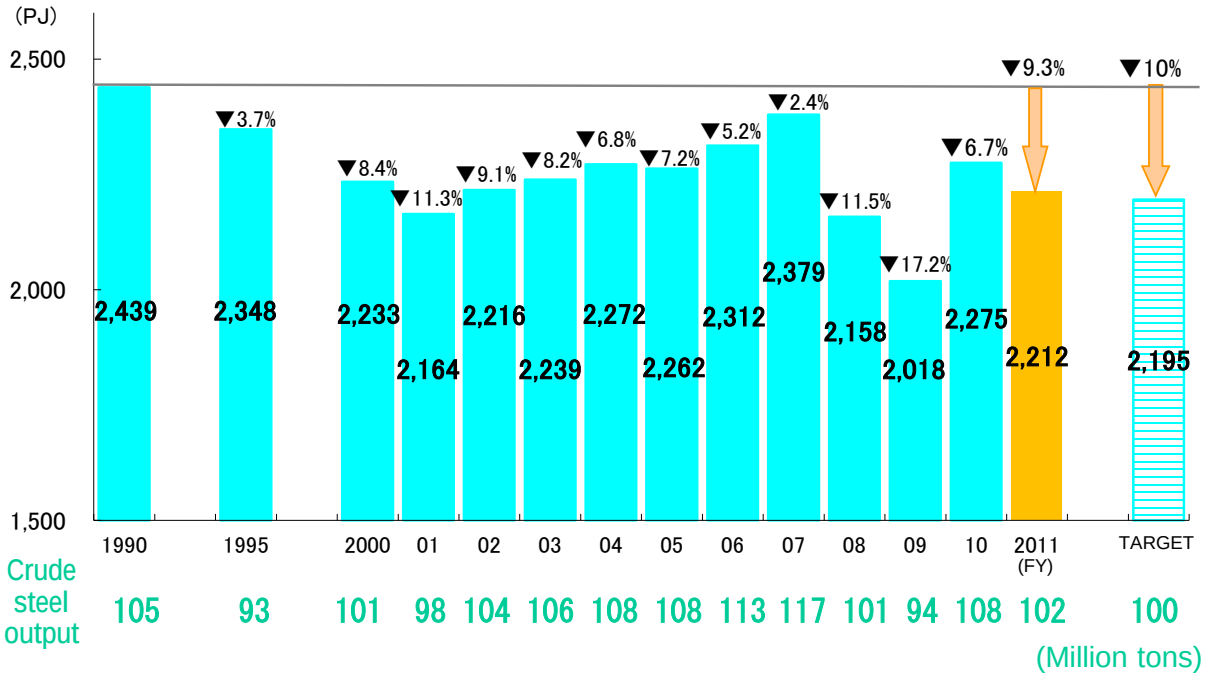
Reference: Data for entire Japanese steel industry

- FY2011 crude steel production was 106,462 thousand tons which is 4.7% less than in FY1990
- Energy consumption was 9.6% less than in FY1990
- CO_2 emissions were 8.6% less than in FY1990

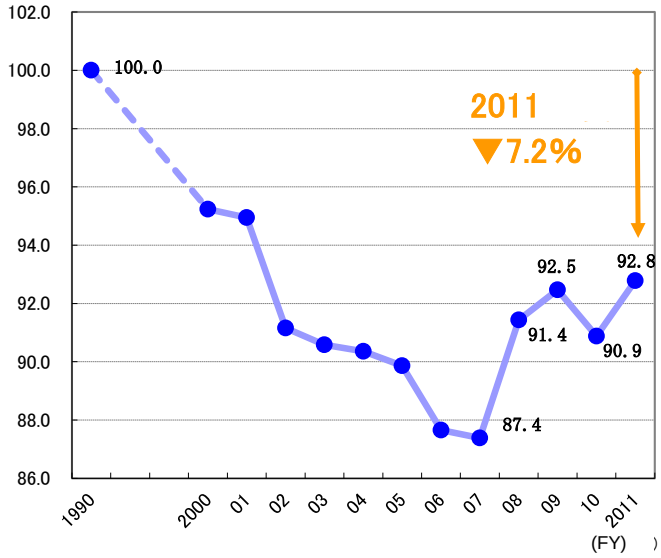
* Energy consumption is total of steel producers. CO_2 emissions were estimated based on "Current Survey of Energy Consumption".

Energy Consumption

Total Energy Consumed



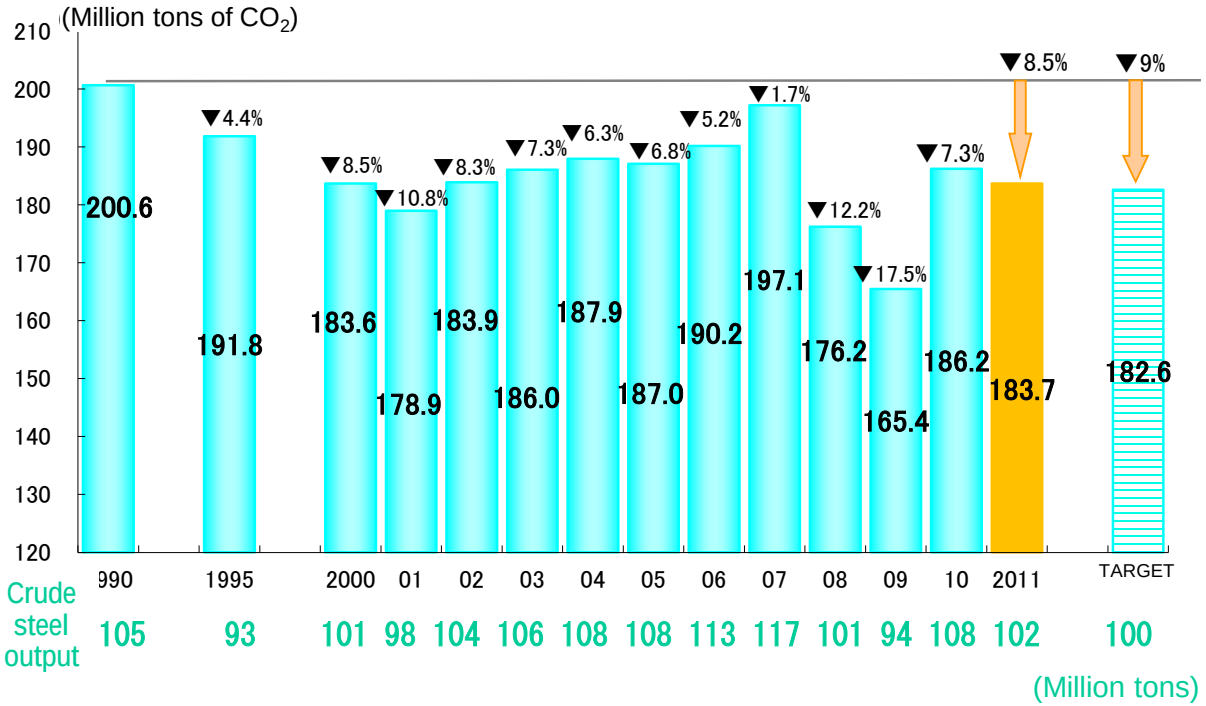
Unit Energy Consumption (Based on FY1990)



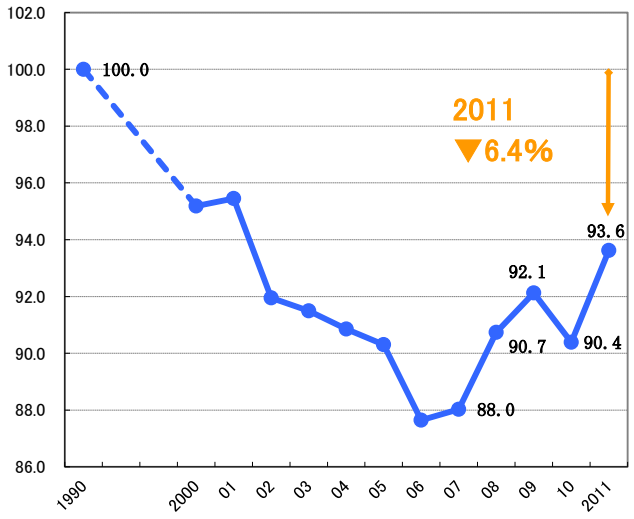
*PJ is a petajoule (10^{15} joules). One joule is 0.23889 calories. 1PJ is equivalent to about 2.58 million kiloliters of crude oil.

CO_2 Emissions from Fuel Combustion

CO_2 Emissions from Fuel Combustion

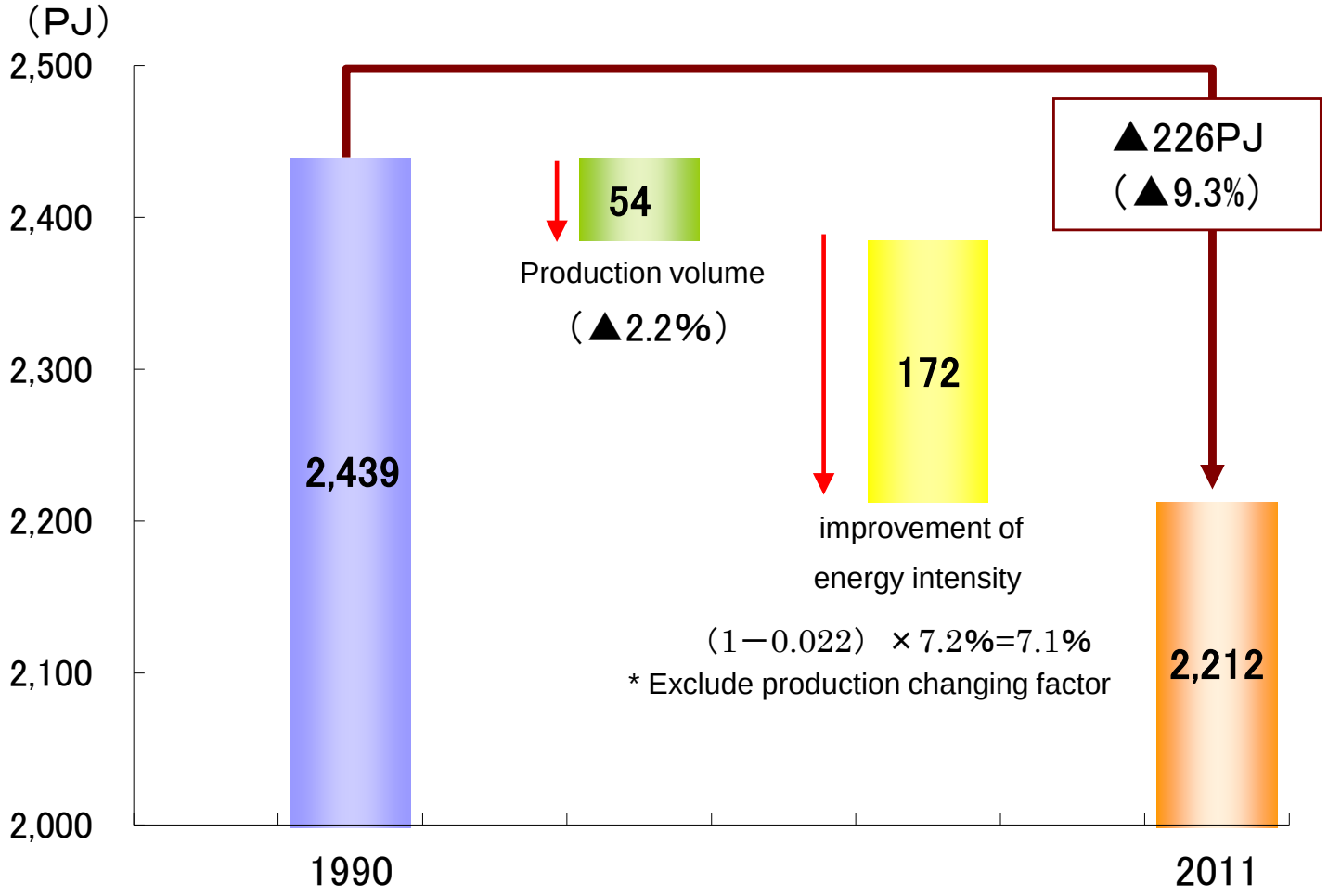


Unit CO_2 Emissions (Based on FY1990)



Causes of Change in FY11 Energy Consumption

- **FY2011 energy consumption was 9.3% less than in FY1990 because of a 2.2% decrease in crude steel production and a 7.1% improvement in unit energy consumption.**

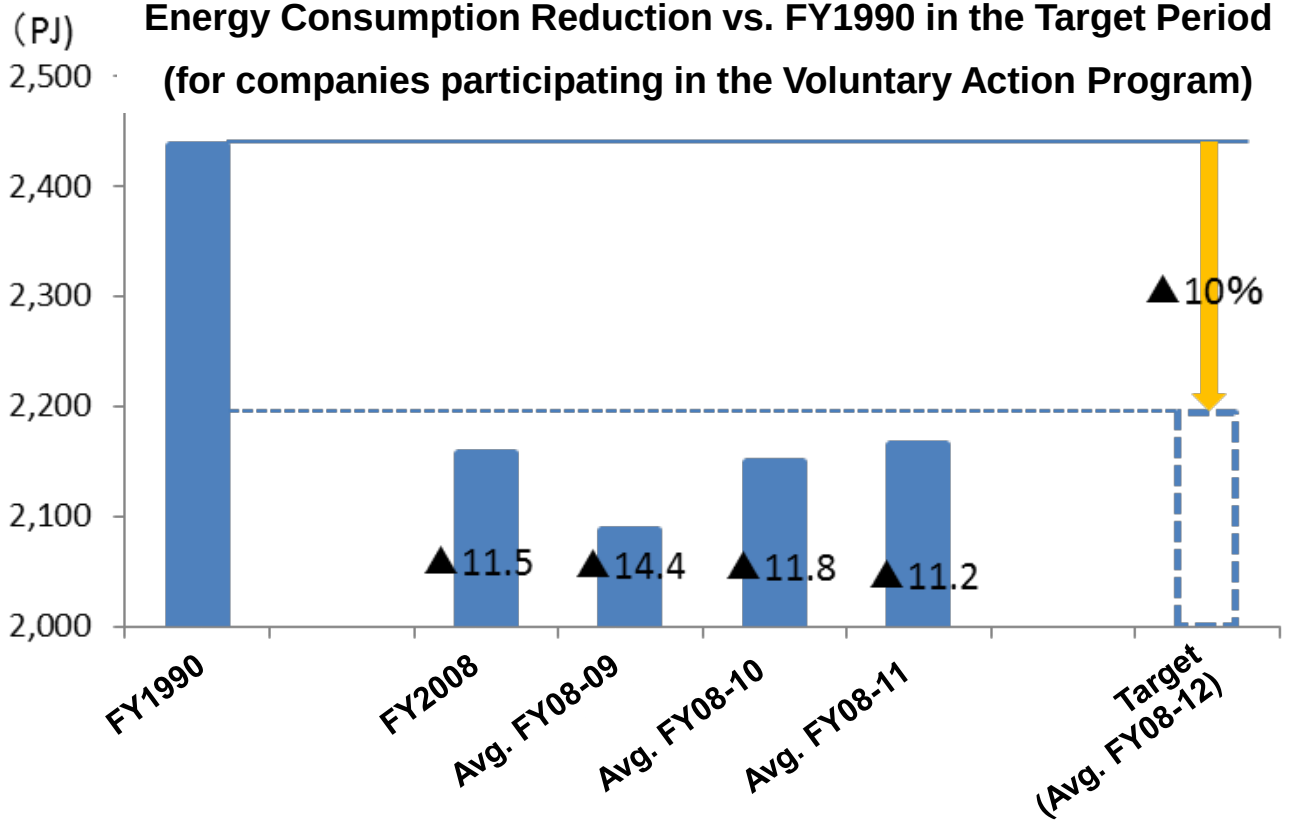


Outlook for Achievement

- Since entering the target period, average energy consumption for the four-year period from FY2008 to FY2011 was ▲11.2% vs. FY1990, which exceeded the target of ▲10%. This was due to energy conservation measures as well as a sharp drop in production activity following the Lehman shock.
- In FY2012, the final year, crude steel output is currently at an annualized level of 108 million tons. We believe that the target is very likely to be achieved due to benefits of further energy efficiency improvements (▲0.2%) and other reasons.

Energy Consumption Reduction vs. FY1990 in the Target Period

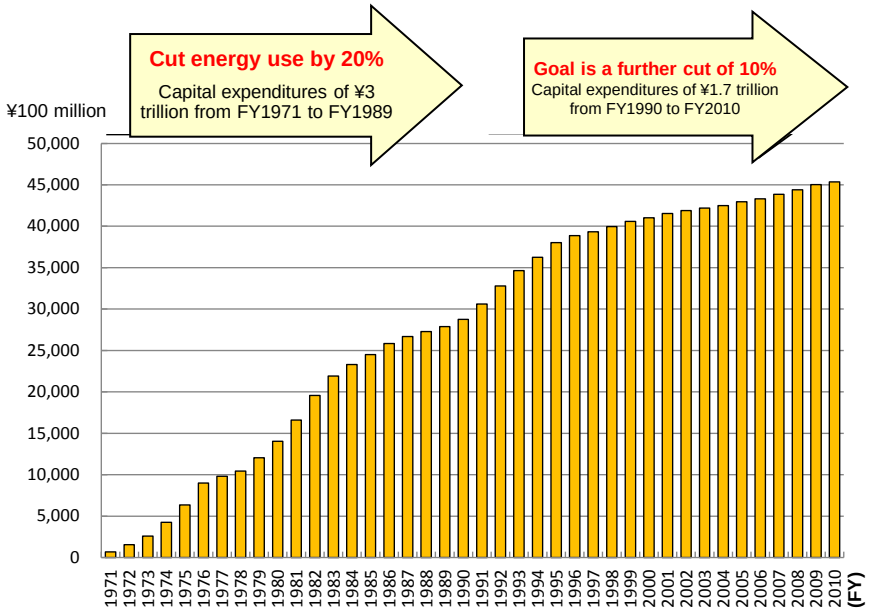
(for companies participating in the Voluntary Action Program)



Outlook for Energy Conservation Measures

- The steel industry made investments of about ¥3 trillion between FY1971 and FY1989 for environmental protection and energy conservation. These investments totaled about ¥1.7 trillion between FY1990 and FY2010.
- Total energy to be conserved by projects under consideration by Japanese steelmakers to FY2012 will cut energy consumption by about 0.2% vs. FY1990.
  About 97% of these projects have been approved.
- Specific actions are listed below.

(Ref.) Steel Industry Environmental/Energy Conservation Investments



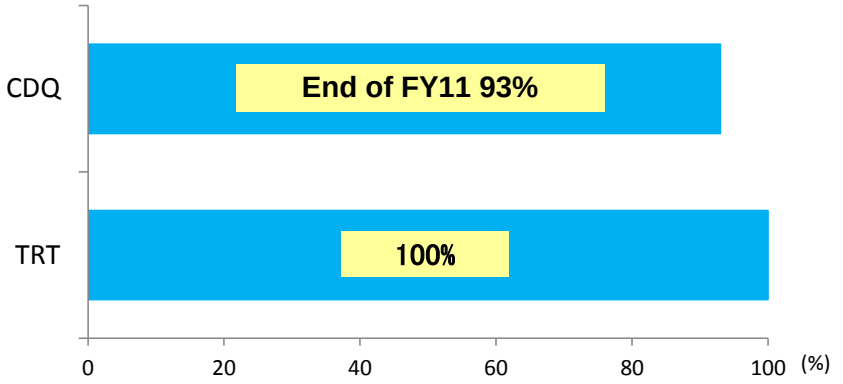
Source: ~FY2011: METI Survey on Capital Investments of Major Industries
FY2002~: METI Survey on Corporate Finance (former Survey on Capital Investments)

FY12 Energy Conservation Measures and Composition

(% share)

Exhaust heat recovery	Increase TRTs, install CDQs, improve efficiency of exhaust heat recovery from private power generation equipment	30
Enhance equipment efficiency	Improved heat insulation, more efficient furnace blowers, adopt sintering technologies based on hydrocarbon gas, more efficient power generation stations, etc.	49
Improve operating efficiency	Oxygen liquefaction equipment, improved mineral ore mesh, optimization of sintering grain growth (reduction of setting material), smaller ratio of reducing agent furnace refurbishment	13
Effective reuse of materials	Reuse of waste plastics, etc., more waste plastic treatment equipment, others	4
Others	Fuel switching	4

(Ref.) Increase in Use of CDQ and TRT



Use of Kyoto Protocol Mechanisms

Use these mechanisms as a supplementary means of achieving the goal.

(1) JISF investments in Japan Greenhouse Gas Reduction Fund and Bio Carbon Fund: Total of 1 million tons

(2) Starting steel energy conservation technology (CDQ/China, Sintering exhaust heat recovery/Philippines) and steel engineering technology (CFC treatment, etc./China) CDMs and other projects: Total of 26 million tons

Signed contracts to purchase 27 million tons (5.4mn tons/year = ▲2.7% of 1990 reference)

26 million tons of this amount has been registered with the UN (5.2mn tons/year = ▲2.6% of 1990 reference)

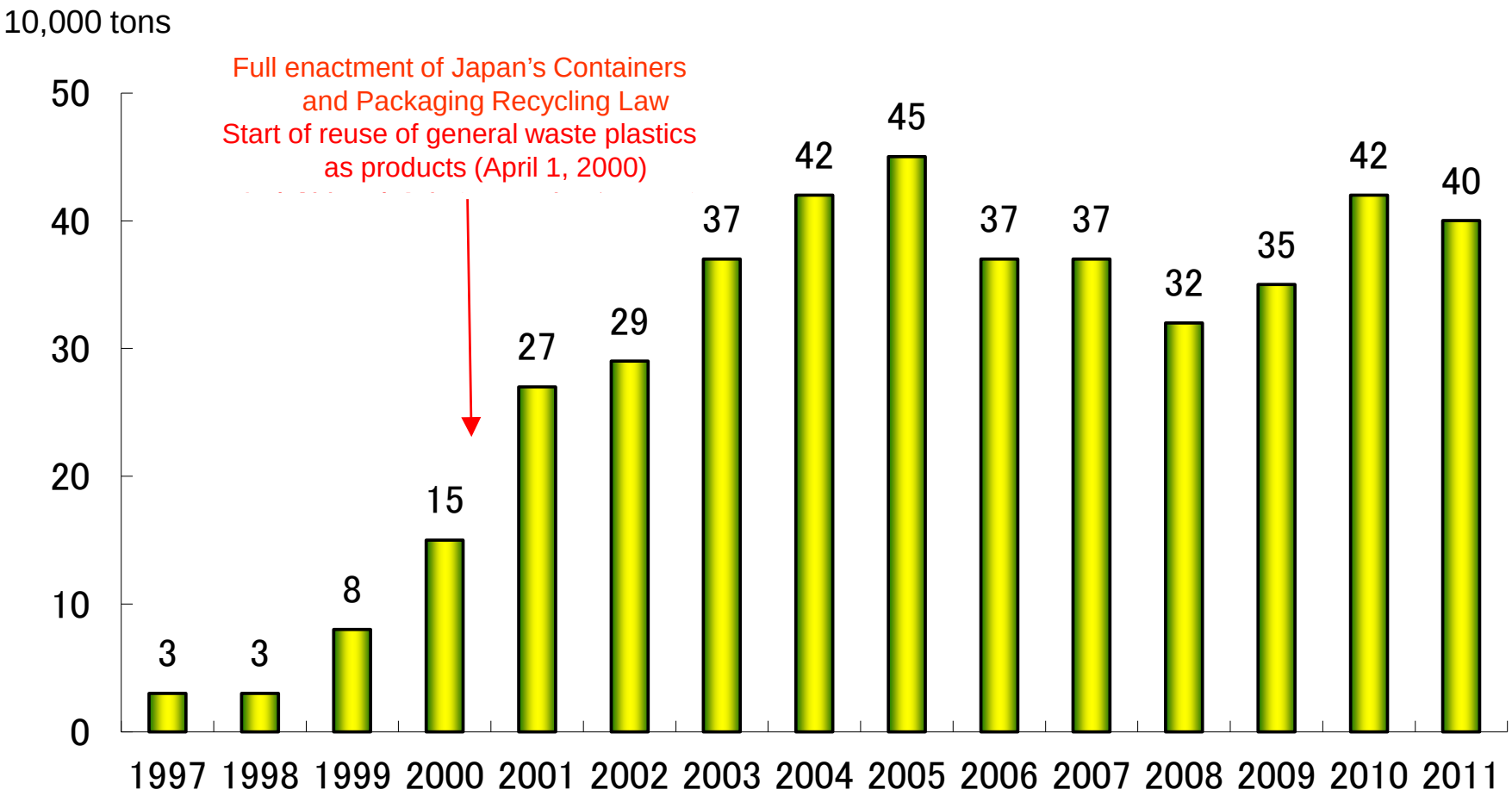
CDM Projects of Japanese Steelmakers (UN Registered)*1

Company	Country	Project	(10,000t CO_2 emission reduction CO_2/year)	Credit period	Amount for first commitment period (10,000t CO_2/year)
Nippon Steel Mitsubishi Corp	China	Shandong Dongyue HFC 23 destruction project	1,011	7 years starting in July '07	1,000 *2
JFE Steel	Philippines	Power generation using exhaust heat from sinter cooling equipment	5.5	10 years starting in Jan. '08	27.5

Notes: *1.These materials are for projects conducted by steelmakers; total is 47mn tons of CO_2

*2. Only Nippon Steel's portion of contractual credits for this project

Reuse of Waste Plastics etc.



Effective Use of Waste Plastics etc.

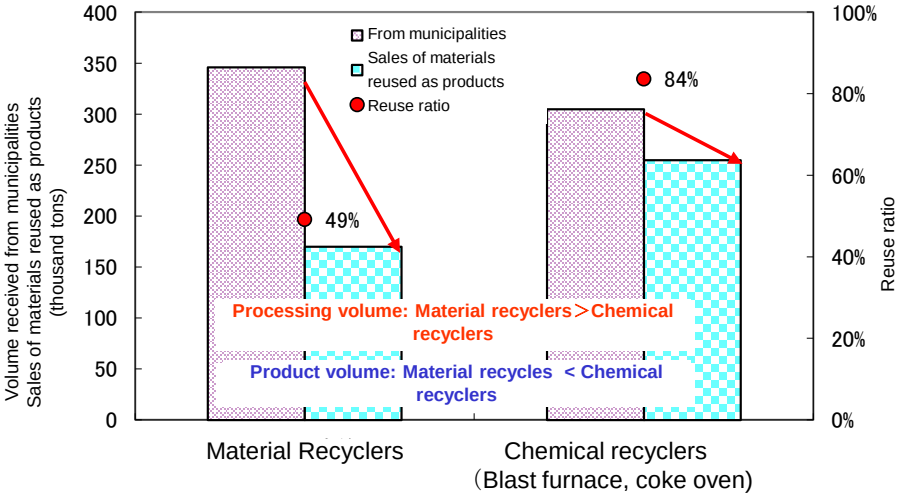
- Due to priority on recycling materials, purchased 250,000 tons of waste plastics in FY2011 under the container and packaging recycling system; current waste plastic processing capacity in the steel industry is about 400,000 tons, leaving significant unused capacity (utilization rate is slightly over 60%)
- A review of policies can produce a big drop in CO_2 emissions through the effective use of waste plastics, etc. We hope to see a quick reexamination of recycling systems from the following standpoints.

(1) From the standpoint of efficiently and effectively using waste materials (recycling waste materials that are highly effective at cutting CO_2 emissions and have a low social cost), the container and packaging recycling system should stop placing priority on recycling materials that produce only small reductions in CO_2 emissions.

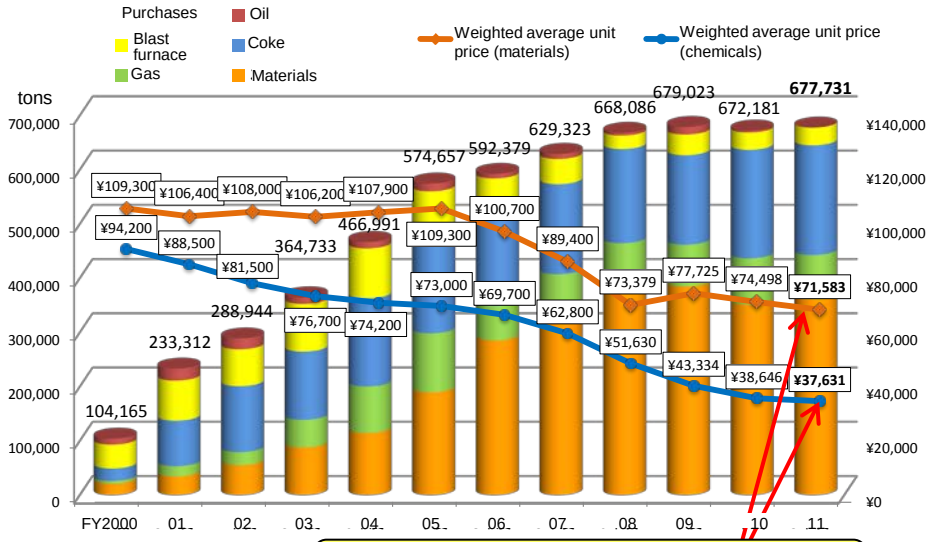
(2) A payment system should be considered to provide incentives to local governments that cut costs below a certain level or make big improvements; this would lower the social cost of recycling by encouraging local governments to improve efficiency of collecting and storing waste materials in separate categories

(3) Collection of waste materials should not be restricted to items covered by the Container and Packaging Recycling Law; collecting product plastic waste and other materials too could reduce the need for consumers to discard trash by category and reduce the trash classification expenses for local governments. The government should thus consider enlarging recycling activities to include more types of materials.

Materials Received, Products Sold and Reuse Ratio by Method (FY2011)



Volume Purchased and Unit Price by Method for Recycling Container and Packaging Plastics



FY11 unit purchase price for recycled materials was ¥72,000/ton and ¥38,000/ton for chemicals

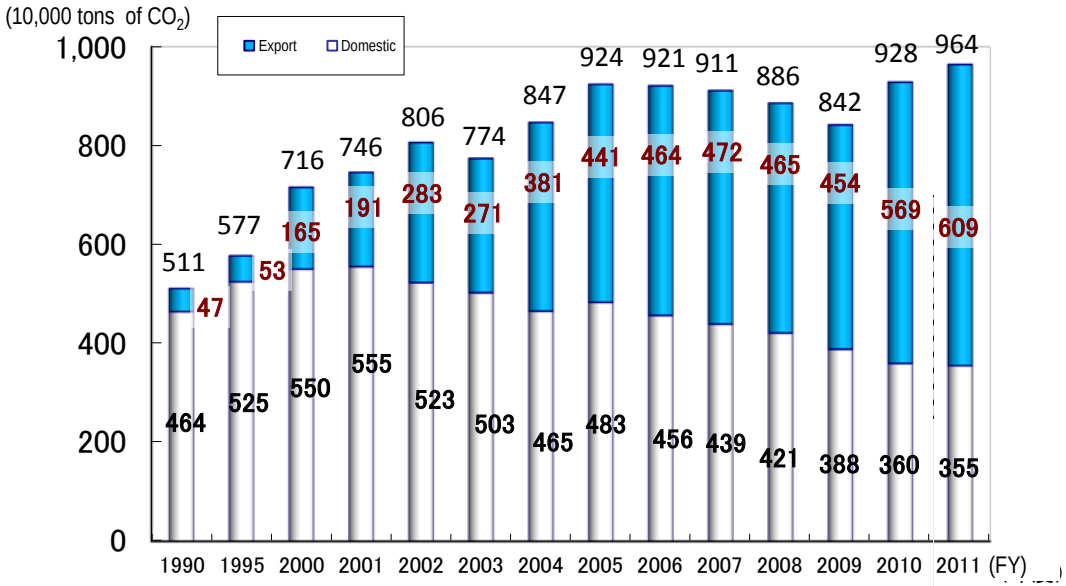
Source: The Japan Containers and Packaging Recycling Association

CO_2 Emission Reduction from Blast Furnace Slag Used in Cement

- Plan for reaching Kyoto Protocol targets assumes a higher pct. of mixed cement (mainly blast furnace cement) as CO_2 reduction in non-energy fields. The plan estimates 24.8% in FY11 and FY12, but actual figure was only 21.1% in FY11
- Higher pct. of mixed cement production can significantly cut CO_2 emissions

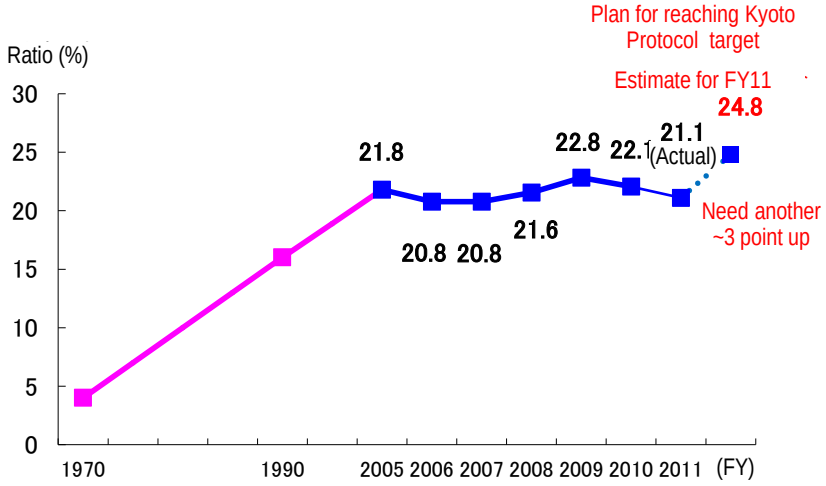
- Blast furnace cement was designated in 2001 as a specified procurement item under Japan's Green Procurement Law.
- National and other green procurement programs along with green procurement efforts of local governments and agencies can significantly cut CO_2 emissions by further increasing use of blast furnace cement.

Estimate of CO_2 Emission Reduction from Use of Blast Furnace Cement (Domestic + Exports)



Assumptions for emission reduction contribution
Conversion to volume of cement: 450kg of slag/ Ton of cement
CO_2 emission reduction: 312kg of CO_2/Ton of cement

Production ratio of mixed cement

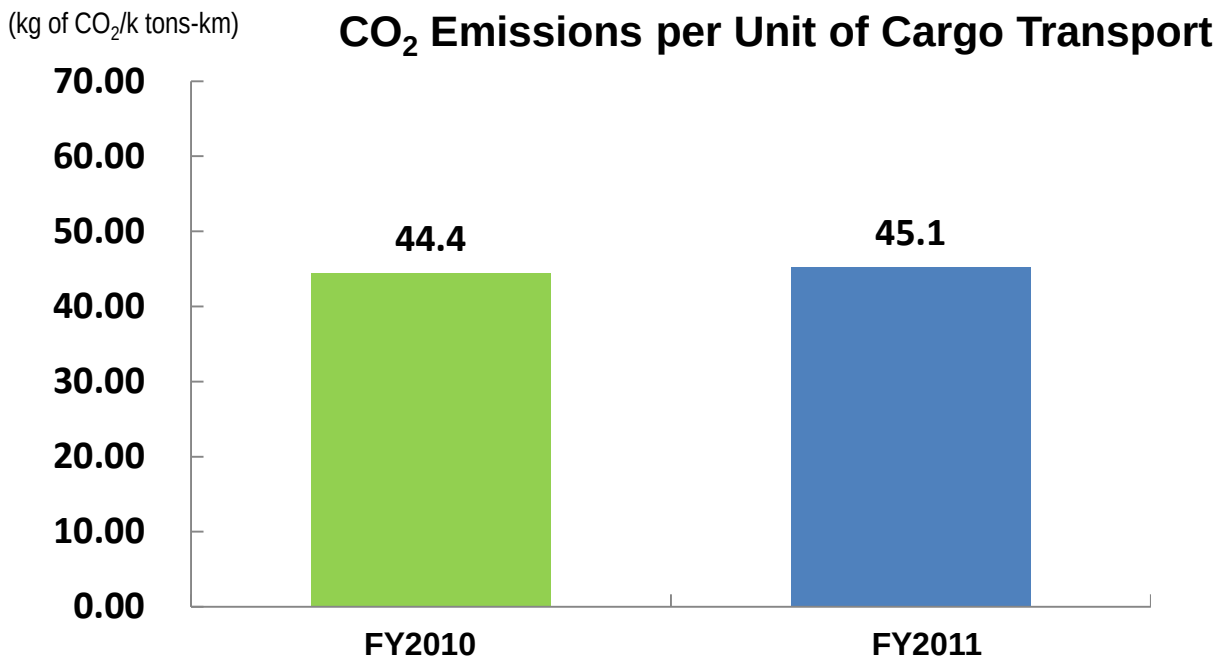


Replacing conventional cement (Portland cement), which generates CO_2 during the firing of raw materials, with slag cement, which does not generate CO_2 during production, reduced CO_2 emissions by 9.64mn tons/year (FY2011).

- Japan: Annual reduction of 3.55mn tons of CO_2
- Exports: Annual reduction of 6.09mn tons of CO_2

Initiatives for Transportation

- CO_2 emissions per unit of cargo transport decreased to 45.1kg of CO_2/k ton-km in FY2011 from 44.4kg of CO_2/k ton-km in FY2010.
- In FY2011, the steel industry modal shift (ships + rail) was 78% for primary transportation and 96% for cargo transported more than 500km. This is far higher than the average modal shift rate of 38.1% for all industries in Japan (Ministry of Land, Infrastructure and Transport FY05 data for more than 500km).
- Steelmakers are taking other actions too, such as improving cargo transport efficiency by using a higher pct. of cargo space on ships, using eco-tires on trucks and using eco-friendly driving methods.



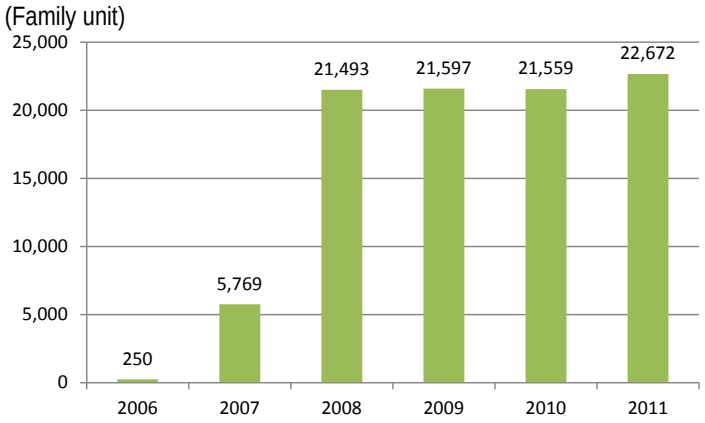
Note: Total CO_2 emissions from use of gasoline, light oil and heavy oil at the 43 companies surveyed divided by total ton-kilometers of cargo transported

Private Sector Initiatives

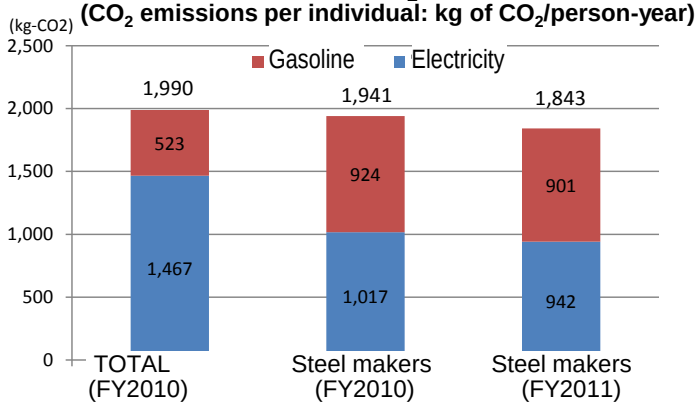
- In FY2005, Japan's steelmakers started energy conservation programs using environmental ledgers for households.
- Steelmakers started education programs that included all employees, including at group companies, promotion of use of household environmental ledgers, and other actions. There were 23,000 households participating in this program in FY2011.

- In the steel industry, to reduce CO_2 emissions at offices, companies have been aiming for the goal of "reducing 2008-2012 average emissions by 5% in relation to 2003-2005 average emissions."
- In FY11, steel industry office CO_2 emissions and energy consumption were both below the reference years.

Households Using Environmental Ledgers

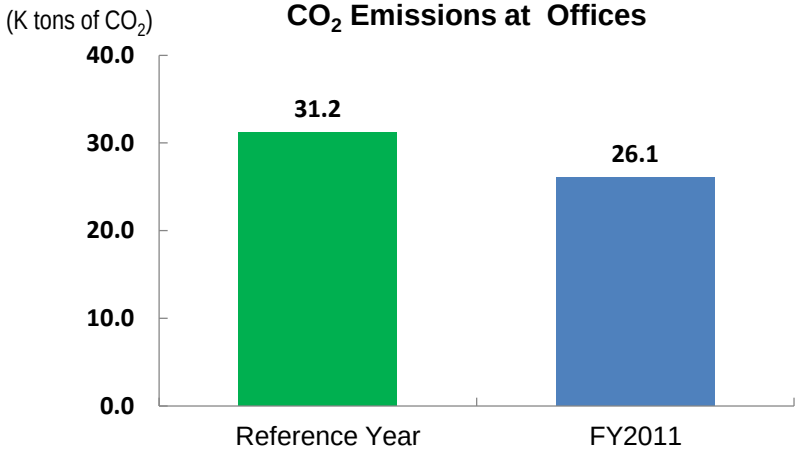


Household CO_2 Emissions
(CO_2 emissions per individual: kg of CO_2/person-year)

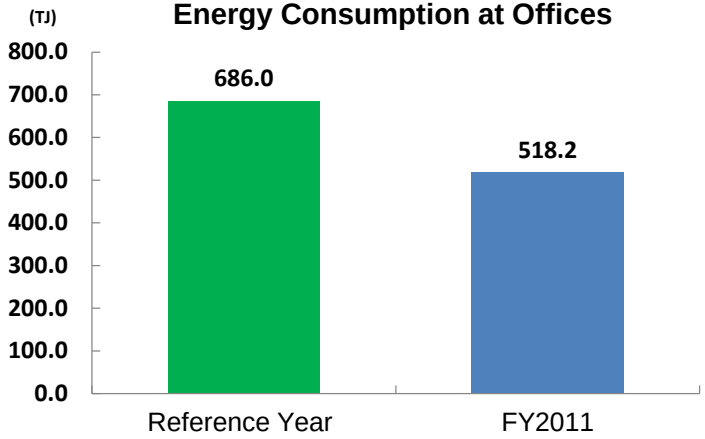


Source: Estimates based on Greenhouse Gas Inventory Office materials
Notes:
1.Total for Japanese households includes households and household use of automobiles.
2. Total for steel industry households is an estimate by JISF based on the inventory in Japan

CO_2 Emissions at Offices



Energy Consumption at Offices



Note: Data for 318 business sites of 77 companies. In principle, FY03-FY05 average is used, but FY04-FY05 average is used in cases where office data was difficult to obtain

2. The Goals and Vision of Japan's Steel Industry

Implementation of Plan to Achieve a Low-Carbon Society

The Goals and Vision of Japan's Steel Industry

- Under the current voluntary action program, the Japanese steel industry is implementing three "eco" initiatives: energy conservation in steel industry production processes (eco processes); lowering global CO_2 emissions by transferring and increasing the use of energy-conservation technologies (eco solutions); and using high-performance steel to lower CO_2 emissions of products using steel (eco products). In addition, the steel industry has started work on developing revolutionary technologies for steelmaking processes (COURSE50) to achieve a medium to long-term reduction in CO_2 emissions.
- Starting in 2013, the steel industry will continue to use the three "eco" initiatives along with COURSE50 to make steady progress in combating global warming under the plan to achieve a low-carbon society.

2020←2013

Eco Process

Aiming for a further improvement in the energy efficiency of the Japanese steel industry's steel production processes, which are already the highest in the world (Reduction of 5 million tons vs. business as usual in 2020)

Eco Solution

The Japanese steel industry will contribute to lowering global emissions by transferring its world-leading energy-conservation technologies associated with eco processes to other countries (mainly developing countries) and increasing the use of these technologies. (Estimated emission reduction contribution of about 70 million tons in 2020)

Eco Product

By supplying the high-performance steel that is essential to create a low-carbon society, contribute to lowering emissions when finished products using this steel are used (Estimated emission reduction contribution of about 33 million tons from major types of high-performance steel)

2050←

Development of revolutionary steelmaking processes (COURSE50)

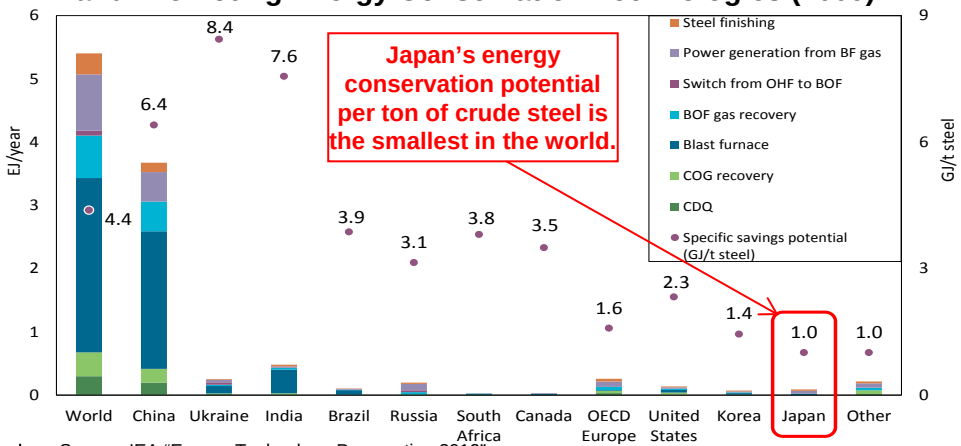
Cut CO_2 emissions from production processes about 30% by using hydrogen for iron ore reduction and collecting CO_2 from blast furnace gas. The first production unit is to begin operations by about 2030*. Goal is widespread use of these processes by about 2050 in line with timing of updates of existing blast furnace facilities.

*Assumes establishment of economic basis for CO_2 storage infrastructure and creation of a practical unit using these processes.

Eco Process

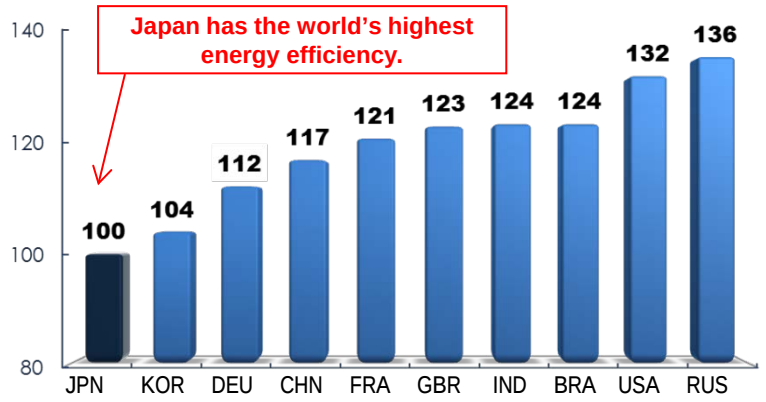
- According to the IEA, Japan has world's smallest potential for energy conservation per ton of crude steel. According to RITE, Japan has the world's most energy efficiency steel industry. These figures demonstrate that virtually all steel mills in Japan use existing technologies and that there is very little potential for further energy-conservation measures.
- Looking ahead to 2020, the Japanese steel industry will be first in the world to begin using relatively new advanced energy-conservation technologies where utilization can still be increased. One example is the next-generation coke oven. This was developed in Japan and there is currently only one in the world (at the Oita Works of Nippon Steel & Sumitomo Metal). The goal is to cut CO_2 emissions by 5 million tons compared with anticipated emissions for each production volume through the maximum use of the most advanced technologies. Achieving this will further increase Japan's world-leading energy efficiency.
- This target incorporates the greatest possible reduction potential and does not take into account the advanced level of the technologies or technological and physical limitations for the use of these technologies.

Energy Consumption Reduction Potential from Transferring and Promoting Energy Conservation Technologies (2009)



Source: IEA "Energy Technology Perspective 2012"

Comparison of Steel Industry Energy Efficiency (2010)



Source: RITE "Estimated Energy Unit Consumption in 2010" (converted to an index by JISF)

Small potential for further energy conservation by using existing technologies

Maximum use of highly advanced energy-conservation technologies = 5 million ton reduction

Eco Process: 2020 Goal

- The goal of cutting CO_2 emissions by 5 million tons compared with anticipated emissions for each production volume through the maximum use of the most advanced technologies is the same as the technological reduction potential of 5 million tons, in principle irrespective of changes in production volume (except in the case of a large change in production volume).
- Specifically, the goal is to cut emissions by 5 million tons by using advanced technologies that have reached the stage of practical use when current facilities are updated or replaced. Examples include the use of next-generation coke production technology, higher efficiency for joint thermal and internal power generation, more energy-conserving equipment like TRT, CDQ and facilities to recover heat emissions and sensible heat, higher efficiency for equipment powered by electricity, and more chemical recycling of waste plastics and other materials at steel mills.
- When starting to use new technologies, in addition to initiatives of the steel industry itself, specific emission-reduction measures (promotion of widespread use, actions to recover and utilize waste plastics and other materials, and other measures) using the cooperation of the public sector and others will be vital as well.
- Furthermore, since the post-Kyoto Protocol international framework and system in Japan have not been determined, no one knows what type of measures to ensure compliance will be established. But from the standpoint of ensuring the plan's reliability, a suitable method will be used in the event of a shortfall.

Emission Reduction Targets for 2020

(Million tons, Million tons of CO_2)

	For lower production (10 million tons less than standard case)	Standard case	For higher production (10 million tons above standard case)
Total crude steel production in Japan	109.66	119.66	129.66
Production at participating companies	105.16	114.75	124.34
BAU emissions at participating companies	183.31	195.40	207.51
Reduction from new technologies	5		
Total reduction at participating companies	178.31	190.40	202.51

*Production volume at participating companies is calculated by using the ratio of FY2005 crude steel production at companies participating in the voluntary action program to total crude steel production in Japan (95.9%).

*A significant change in production volume may cause these figures to become greater or less than the anticipated range. If this happens, the suitability of the BAU and emission reduction volumes will have to be reexamined based on actual production volume.

Eco Process (Revolutionary steelmaking technologies)

(Reference: Advisory Committee on Energy and Natural Resources report)

Premise for long-term energy supply-demand outlook (recalculated) (proposal)

About 5 million tons of CO_2
About ¥1 trillion

Maximum use of advanced technologies at practical stages when facilities are updated or replaced

In Japan's steel industry, which is already the world's most efficient, cut CO_2 emissions by using the following types of advanced technologies.

Ironmaking

Major technologies envisioned

○ Higher efficiency for internal and joint thermal power generation equipment — 420,000kL

Replace internal and joint thermal power generation facilities with more efficient equipment → Install more efficient equipment when existing facilities are due for replacement to create the optimum composition of equipment in the future

○ Increase chemical recycling using waste plastics at steel mills — 470,000kL

Use less coal by utilizing waste plastics and other materials collected in accordance with Japan's container recycling law. → Collect and use 1 million tons of waste plastics and other materials

○ Improve efficiency of equipment powered by electricity — 120,000kL

Replace electrically powered equipment at steel mills with more efficient facilities.

○ Increase the use of energy-conservation equipment — 510,000kL

Install more facilities for utilizing waste heat, such as blast furnace top equivalent pressure gas recovery and coke oven sensible heat recovery. → When updating or replacing equipment, raise efficiency to the highest possible level.

○ SCOPE21 coke oven — 310,000kL

Conserve energy when producing coke by using preliminary coal processing and other measures. → Start using new technologies at all coke ovens as they are updated or replaced (six ovens by 2020).

Major associated initiatives thus far

Development of a revolutionary coke production technology (SCOPE21) that conserves energy and produces coke very efficiently
(FY1994-FY2003: ¥8.2 billion)

Issues

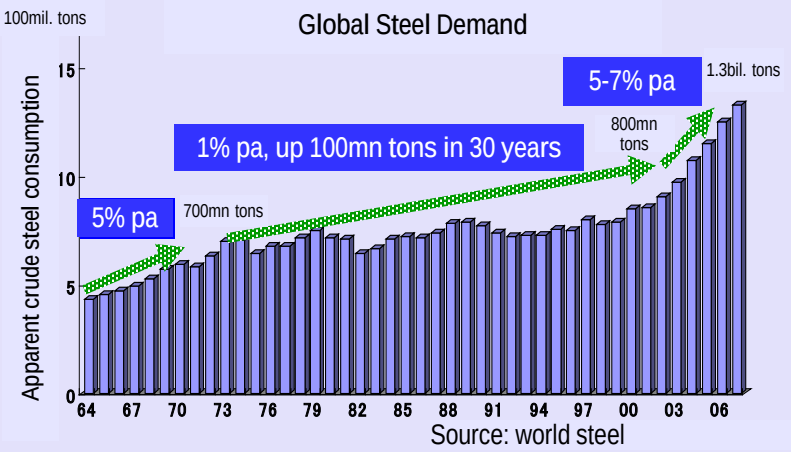
○ **Issues involving users of advanced technologies**
- Limited space for new equipment
- Compatibility with current infrastructure (energy supplies, etc.)
- Restrictions on timing of installation work (need to reflect production plans, limitations on lost output during installation)

○ **Issues involving providers of advanced technologies**
- Ability of manufacturers to supply technologies (technology development, design and production capabilities)
- Engineering capabilities

○ **Other restrictions**
- Limitations on the ability to collect and supply waste plastics and other materials

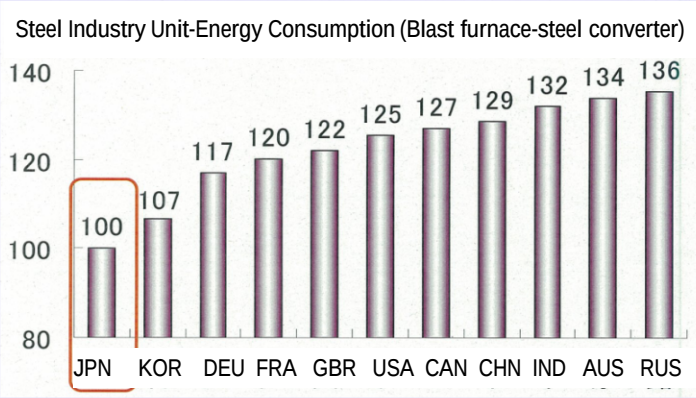
*These materials are based on assumptions that use model calculations.

Rapid increase in global steel demand due mainly to higher demand in developing countries



Source: world steel

Japan's steel industry has the world's highest energy efficiency. As global steel demand rises, lowering Japan's production while raising production in other countries would thus cause worldwide CO_2 emissions to increase.

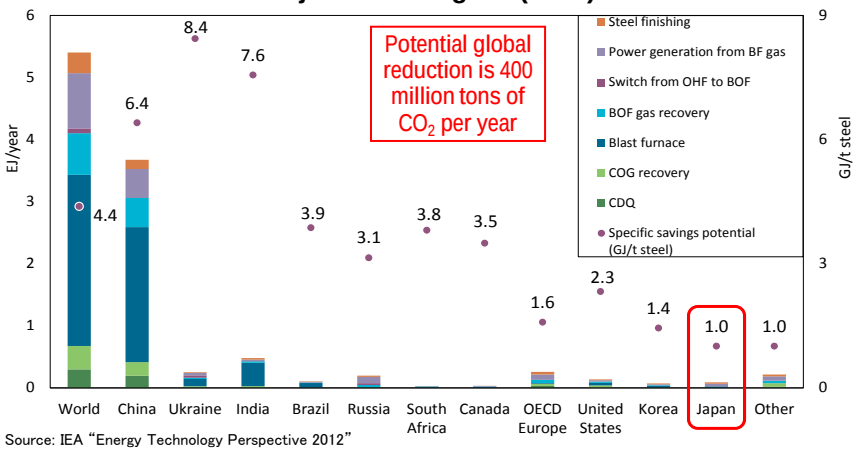


Source: RITE "International Comparison of Energy Efficiency (Electric Power, Steel and Cement)"

Eco Solution

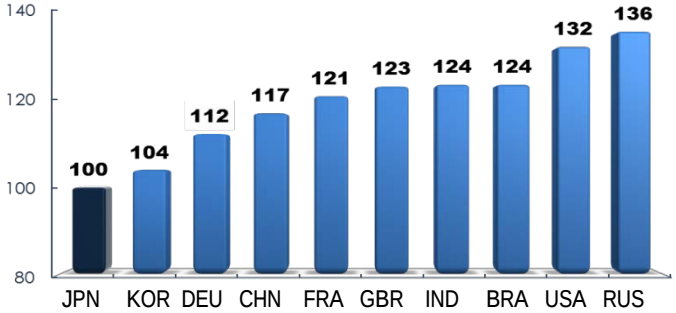
- According to steel industry analysis using the most recent data by both the IEA and RITE, the Japanese steel industry is the most energy efficient in the world.
- According to the IEA, if energy-conservation technologies (including efficient blast furnaces, etc.) were used worldwide, the potential reduction in global CO_2 emissions is about 400 million tons per year (equivalent to 30% of Japan's total CO_2 emissions).
- Major energy-conserving technologies developed and applied by the Japanese steel industry have been transferred to other countries by Japanese companies. Looking only at coke dry quenching (CDQ), top pressure recovery turbines (TRT) and other major facilities, these technologies have cut annual CO_2 emissions by about 43 million tons collectively in China, Korea, India, Russia, Ukraine, Brazil and other countries.
- Based on the potential for lowering global CO_2 emissions through major energy-conserving technologies, the current share (of CO_2 emissions) of Japanese companies, their supply capacities and other factors, Japan's contribution for lowering annual CO_2 emissions globally in 2020 is estimated at 70mn tons .

Estimates of potential reductions resulting from use/transfer of the major technologies (2009)



Source: IEA "Energy Technology Perspective 2012"

Comparison of Steel Industry Energy Efficiency (2010)



Source: RITE "Estimation of Energy Unit in 2010" (Indexed by JISF)

Emission Reductions in Other Countries from Japanese Energy-conserving Equipment

	No. of units	Reduction (10,000 tons/year)
Coke dry quenching (CDQ)	71	1,205
Top-pressure recovery turbines (TRT)	51	897
Byproduct gas combustion (GTCC)	27	1,274
Basic oxygen furnace OG gas recovery	21	792
Basic oxygen furnace sensible heat recovery	7	85
Sintering exhaust heat recovery	6	88
Total emission reduction		4,341

CDQ : Coke Dry Quenching
TRT : Top Pressure Recovery Turbines
GTCC : Gas Turbine Combined Cycle system

Potential CO_2 emission reduction
400 million tons/year world wide

Japan's contribution by transferring major energy-conserving technologies

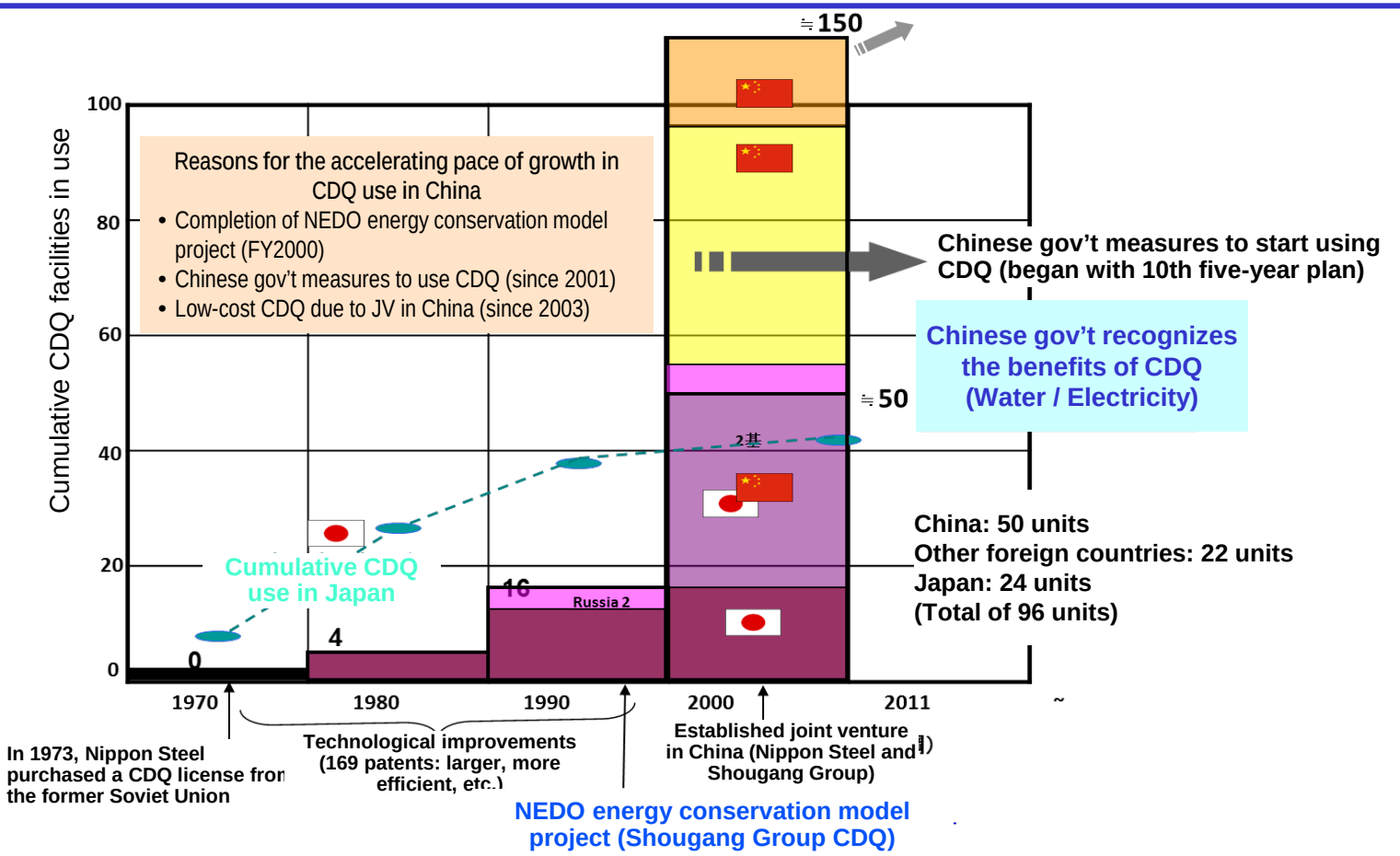
FY2011: 43million tons

FY2020: 70million tons

Example of an Eco Solution

(Use of coke dry quenching (CDQ) in China)

- The use of a Japanese CDQ started in the 1990s as a NEDO energy conservation model project.
- Recognizing the ability of CDQ to conserve energy, the government of China started to use CDQ under its 10th five-year plan, which started in 2001.
- JV with a Japanese engineering company was established in China. The JV and the associated decline in the cost caused CDQ use to increase at an accelerating pace since in the mid 2000s. In addition, Chinese company accomplished domestic production.
- Achieving the widespread use of CDQ in China is an excellent example of how making a technology from Japan a standard technology can lead to rapid growth in the use of the technology.



Eco Solutions –Encouragement of International Alliances I

- The Japanese steel industry has achieved concrete results by using the Japan-China Steel Industries Conference on Exchange of Advanced Technologies on Environmental Preservation and Energy-Saving, World Steel Association (60 countries) and other forums to encourage adoption of the global sectoral approach.
- The Japanese steel industry is making a significant contribution by transferring the industry's outstanding energy-conserving technologies and equipment to other countries and increasing their use in these countries.

1.Japan-China Steel Industries Conference on Exchange of Advanced Technologies on Environmental Preservation and Energy-Saving

- Japanese and Chinese executives signed a memorandum of understanding at the first meeting that was held in July 2005 in Beijing. Since then, technology exchange conferences attended by experts from the two countries have been held every year.
- The foundation for international cooperation in the steel industry
- The seventh conference is to be held in Laiwu during FY2012.

	Date	Location
1st	July 4-5, 200	Beijing
2nd	November 1-2, 2006	Beppu (Oita)
3rd	September 26-28, 2007	Beijing
4th	March 12-13, 2009	Makuhari (Chiba)
5th	April 27-28, 2010	Anshan
6th	November 9-10, 2011	Kobe
7th	To be decided	Laiwu

2. International cooperation using the World Steel Association

- The World Steel Association is working on a global scale on measures in the steel industry to conserve energy and combat global warming.
- The CO_2 Breakthrough Programme was started in 2003 with the goal of developing breakthrough technologies for substantial CO_2 emission reductions. Japan is participating in this initiative through COURSE50, an initiative to develop innovative technologies for steelmaking processes that lower CO_2 emissions.
- In April 2008, the World Steel Association started the Global CO_2 Emissions Data Collection Programme. The association's own methods for calculating CO_2 emission volumes and unit-emissions were developed and CO_2 emission data at the world's major steel mills are being gathered and reported.

1. International standard (ISO 14404) Calculation method of carbon dioxide emissions intensity from iron and steel production

- In November 2008, the Japanese Ministry of Economy, Trade and Industry proposed making a measurement method for industrial energy efficiency (unit CO_2 emissions) an international standard.
  An approach using individual industrial sectors is effective at achieving greenhouse gas emission reductions in a manner that is fair and viable. To reflect this approach in the next framework, international agreement for a sectoral energy efficiency (unit CO_2 emissions) measurement method is vital. Establishing an international standard is an effective way to accomplish this.
- In response to this statement, the Japanese steel industry formed a working group at the JISF that began working in 2009 on an international standard for calculation method of CO_2 emissions intensity from iron and steel production based on the calculation method developed by the World Steel Association. Voting is now under way (November 28, 2012 to January 28, 2013) on the Final Draft International Standard. The goal is to issue this standard by the end of FY2012.

Highlights of ISO 14404

- ✓Has two parts: Part 1 for steel mills with blast furnaces and part 2 for steel mills with electric arc furnaces
- ✓Provides common boundary concept and default conversion factors
- ✓Provides up-stream concept: compensates the difference in site configuration on iron and steel making process
- ✓Optional conversion factor allowed if credible

Eco Solutions –Encouragement of International Alliances II

The Japanese steel industry is encouraging adoption of the global sectoral approach on Asia-Pacific Partnership and GSEP (Global Superior Energy Performance Partnership) in close cooperation between public and private.

1. APP Steel Task Force

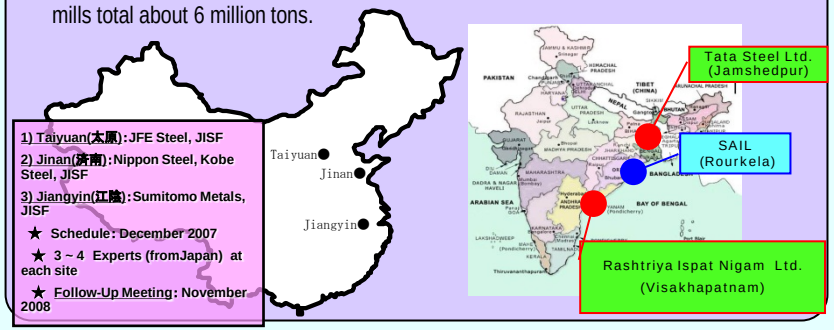
- This task force was started in April 2006 by the ministers of six countries: Japan, Australia, China, India, Korea and the U.S. (Canada joined in 2007), raising participation to the current seven countries. Meetings are held twice each year and were consistently producing benefits until GSEP took over in 2010.
- There are eight task forces, including for steel and cement, and Japan chairs the steel task force.
- Member countries have given the steel task force high marks for facilitating the sharing of energy-conservation technologies, establishing a uniform system for measuring efficiency, performing energy-conservation diagnoses using specialists, and performing other activities.

SOACT Handbook

- The State-of-the-Art Clean Technologies (SOACT) for Steelmaking Handbook contains 22 environmental-protection technologies and 42 energy-conservation technologies. Of these technologies, 27 are provided by Japan.
- All technologies are posted on a website and are available to the public.

Steel Mill Diagnostic Surveys

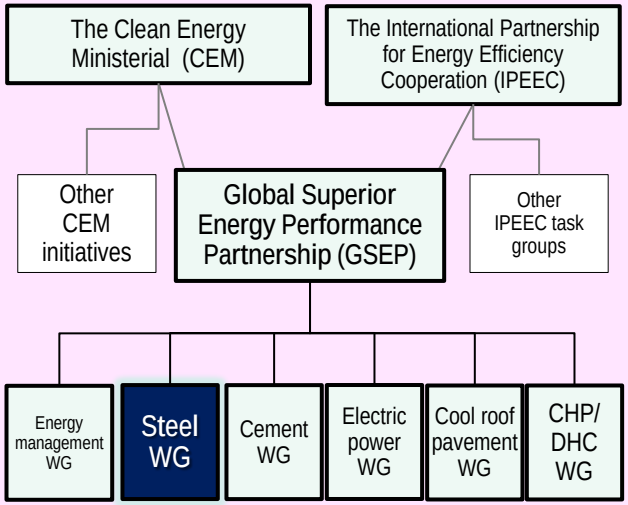
- Engineers performed energy-conservation diagnostic surveys at three steel mills in China and three steel mills in India between fiscal 2007 and 2009.
- These surveys showed that the potential CO_2 emission reductions at the six steel mills total about 6 million tons.



2. GSEP Steel Working Group

- At the July 2010 Clean Energy Ministerial, the decision was made to terminate APP to form a new international organization called GSEP, a proposal by Japan and the U.S. for improving energy efficiency. With public and private-sector participation, GSEP is moving forward with six working groups, including a steel working group.
- Under the leadership of Japan, the steel working group is involved in increasing the use of clean technologies in member countries and activities for energy security, economic progress and environmental protection.
- The conference will be held once each year, as a rule. The first conference held in Tokyo March 2012.

Structure of GSEP



The Five Objectives of the GSEP Steel Working Group

1. Develop and implement energy management framework which can be used in the wide range of steel plants.
2. Develop and implement techniques to utilize, update and verify performance indicators. .
3. Identify and disseminate existing and breakthrough technologies to reduce energy usage, and consequential reduction in CO2 emissions from steel production.
4. Disseminate information on reducing environmental burden and increasing recycling in steel industry.
5. Share and exchange information on policy frameworks for the steel industry and financial mechanisms for technology deployment

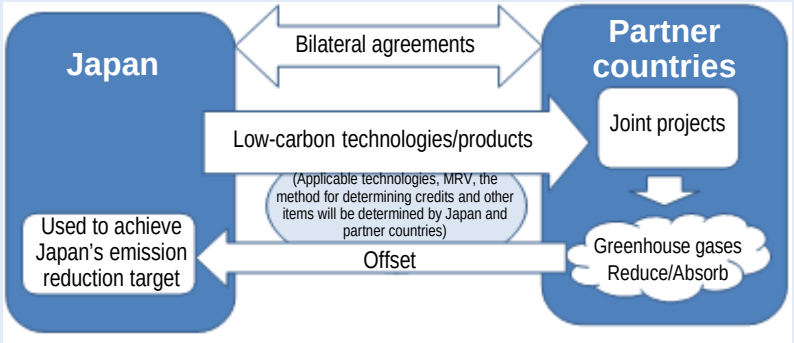
Eco Solutions –Encouragement of International Alliances II

- The Japanese government is proposing the bilateral offset mechanism as a means of reducing and absorbing global CO_2 emissions. The mechanism aims to establish a framework for technology transfers and actions that respond with flexibility and speed to conditions in developing countries.
- This mechanism is consistent with the international cooperation activities of the Japanese steel industry. It is also an effective method for evaluating and promoting international contributions from transferring and utilizing Japan's energy-conservation technologies. As a result, the Japanese steel industry as well cooperating in many ways with the Japanese government.

1. Bilateral Offset Mechanism

- This mechanism uses bilateral agreements for the flexible and rapid assessments and recognition of contributions to overseas CO_2 emission reductions from Japan's low-carbon technologies. The reductions are then certified as emission reductions for Japan.
- There are three GS under way in FY2012.

Offset Mechanism Flowchart



Steel Industry Bilateral Offset Mechanism FS in FY2012

Steel Industry (India)
Study concerning policy advice for increasing the use of energy-conservation technologies in the steel industry of India (see "2. Japan-India Private-Public Sector Steel Cooperation Conference" for more information)

JFE (India)
Study for energy conservation project at JSW steel mill

JFE (Vietnam)
Study for policy advice and commercial feasibility concerning CO_2 emission reduction in the Vietnamese steel industry by using energy-conservation technologies of the Japanese steel industry

2. The public and private collaborative meting between Indian and Japanese iron and steel industry

- As a result of discussion among The Japanese Ministry of Economy, Trade and Industry (METI) and JISF and the Indian Ministry of External Affairs and Ministry of Environment and Forests, this meeting is focusing on technological issue for development the list that are truly suitable for India's steel industry.
- The first conference was held in November 2011. The next conference was in New Delhi in November 2012 and the following meeting is to take place in Tokyo in early February 2013.
- These activities are included in the joint statement of the 5th and 6th Japan-India Energy Policy Dialogue (an initiative of METI and the India National Planning Commission).

Full list
List covering all major steel-related energy-conservation and environmental recycling technologies in the world (136 technologies)

Japan-India Private-Public Sector Steel Cooperation Meetinge

Use Japan's experience to customize technologies to match the characteristics of the India's steel industry

Technologies customized List
List of energy-conservation technologies that truly match the needs of India's steel industry (Currently, 17 technologies have been selected)

Eco Product

- Japanese manufacturers have taken the lead in developing and commercializing many highly efficient industrial products. Examples include fuel-efficient automobiles and highly efficient power generation equipment and transformers. These products have made a big contribution to conserving energy and cutting CO_2 emissions in Japan and worldwide.
- The Japanese steel industry has established a close relationship with these manufacturers by developing and supplying steel that has a variety of characteristics. This high-performance steel is a vital to achieving the outstanding functions of advanced products and has earned a reputation for reliability among manufacturers.
- Steel from other countries cannot match Japan's high-performance steel in terms of performance, quality, supply and other attributes. This steel is the core element of the international competitive edge of the Japanese steel industry. In recent years, overseas demand has been strong for high-performance. The main reason is economic growth and industrial progress in China and other Asian countries. Japan's steel exports have been climbing as a result.
- Most high-performance steel is an eco product that helps make products more energy efficient, thereby lowering CO_2 emissions. Supplying this steel enables Japan to make a big contribution on a global scale to conserving energy and cutting CO_2 emissions. Furthermore, by meeting demand worldwide, this steel helps drive "green" growth in Japan that underpins the Japanese economy and creates jobs.
- More growth is foreseen in the need for high-performance steel. To meet this demand, the Japanese steel industry will continue to supply this steel and develop more technologies. These activities will enable steel eco products to continue to contribute to economic growth in Japan and to improving the global environment.

The Competitive Edge of Eco Product in Global Markets

- Global crude steel production has increased rapidly since 2000 and is expected to continue to grow.
- In the Japanese steel industry, external demand (direct and indirect exports) has grown to account for almost 60% of total demand.
- The main reason is the ability of Japanese steelmakers to use the international competitiveness of eco products to target overseas demand for steel, chiefly in Asia. Japan is the only country that is a net exporter of steel to China, the world's largest steel producer. This is proof of Japan's international competitive edge.

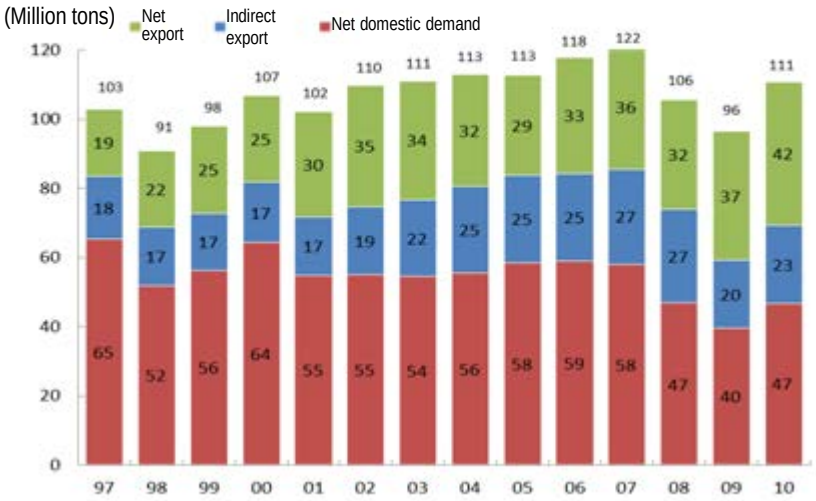
Global crude steel output has increased rapidly since 2000 and more growth is foreseen.

2000	2010	2050 (Forecast)
~0.9bn tons	~1.4bn tons	~2.7bn tons (IEA)
		~2.2bn tons (RITE)

Source: worldsteel

External demand has increased to almost 60% of total demand for steel made in Japan.

Japan's Crude Steel Production by Demand Category

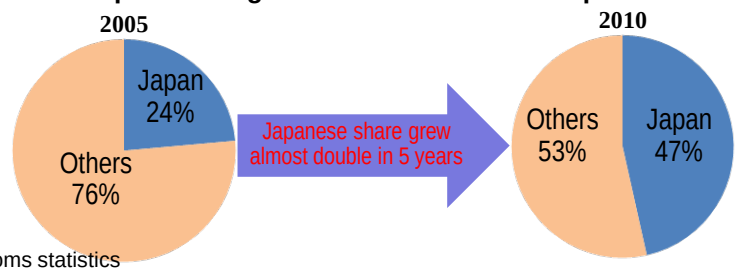


Source: JISF

China, the world's largest steel producer, became a net exporter in 2006 but imports from Japan still exceed exports.

Steel Trade of China (Total) (10,000 tons)

Japan's rising share of China's steel imports



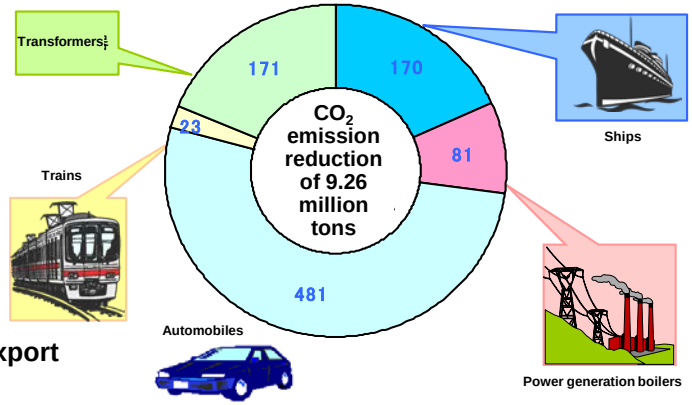
Source: China Customs statistics

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

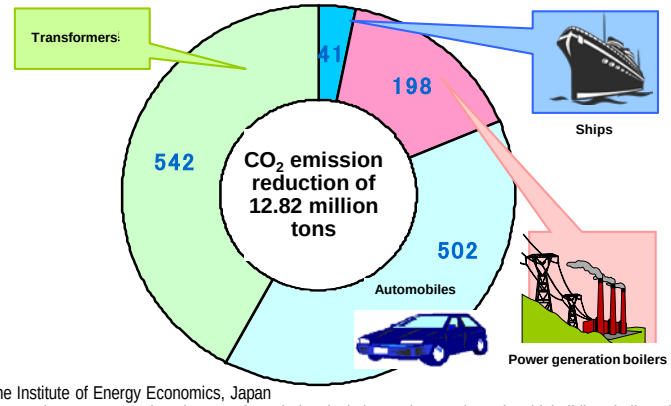
- To establish a method to determine the quantitative contribution of high-performance steel, JISF established in FY2001 a committee with the participation of associations of steel-consuming industries, The Institute of Energy Economics, Japan and the Japanese government. The committee has been monitoring contributions every year since then.
- Statistics are for the five major types of high-performance steel for which quantitative data are available (FY2011 production of 9.14 million tons, 8.6% of Japan's total crude steel output). The use of finished products made of high-performance steel cut FY2011 CO_2 emissions by 9.26 million tons for steel used in Japan and 12,82 million tons for exported steel, a total of 22.08 million tons of CO_2.
- In FY2020, the CO_2 reduction from the use of finished products made of these steel products will be an estimated 9.83 million tons for steel used in Japan and 23.62 million tons for exports, a total of about 33.45 million tons of CO_2.

1. Domestic

CO_2 Emission Reductions FY11



2. Export

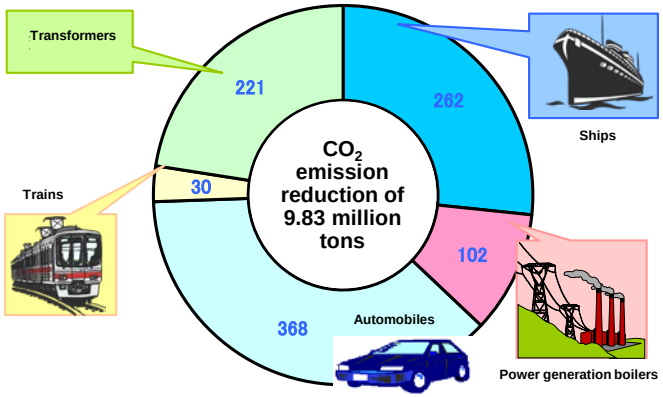


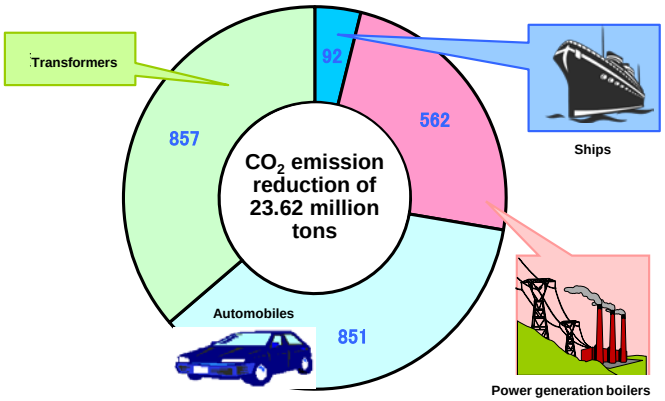
22.08 million tons

Reduction by 9.14 million tons of the five major types of high-performance steel

33.45 million tons

CO_2 Emission Reductions FY20 (E)





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 FY2011, use of the five categories of steel products in Japan was 4.39 million tons and exports were 4.75 million tons for a total of 9.14 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.

*The estimate for the FY2020 emission reduction assumes that high-performance steel output will increase starting in FY2011 at the same rate as crude steel output and that demand for the five categories of high-performance steel will increase. (Estimated FY2020 crude steel output is about 120 million tons based on the macro framework of the METI Fundamental Policies Committee.)

For electric power generation boilers in Japan, the estimate is based on the coal power generation development plan to 2020 in materials of the Fundamental Policies Committee.

Eco Product Contribution II: Estimated Contributions of Energy-conservation and Renewable Energy Measures

- In addition to the Contributions of Major High-performance Steel Products on the previous page, the FY2020 contribution of high-performance steel was estimated for the energy-conservation and renewable energy measures proposed by the Energy and Environment Conference and METI Fundamental Policies Committee during the phase of studying revolutionary energy and environmental strategies.
- High-performance steel with the functions shown in the table below is essential for using the energy-conservation and renewable energy measures presented by the conference and committee.
- The contribution of this steel is calculated by converting these two measures into CO_2 emission reductions and assuming that one-fourth comes from high-performance steel results in emission reduction contributions of 3.81 million tons for energy-conservation measures and 7.61 million tons from renewable energy, a total of 11.42 million tons.

(1) Energy conservation *1	CO_2 emission reduction (10,000 tons)		High-performance steel used	Contributing function
	Total	Due to steel*3		
Industrial motors	32	8	Oriented electrical sheets	Outstanding electromagnetic properties
High-efficiency boilers	254	64	Seamless high-chrome tubes	Resists high temperatures and corrosion
Energy-efficient transformers	6	2	Oriented electrical sheets	Outstanding electromagnetic properties
Hybrid construction machinery	29	7	Oriented electrical sheets	
Next-generation automobiles	1200	300	Oriented electrical sheets	
Total	1521	381		

(2) Use of renewable energy*2	CO_2 emission reduction (10,000 tons)		High-performance steel used	Contributing function
	Total	Due to steel*3		
Small/midsize hydroelectric power	1789	447	Abrasion-resistant steel bearings	Outstanding durability
Wind power	307	77	Heavy plates for easy welding Oriented electrical sheets	High strength, ease of welding Outstanding electromagnetic properties
Geothermal power	205	51	Corrosion-resistant pipes	Resistance to corrosion
Biomass power generation	746	186	Corrosion-resistant pipes	
Total	3047	761		

*1 The CO_2 reduction benefit from energy-conservation is an estimate of The Institute of Energy Economics, Japan based on the crude oil equivalent energy conservation in document 5 "Basic Data concerning the Proposal for Energy Mix Options" of the 27th Fundamental Policies Committee meeting.

*2 The CO_2 reduction benefit from renewable energy is an estimate of The Institute of Energy Economics, Japan using the "0.316kg-CO_2/kWh" FY2010 performance of The Federation of Electric Power Companies of Japan and based on the electricity produced by source in 2020 in the "25 Scenarios" of the "Scenario Data" on the website of the National Policy Unit.

*3 Assumes 50% benefit from technological designs and 50% from improved materials, then half (25%) from steel. For quantitative assessments, uses the method for electric power generation boiler tubes.

Development of Revolutionary Technology for Steelmaking Process (COURSE50)

(COURSE50：*CO_2 Ultimate Reduction in Steelmaking process by Innovative technology for cool Earth 50*)

CO_2 emissions are unavoidable when coal is used for the reduction of iron ore.

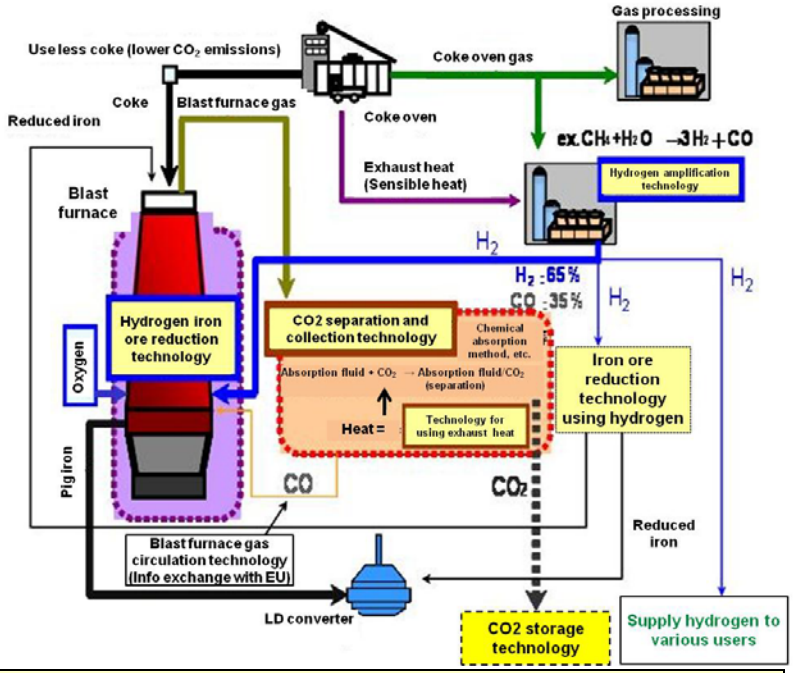
The goal is to cut total CO_2 emissions by about 30% by using hydrogen to reduce iron ore and collecting CO_2 from blast furnace gas.

The first practical system is to start operating by about 2030*. All blast furnaces are to be switched to this technology by 2050 as blast furnace facilities are updated and replaced.

*Assumes establishment of economic basis for CO_2 storage infrastructure and creation of a practical unit using these processes.

Project summary

1. Total cost (Phase1, Step 1): About ¥10 billion (tentative)
2. R&D activities (technology development)
   a) Development of hydrogen amplification technology using unused coke oven gas sensible heat (800ºC)
   b) Development of iron ore reduction technology using hydrogen
   c) Collection of CO_2 from blast furnace gas by using unused exhaust heat at steel mills



NEDO Project（Phase1 Step1　2008～12）

2008	09	10	11	12
1.6	2.5	2.0	2.6	1.8 (billion yen)

Medium/long-term timeline

2010　2020　2030　2040　2050

Phase1 Step1 (2008～12)　Phase1 Step2 (2013～17)　Phase2　Practical applications, more widespread use

COURSE50 Progress Report

FY2012 Topic 1: Operation of trial hydrogen reduction blast furnace
See explanation on the right

FY2012 Topic 2: Development of hydrogen amplification technology*
Actual gas test using bench plant (Diagram below)

Catalytic large reactor (shown during installation)

1. Confirmed a twofold increase in hydrogen amplification; test facility was a tar catalytic reforming bench plant with a scale of about 30Nm3/hour that uses actual COG.
2. Currently evaluating the durability of the reforming properties.

Progress Overview and Upcoming Issues

Hydrogen reduction operation at the trial blast furnace of LKAB in Sweden started on April 16, 2012 and ended on May 11 as planned. All initially planned test levels were achieved.

(1) A decline in input C volume (CO_2 emissions) was confirmed for tests using both the tuyere input and shaft input. Next will be analysis of the depth of COG permeation, blast furnace interior reactions, etc. and confirmation of the CO_2 emission reduction at an actual blast furnace.

(2) In the final year of step 1, every item for all COURSE50 technologies will be evaluated to enable a smooth transition to step 2.

(3) During step 2, the primary activity is to develop matching for hydrogen reduction and collecting separated gases, primarily using the mini-trial blast furnace, while at the same time studying the potential for additional seeds for innovation.

* When an external supplier is used for the hydrogen needed for the hydrogen reduction of iron ore in a blast furnace, CO_2 will be produced where the hydrogen is manufactured. Therefore, hydrogen must be produced at the steel mill in order to prevent a new source of CO_2. This technology uses heat for the separation of tar from the gas in order to increase the amount of hydrogen, which is sent to the blast furnace. Currently, this method can be used to reduce the amount of coke used for reduction in a blast furnace.

3. Requests Concerning Initiatives in Japan

The Urgent Need for an Inexpensive and Stable Supply of Electricity

- In Japan, thermal power plants account for about 90% of electricity because almost all nuclear power plants are not operating.
- If all nuclear power plants are shut down and their output is replaced with fossil fuel electricity, electricity bills in Japan would rise by an estimated ¥3.7/kWh. Since the resulting cost would be 3.2 times more than the ordinary income of the EAF steelmaking industry, allowing this cost increase would be equivalent to ordering this industry to cease operations.
- Due to the higher cost of fuel, Tokyo Electric Power will raise its rates in April 2013 and Kansai Electric Power and Kyushu Electric Power have applied to raise their rates in November. Tohoku Electric Power and Shikoku Electric Power also plan to raise their rates, indicating that the cost of electricity will rise in all areas of Japan.
- The Japanese economy is already sluggish. A rapid increase in the cost of electricity would deal a severe blow to industrial activity and could trigger the collapse of the economy. The steel industry strongly urges the Japanese government to quickly restart nuclear power plants, based on the premise of ensuring safety and obtaining the understanding of nearby residents, in order to secure an inexpensive and stable supply of electricity as soon as possible.

Impact of Higher Electricity Cost on EAF Steelmakers

	Electricity used (billion kWh)	Increase in cost of electricity (¥billion)	Ordinary income (¥billion)	Higher cost/Ordinary income (%)
Nationwide increase of ¥3.7/kWh if all nuclear power plants are shut down (estimate of IEA, Japan)	**4.7**	**17.4**	**5.5**	**316%**

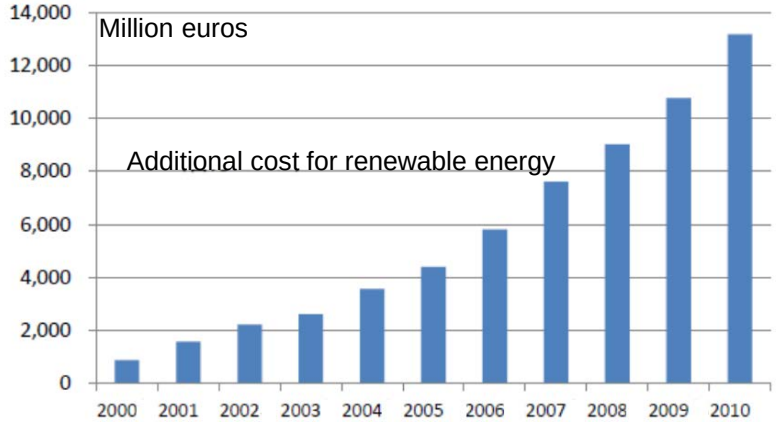
Notes:
1. For all 23 EAF steelmakers in Japan
2. Unit price increases for all estimates use the estimates of The Institute of Energy Economics, Japan (estimated effect of shutting down all nuclear power plants).
3. Ordinary income is for FY2010.

Source: Data collected by the JISF

The Feed-in Tariff System Needs a Sweeping Reexamination

- There are both technological and economic problems with renewable energy. For instance, the generation cost is high and measures are needed to maintain grid stability. Furthermore, since renewable energy will require a long-term approach, this energy cannot immediately contribute to solving the current electricity problem.
- In fact, the current feed-in-tariff (FIT) system is a step in the opposite direction from solving the electricity problem. Rapidly raising the amount of renewable energy use would increase the cost of fuel. This would simply accelerate the rise in electricity rates in the form of a surcharge at a time when there are already worries about the higher cost of electricity.
- The FIT system that started in Japan in July 2012 has extremely favorable terms for producers of electricity from renewable sources. As a result, the additional cost in the first year (FY2012) is ¥0.29/kWh, which is already 60% higher than expected. (The initial outlook was a maximum increase of ¥0.5/kWh in FY2020.)
- The German FIT system also gives preferential treatment to producers of renewable energy electricity. This has created the problem of a high cost of electricity for the people of Germany because of the costly surcharge. Germany is now in a situation where the purchase price must be lowered.
- Due to the current electricity situation, this same problem must not be allowed to happen in Japan, too. We therefore ask for a prompt and comprehensive reexamination of FIT, including the upcoming price for buying electricity.

Growth of the Renewable Energy Surcharge in Germany



Source: Excerpt from materials distributed at the 13th Fundamental Policies Committee meeting

Household Electricity Bills and the Surcharge in Germany

	Germany (2009)
Household electricity bill	$97/month
Household surcharge	$5.40/month ($14.70 in 2011)
Unit surcharge	1.8 cent/kWh (4.9 cents/month in 2011)

The Global Warming Tax Must Be Reexamined

- Japan is working on post-earthquake energy and environmental policies, but there is little progress toward establishing a basic energy plan. Even targets for measures to combat global warming have not been determined.
- The current framework for a global warming tax and amount of taxes collected were determined before the Great East Japan Earthquake and do not reflect the effects of this disaster.
- However, there is sufficient growth in oil and coal taxes resulting from increased thermal power generation because of nuclear power plant shutdowns. Consequently, since Japan already has adequate revenue from the global warming tax, there is no need for a tax hike.
- There is an economic crisis in Japan. With electric utilities announcing plans to boost their rates, a higher cost of energy would undoubtedly weigh heavily on any recovery in the economy.
- Once Japan makes progress toward establishing an energy policy and measures to combat global warming, the country should once again think about whether or not a tax to combat global warming should be imposed and reexamine this tax system.

Global Warming Tax Collections
(added to the oil and coal tax)

FY2013: About ¥80 billion

Revenues were ¥39.1 billion in the first year (FY2012), a six-month period that started in October.

Oil and Coal Tax Associated with Nuclear Power Plant Shutdowns (excluding surcharge)
Estimated Natural Increase in FY2012

Fuel	Power generated*1	Tax revenues*2
Coal	15.3bn kWh	~¥3.7bn
LNG	123.1bn kWh	~¥20.2bn
Oil	120.9bn kWh	~¥57.8bn
Total	259.3bn kWh	**~¥81.7bn**

*1 Electricity generated for each energy source according to the Japanese government Electricity Supply and Demand Investigation Committee

*2 Estimates based on generating efficiency for each energy source and unit calorific value of each type of fuel

The Urgent Need to Reexamine the "Innovative Strategy for Energy and the Environment"

- Japan's Innovative Strategy for Energy and the Environment was approved on September 14, 2012. The strategy is based on unrealistic assumptions about the nuclear power ratio, energy-conservation measures and the use of renewable energy sources. As a result, the strategy will have an extremely severe impact on the Japanese economy along with jobs and the lives of the people of Japan. The government must take another look at these unrealistic assumptions.
- According to the scenario used when the strategy was formulated, if there is no nuclear power, electricity rates in Japan will rise by 110% between 2010 and 2030[*1]. Choosing the stance of "aiming for no nuclear power" is the same as ordering Japan's manufacturing sector to cease operations. This is particularly true for the EAF sector, which consumes massive amounts of electricity.
- Furthermore, Japan must have many choices for energy sources because the country has few natural resources. Aiming for no nuclear power would be voluntarily abandoning measures to secure energy diversity and is thus not a conceivable or viable national policy.
- In addition, the assumptions for energy conservation and renewable energy in the scenario are unrealistic. This assumption would result in dire sacrifices for Japanese industry and the people of Japan. There is an estimate indicating that a reexamination of the above assumptions would enable a big reduction in the impact on electricity rates while achieving energy conservation on a par with other industrialized countries.[*2]
- The energy and environmental policies should be thoroughly reexamined to create a realistic approach that can support both the Innovative Strategy for Energy and the Environment. The policies must once again adopt the standpoint of supporting economic growth and living standards. We therefore ask for the creation of a proper energy policy along with the closely related policy for measures to combat global warming.

*1 "Summary of RITE Analysis for Energy and Environment Conference Options" of the Research Institute of Innovative Technology for the Earth (July 2012)

*2 "Proposal for Alternate Options for Energy and Environmental Conference Options" of the Research Institute of Innovative Technology for the Earth (August 2012)

(Reference) Excerpt from “Proposal for Alternate Energy Options for Energy and Environmental Conference Options” (August 2012)

RITE

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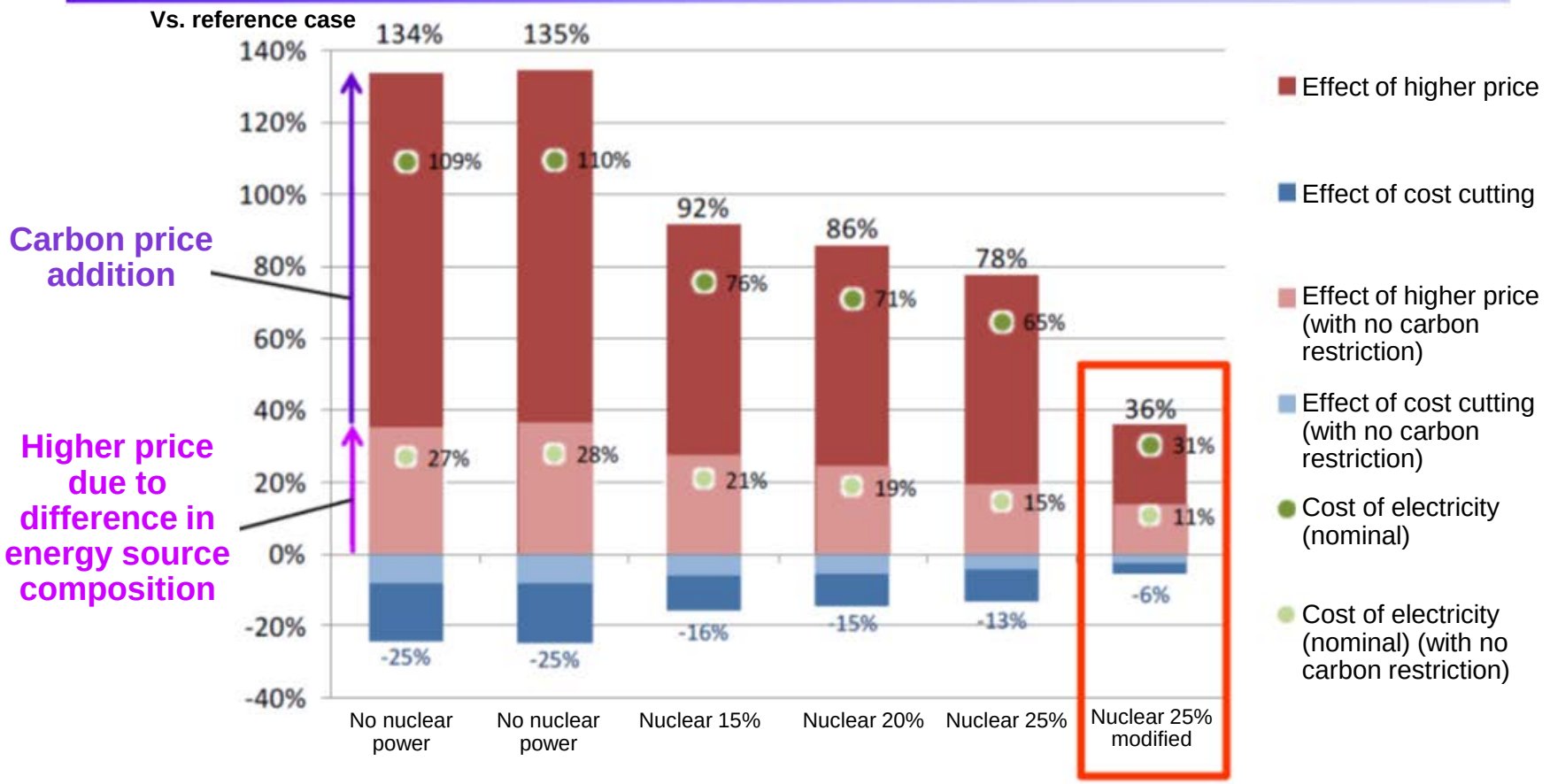
Cost of Electricity for Industrial Use (2030)



For industrial use as well, this study shows that the “Nuclear 25% modified” option makes possible a large reduction in the carbon price addition. Furthermore, for the rise in the cost of electricity caused by differences in energy source composition, the “Nuclear 25% modified” has an increase of only 11% compared with an increase of 15% for the “Nuclear 25%” scenario and an increase of almost 30% for the “No nuclear power” scenarios.