Addressing for Climate Change and Energy Issues of Global Steel Industry

～ from the point of Technology Diffusion and Innovation ～

Akio Mimura, President
Nippon Steel Corporation
March 13, 2008

Today's program

1. Measures for energy conservation and the prevention of global warming in steel manufacturing

○Efforts made for energy conservation in the steel industry up to now

2. Contributions made to energy conservation and global warming prevention measures through product development, etc.

○Development of eco-products that meet the needs of the customer

3. International sectoral approach in the steel industry

○Efforts concerning a sectoral approach in the Japan-China Steel Industry Exchange Association, APP, the International Iron and Steel Institute, and others

4. After the Kyoto Protocol

○Construction of a new framework based on evaluations of the Kyoto Protocol

1. Measures for energy conservation and the prevention of global warming in steel manufacturing

○Efforts made for energy conservation in the steel industry up to now

Steel manufacturing process and the recycling of energy and resources

2005fy JISF

Energy

energy (1800PJ)

Power from grid (51TWh)

Fresh water (1.3Bm3)

Natural resource

Coal (6.6Mt)

Iron-ore (122Mt)

By-products from other sectors

Recycling of energy Global warming

Gas as fuel 54%

Power from waste heat recovery 3.7TWh

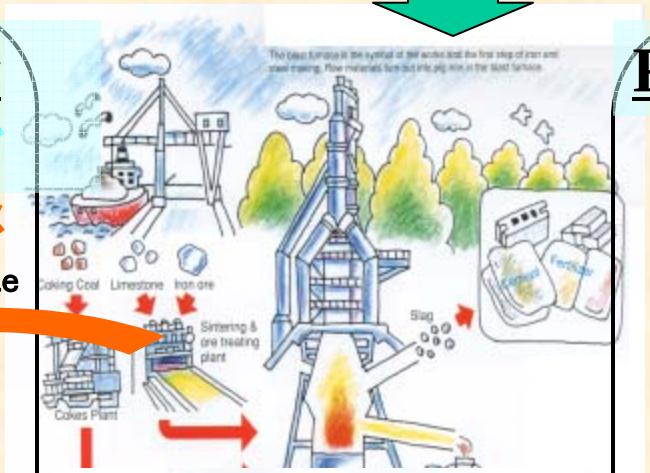
20% power

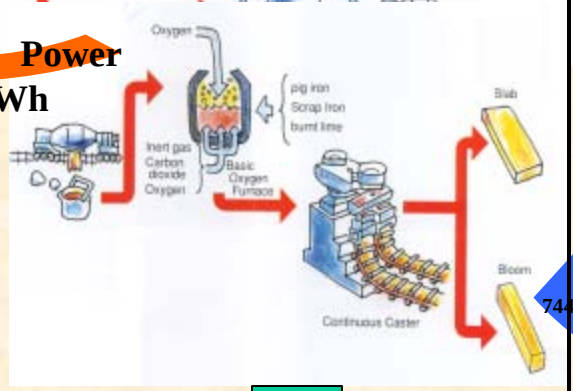
In-house Power 25TWh

By-pro gas 100%

By−pro gas

Gas discharge





Crude steel 113Mt

Recycling of resources

Scrap purchased

In-house scrap (15.19Mt)

Cement industry etc

Sell

Slag 36.55Mt

Reuse/recycle 99%

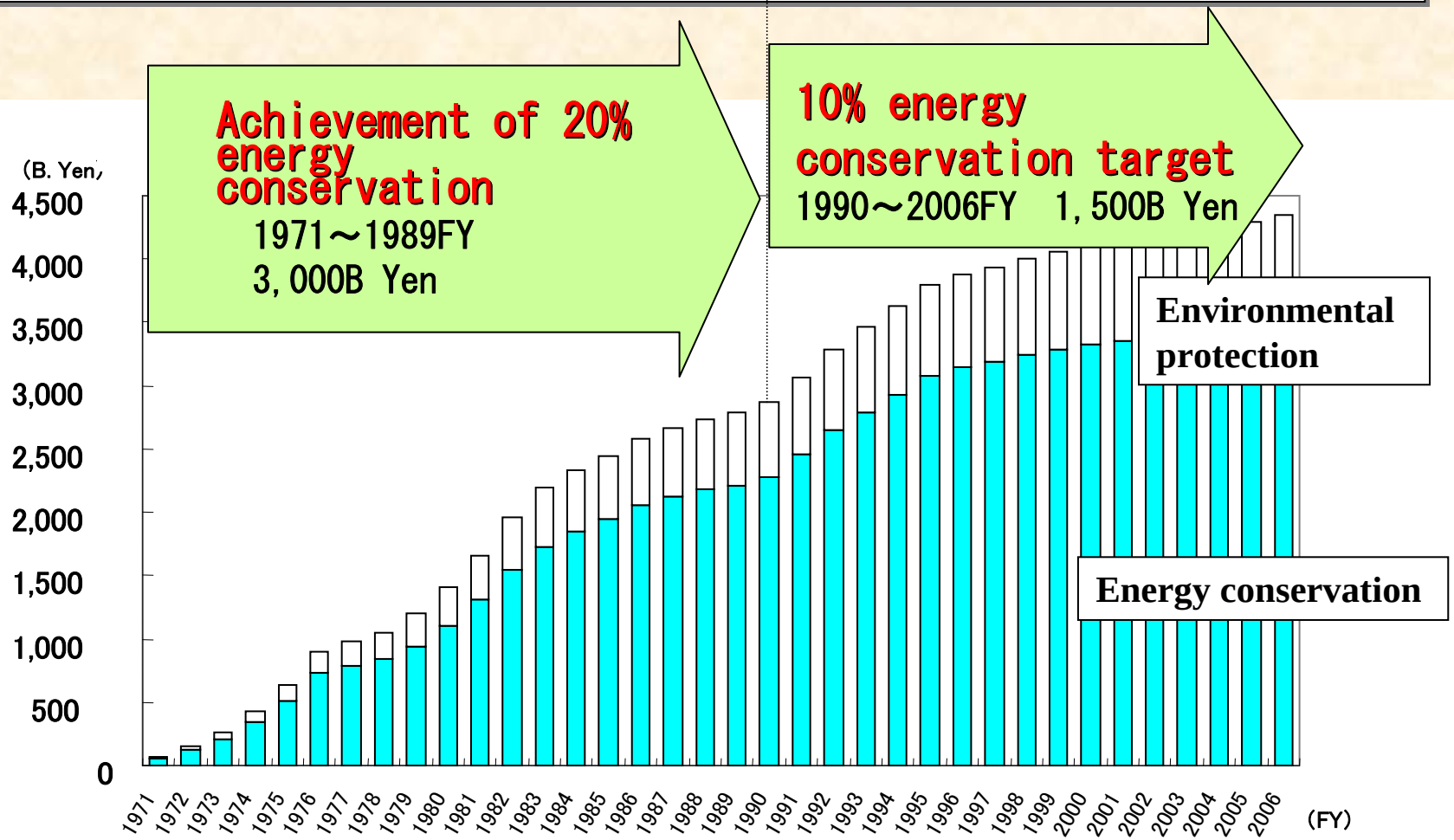
Disposal landfill 1%

Landfill 0.69Mt

744ha

By−products (47.24Mt)

Trend of the accumulated investment amount for energy conservation and environmental measures in the steel industry



Source：Before2001FY:Facility investment plan of main industry、
After2002FY: Facility investment survey

Trend of energy conservation activities

70s | 80s | 90s | 2000s

Process continuation / elimination (CC, etc.)

Increased energy use (higher value-added products, environmental-protection measures, etc.)

Breakthrough technology（SCOPE-21）

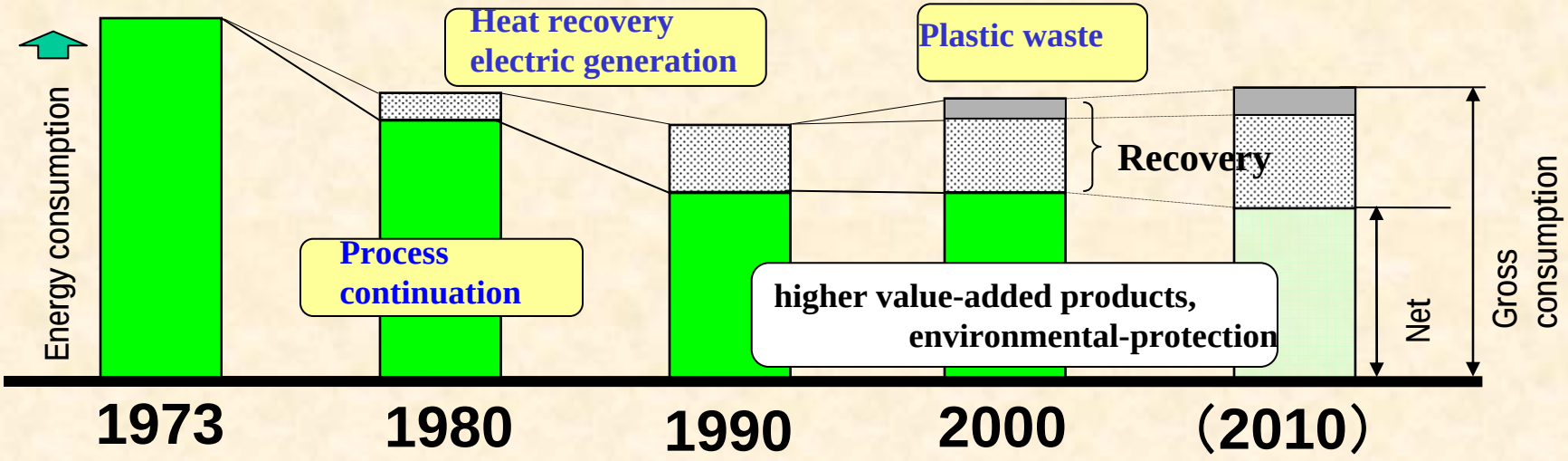
Large-scale waste energy recovery（TRT、CDQ etc）

Further recovery･Higher-efficiency operation of energy equipment

By-product gas recovery→Oilless

Increased application ratio of soft coking coal（PCI、CMC）

Utilization of resources (plastic waste, tire,etc.)



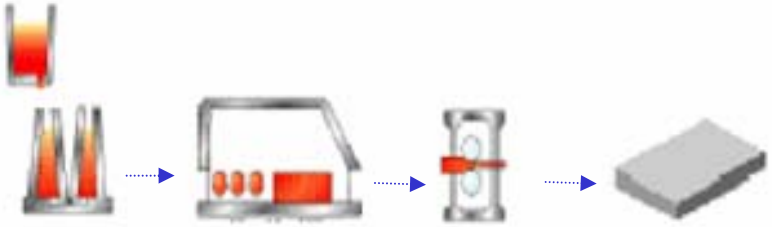
Process serialization / process omission (continuous casting method)

Energy conservation: 350 thousand Kcal/t-s (approx. 6%)

CO_2 reduction: 13 million t-CO_2/year

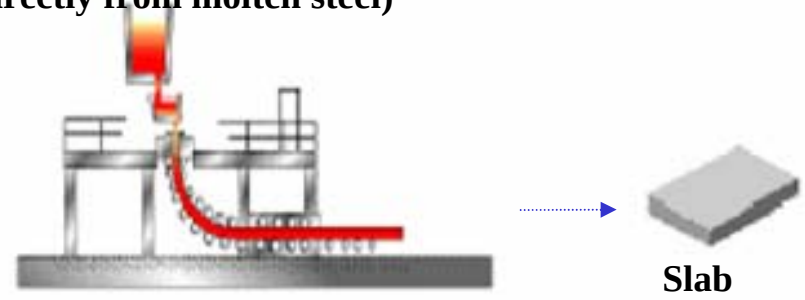
Japan is the foremost in the world for achieving a high continuous casting rate

Ingot casting (conventional)



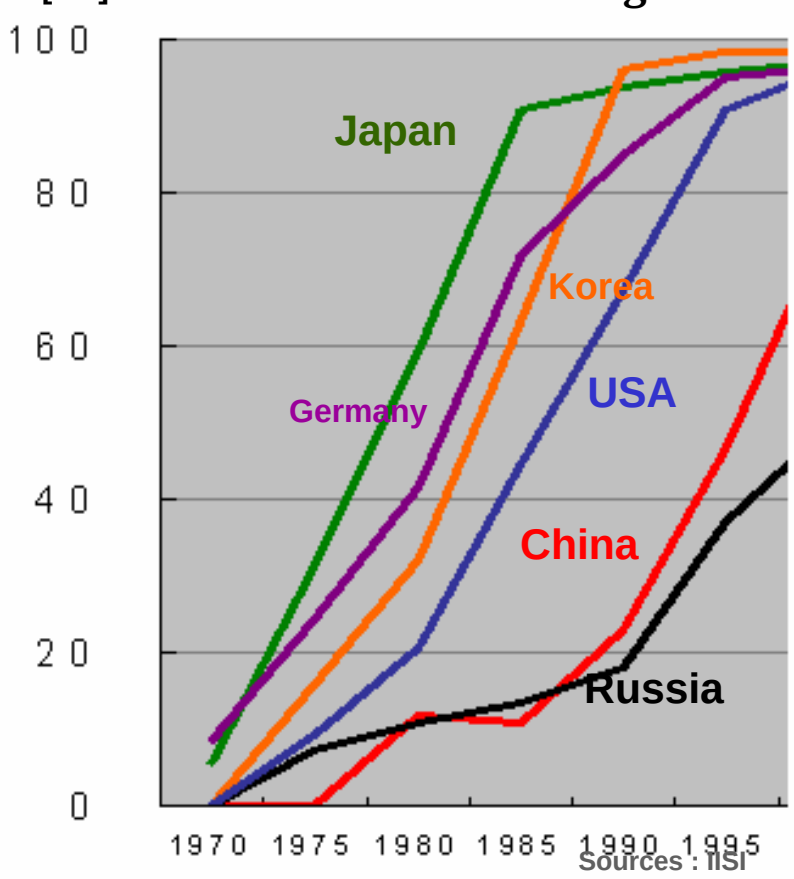
Ingot Soaking pit Blooming mill Slab

Continuous casting (Manufacture of slabs directly from molten steel)



Slab

Continuous casting rate



Waste heat recovery technology (Coke dry quenching: CDQ)

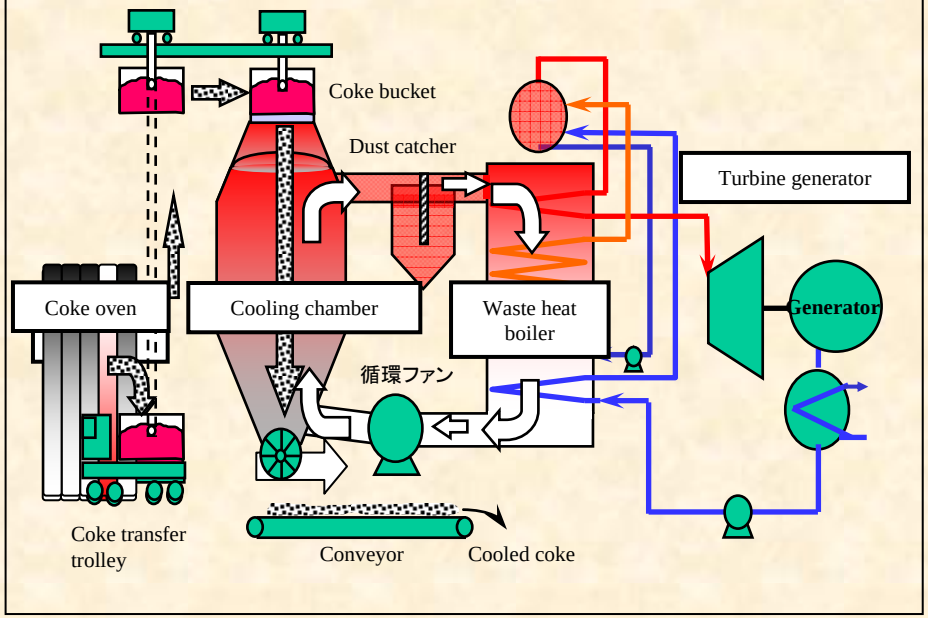
Energy conservation: 400 thousand Kcal/t-coal (4% on a blast furnace base)

CO_2 reduction: 6 million t-CO_2/year

Wet quenching of red hot coke (conventional)

Coke dry quenching (CDQ)

(Coke is quenched with inert gas, and sensible heat is recovered.)



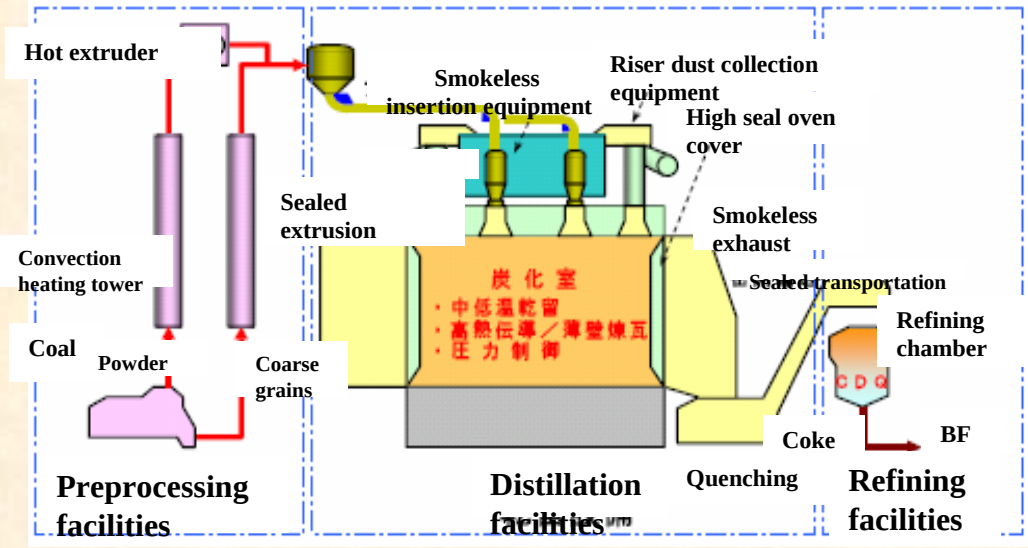
Innovative steel manufacturing technology (next-generation coke oven)

Energy conservation: 20% (vs. conventional oven)

CO_2 reduction: 400 thousand t-CO_2/ Year-oven

Next-generation coke oven

- Effective utilization of coal
- Increased productivity
- Environmental improvement (NOx, dust emission, etc.)
- Energy conservation

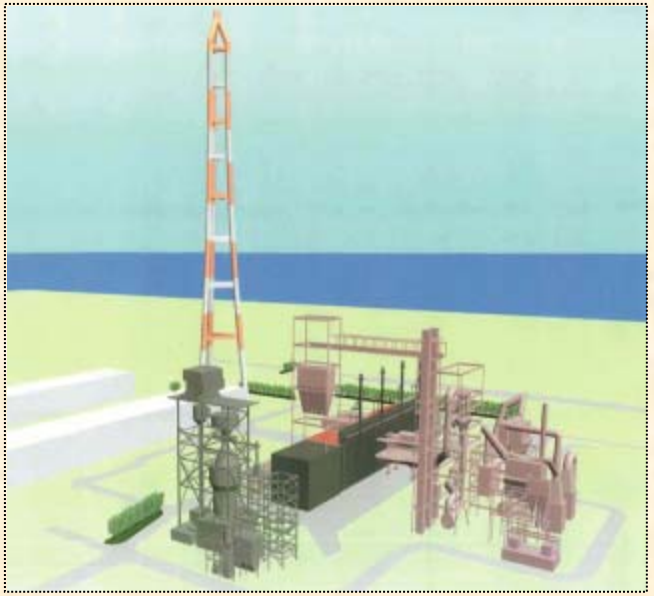


- **Development under a national project**

  We have been participating in a project sponsored by the Ministry of Economy, Trade, and Industry as a representative of the Japan Iron and Steel Federation since 1994.

- **World's first practical application**

  The new coke oven went into operation at Oita Steelworks of the Nippon Steel Corporation in February 2008



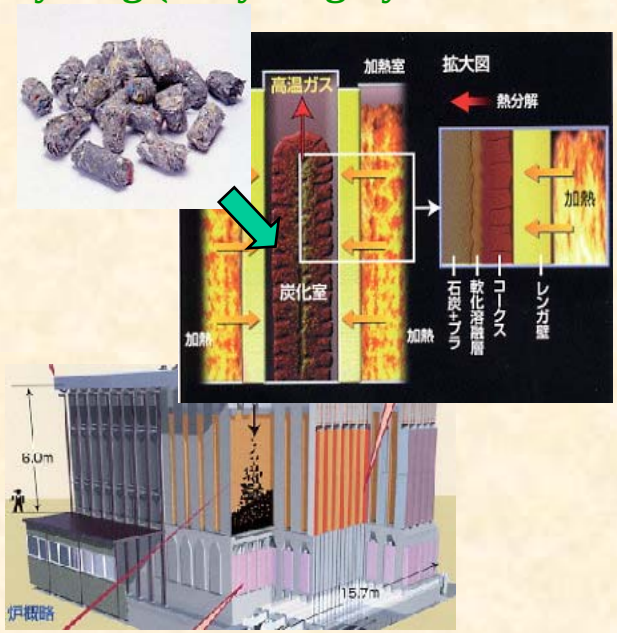
Effective utilization of waste plastic, etc

In the steel industry, the steel manufacturing process is used to recycle waste plastic, etc.
In fiscal 2006, some 400 thousand t were processed. (Target: 1 million t)

Nippon Steel's waste plastic recycling activities

- Chemical recycling using a coke oven
- In 2006FY, we processed 170 thousand t. Going forward, we intend to increase our processing capacity

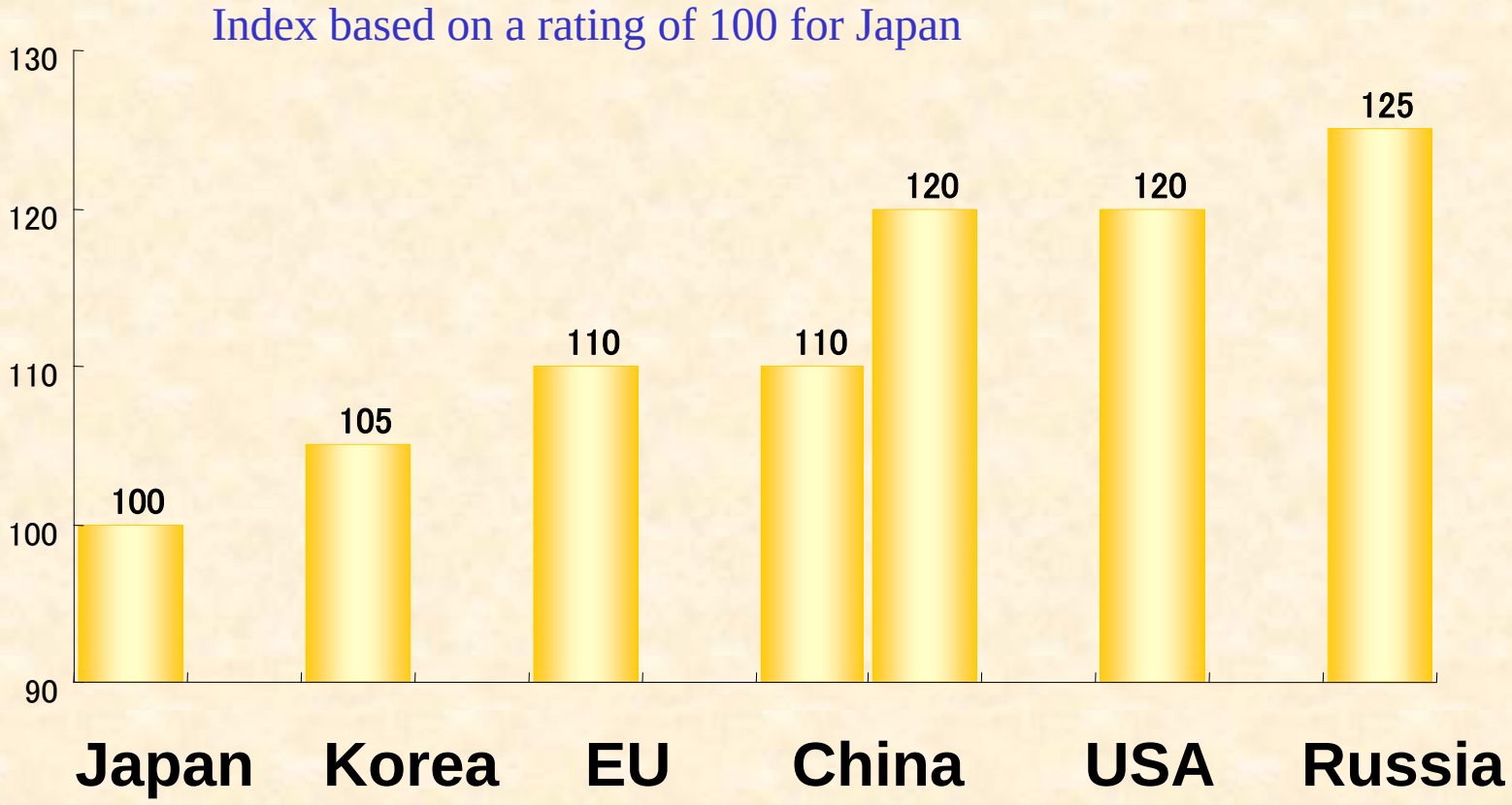
Chemical recycling (Recycling by means of a chemical reaction)



Coke Oven

- 40% COG
  Power station Fuel cell (in the future)
- 40% Hydrocarbon based oil
  Plastic raw material
  Paint, etc
- 20% Coke
  Blast furnace reduction material

Comparison of energy efficiency for integrated steelmaking among major countries/region



Source: Prepared from information obtained from the Korea Iron and Steel Association, China Iron and Steel Association, individual hearings, etc. (2005)

Note: Regarding the data for China, the boundary and definition, etc. are unclear.

2. Contributions made to energy conservation and global warming prevention measures through product development, etc

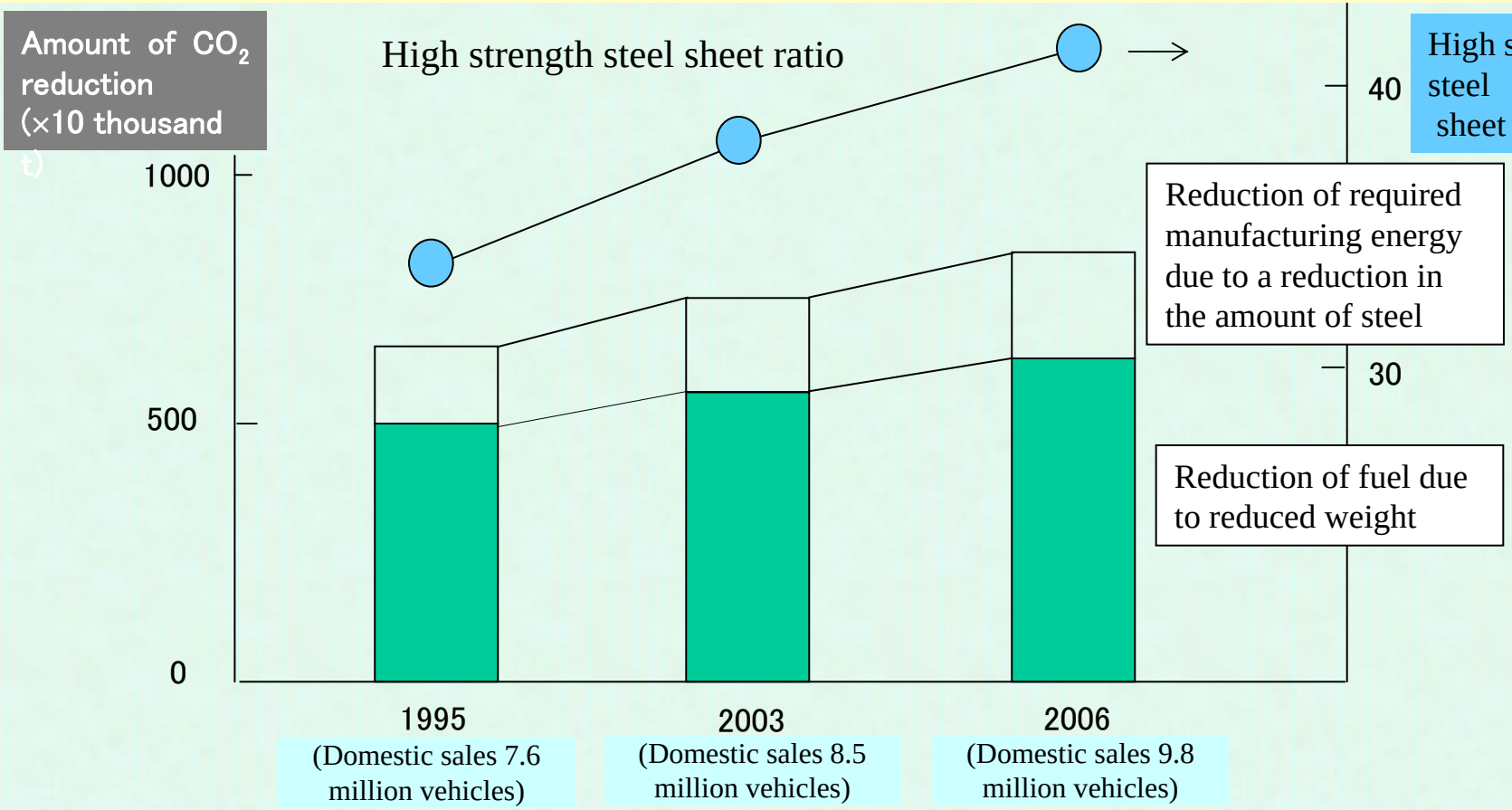
○ Development of eco-products that meet the needs of customers

Development of eco-products that meet the needs of customers

Customer needs		Eco-Products
Automobiles	Further weight reduction and enhanced collision safety	High strength steel sheets, steel pipes, and bars and wires
	More efficient motors for hybrid vehicles	Highly efficient non-oriented magnetic steel sheets
	Simplification of user's machining process	Steel pipes, etc., for hydroforming
Shipbuilding	Increased size of container vessels	High strength high toughness thick sheets
Domestic appliances and electrical machinery	More efficient motors	Highly efficient non-oriented magnetic steel sheets
	Simplification of user's machining process	Precoated steel sheets, highly formable stainless steel sheets
	Improved heat dissipation	Highly heat absorbent steel sheets
Electric power, energy	Improved power generation efficiency	Steel pipes for high temperature boilers
	Improved transformer efficiency	Highly efficient oriented magnetic steel sheets
	Improved energy transmission efficiency	High strength line pipes
Construction, civil engineering	Improved execution efficiency	Tough high strength thick steel sheets for parts to be welded
	Energy conservation	Steel houses

Weight reduction achieved by high strength steel sheets for automobiles

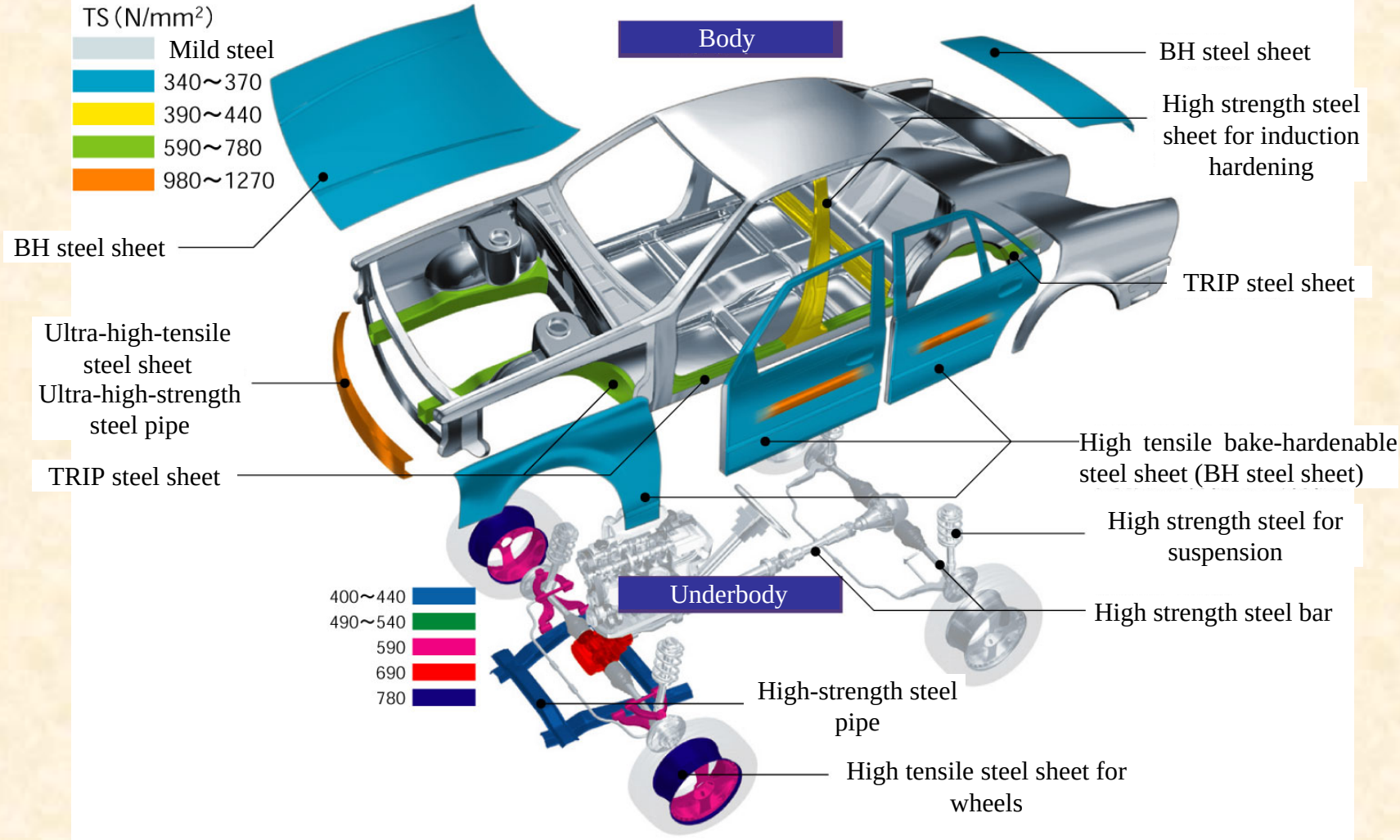
The weight of automobiles is reduced by increasing the applicable range of high strength steel sheets. This contributes to enhanced fuel economy and CO_2 reductions.



High strength steel sheet ratio and CO_2 reduction amount

Prepared from data obtained from the Institute of Energy Economics, Japan

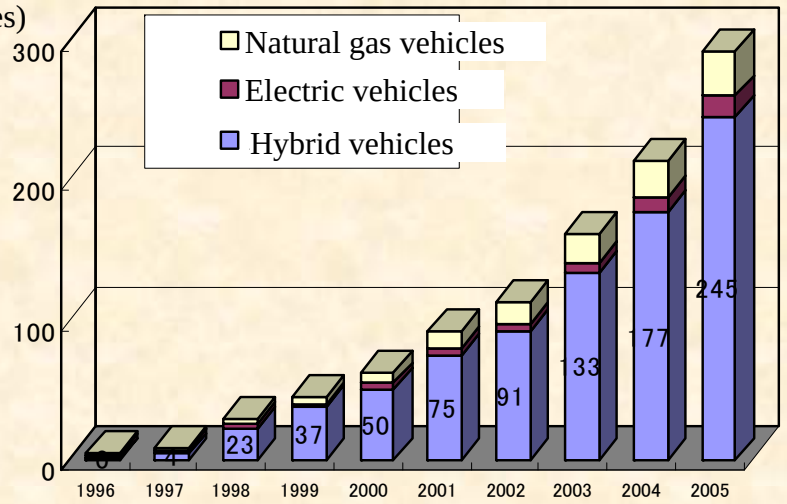
Actual example of a use of high strength steel sheets for automobiles



Non-oriented magnetic steel sheet for hybrid vehicles

We offer low energy loss, high flux density magnetic steel sheets for manufacturing the drive motor of a hybrid vehicle

(Unit: 1000 vehicles)



The expected production of hybrid vehicles in fiscal 2008 is 1,000 units

Source: JIMA, Estimated

Nippon Steel's domestic shipment of magnetic steel for hybrid vehicle motors in 2005 was eight times that of 2000.

<<Highly efficient non-oriented magnetic steel>>

Material for HEV motors

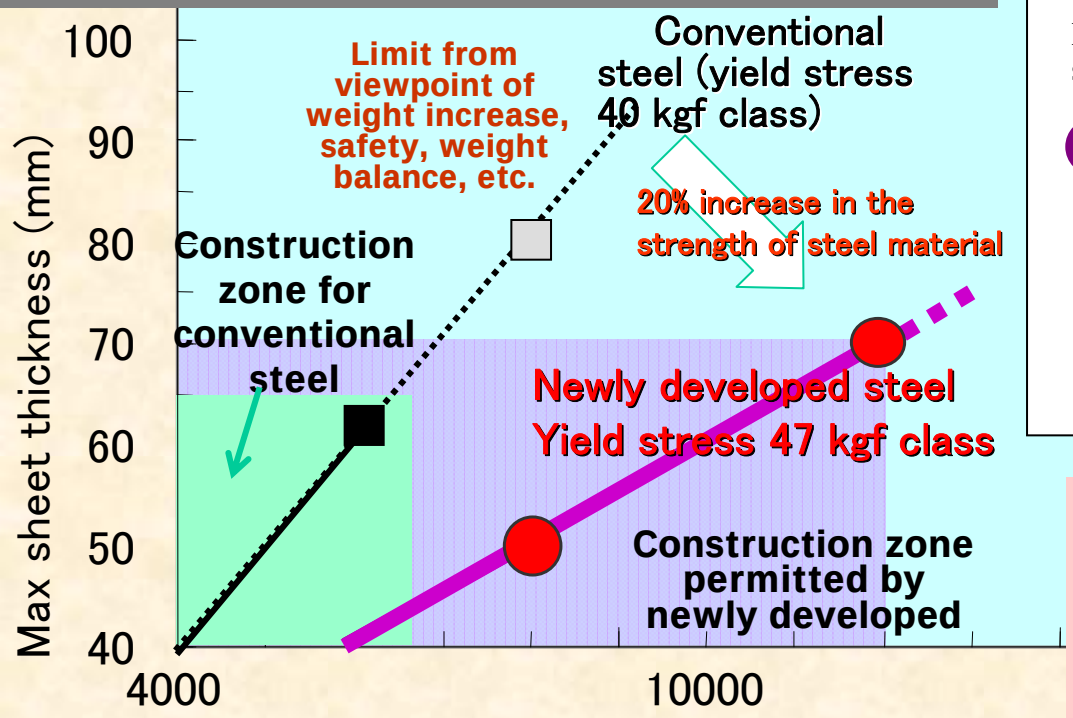
⇒

Major improvement in fuel economy

High strength tough thick sheets for large container vessels

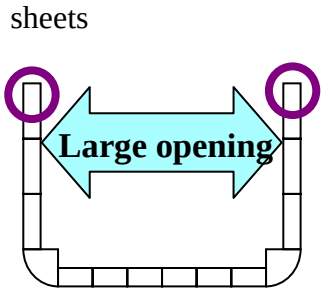
We offer high strength tough thick sheets and also our welding technology in order to cope with the increasing size of container vessels (4,000 → 8,000 or more containers)
Increase in the allowable design stress → Enhanced transportation efficiency (approx. 3%) → Reduction of CO_2 (Yearly reduction of 1,000 tons of CO_2/vessel)

A 20% increase in the strength of steel material enables the thickness to be reduced by 40%.



Requirements for ultra-large container vessel

A large load acts on the upper deck, necessitating the use of thick sheets.
The development of high strength tough steel enables a safe, large container vessel to be built without the need for thick sheets



＜Cross-section of a container vessel＞

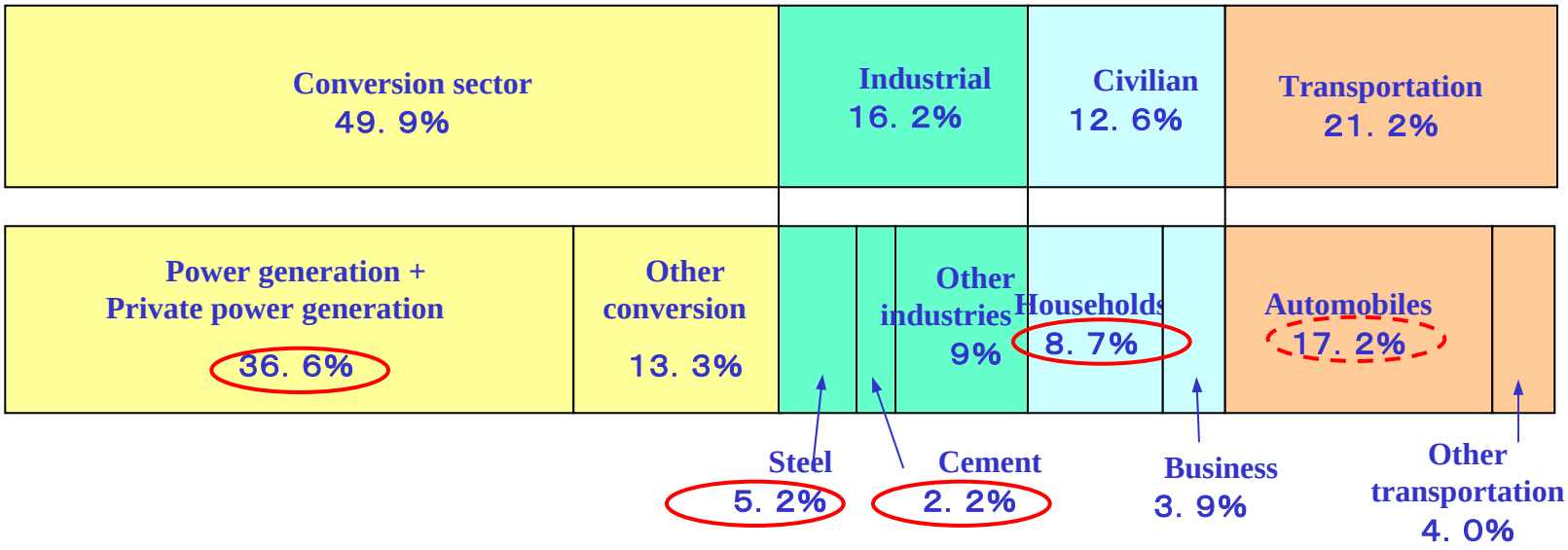
We developed high strength (YP47 kgf class) tough thick sheets jointly with the shipbuilding industry, which were used in the construction of an 8,000TEU container vessel (in 2007).
At present, we have outstanding orders for over 30 vessels.

3. International sectoral approach in the steel industry

○ Efforts toward a sectoral approach made by the Japan-China Steel Industry Exchange Association, APP, the International Iron and Steel Institute, and others

CO_2 emissions for each sector throughout the world

* When the total CO_2 emitted throughout the world is classified according to each sector,
(1) the ratio of the APP cooperative object field (electric power, steel, cement, electrical machinery and equipment, etc.) is 53%, and
(2) if the automotive field is included in the above, it becomes to 70%.



Note: The emissions from each sector are the direct emissions (all electricity is counted in the electrical generation sectors). Heat is divided proportionately according to the demand of each sector. CO_2 that is emitted from industrial processes such as cement is not counted.

Source* IEA

Effectiveness of the “sectoral approach”

（1）Existence of major reduction potential

Regarding power generation, steel manufacturing, cement production, transportation (automobiles), and the civilian sector (electrical equipment), which account for more than 70% of worldwide CO_2 emissions, if the existing environmental protection and energy conservation technology (best available technology: BAT) comes into widespread use, it should be possible to greatly reduce emissions worldwide.

(Thermal power: 1.7 billion tons, Steel: 300 million tons)

（2）Promotion of tangible technology transfer

In developing countries, the actual technical needs that must be pursued become clear, enabling individual and solid efforts to be made.

（3）Acquiring balance when setting targets

From the viewpoint of acquiring competitive strength, the direction that must be aimed for (improved energy efficiency) in the same sector becomes clear. Also, balanced targets can be set based on the situation in each country.

（4）Preventing carbon leakage

The targets are set for each sector transcend national boundaries, so carbon leakage that occurs when the targets are set can be prevented on a per country basis.

Japan-China Steel Industry Advanced Technology Exchange Meeting in Environmental Protection & Energy-Saving

4-5 July 2005 :the 1st meeting in Beijing, China

Agreement

The Japan Iron and Steel Federation and the China Iron and Steel Association will recognize the importance of technical exchanges in the area of environmental preservation and energy-saving technologies, from the standpoint of the effective use of resources and the preservation of the global environment and continue exchanges of information and experts on environmental preservation and energy-saving.

1-2 Nov. 2006 :the 2nd meeting in Beppu, Japan (#1 Expert meeting)

- Handbook relating environmental protection and energy saving has been published.
- Experts meeting (Japan side;31 members,China side;30members)
  Site tour(Nippon steel Oita works)

28 Sep. 2007:the 3rd meeting in Beijing, China (#2 Expert meeting)

- Experts meeting (Japan side;36 members,China side;56members)
  Presentation about environmental preservation and energy-saving(Japan 4 , China5)
  Site tour(Tang shang steel)

Asia-Pacific Partnership on Clean Development and Climate（APP）

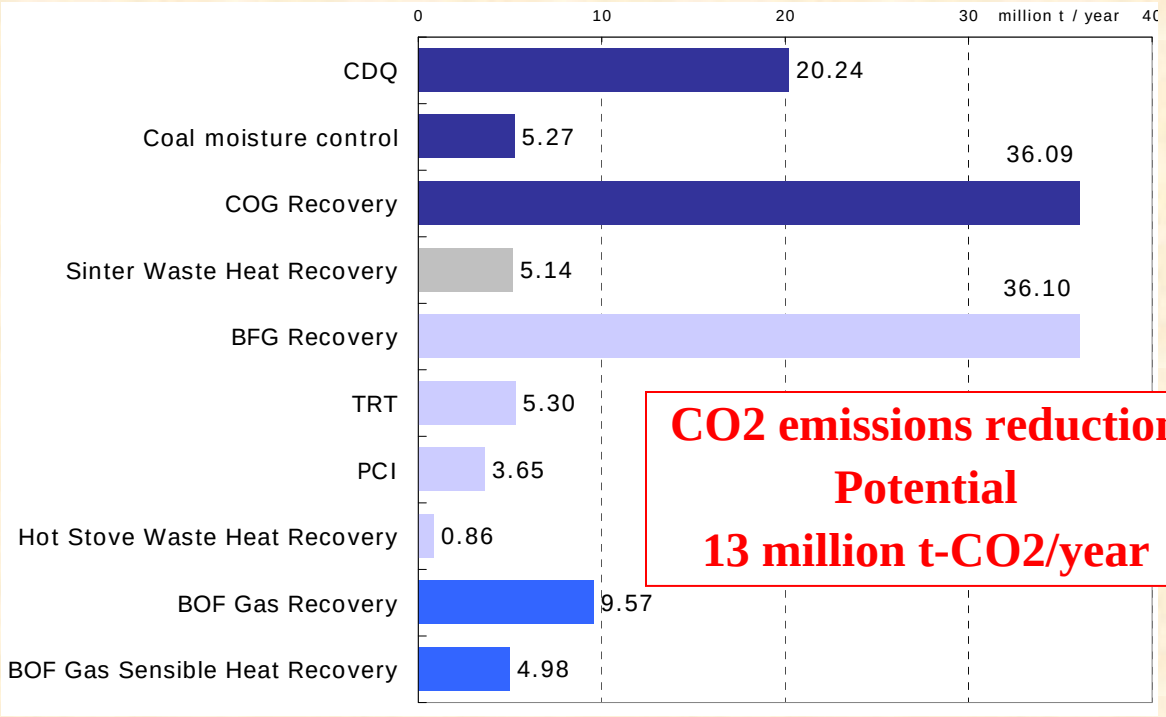
International technical cooperation

APP started by Government-Private collaborations in 2005. APP covers energy security and climate change issues etc. with 7 nations(Australia、Canada 、China、India、Japan、Korea、USA）

APP 7nations hold about half of economy, population and energy consumption in the world and produce 65% of coal, 60% of steel, 37% of aluminum amd 61% of cement in the world.

Technology oriented, sector-based and bottom-up approach

Cleaner Fossil Energy/ Renewable Energy and Distributed Generation/ Power Generation and Transmission/ Steel / Aluminum/ Cement/ Coal Mining/ Buildings and Appliances



CO2 emissions reduction Potential 13 million t-CO2/year

1stTF：July2005@Berkley
2ndTF：Sep. 2006@Tokyo
3rdTF：Mar. 2007@Calcutta
4thTF：Nov. 2007@Sidney

International cooperation in the steel industry

International technical cooperation

IISI(International Iron & Steel Institute)-Statement (2007. 10)

- Global Sectoral Approach is the best method for the promotion of global warming countermeasures.
- Cap and trade policies such as those currently used in the EU are making global carbon dioxide emissions worse .
- Promotion of the universal application of current best practice and technology and the the development of radical new steelmaking technologies by participation of all major steel producing countries and focusing on improving intensity.

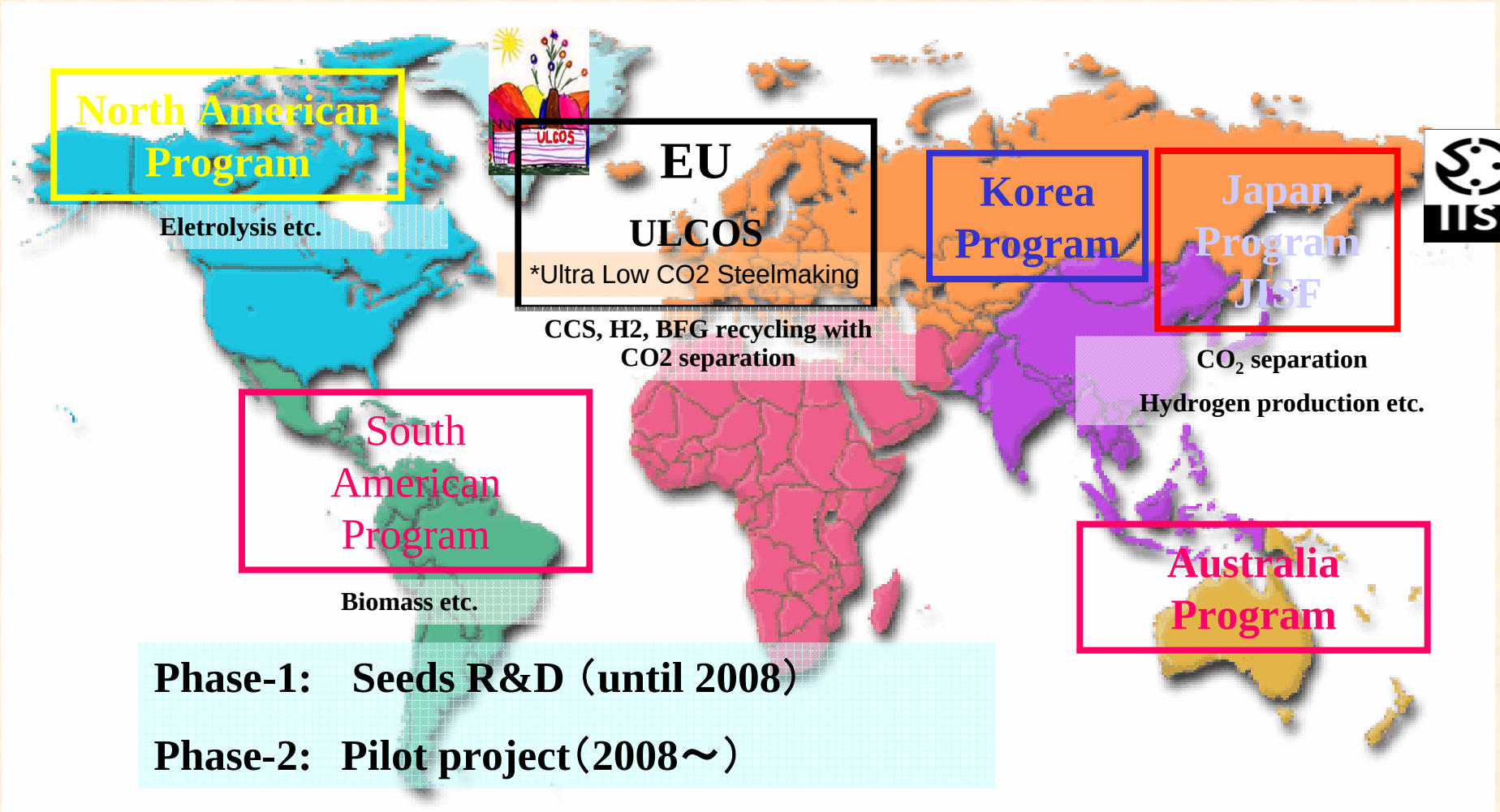
IISI CO_2 Break-through programme(2003. 10～)

- IISI has been engaged in a "CO_2 Break-through programme" for drastically reducing CO_2 emissions. Based on the outcome from the first phase,the second phase is starting for the further global collaborating R&D in this year.
- CO_2 separation 、Hydrogen utilization、Eletrolysis、Biomass、Smelting reduction at Steel making process are nominated. Japan is going to join the study of CO_2 separation 、Hydrogen utilization.

IISI's CO2 Breakthrough Program
October 2003 ~

International technical cooperation

Currently, five themes in the steelmaking process: CO_2 recovery by separation, hydrogen utilization, electrolytic refining, biomass utilization, and reduction by melting, are listed as current nominees, and Japan is scheduled to participate in the fields of CO_2 recovery by separation and hydrogen utilization.



Technical development taken up by the Japanese steel industry

International technical cooperation

COURSE 50

Significant reduction of CO_2 emissions by the year 2050

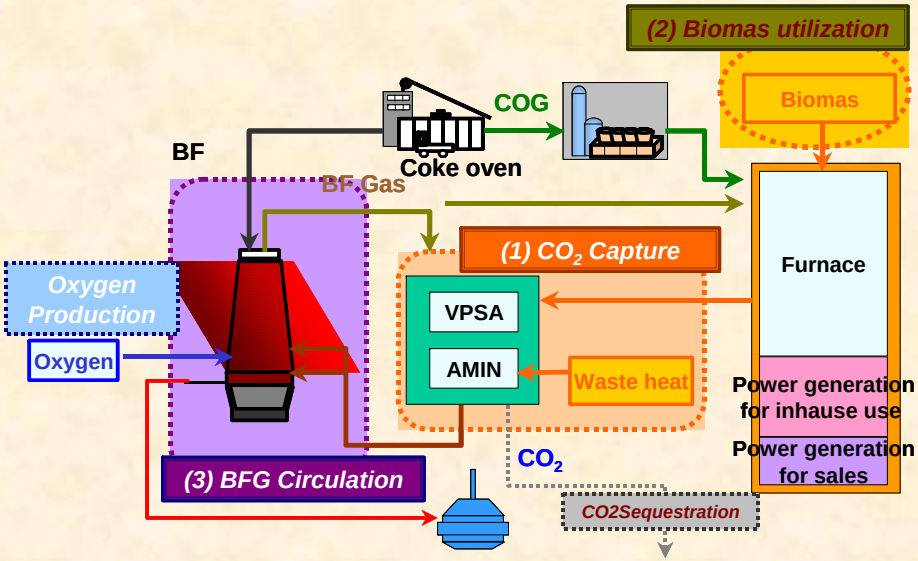
CO_2 Ultimate Reduction in Steelmaking Process by Innovative Technology For Cool Earth 50

METI,NEDO,JISF,BF5companies
（April.2008～）

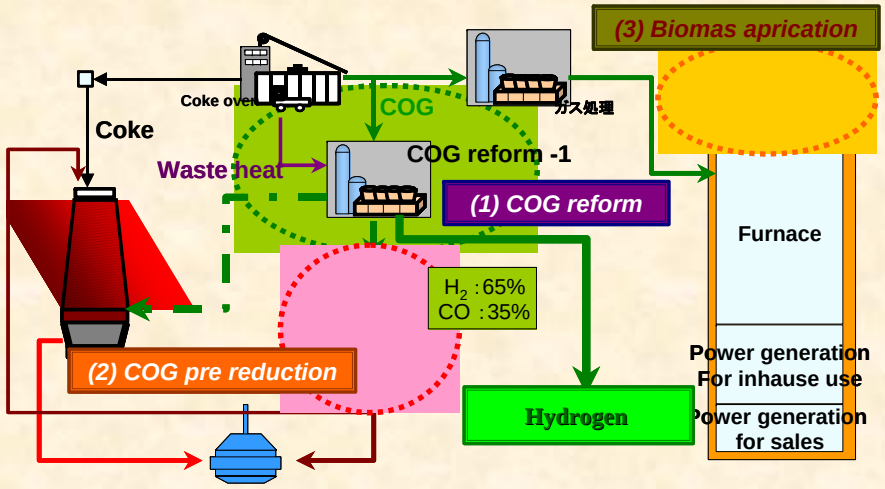
International collaboration

IISI-CO_2-Breakthrough program
EU-ULCOS

1. Separation and recovery of CO_2



2. Hydrogen reduction of iron ore



4. After the Kyoto Protocol

- Construction of a new framework based on evaluations of the Kyoto Protocol

Emission of carbon dioxide originating from world energy (2004)

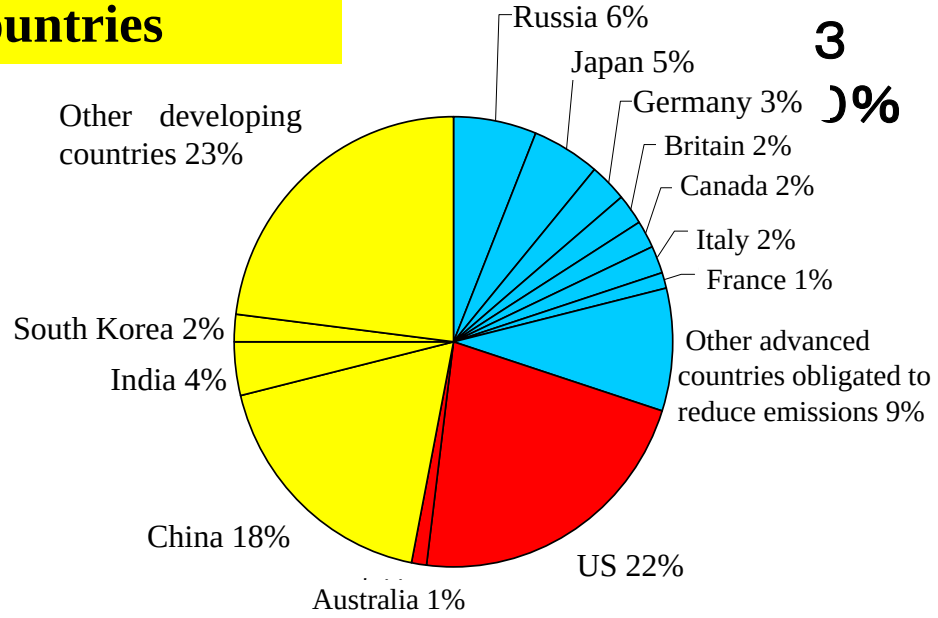
47%

Developing countries

Developed countries obligated to reduce emissions

3

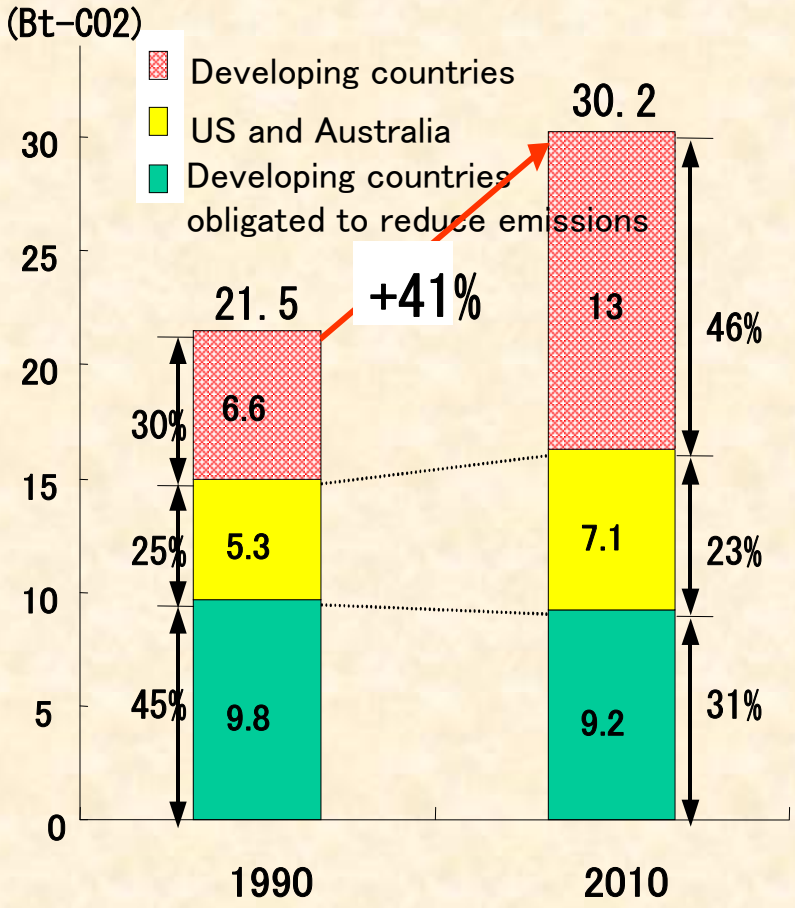
)%



US and Australia, who dropped out

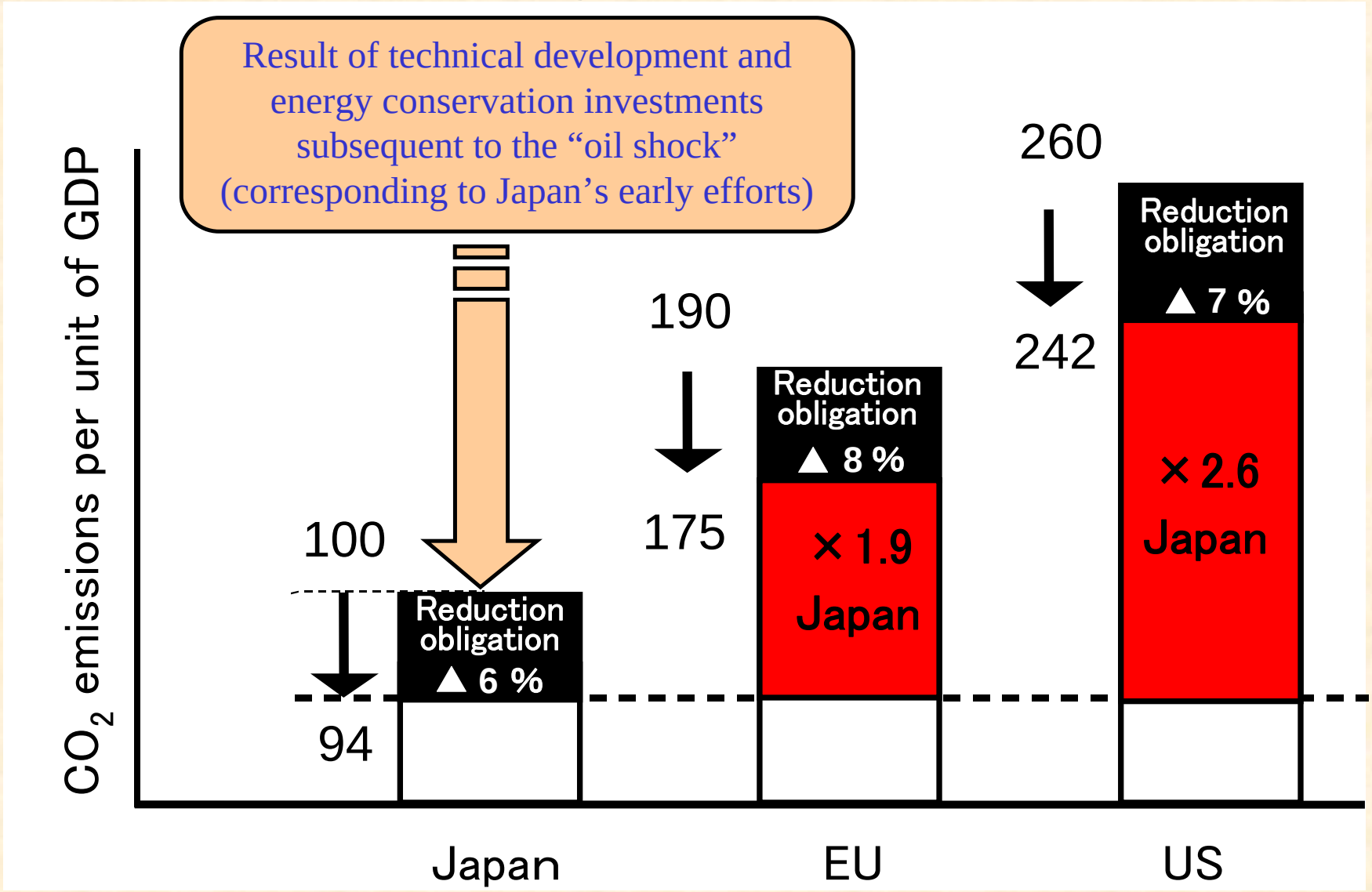
23%

Source：IEA



Source: US Department of Energy

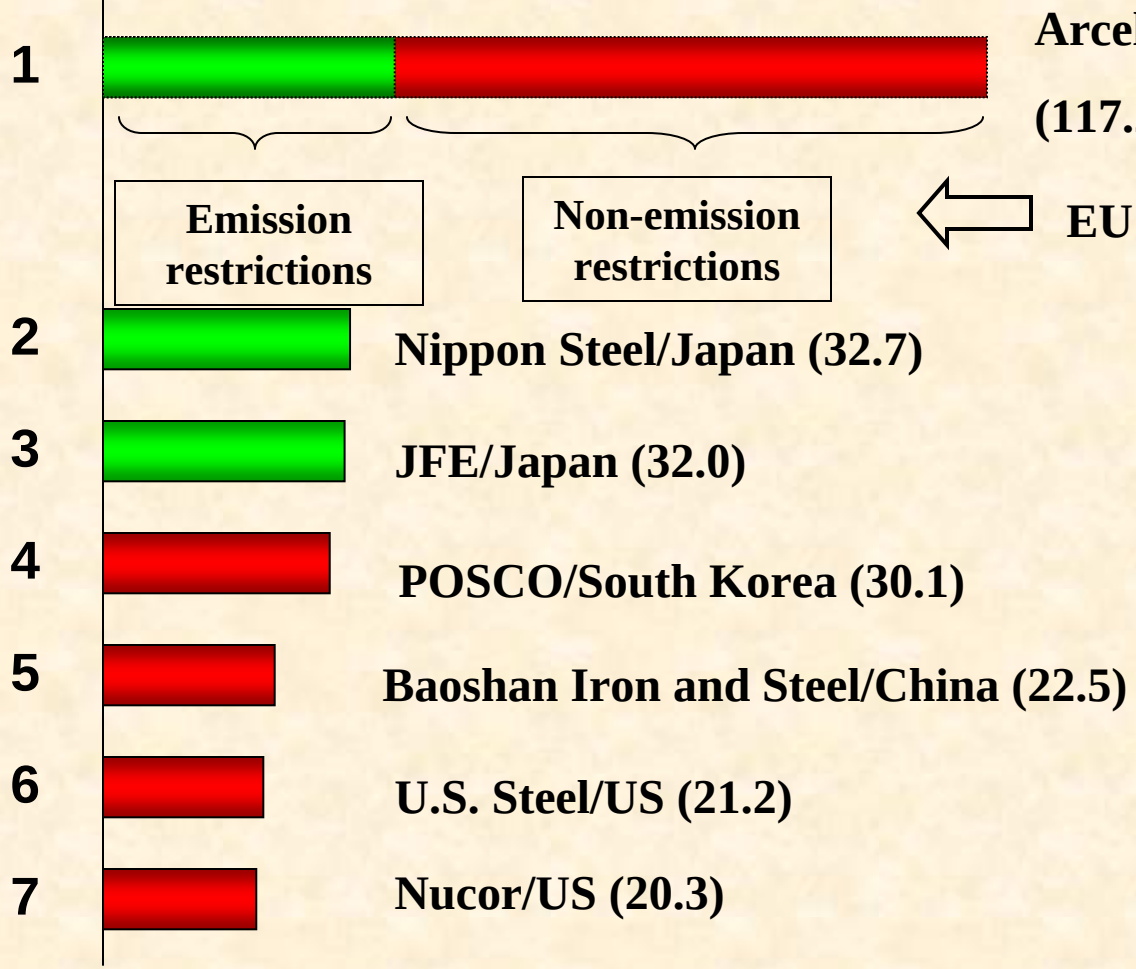
Actual level of emission allocations for each country (as of 1990)



Effect of the Kyoto Protocol on Japan's steel industry

The world's leading steel manufacturers who produce at least 20 million tons/year

(Production amount and existence of an obligation to reduce CO_2 emissions)



Of the world's leading steel manufacturers, the only country that has actually undertaken to restrict CO_2 emissions is Japan.

(Arcelor Mittal in Europe accounts for only 1/3 of the EU burden. Production centers can also carry out production coordination with each other.)

Summary

1. Conditions regarding global warming measures

(1) Participation by all major emitting countries

(2) Technology is the solution

(3) International collaboration between major industries who share a common technical foundation (sectoral approach)

2. Role of Japanese industry

(1) The maintenance and pursuit of energy efficiencies at the highest levels in the world regarding manufacturing technology and products, through continuous technical development

(The strength of Japanese industry lies in its "Collaboration between industries from the raw material to part or final product, and the effective utilization of resources and energy among different industries")

(2) Contributions to global warming measures through the transfer and spread of excellent manufacturing technology and products

(3) Promotion of innovative technological development (Promotion of Cool Earth 50)

Nippon Steel Corporation