Factors that affect innovation, deployment and diffusion of energy-efficient technologies

- Case studies of Japan and iron/steel industry

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Prof. Mitsutsune Yamaguchi
Teikyo University, Japan

Outline

1. Effects of energy efficiency measures in Japan

2. Energy efficiency technologies of iron/steel industry

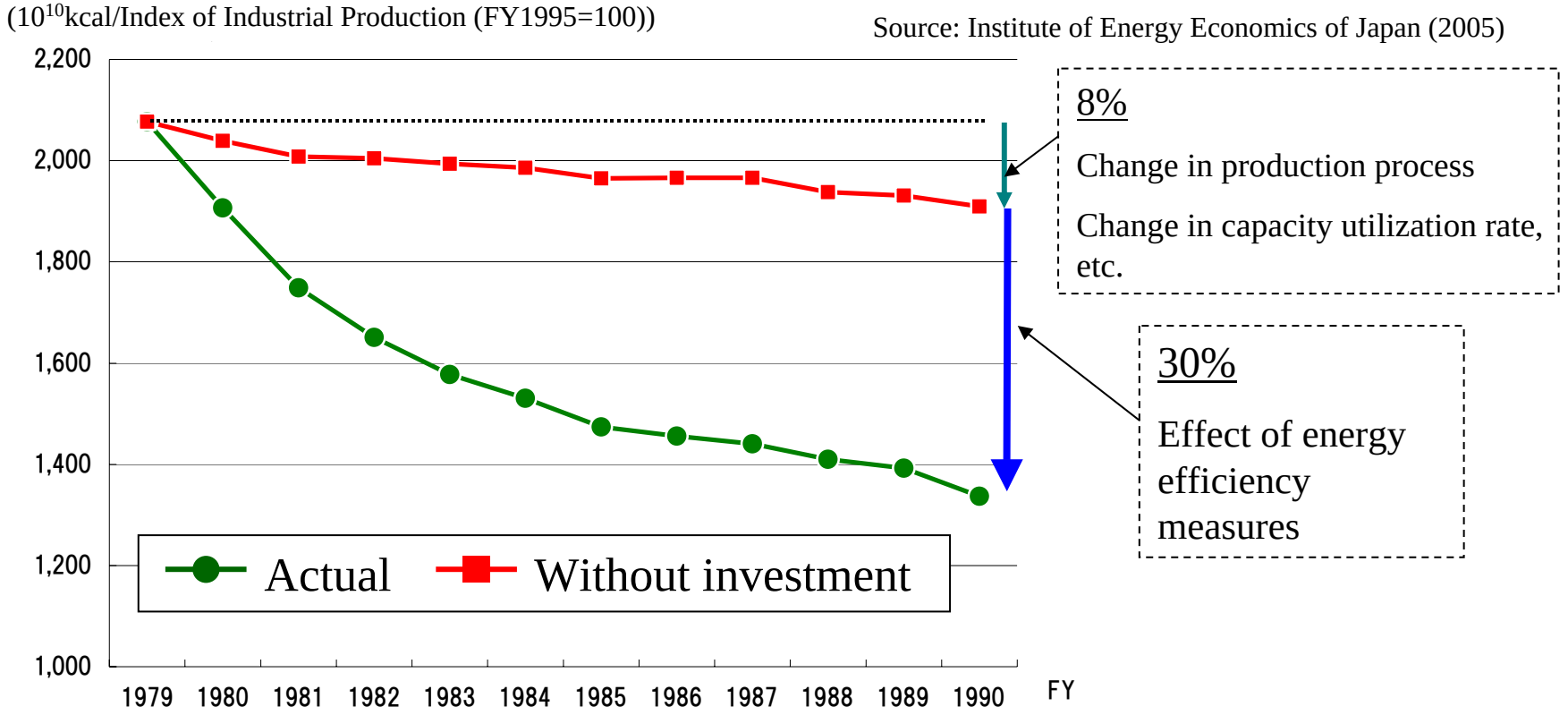
3. Factors that affect diffusion of energy efficiency technologies
   - Case study of technology transfer between Japan and China

4. Lessons learned

Effects of energy efficiency measures in Japan

- macro perspective

➢The energy intensity of Japanese manufacturing industry improved by 30% because of investment in energy efficiency technologies during 1980s.



➢The accumulated energy cost-saving during 1980s due to such investment is estimated at 18 trillion yen (US$ 170 billion), while the total investment in energy efficiency measures was 3.3 trillion yen (US$ 31 billion).

Effects of energy efficiency measures in Japan

- micro perspective (case study of a Japanese steel plant)

Introduction of

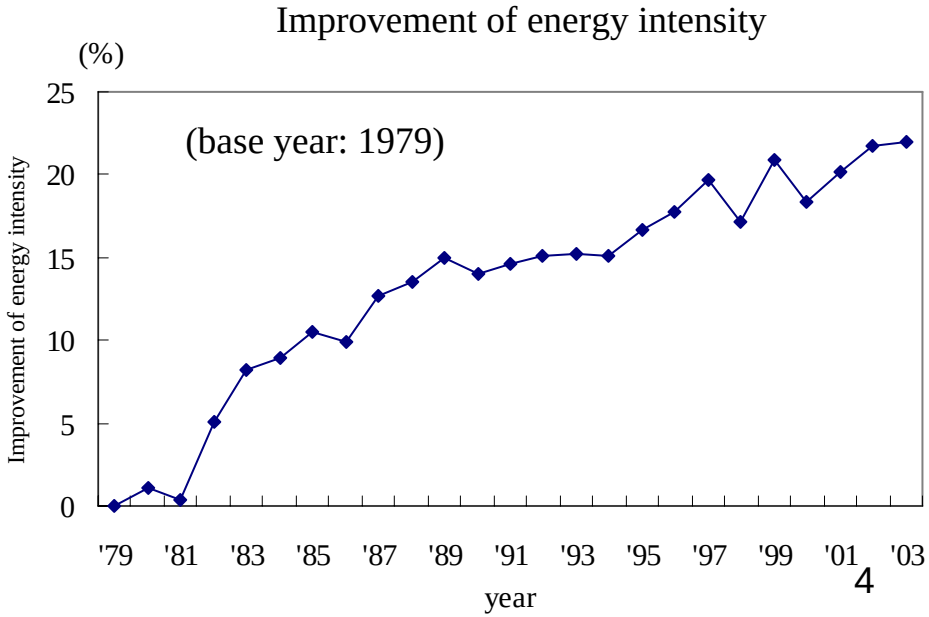
- Heat/gas pressure recovery system to generate electricity
  (Coke Dry Quenching (CDQ), Top-pressure Recovery Turbine (TRT), etc.
- Reduction in number of processes *(continuous casting etc)*
- Improvement in efficiency of each process
- Waste recycling *(use of plastic waste in cokes ovens, recycling of dust and sludge, etc)*

<u>Improvement of energy intensity: 22%</u>
(in comparison with late 1970s)

- Saving of 20% of all electricity demand
  (= saving of US$ 80 million per year per plant)

  - Reuse of more than 90% of steam

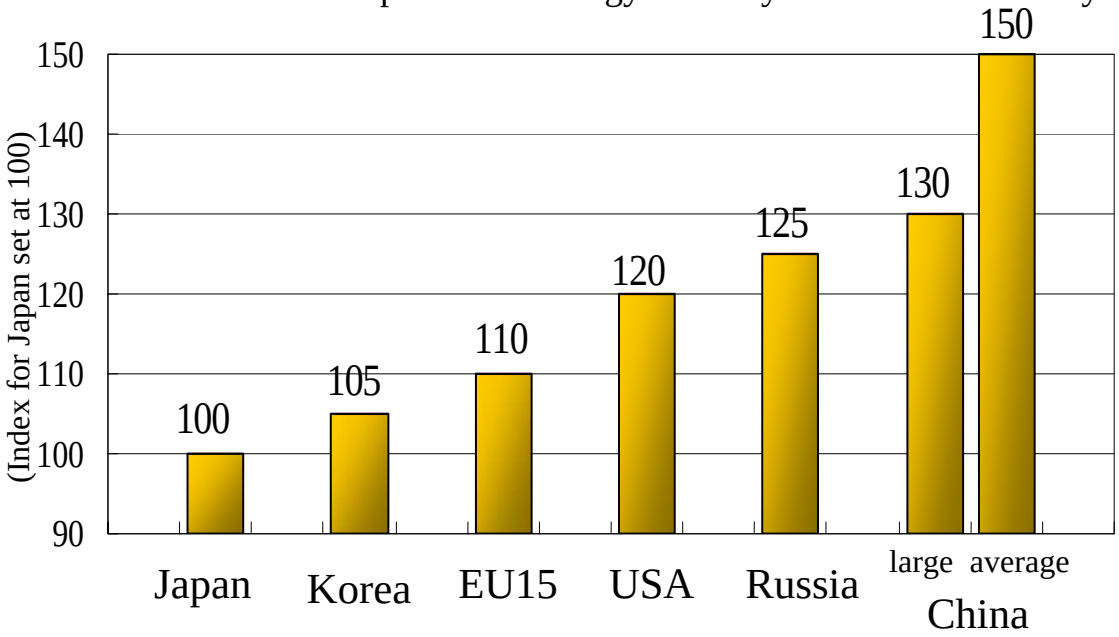
  - Reuse of H2 and CO in exhaust gas
    to generate electricity



Energy efficiency technologies of iron/steel industry

- *international comparison*

International comparison of energy intensity of iron/steel industry



Source: Japan Iron and Steel Federation

Potential of CO2 reduction for steel industry in China and Russia

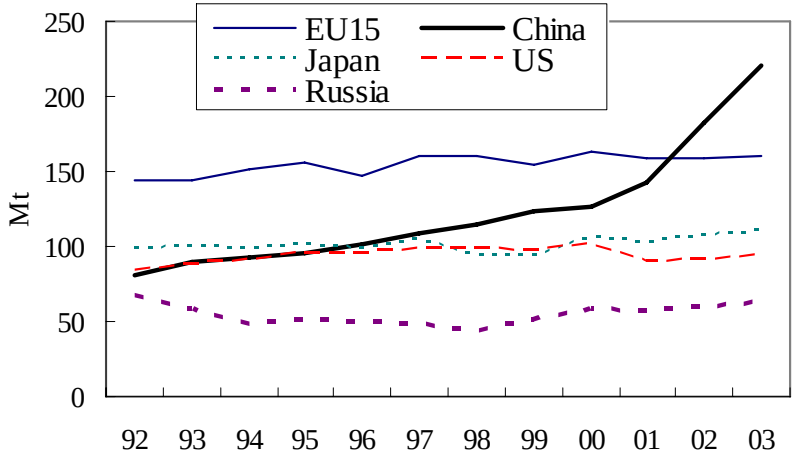
(Assuming national average energy efficiency is improved to the level of Japan)

China: 180 M tons of CO2/year

Russia: 25 M tons of CO2/year

Diffusion rate in Japan
CDQ: 90%
TRT: 100%

Trends in crude steel production



Source: International Iron & Steel Institute

Energy efficiency technologies of iron/steel industry

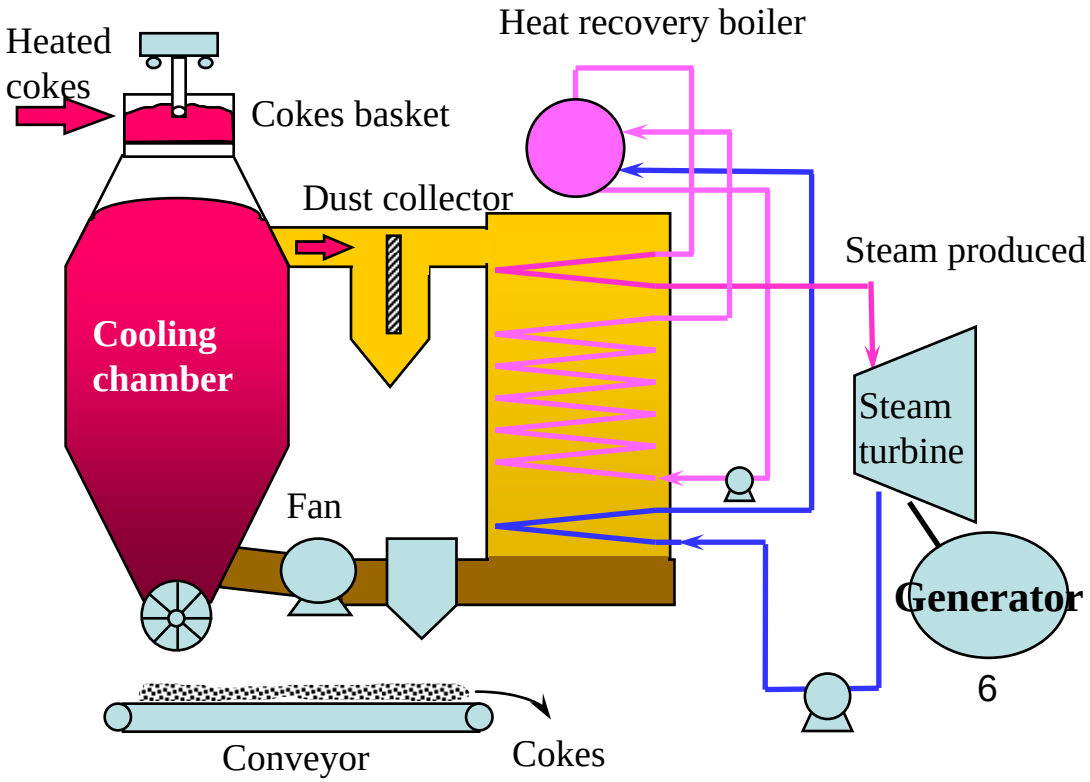
- typical examples

CDQ (Coke Dry Quenching)

➢Heat recovery system in which heated inert gas is used to generate electricity after quenching hot cokes.

➢Effects of CDQ

- Energy conservation (generation of electricity)
  →CO2 emission reduction
- Improvement of quality and strength of cokes
- Prevention of air pollution (SOx, dust, etc.)
- Reduction in usage of water



➢Cost of installation
US$ 20-40 million

➢Payback period
3-5 years (model case in China)

Energy efficiency technologies of iron/steel industry

- typical examples

TRT (Top-pressure Recovery Turbine)

➢Turbine generator system using the pressure of gas generated in blast furnaces

➢Effects of TRT

- Energy conservation (generation of electricity from conventionally wasted gas)

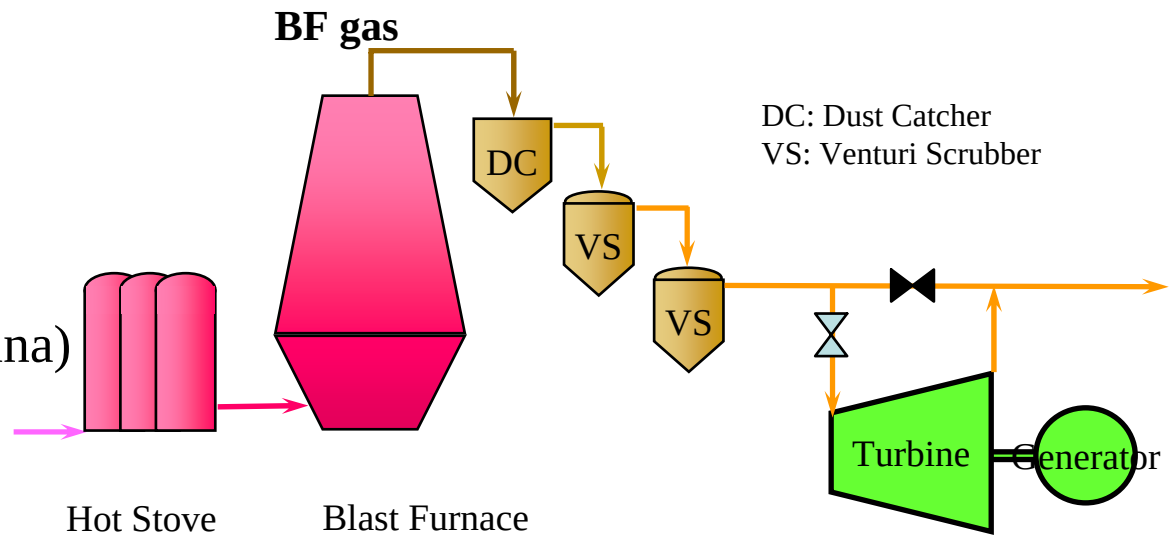
→CO2 emission reduction

➢Cost of installation

US$ 20-30 million

➢Payback period

4-5years (model case in China)



Among many energy efficiency technologies, CDQ & TRT were selected because of their energy-saving potential, ease of installation, etc. by experts in the steel/iron industry

Energy efficiency technologies of iron/steel industry

- emission reduction potential in China

CO2 emission reduction potential of specific technologies in China

(Unit: Mt-CO2/year)

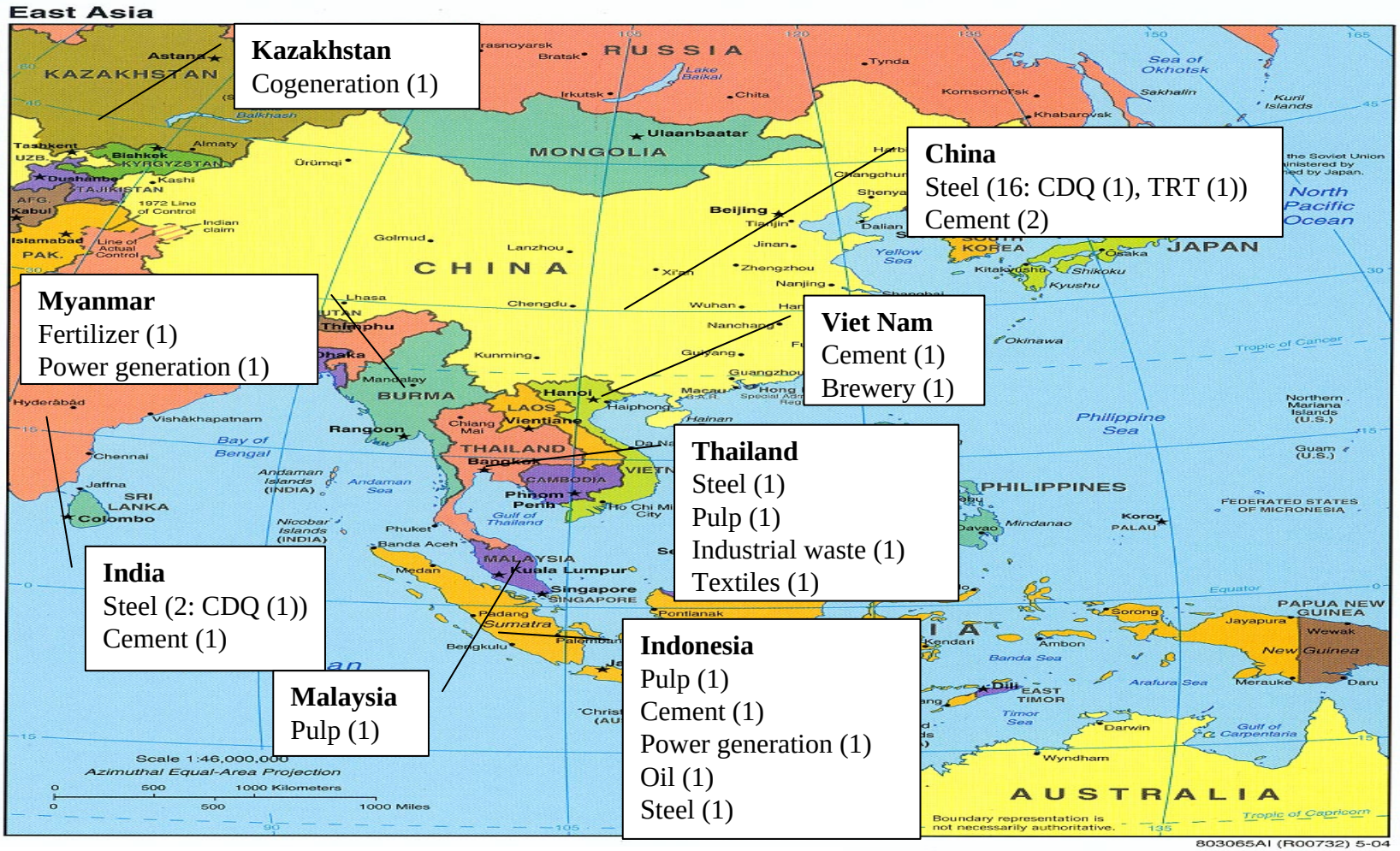
	CDQ	TRT	Cement Industry (5 technologies)	Chemical & Oil refinery (4 technologies)
Physical potential	4.0	1.0	13.3	8.6
Economically practical potential *	5.0		2.0	8.4

*This means the CO2 reduction potential corresponding to the CER price up to 10$/t-CO2.

Source:
"CDM Potential in the power generation and energy intensive industries in China, A technology-based bottom up study", Climate Policy, Vol. 5, Issue 2, 2005, Mitsutsune Yamaguchi, forthcoming

Factors that affect diffusion of energy efficiency technologies
- *demonstration projects*

➢The Ministry of Economy, Trade and Industry has implemented 36 projects since 1993 and contributed to the diffusion of energy efficiency technologies in the Asian region.



*Average project size: approx. US$ 10 -20 million for 2-3 years

Factors that affect diffusion of energy efficiency technologies
-case study of CDQ in China

- Demonstration project at a steel plant in Beijing to install CDQ

Period: 1997-2001
Budget: ¥ 2.97 billion (US$ 28 million)
Site: Shougang Corporation, No.1 Cokes Oven
Technical support: Nippon Steel Corporation
Energy conservation: 24,700 toe/year
CO2 emission reduction: 68,300 t-CO2/year

- Follow-up program of the demonstration project (on-site seminars, operational advice, etc.)

- A joint venture between Chinese and Japanese steel companies (Oct 2003) to design, produce and sell CDQ and other energy conservation facilities

8 CDQ will be installed in China because of this demonstration project

Factors that affect diffusion of energy efficiency technologies
- *implications from case study of CDQ in China*

Keys for success

Local steel manufacturers tend to choose investment to increase production capacity, but this can be changed by:

(1) Awareness of local industry

- Energy-saving effect
- Co-benefits such as better air quality (very visible in CDQ)

(2) Initial cost reduction through localization of manufacturing

- Business strategies, such as IPR, of the investing company from Japan
- Local competitor

(3) Local environmental policy

- 10th 5-year National Plan in China (target of diffusion rate of CDQ: 60% by 2005)
- Pressure from local governments (air quality, water usage, etc.)

Lessons learned

- The energy-saving potential is enormous. By exploring these opportunities, a win-win situation can be created: energy security, lower energy cost, better air quality, higher competitiveness, etc. This is clear from Japan's experience.

- Technology transfer and diffusion are not unilateral actions but collaboration between developed and developing countries.
  - Business incentives for investment: reform of CDM (next slide)
    IPR protection
  - Local industry's awareness and host government's environmental policy

- Bilateral and multilateral cooperation should have a sectoral focus which would enable us to enhance technology transfer by clearly identifying technology needs and energy-saving opportunities.

Lessons learned

- *promotion of CDM activities*

- CDM should be designed to facilitate technology transfer by providing business incentives for investment in energy efficient technologies.
- Such CDM projects would contribute best to sustainable development in developing countries.

<Recommendation>

For host country

- Clear rules
- Collection of accurate data

For developed countries

- Scheme to promote CDM
  (ex. financial support, such as Japan's Upfront Payment)

For CDM Executive Board

- Turning from perfectionism to "learning by doing"

<GOJ's initiative>

The GOJ has been holding workshops, seminars and establishing WGs for energy efficiency etc. by CDM experts to identify challenges.

Thank you for your attention!