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

- Case studies of Japan and iron/steel industry

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Outline

1. Effects of energy efficiency measures in Japan

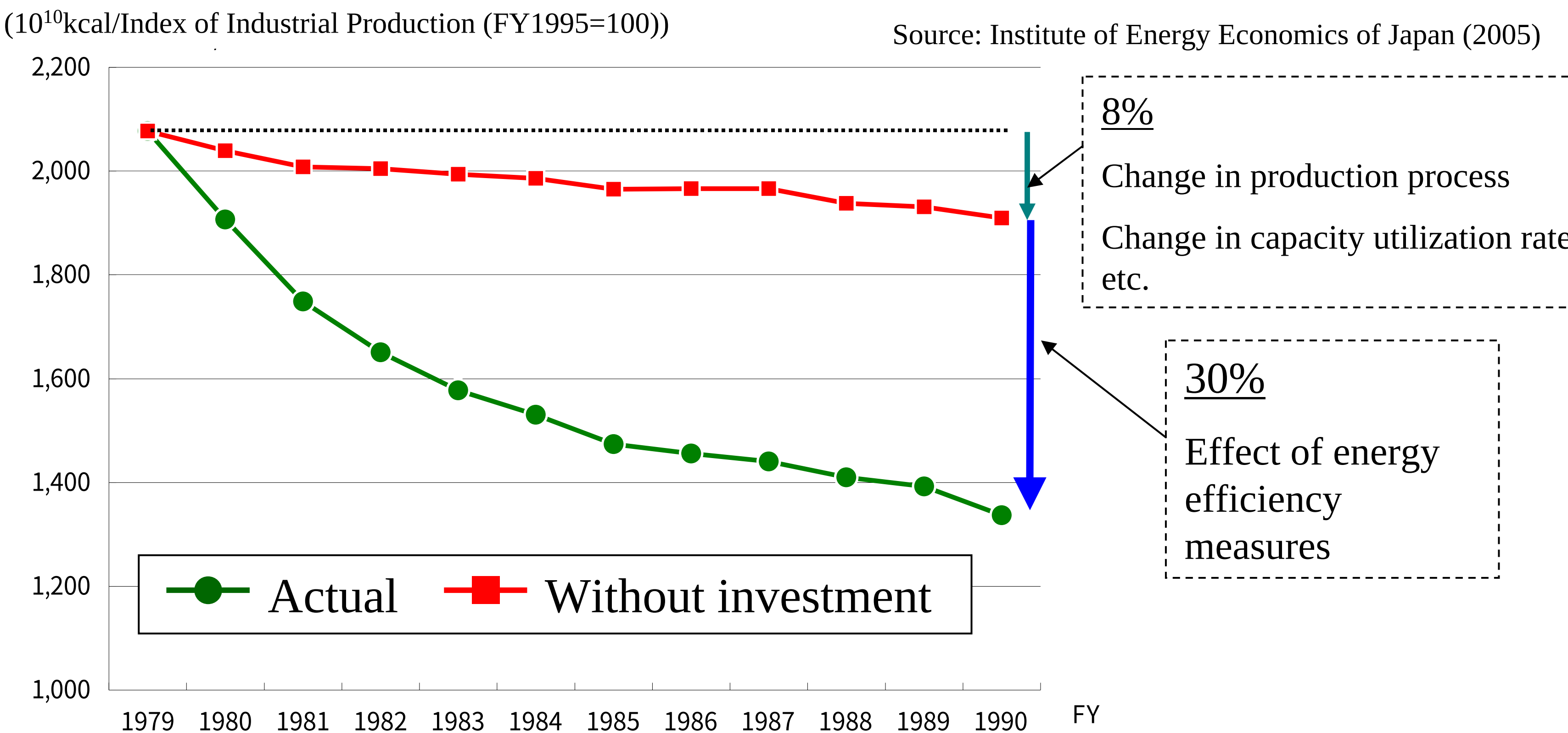
2. Energy efficiency technologies of iron/steel industry

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.



- Energy efficiency investments pays: BCR was 5.5:1
  Benefit (cost-saving during 1980s) was estimated at US$ 170 billion
  Cost (total investment) was around 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)*

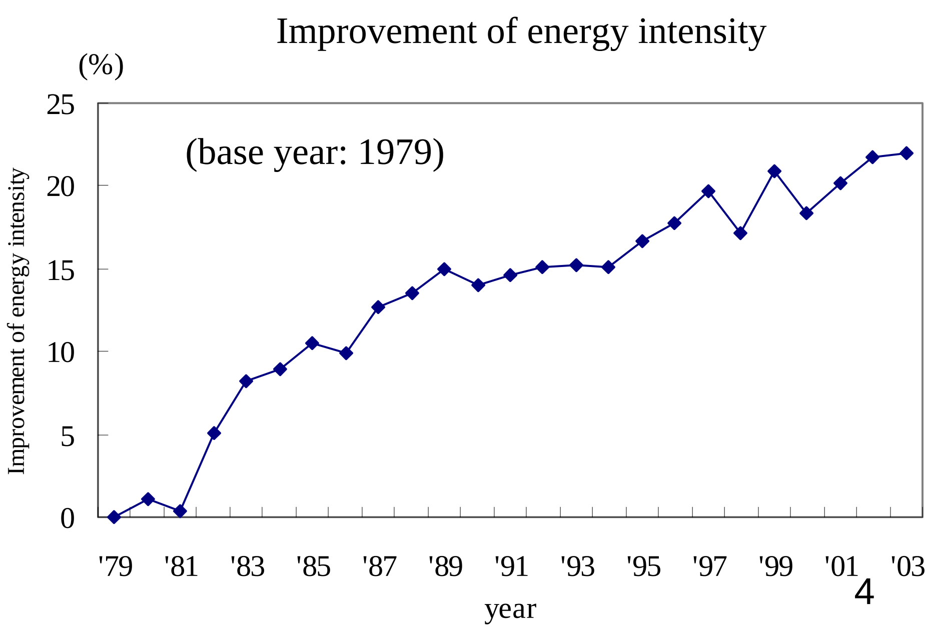
<u>Improvement of energy intensity: 22%</u>

(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

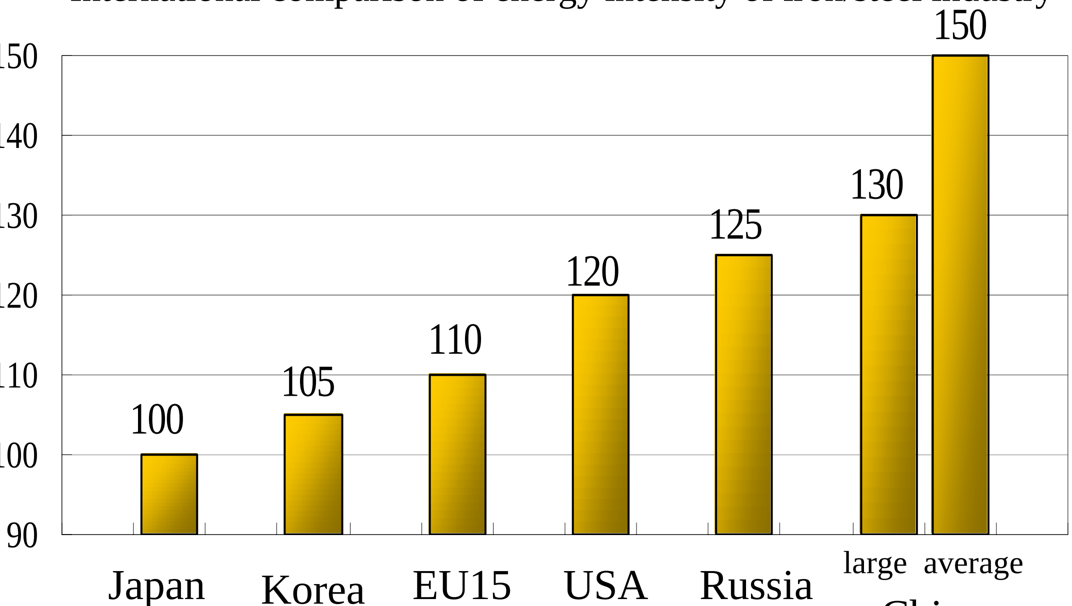
- Reuse of H2 and CO in exhaust gas
  to generate electricity



Energy efficiency technologies of iron/steel industry

- Huge potential

International comparison of energy intensity of iron/steel industry



Source: Japan Iron and Steel Federation

<u>Potential of CO2 reduction for steel industry in China and Russia</u>

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

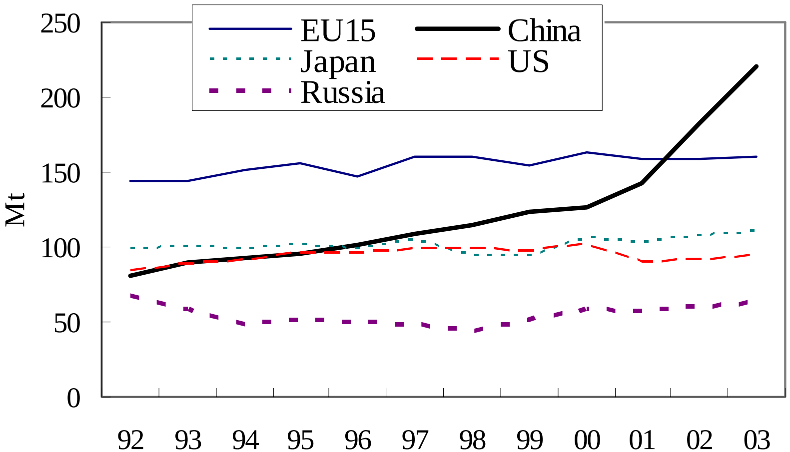
China: 180 M tons of CO2/year

Russia: 25 M tons of CO2/year

(1% of world CO2 emissions)

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

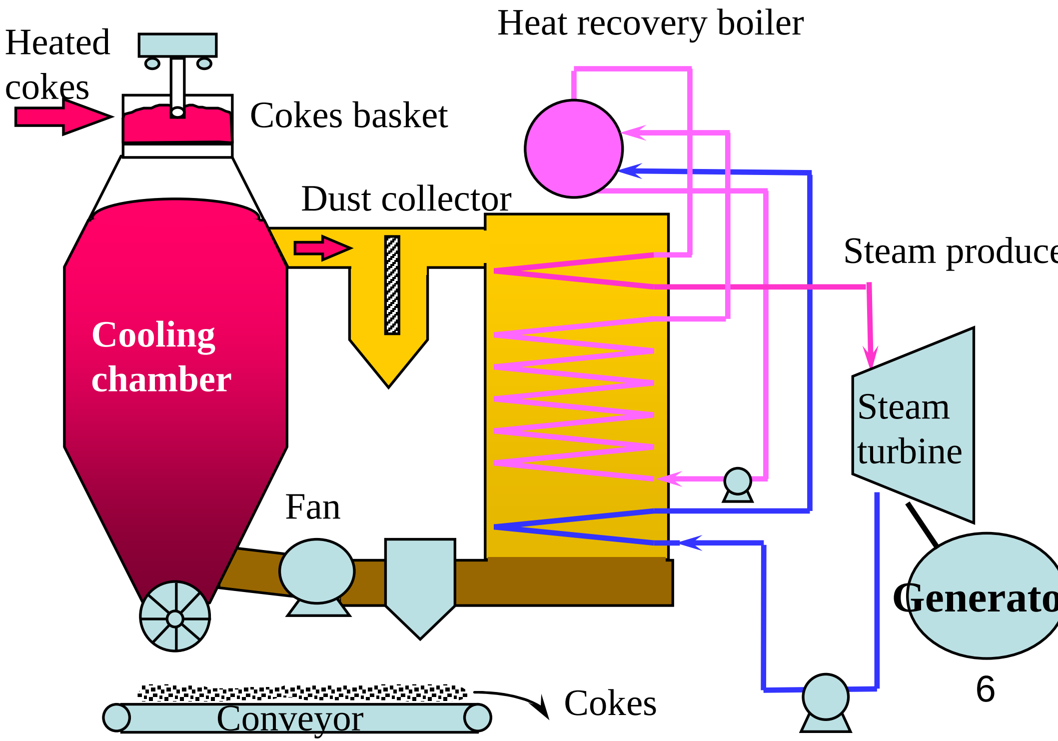
CDQ (Coke Dry Quenching)

- 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*

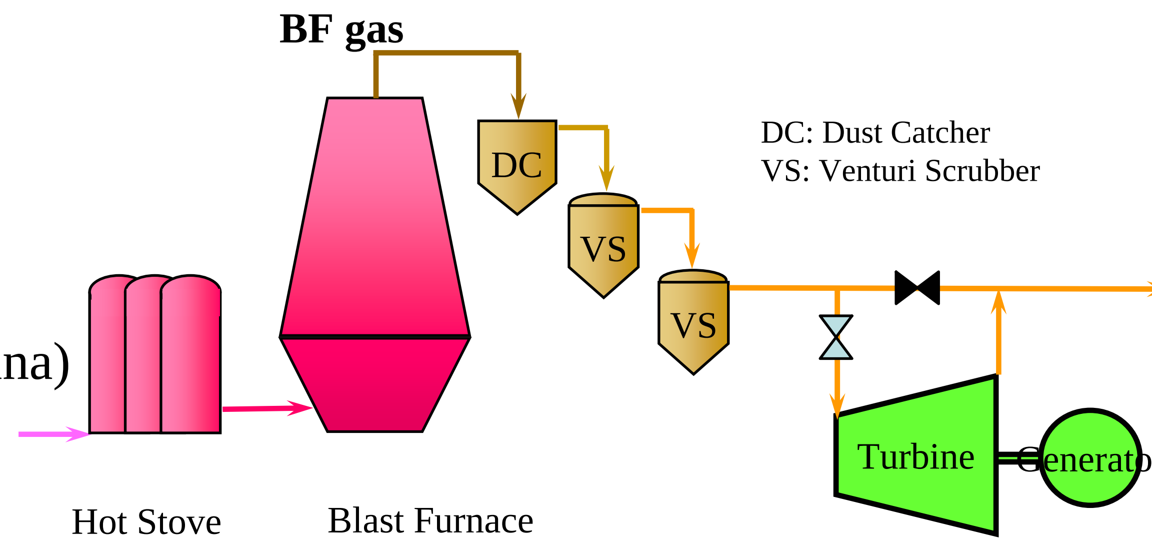
TRT (Top-pressure Recovery Turbine)

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

- Effects of TRT
  - Energy conservation (generation of electricity from conventionally wasted gas)
  →CO_2 emission reduction

- Cost of installation
  US$ 20-30 million

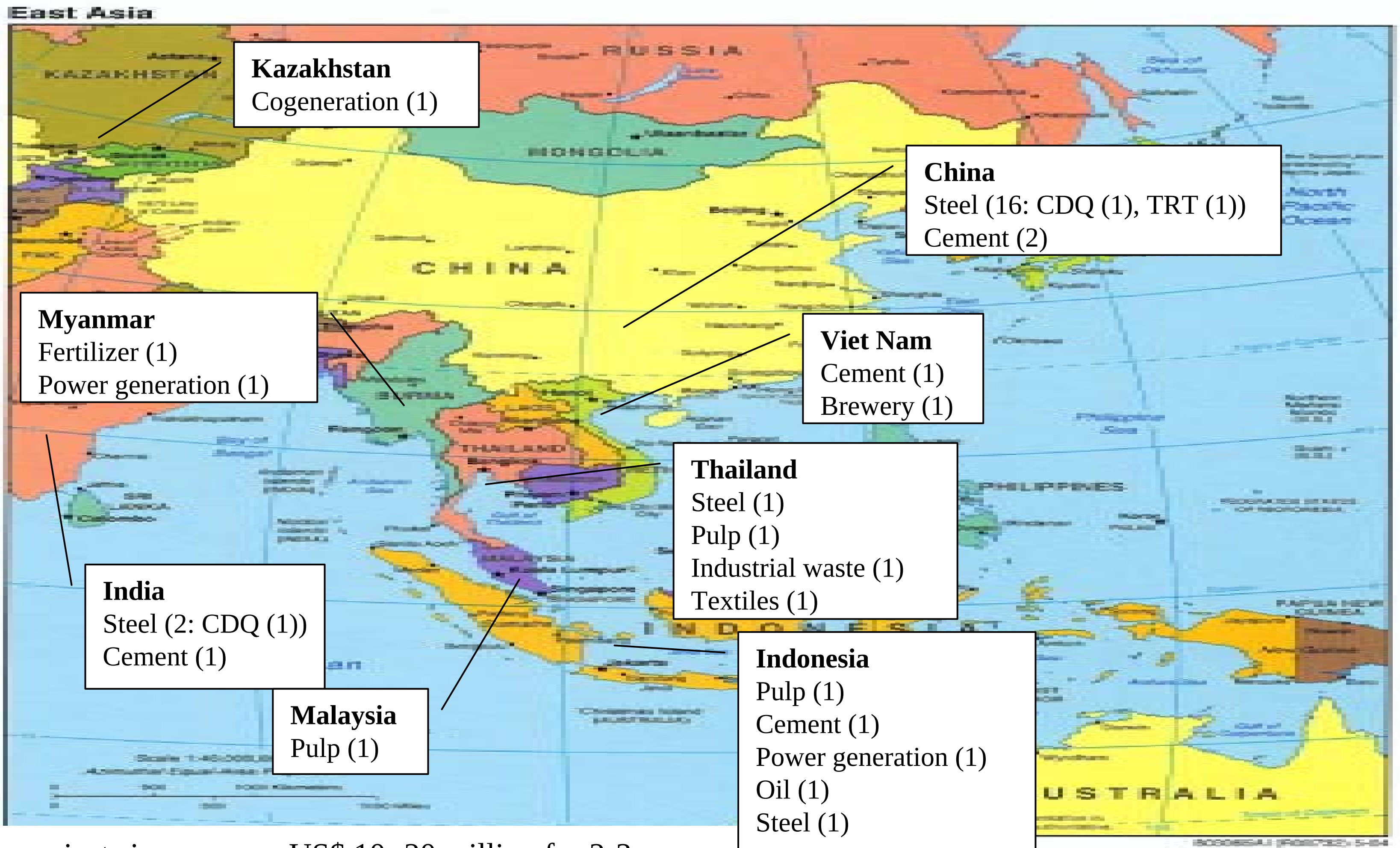
- Payback period
  4-5years (model case in China)



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

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
CO_2 emission reduction: 68,300 t-CO_2/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

Keys for success – in case of CDQ

Local steel manufacturers tend to choose investment to increase production capacity rather than energy efficiency improvement, but this can be changed by:

(1) Local industry awareness

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

(2) Initial cost reduction through localization

- IPR may become barriers to localization
- Local competitor

(3) Host Government's environmental policy

- 10^{th} 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

- Enormous potential: (not confined to iron and steel sector)
  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.

- North-South collaboration: especially,
  - Host Governments' policy on Environment and IPR protection
  - Local industry's awareness
  - CDM can accelerate technology transfer (next slide)

- Sectoral focus:
  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 in energy efficiency field*

- 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.

Usually energy efficient project pays in a long run.

CDM Executive Board

- Turning from perfectionism to “learning by doing” (chicken and egg)

<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!