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
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.

Source: Institute of Energy Economics of Japan (2005)
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.)

Improvement of energy intensity: 22%
(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

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
(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)
  - CO₂ emission reduction

- Cost of installation
  - US$ 20-30 million

- Payback period
  - 4-5 years (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.
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
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
   - 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

- **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!