# Technology Transfer in Energy Efficiency : Benefits and Challenges

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(The views do not necessarily represent the GOJ's)

# Outline

1 Benefits of Technology Transfer in Energy Efficiency in Asia
- Importance of EE
- Potential for energy saving
- Cost effectiveness of EE investment
- Concept of TT in EE in Asia

2 Japan's Success in EE
- Performance
- Factors

3 Japan's Int'l Cooperation on EE
- Japan-China bilateral cooperation
- China's energy saving potential
- Example of cooperation in steel sector

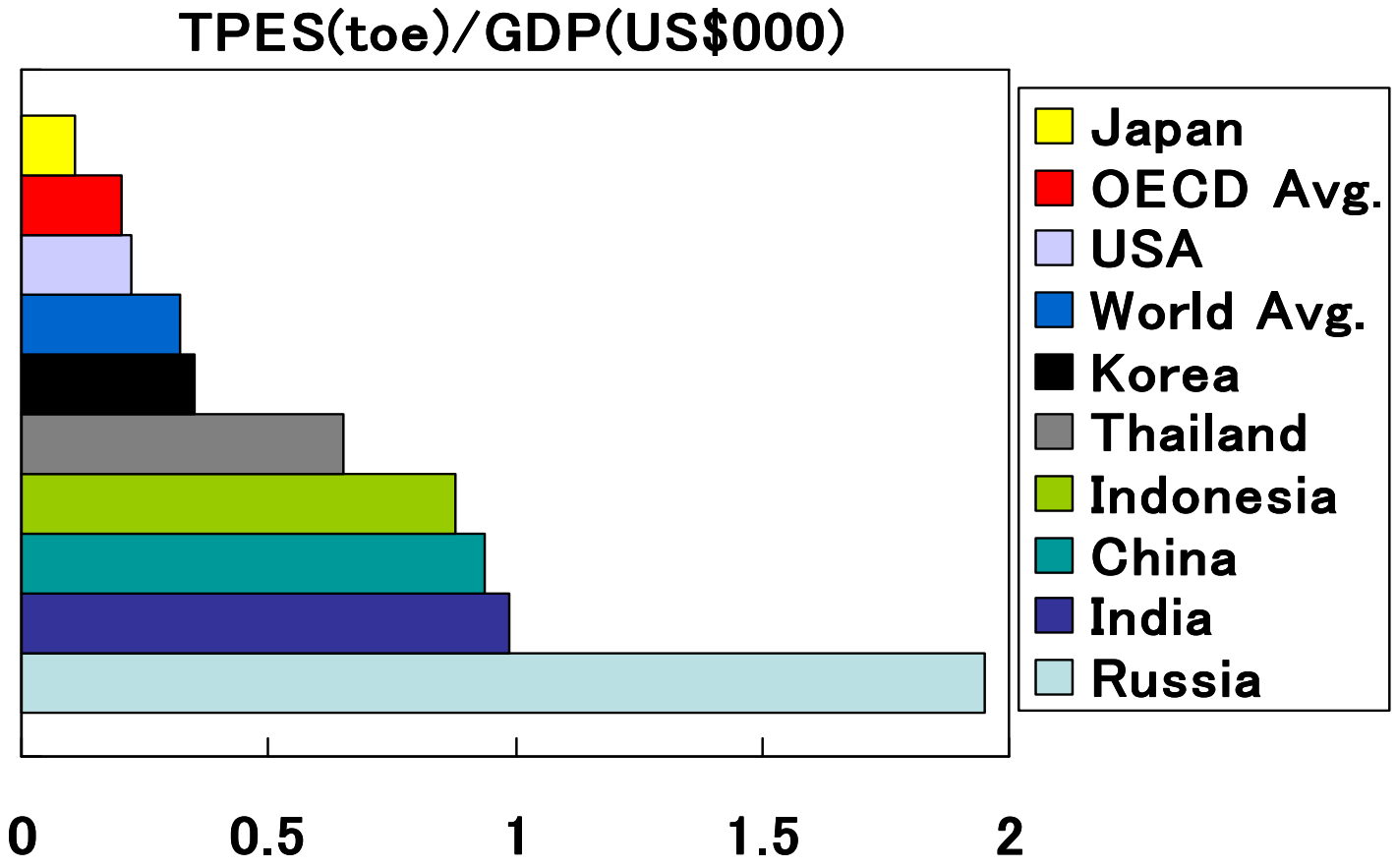
4 Barriers and Challenge

# Importance of Energy Efficiency

Energy Efficiency = Triple Win (一石三鳥)

- For Energy Security : energy saving creates available energy
- For Environment Protection : to mitigate environmental impact from energy consumption
- For Economic Growth : to reduce cost, promote technology development/diffusion

# Substantial Gaps in Energy Efficiency among Countries




(Source:IEA)

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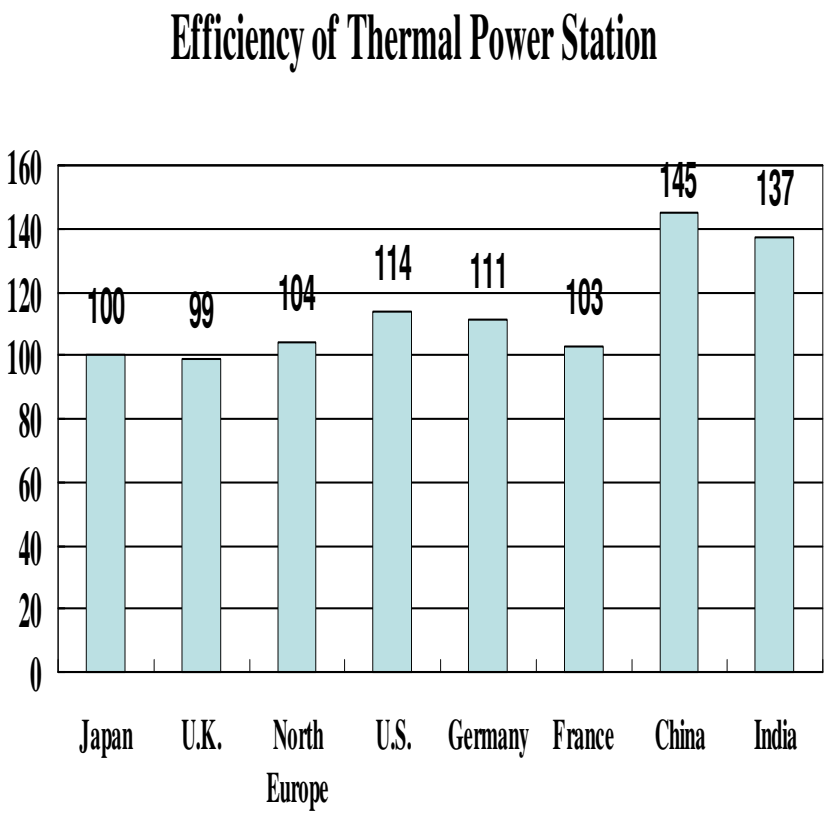


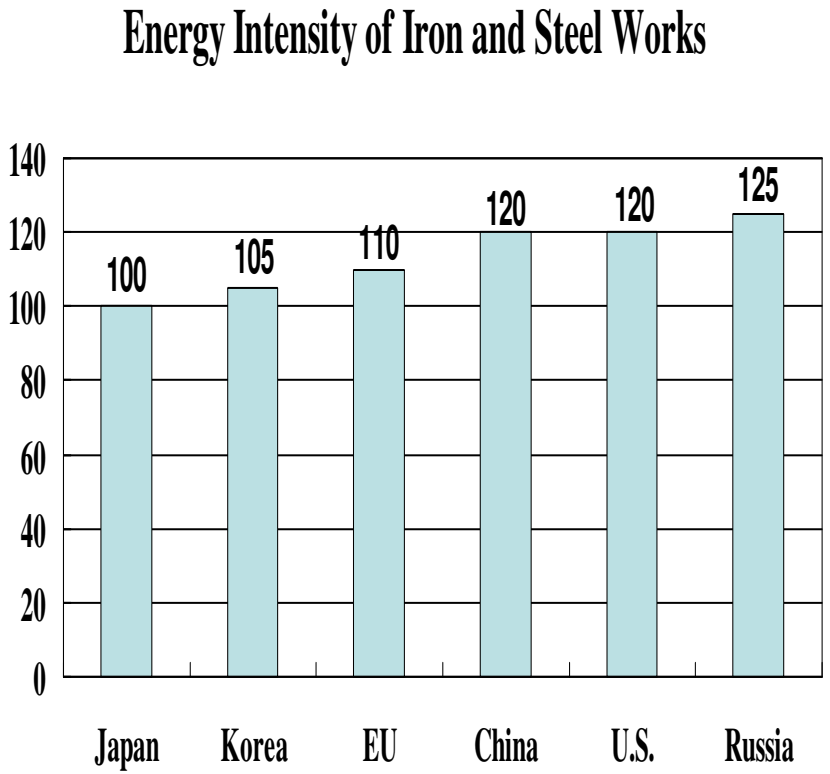


（Source: METI/KEIDANREN)

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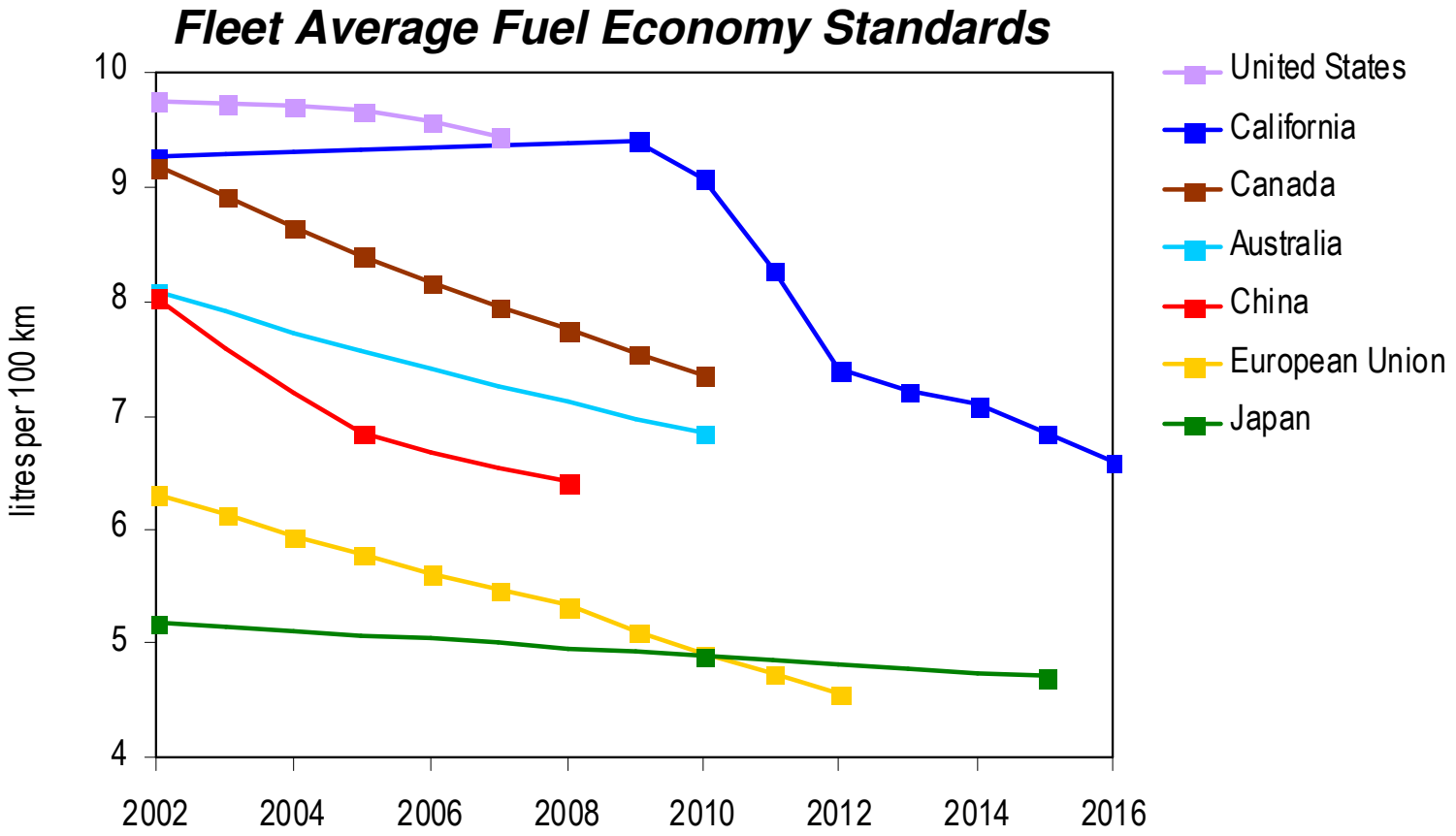
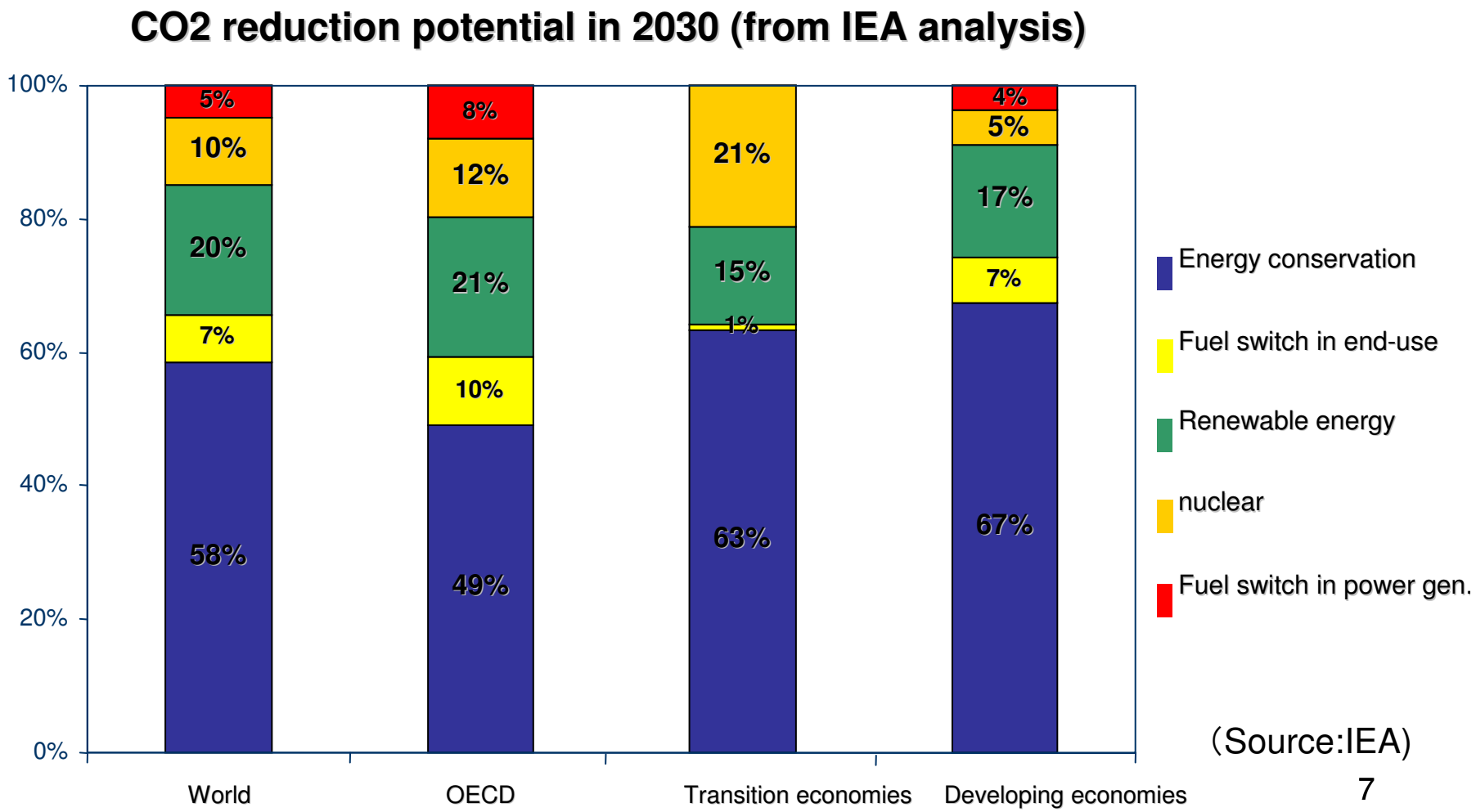



(Source: IEA)

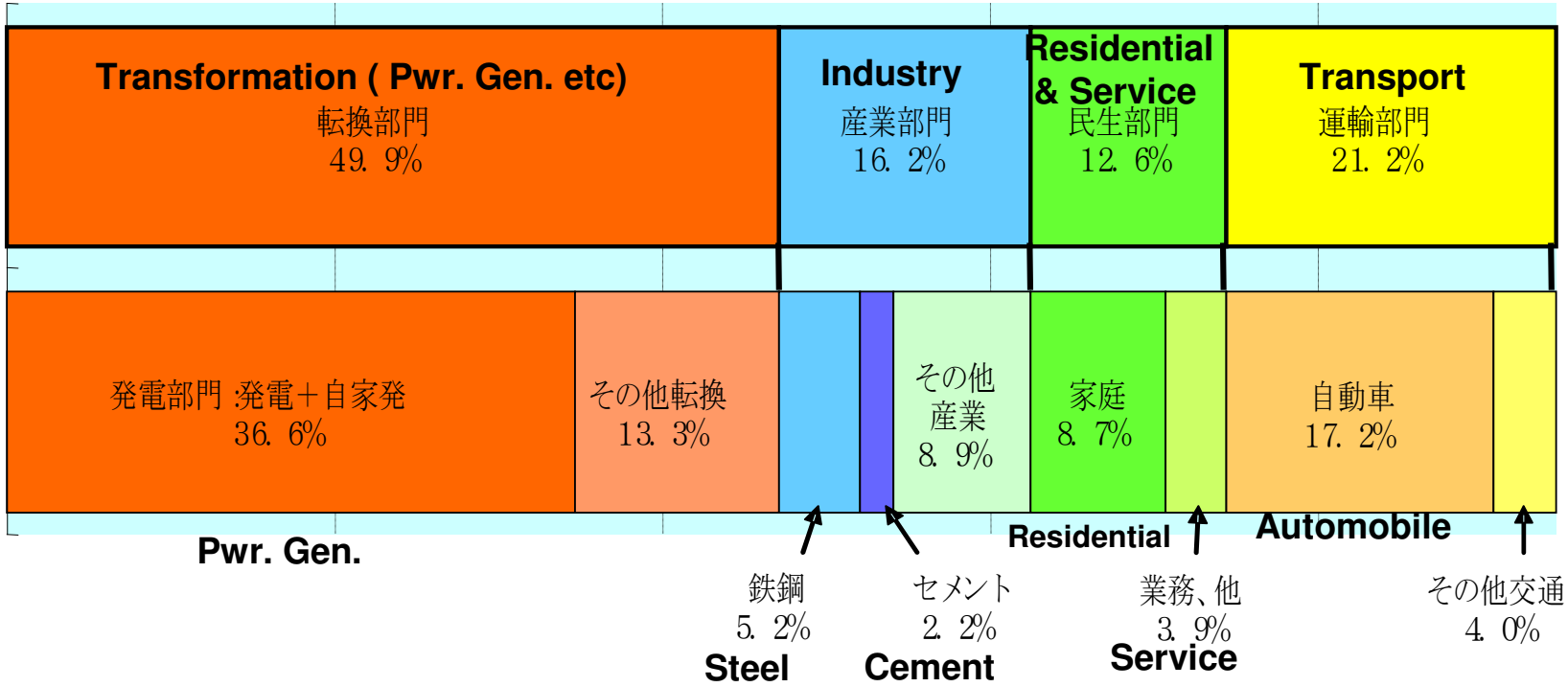
# Potential for Energy Saving




(Source:IEA)

# Which Sectors to Be Tackled?

**CO2 emission in the world by sectors**



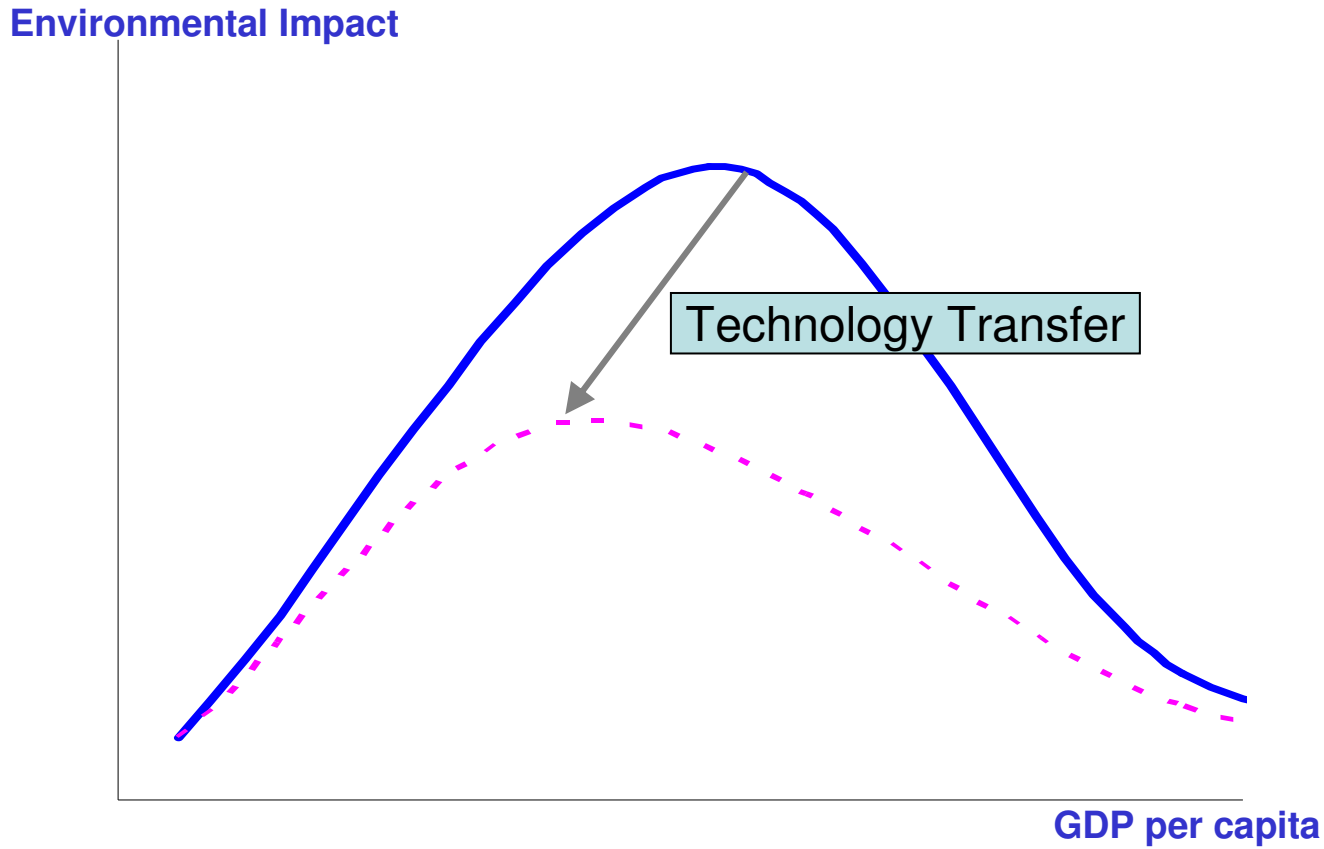

（Source: IEA/METI)

# Cost Effectiveness of Energy Efficiency Investment

- IEA analysis(2006) shows energy demand in 2030 will be 10%, 1.7 bil.toe, lower than the reference scenario, if consumers spend $2.4 tril. more, reducing energy supply investment needs by $3 tril.
- It means, in the electricity chain, $1 invested in more efficient equipments (cars, home appliances, etc.) avoids more than $2 in supply side investment. This ratio is higher in non-OECD countries.
- Average payback period ranges from 1 to 6 years in non-OECD countries.

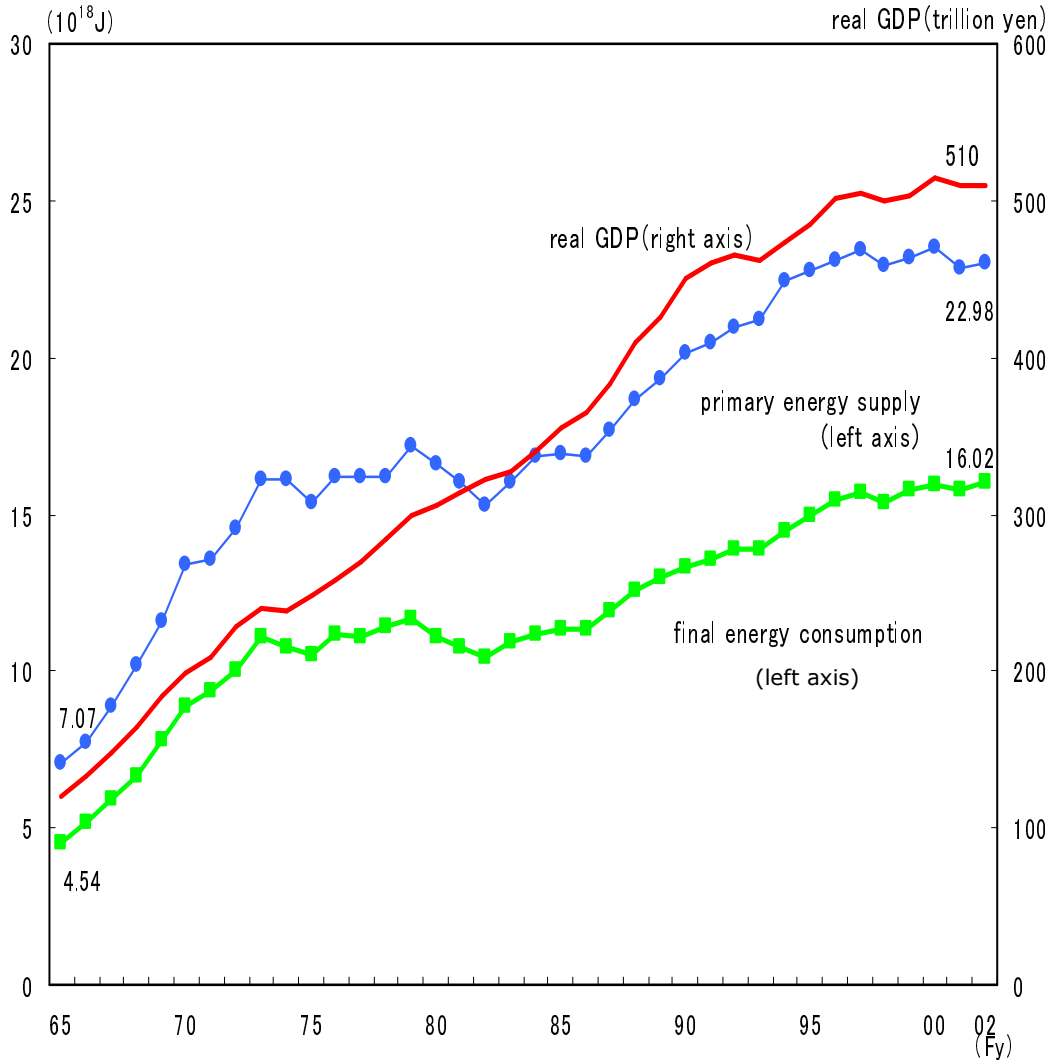
# Technology Transfer in Asia : From “Cool Japan” to “Cool Asia”

## Environment Kuznetz Curve Should Be Challenged




Source: Author

# Japan's Success in EE: Performance



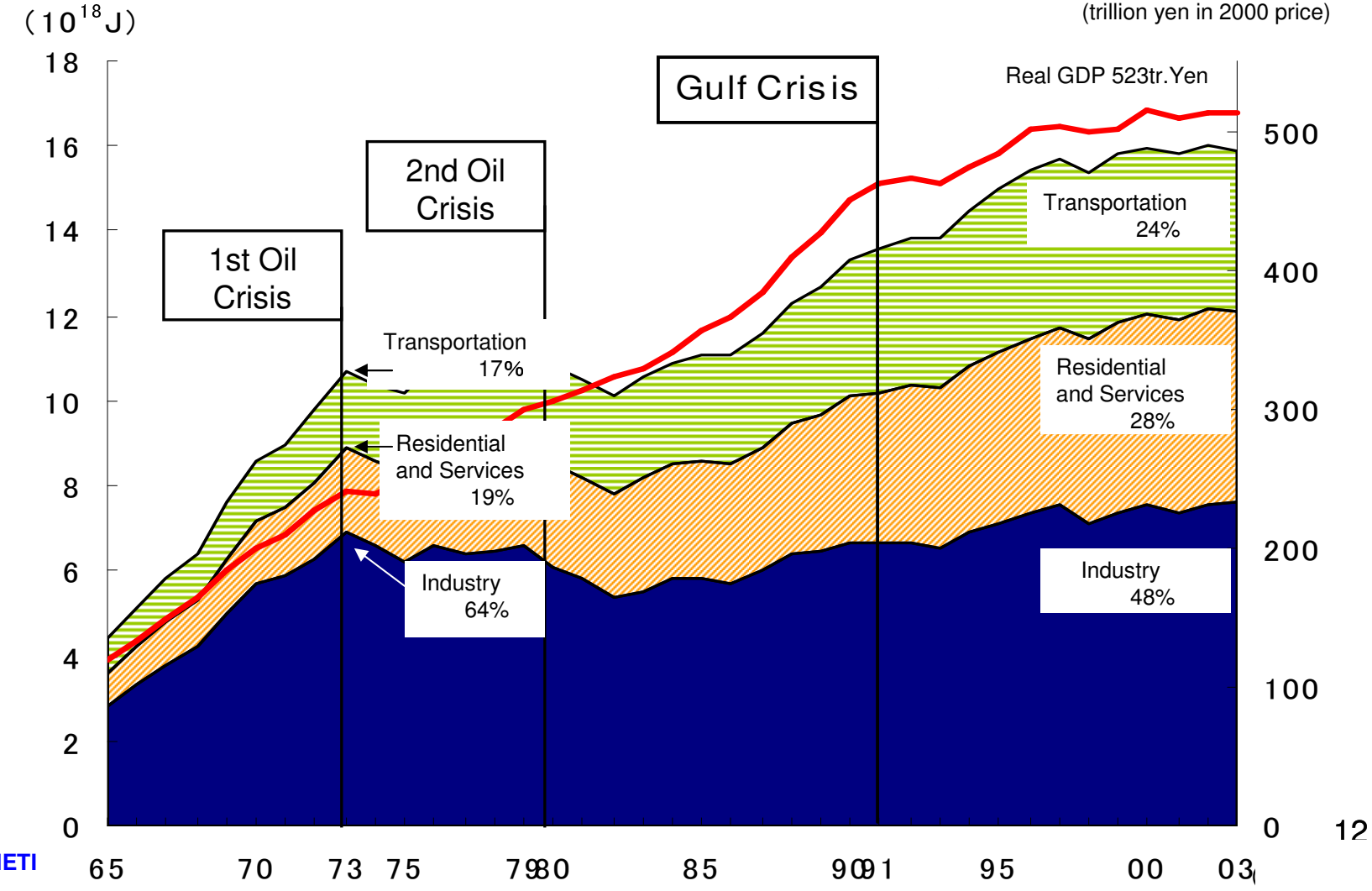

## Elasticity

| 1965–'73 | '73–'79 | '79–'86 | '86–'91 | '91–2003 |
|---|---|---|---|---|
| 1.19 | 0.29 | −0.11 | 0.85 | 0.71 |

**Source : METI**

# Japan's Success in EE: Performance

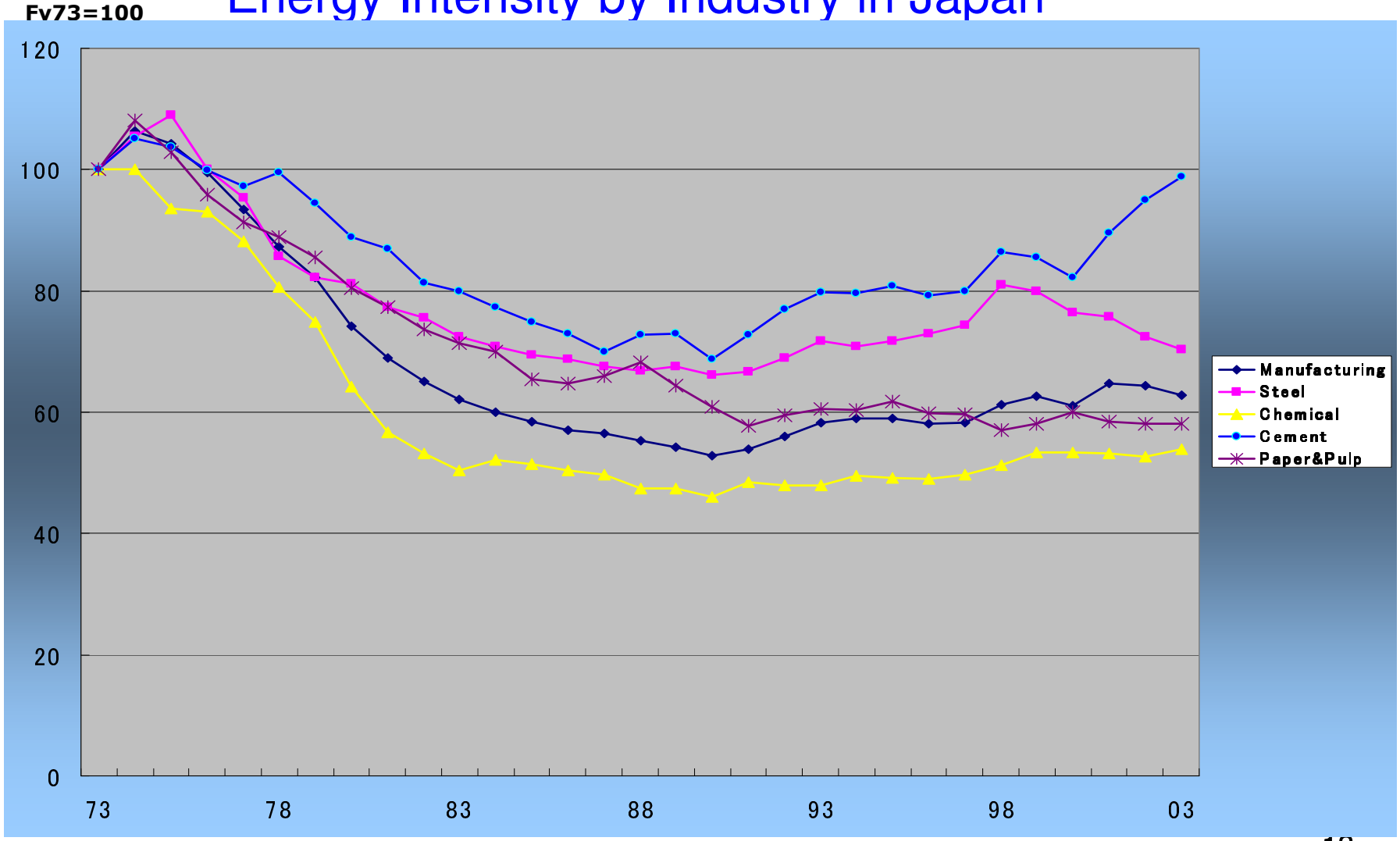
## Energy Consumption by Sector in Japan




Source : METI

# Japan's Success in EE: Performance

## Energy Intensity by Industry in Japan

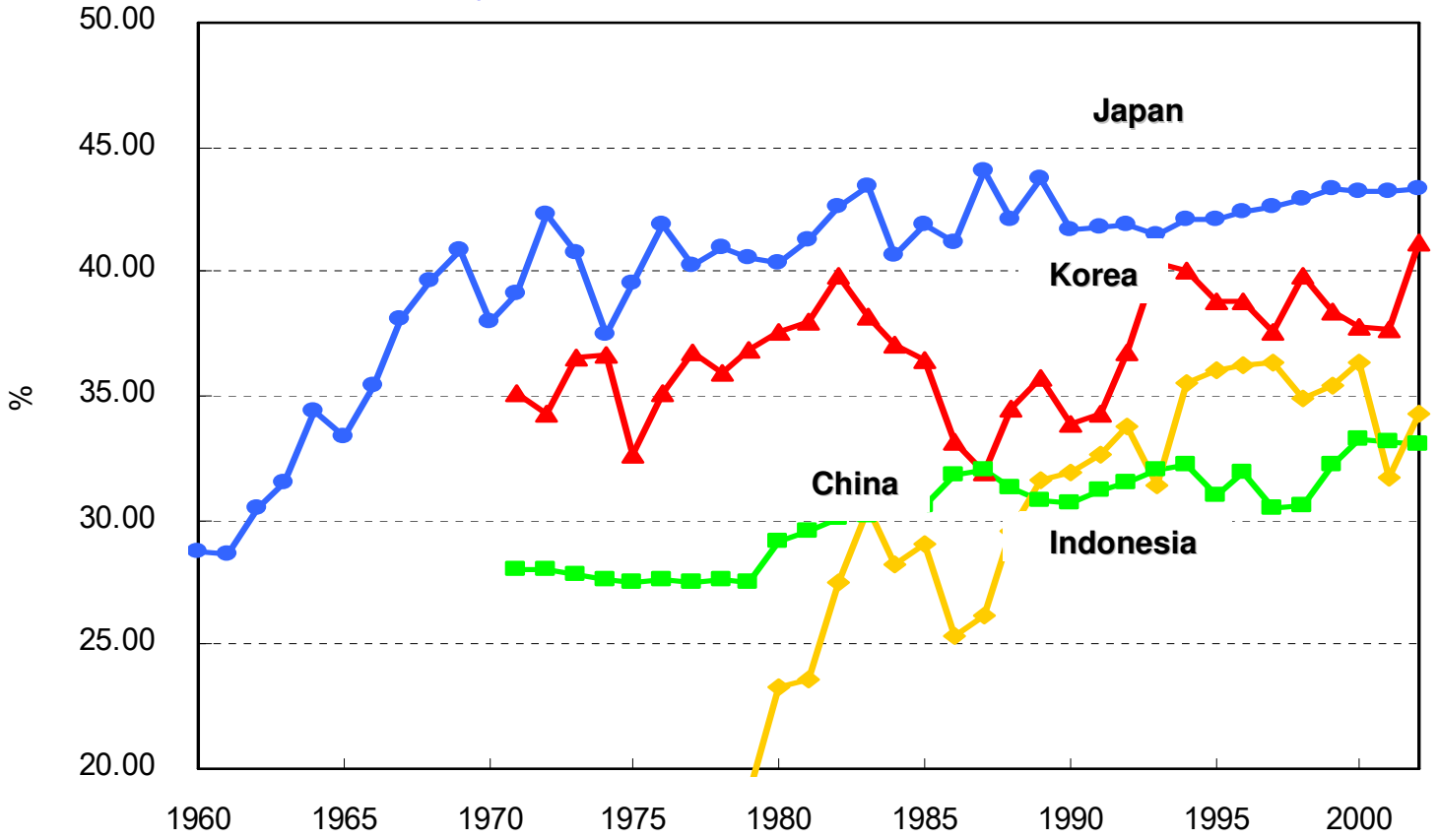



(energy consumption / IIP)

Source : METI

# Japan's Success in EE: Performance

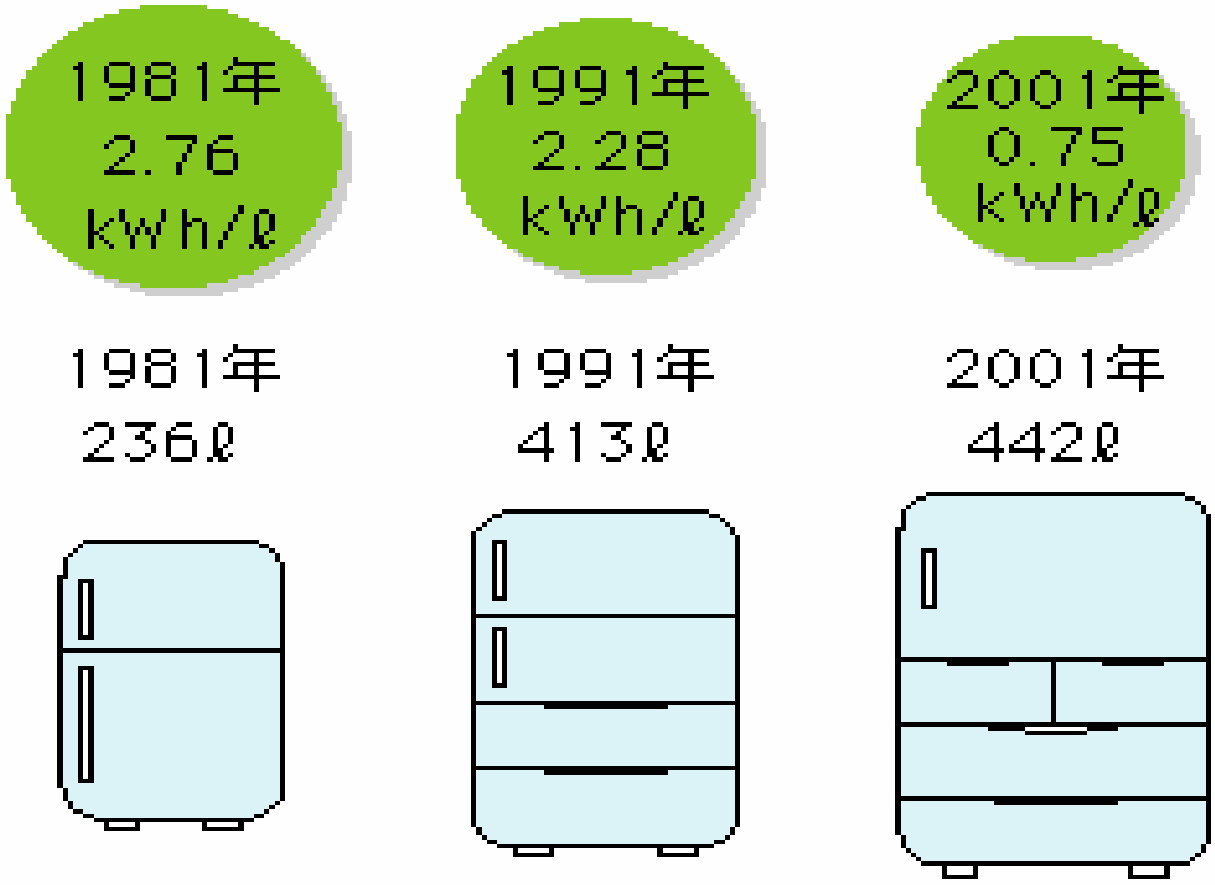
## Efficiency of Thermal Power Generation




Source : IEA

# Japan's Success in EE: Performance

Energy Efficiency of Refrigerator : Perfect example of "Factor 4"

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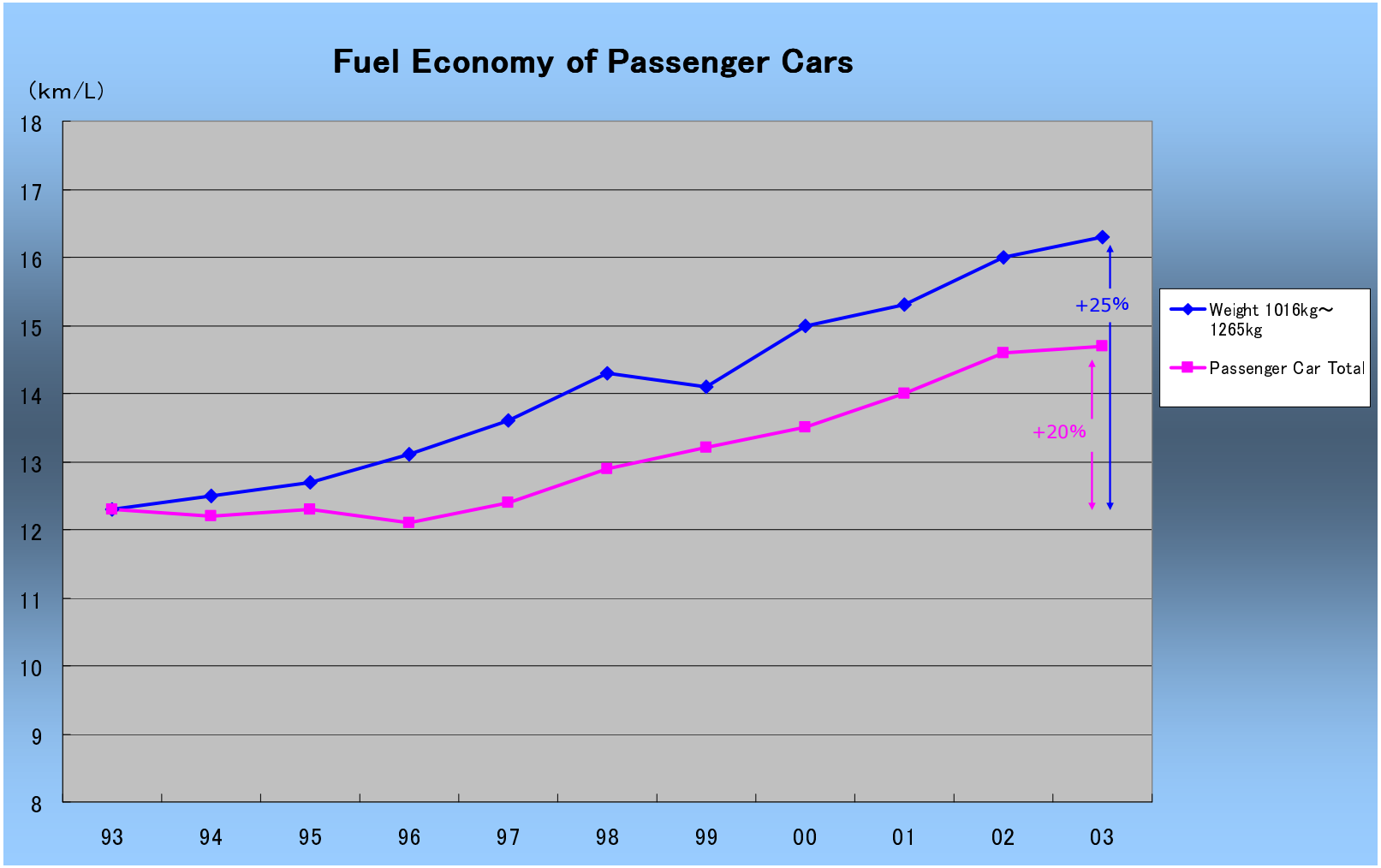
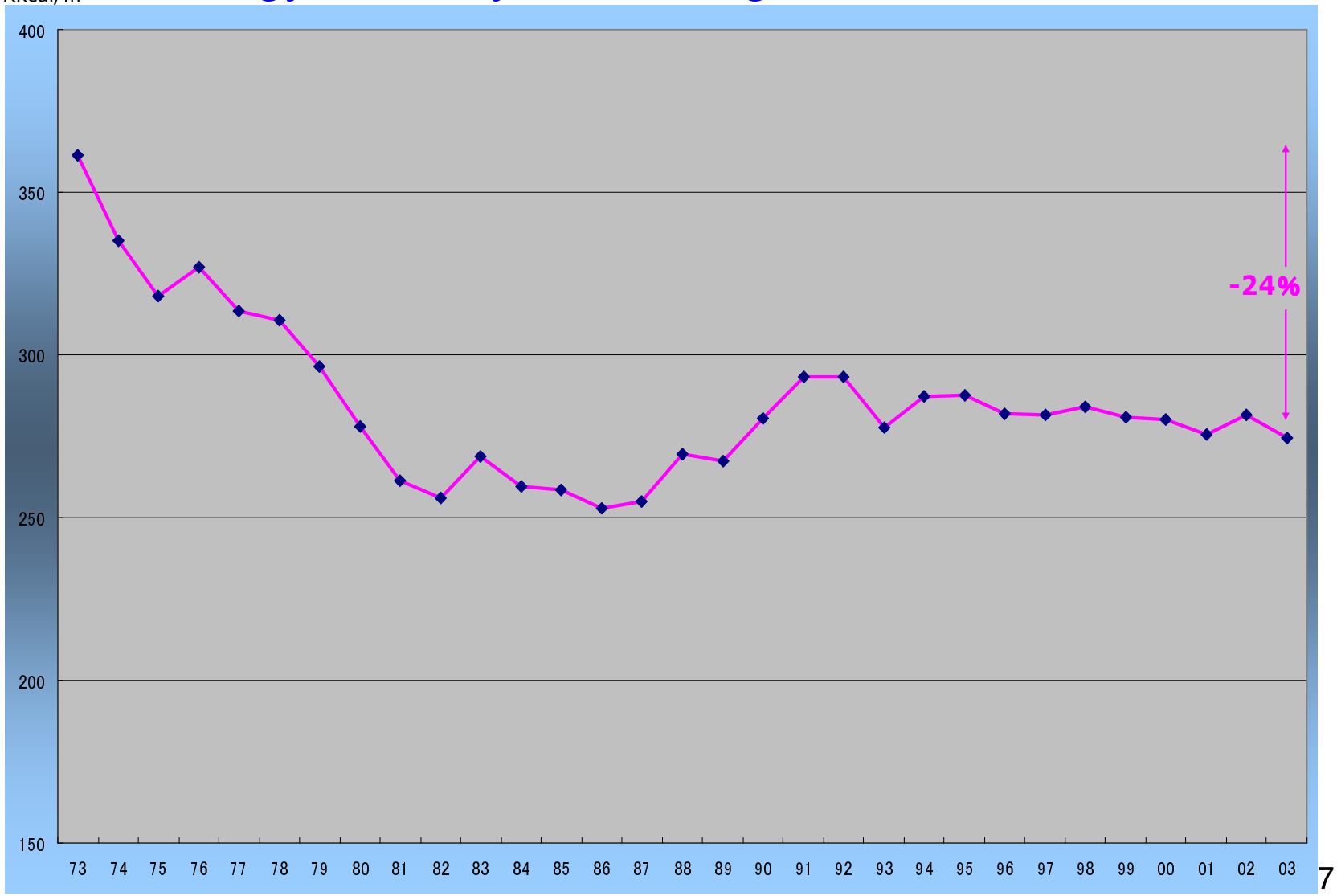



Source : METI

# Japan's Success in EE: Performance

## Energy Intensity of Buildings




**Source : METI**

# Japan's Success in EE: Factors

- **Government tried to boost the energy conservation with laws, tax system, subsidies and campaigns, but the principal force is market economy (price/cost motivation).**
- **Industrial sector strengthened their competitiveness with "KAIZEN"(TQM) effort in operation and related investment on plants and equipments.**
- **People switched the lifestyle to be conscious of energy conservation.**

# Japan's Int'l Cooperation on EE

- IEA: special commission on sectoral data collection and benchmarking for EE
- APP(Asia-Pacific Partnership on Clean Development and Climate, US, Ch, Jp, Can, Au, Kr, In): active TT activities, chairing steel TF
- EAS: commit to 1000 trainees and 500 experts on EE
- Bilateral: China, India, ASEAN, etc.

# Japan-China Cooperation

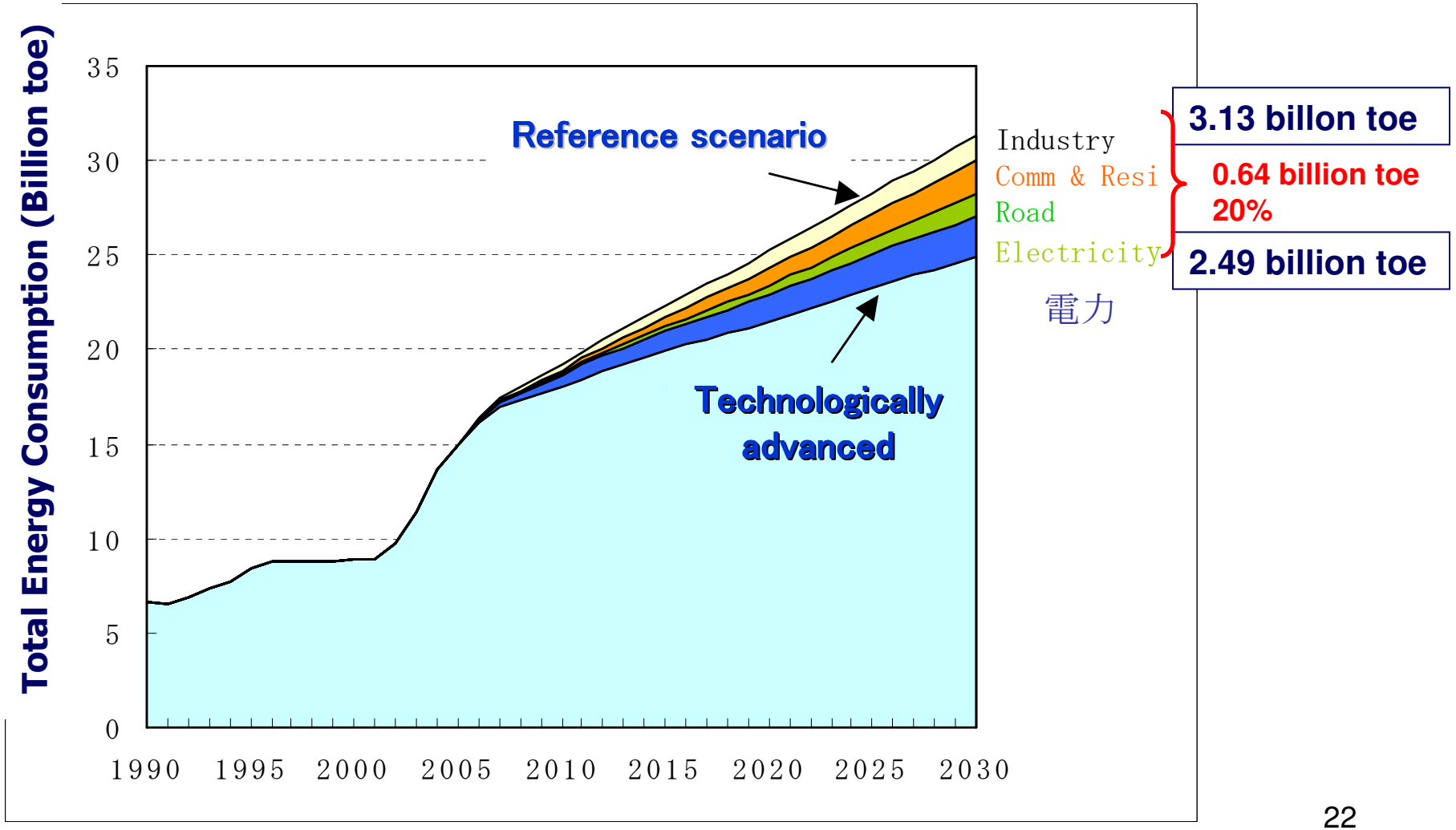
- 1990s- Implementation of Green Aid Plan (technical cooperation in model plants building and training on energy conservation)
- 1996- Energy Dialogue between Japan and China
- 2006 1st Forum Japan-China Energy Conservation
- 2007 Visit of Wen Jiabao to Tokyo, Promotion of Energy cooperation such as energy conservation, etc. as a part of “strategic mutual beneficial relationship”

# Japan-China Energy Conservation Business Promotion Model Projects

( Agreed in Sep. 2007)

- Energy conservation diagnosis and technology improvement for coal power plants ( Coal Energy Center of Japan, etc.)
- Energy conservation improvement for textile factories ( KEPCO etc.)
- Energization and utilization of sewage, urban waste and unutilized biomass ( JGG etc.)
- Energy conservation and waste heat/pressure utilization of electric system for steel and chemical sectors ( Hitachi etc.)
- R&D and application cases trial of equipments network for energy conservation businesses ( Matsushita etc.)

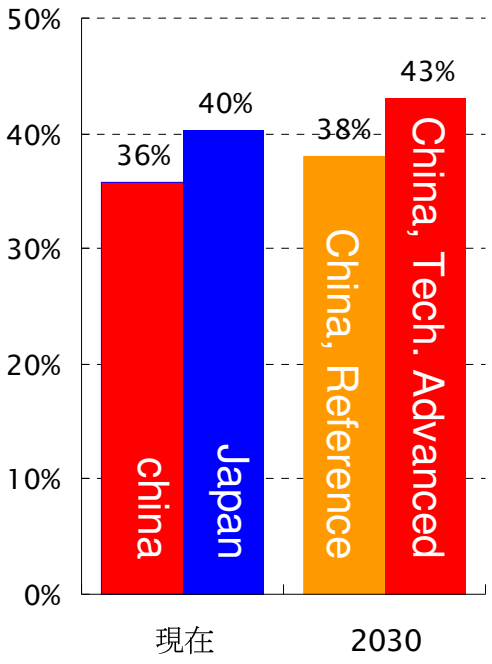
# China's energy saving potential with available technology




(Source: Institute of Energy Economics, Japan)

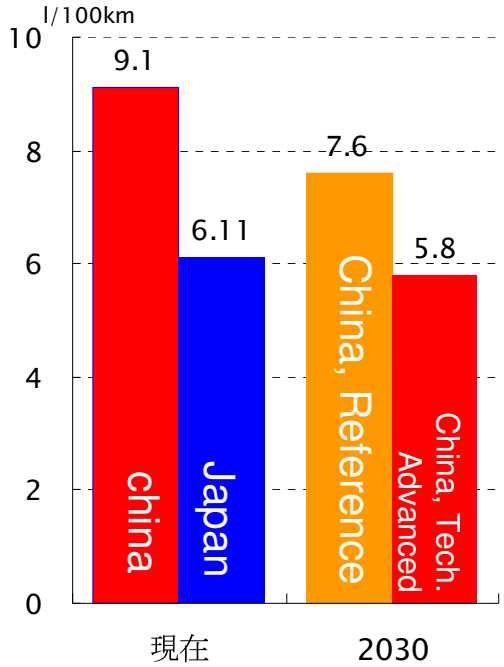
# China's energy saving potential with available technology

## Coal Thermal Efficiency



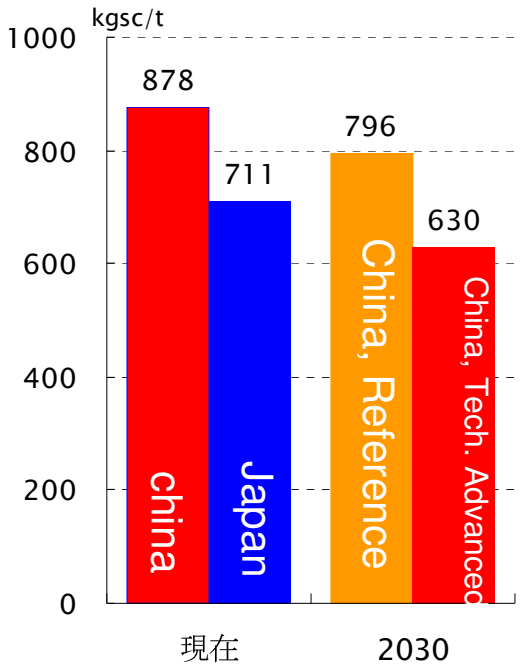

- **Enlargement of Equipment Scale**
- **Higher temperature and Pressure**
- **Improvement of Daily Maintence**

## Fuel Economy of Vehicle




- **Improvement of fuel efficiency technology**
- **Strengthen Fuel Economy Standard**
- **Improvement of Oil Product Quality**

## Efficiency of Crude Steel Production




- **Enlargement of Furnace**
- **CDQ、TRT**
- **Reuse of waste gas**



(Source: Institute of Energy Economics, Japan)

# Examples of J-C Cooperation in Steel Sector

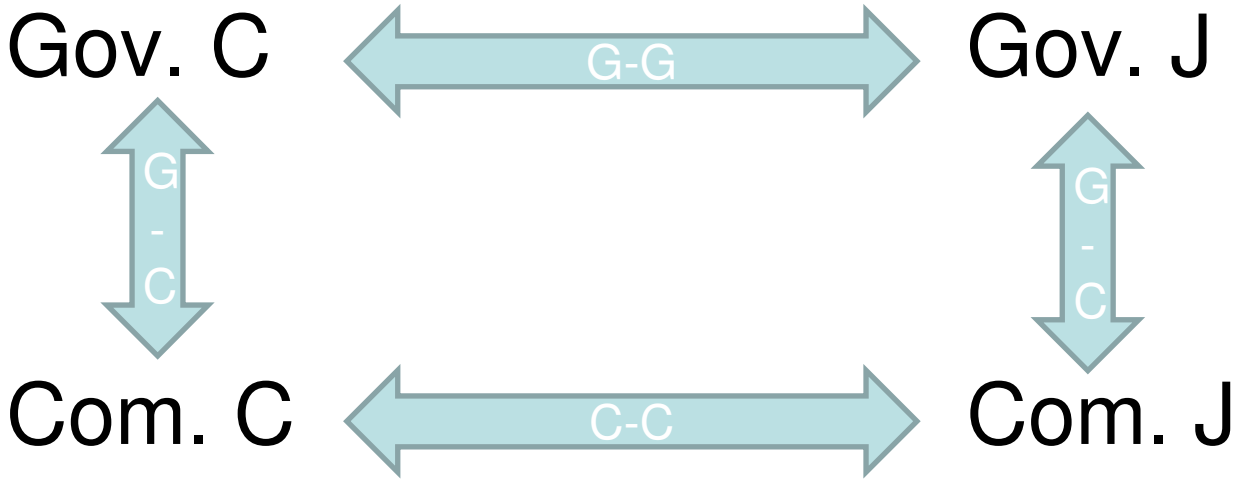
- 90's Model plant building by NEDO under GAP included 9 steel projects in total 18, demonstrated CDQ(Coke Dry Quenching) process
- 2003 J/V b/w Nippon Steel & Shougang for CDQ technology
- 2005 business-led meeting of JISF and CISA and government on EE cooperation
- 2006 CDQ project of Nippon Steel and Qian'an Coke gains CDM approval
- 2006 Top 1000 steel sector energy audits and VAs

# Barriers to Technology Transfer

- The economic theory tells market forces should function, but not, if there is market failure or actors are not rational.
- There may be market failures in technology transfer in three dimensions: a) cross-border b/w GOJ & GOC, b) cross-border b/w J-companies & C-com. c)internally in China (and Japan),
- Gov. should intervene the market with regulation, incentive, direct gov. action etc., if there is market failure
- Market failure is caused by;
  - Imperfect competition, monopoly, etc.
  - Short-term business tendency (vs. long-term market equilibrium)
  - Asymmetric information
  - Public goods (free riders)

  etc.

# Barriers to Technology Transfer b/w Japan & China




G-G: political climate, level of dialogue, lack of formal agreement (e.g. CDM)

C-C: competitor or partner?, lack of info. on potential partners, commercial conditions, concern on IPR

G-C: lack of proper encouragement, incentive, regulation, etc.

# Challenge ahead in broader context

- Continuous confirmation of political will of international cooperation
- Continuation and pursuit of practical policy cooperation among technocrats (including IEA, etc.)
- Pursuit of economic and business interest by business actors
- Power of Epistemic Community