Energy Efficiency : Lessons from Japan

"From Cool Japan to Cool Asia"

NEAT Energy Security WG
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Yasuo Tanabe

Vice President
Research Institute of Economy, Trade and Industry (RIETI)

Outline

1. Relevance of the Issue
2. Performance of Japan's Energy Efficiency
3. Driving Forces
   - ① Market Forces (Price Mechanism)
   - ② Industry Efforts
   - ③ Government Policy
4. How Much Can Be Saved?
5. Conclusion

1. Relevance of the Issue

Q1. Why energy conservation / efficiency?

A.

- **Decrease irrational consumption, create potential supply**
- **Lead to energy security through shift in supply-demand balance**
- **Economic growth through reduced cost, economic efficiency**
- **Environment protection, sustainability through rational use of energy.**

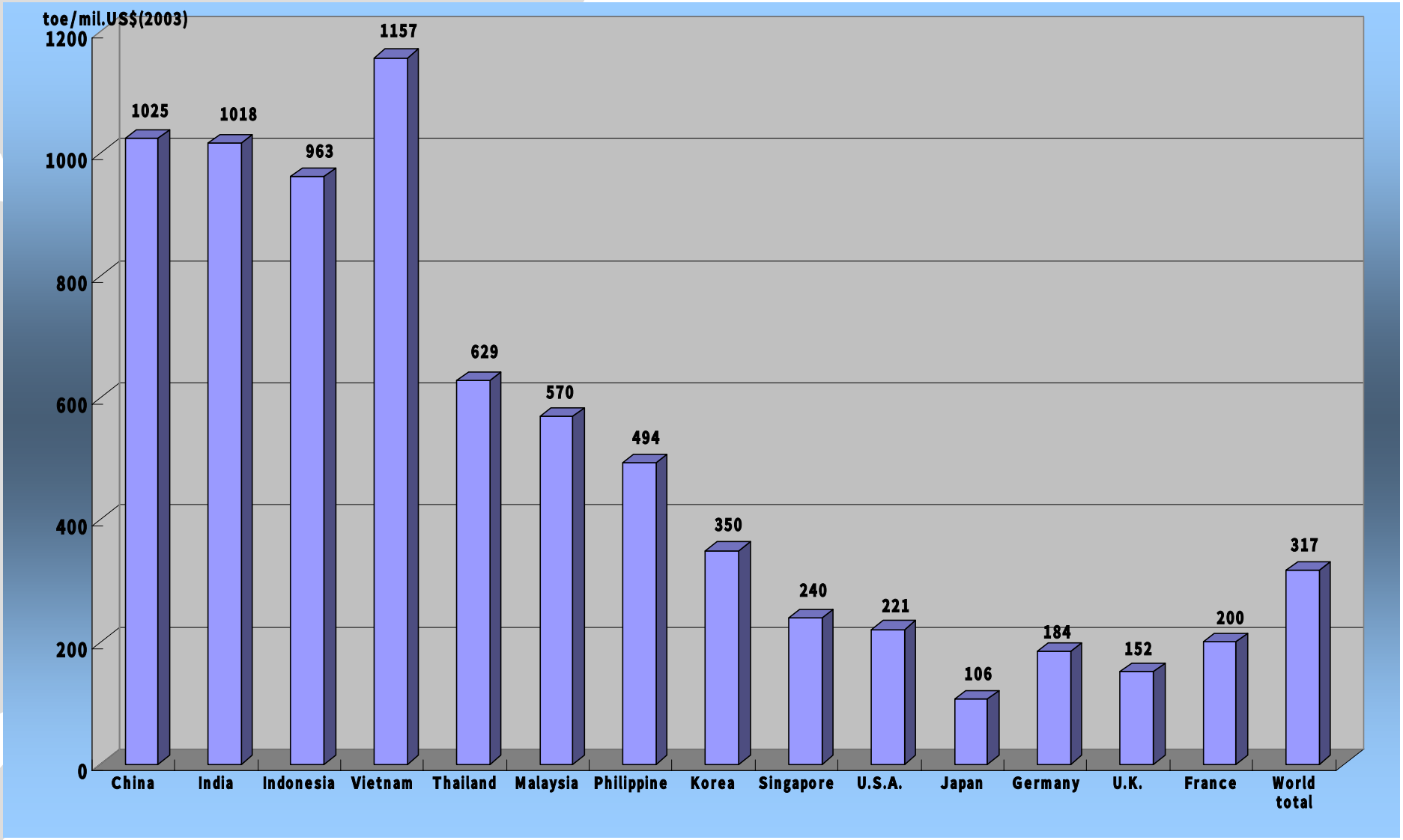
Q2. Why cooperation in Asia?

A.

- **Asia is the fastest growing consuming, net importing region: common interest, demand-side cooperation**
- **Complementarity in Asia, win-win scenario: resource rich Japan vs. resource developing countries**
- **Can demonstrate the Asian model, “Cool Asia”, to the world: Sustainable development through Asian way of cooperation, challenge the Environmental Kuznets Curve**

1. Performance of Japan's Energy Efficiency

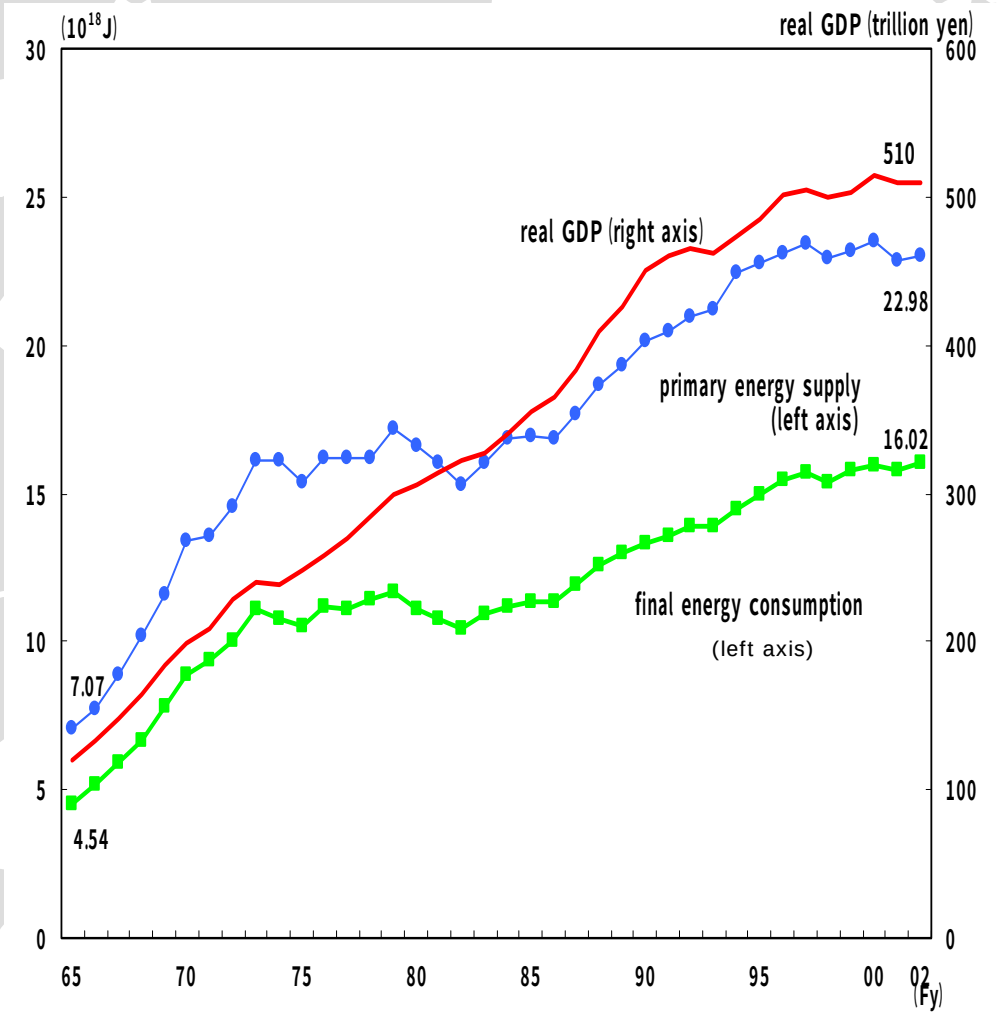
Energy Intensity of Key Countries



Source : IEA

1. Performance of Japan's Energy Efficiency

GDP and Energy Consumption in Japan



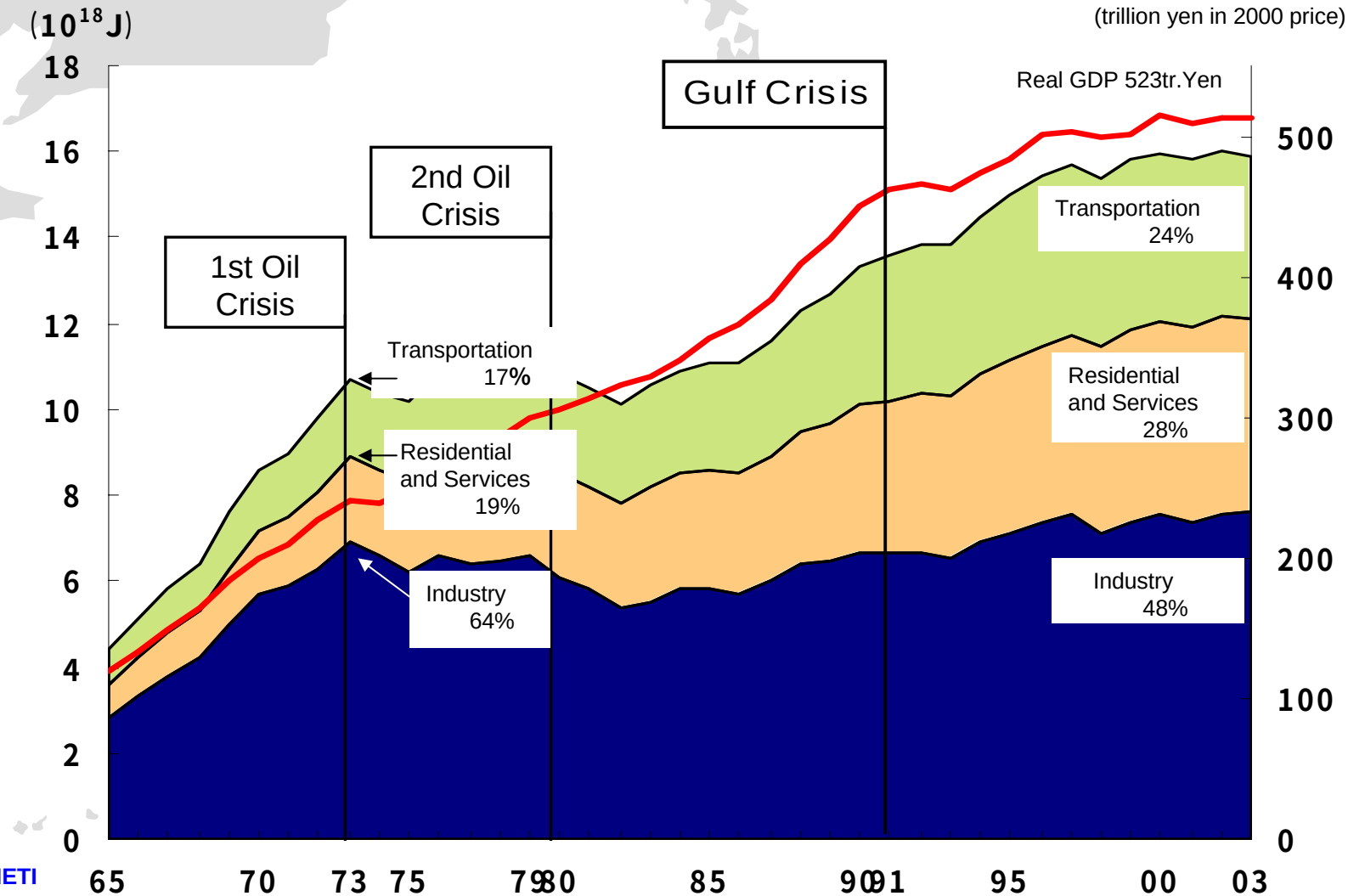
Elasticity

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

Source : METI

1. Performance of Japan's Energy Efficiency

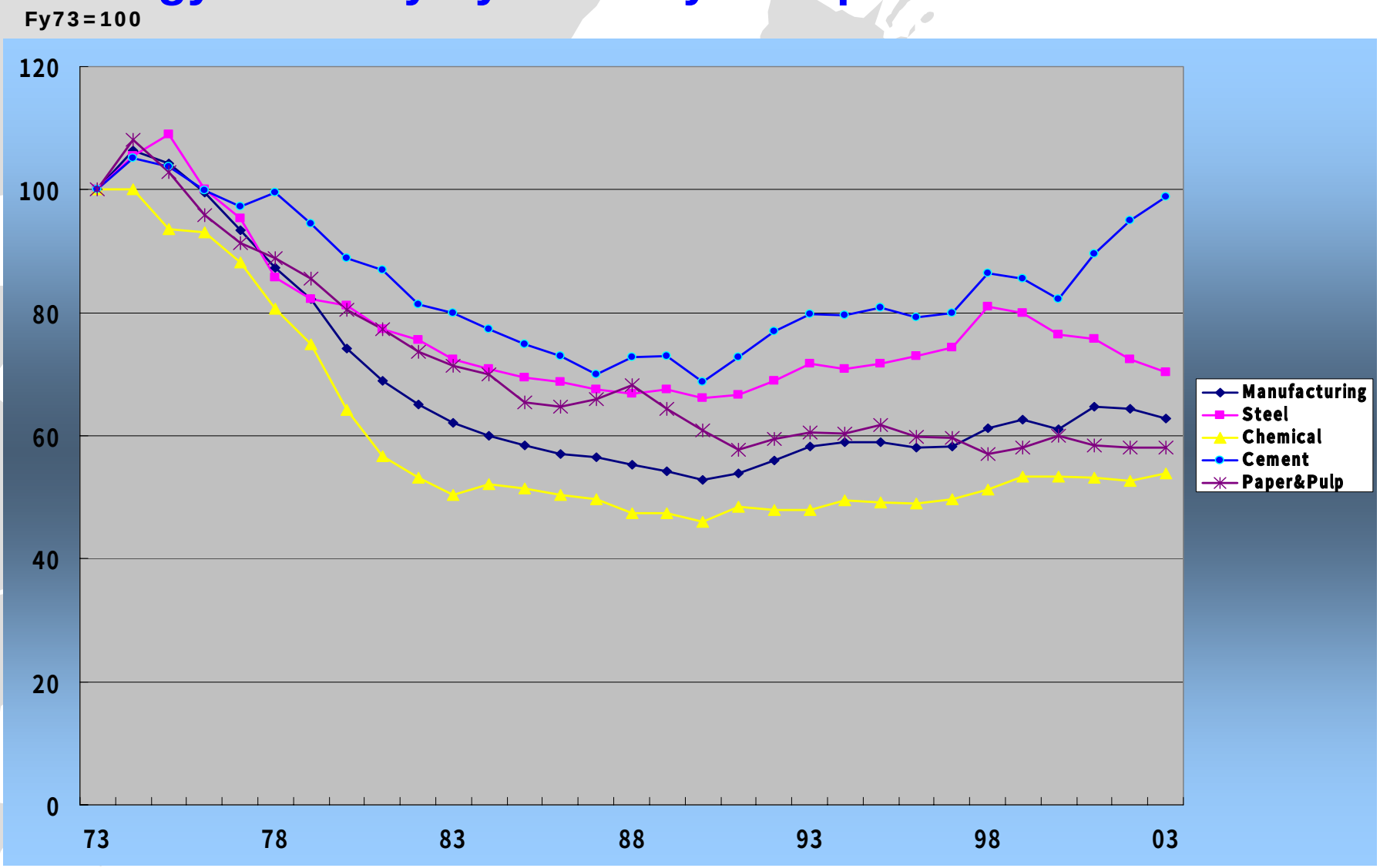
Energy Consumption by Sector in Japan



Source : METI

1. Performance of Japan's Energy Efficiency

Energy Intensity by Industry in Japan

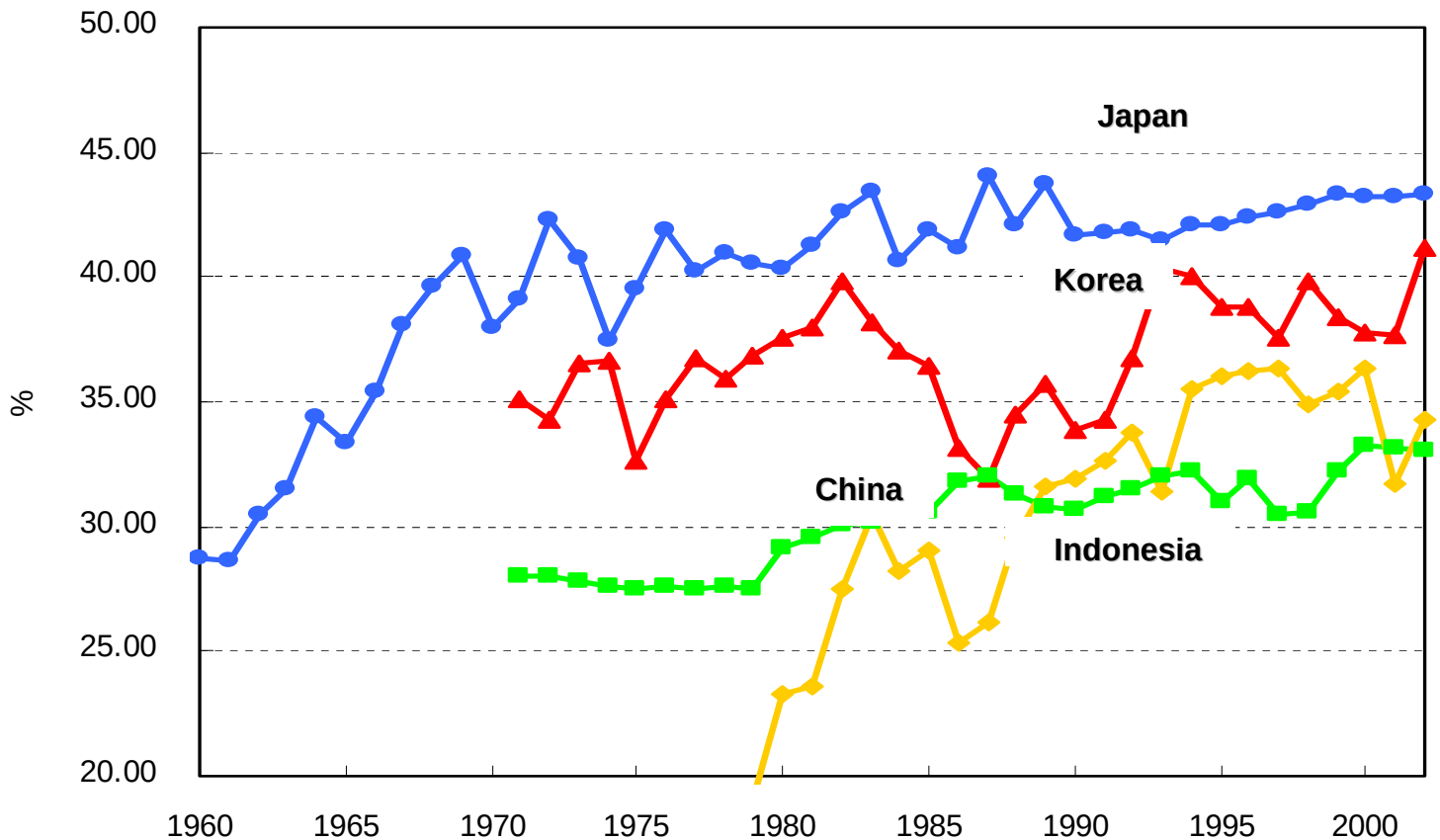


(energy consumption / IIP)

Source : METI

1. Performance of Japan's Energy Efficiency

Efficiency of Thermal Power Generation

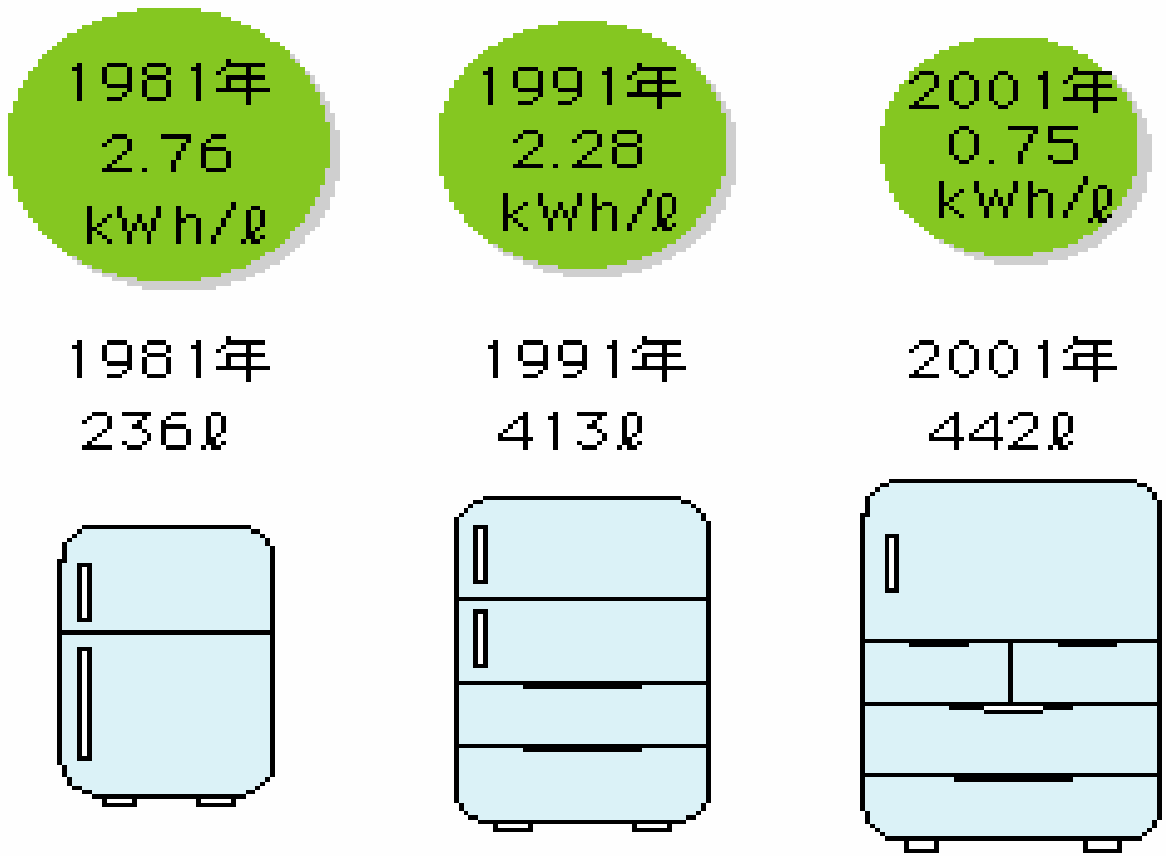


Source：IEA

1. Performance of Japan's Energy Efficiency

Energy Efficiency of Consumer Products

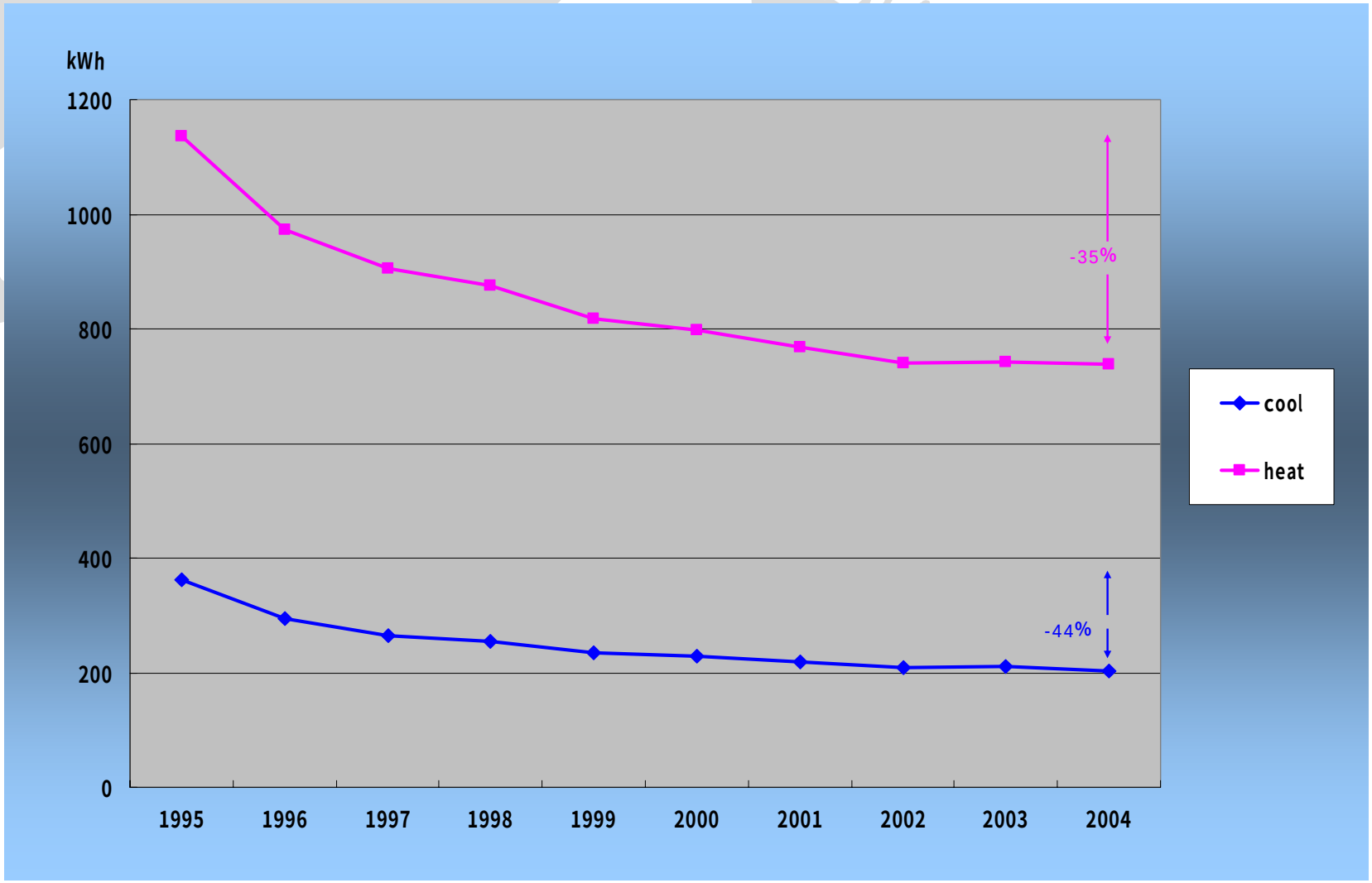
a) Refrigerator : Perfect example of "Factor 4"



Source : METI

1. Performance of Japan's Energy Efficiency

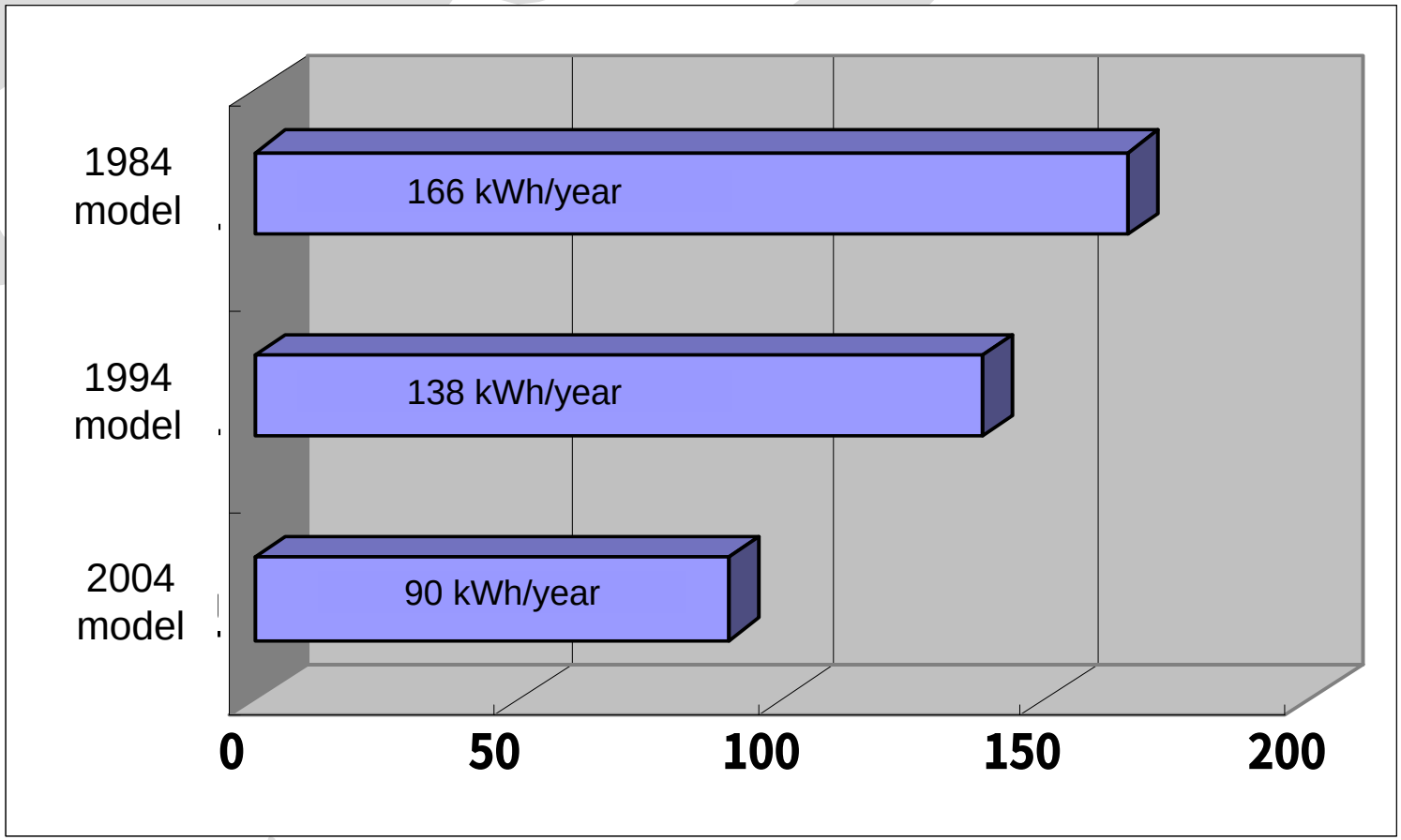
b) Air Conditioner



Source : METI

1. Performance of Japan's Energy Efficiency

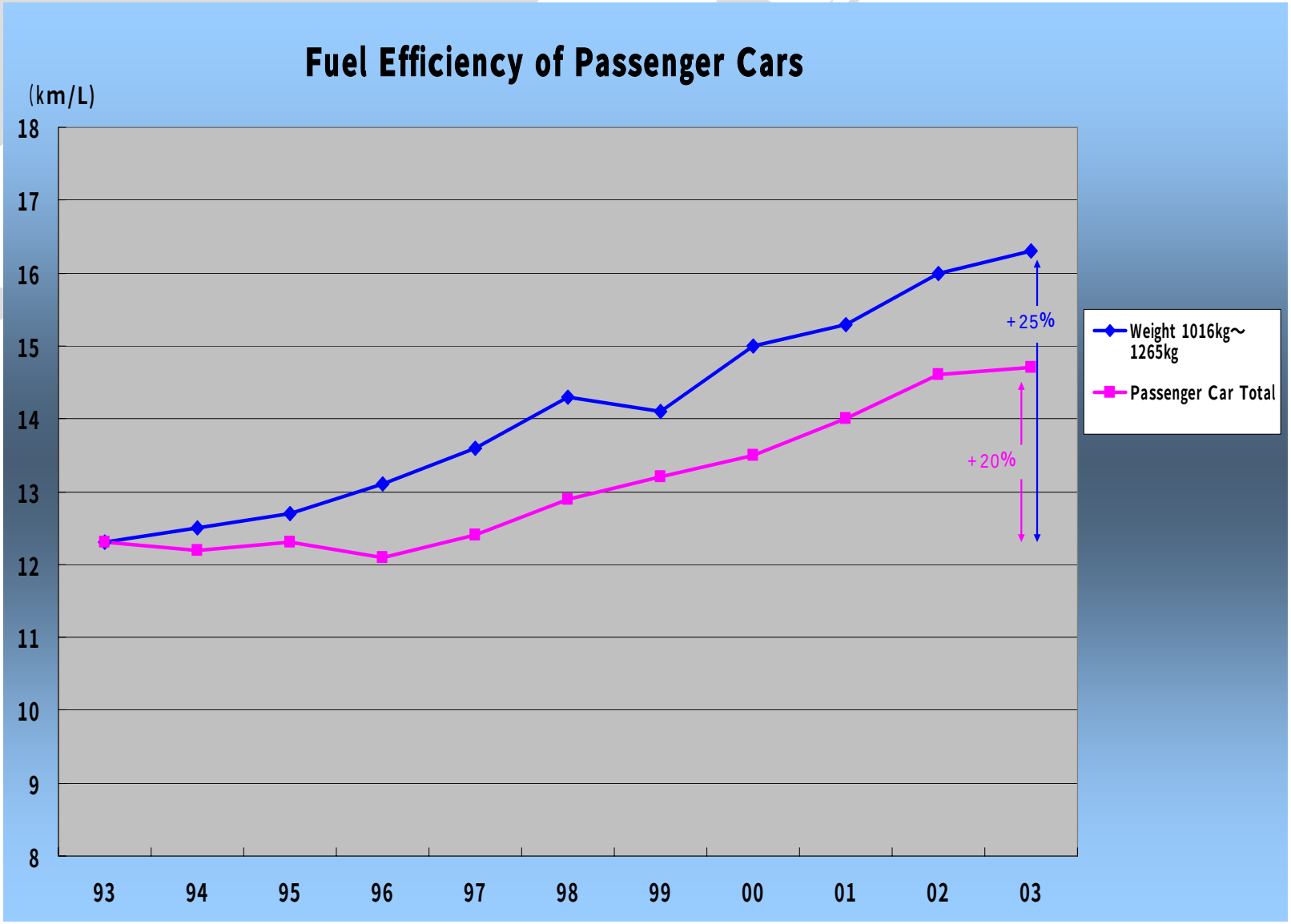
c) CRT Television (21-inch)



Source: Japan Electronics and Information Technology Industries Association

1. Performance of Japan's Energy Efficiency

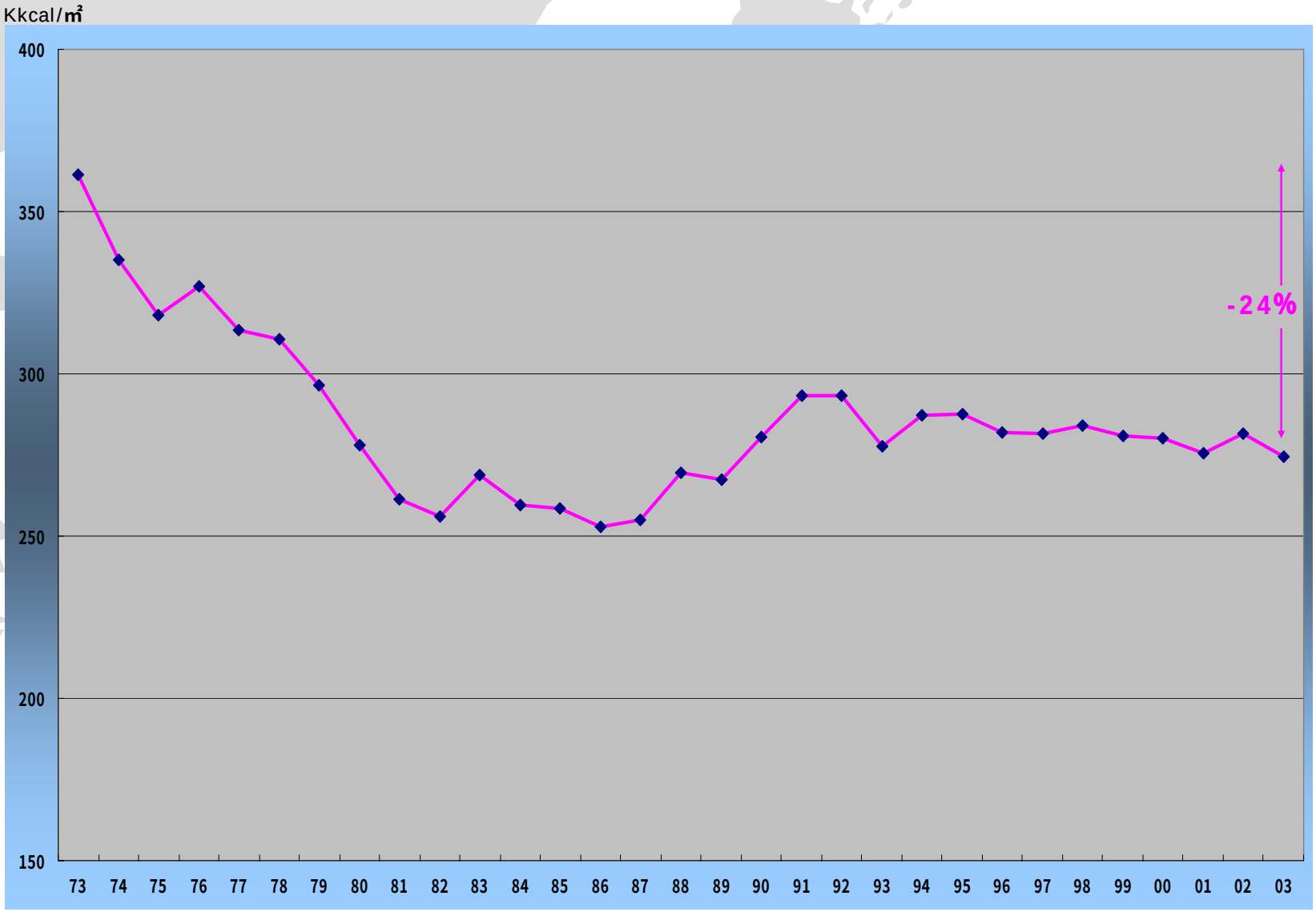
d) Passenger Car



Source : METI

1. Performance of Japan's Energy Efficiency

Energy Intensity of Buildings



Source : METI

2. Driving Forces

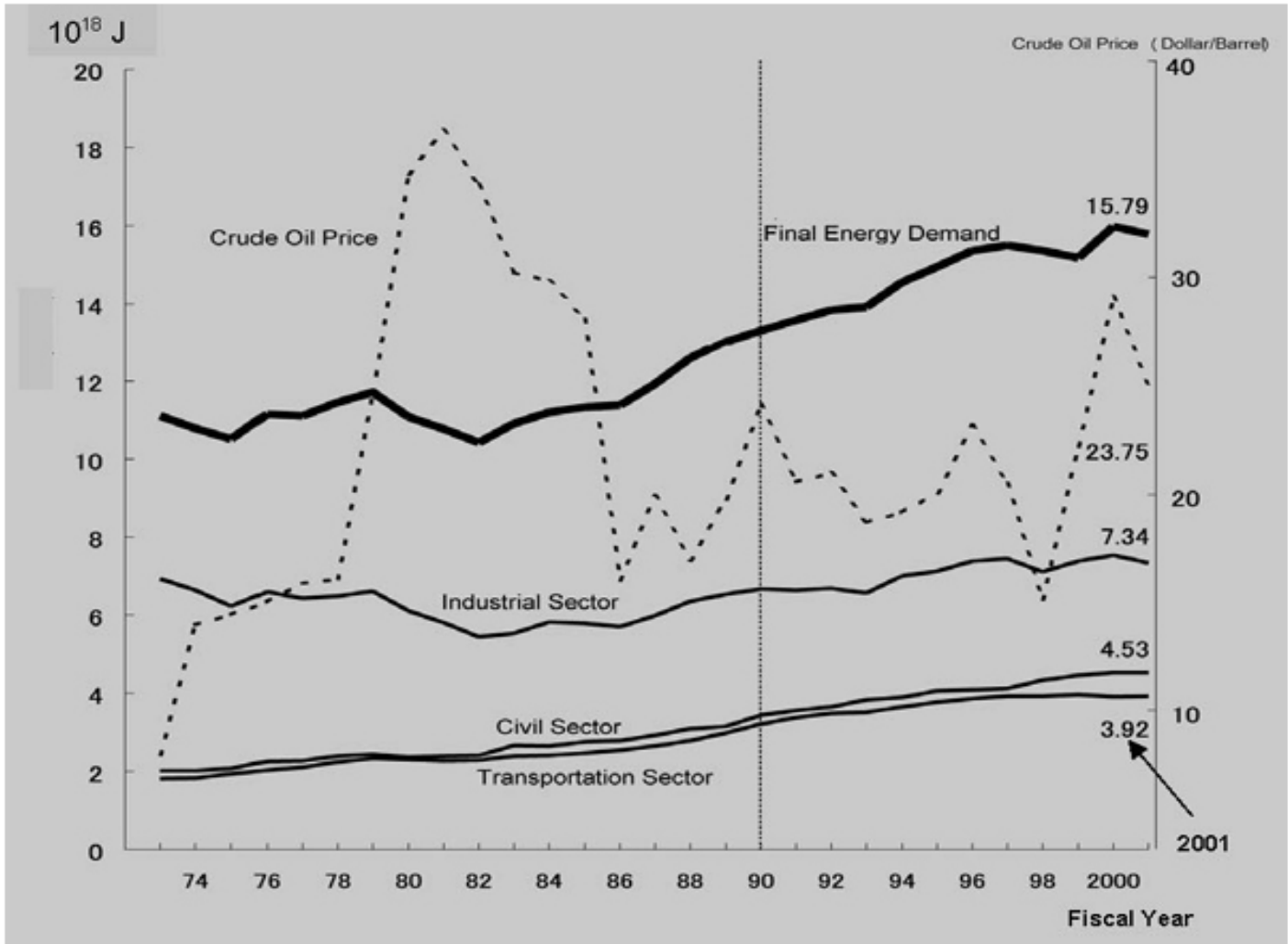
① Market Forces = Price Signal

- "Market forces play a key role in conserving scarce energy resources, directing those resources to their most highly valued uses." (Greenspan)

- In order for energy efficiency investment to receive fair return, energy prices have to go up.

2. Driving Forces

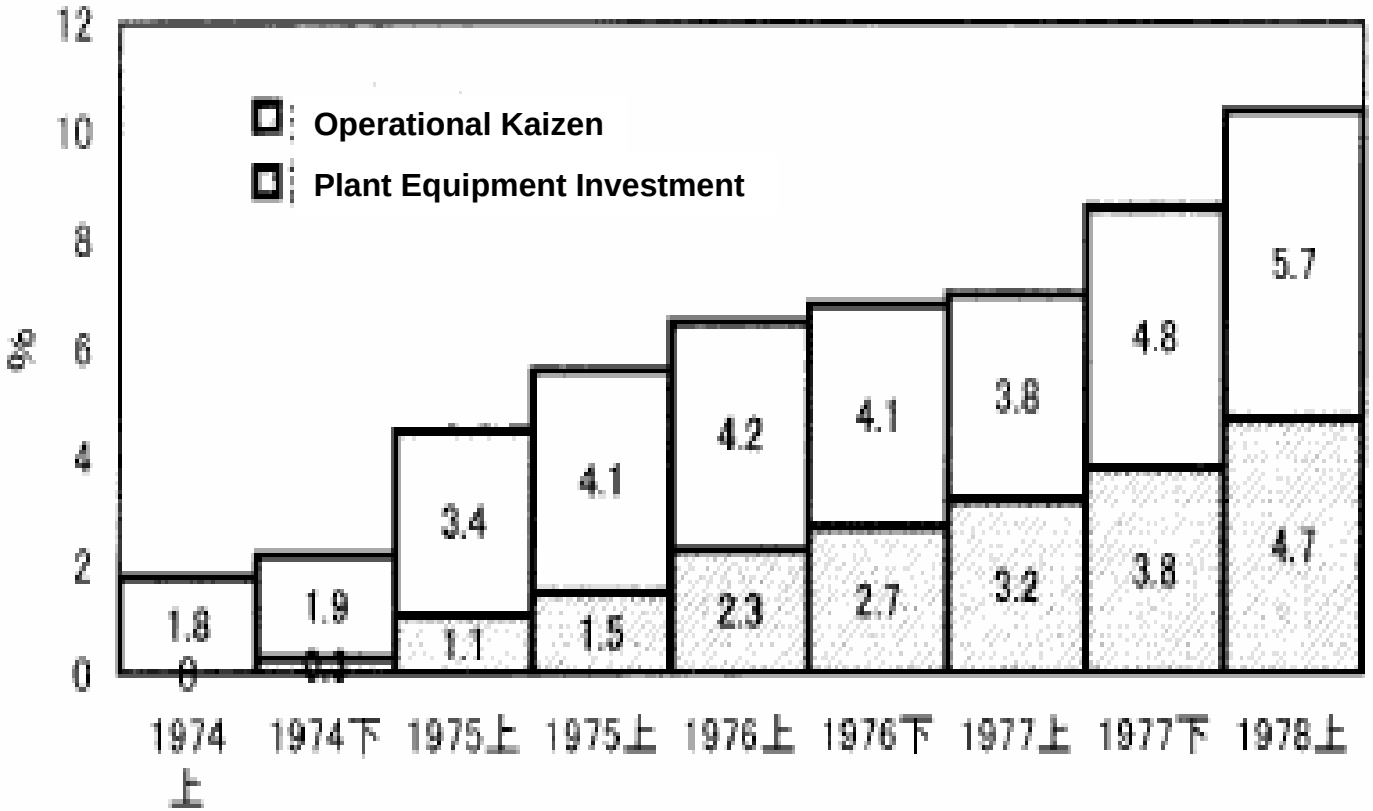
① Market Forces : Price Signal



2. Driving Forces

② Industry Efforts

-TQC (Kaizen) and Capital Investment

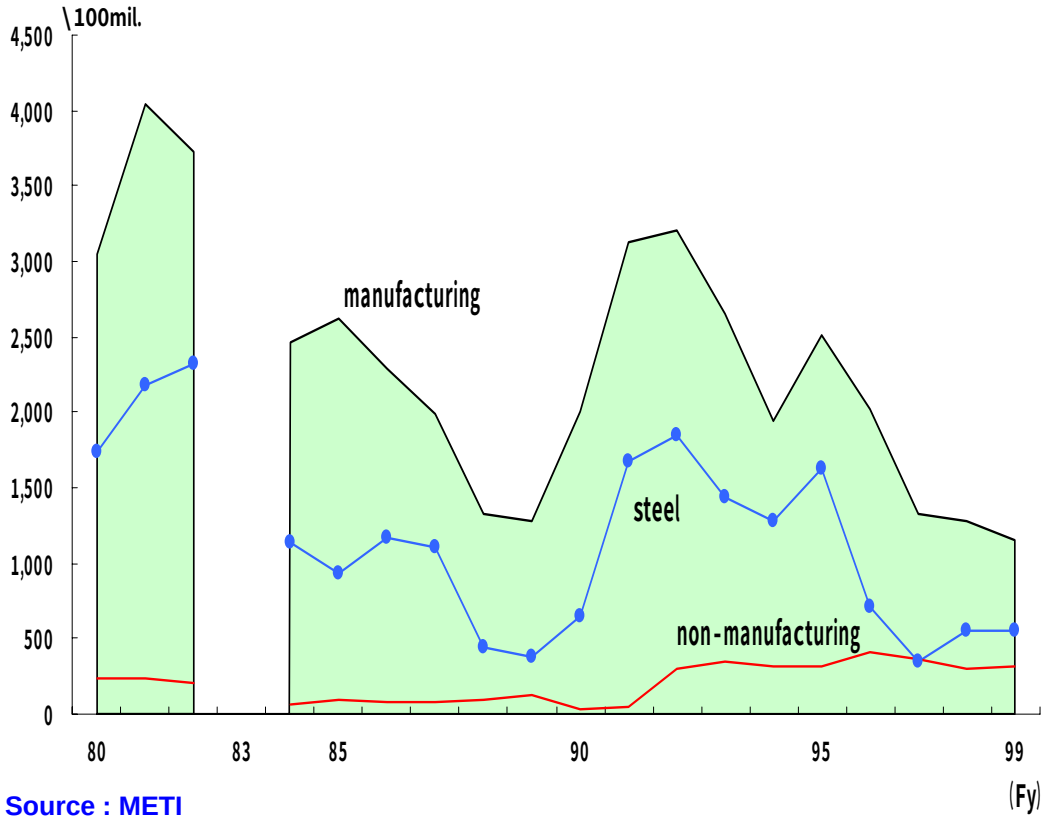


Source : Nippon Steel

2. Driving Forces

② Industry Efforts

- Capital Investment for Energy Conservation



Source : METI

2. Driving Forces

② Industry Efforts

Effect of Measures and Dissemination Rate of Typical Higher Efficient Equipment for Energy Conservation

Industry	Improved Energy Intensity(94/73)	Typical Energy Conservation Equipment	Dissemination Rate as of 1998
Iron & Steel	81 %	Continuous caster (CC)	100 %
		Blast furnace top gas pressure recovery equipment (TRT)	100 %
		Coke dry quenching equipment (CDQ)	91 %
Petrochemical	58 %	High-efficiency naphtha cracking reactor	100 %
		High efficiency compressor	100 %
		Gas turbine	100 %
Cement	65 %	SP, NSP kiln (Heat recovery)	100 %
Paper & Pulp	61 %	Continuous digester	100 %

Source : ECCJ

2. Driving Forces

② Industry Efforts

Voluntary Environmental Action Plan of *Keidanren*

(Japan Federation of Economic Organizations)

*** Participants : 35 industries (Coverage Ratio: 83%) as of Mar. 2003**

*** Implementation of Energy Conservation Measures aiming at the Target by each Industry**

Overall Target in FY2010:

☆ To reduce CO_2 emission from Industrial and Energy-Converting Sector below the amount in 1990 :

- **Steel Industry:**
  ▲10% Energy Consumption below 1990 by 2010
- **Chemical Industry and Paper and Pulp Industry :**
  ▲10% Energy Intensity below 1990 by 2010

☆ Trend of CO_2 emission in the industry sector :

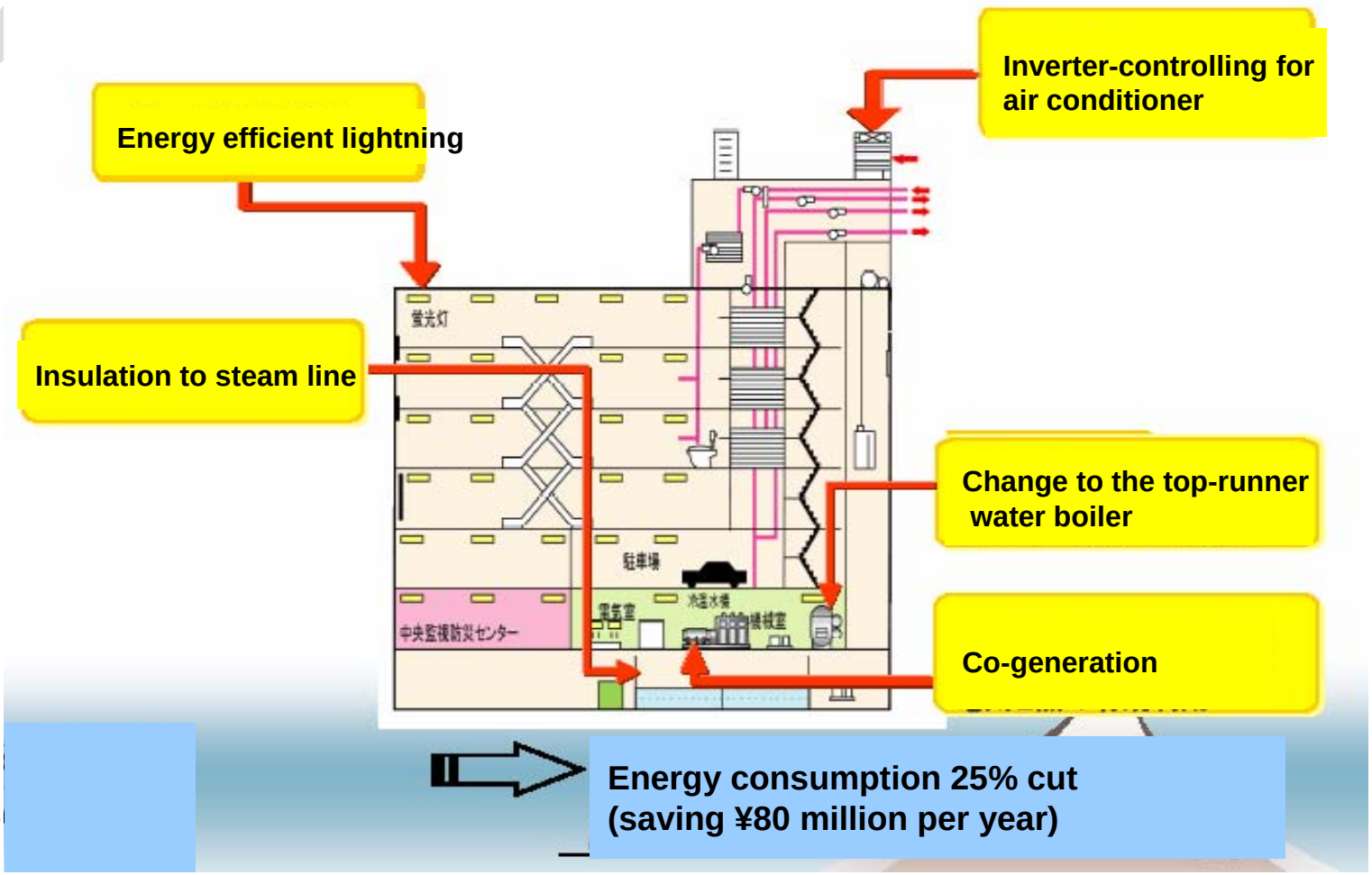
	FY1990	FY1999	FY2000	FY2001	FY2002	**FY2010**	FY2010
	Actual ---------->					**Target**	BAU
CO_2 emission (Mt)	508.0	506.9	503.3	489.6	498.5	< 508.0	538.0
% to FY1990	**100.0**	99.8	99.1	96.4	98.1	**< 100.0**	105.9

Source: *Keidanren* (Japan Federation Economic Organizations)

2. Driving Forces

② Industry Efforts

Esco Service for
Osaka Health-care Center



Energy consumption 25% cut
(saving ¥80 million per year)

Source : ECCJ

2. Driving Forces

② Industry Efforts

Industry Response to the Hike of Oil Prices (METI Survey, April, 2006)

Chemical
- cost cut, diversification of feedstock
- fuel conversion from heavy oil to natural gas

Textile
- fuel conversion from heavy oil to natural gas, biomass
- shift to higher value-added products

Paper & Pulp
- fuel conversion from fossil fuel to RPF

Steel
- fuel conversion from heavy oil to natural gas
- increase byproduct hydrogen gas

Electrical Machines
- reduce chemical materials

Automobile
- energy conservation, decrease loss

2. Driving Forces

③ Government Policy

Energy Conservation Law of Japan (introduced in 1978, latest amendment in 2005)

Factories

Guidelines
- Heat/Power Loss Control
- Waste H/P Recovery
- Measurement/Record
- Maintenance/Management

Target
- Annual 1% improvement
- (Unit energy management)

Registration according to size → **Obligations**

Factories: Type-1 (Fuel:3000kl/y, Power:12 million kwh)	Energy Manager Middle/Long Term Plan Periodical Report
Factories: Type-2 (Fuel:1500kl/y, Power:6 million kwh)	Energy Mgt Officer Periodical Training Periodical Report

Transport

Guidelines
- Energy Efficient Vehicles
- Eco-Drive/Load Factor
- Modal Shift

Building

Guidelines

Products — Motor Vehicles, Machines & Appliances

Guidelines

Transport Business Cargo Consignor (30 million ton-km)	Energy Conservation/ Rationalization Plan Periodical Report
General Entities	Commuting on Public Transport
Non-Residential Building (Over 2000m²)	Construction and Renovation Plan
Top Runner Program Indication of Energy Efficiency	Hearing/Inspection

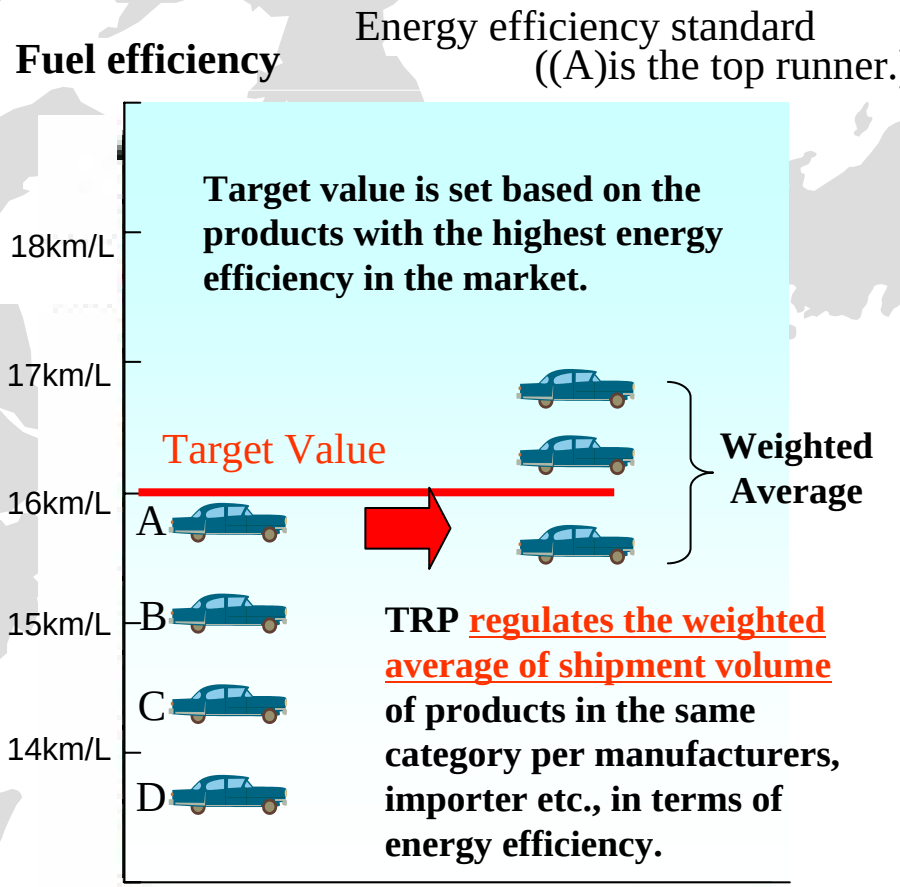
Source : ECCJ

③ Government Policy

Energy Conservation Measures for Machinery & Equipment

"Top Runner Program"

Concept for setting target standard



Source : ECCJ

Currently designated products

Total 21 products designated

1. Air conditioners
2. Fluorescent lights
3. Television sets
4. Copying machines
5. Computers
6. Magnetic disk units
7. Video cassette recorders
8. Passenger vehicles
9. Freight vehicles
10. Electric refrigerators
11. Electric freezers

11 products designated in 1999

12. Space heaters
13. Gas cooking appliances
14. Gas water heaters
15. Oil water heaters
16. Electric toilet seats
17. Vending machines
18. Transformers (molded)

7 more products designated in 2002

19. Electric Ovens
20. Electric Rice Cookers
21. DVD Recorders

3 more products designated in 2006

2. Driving Forces

③ Government Policy

Actual Improvement of Energy Saving in Target Fiscal Year

Equipment	Base Year	Target Year	Initial Expected Energy Saving (%) compared to the Base Year at the Targetl Year	Actual Improvement Energy Saving (%) compared to the Base Year at the Target Year
Air Conditioners (below 4kW)	FY1997	FY2004	63.0	67.8
TV sets <Cathode Ray TV>	FY1997	FY2003	16.4	25.7
VCRs	FY1997	FY2003	58.7	73.6
Electric refrigerators	FY1998	FY2004	30.5	55.2
Electric freezers	FY1998	FY2004	22.9	29.6
Gasoline Passenger Vehicles	FY1998	FY2004	23.0 (*)	22.0

Source : ECCJ

(*) 1995->2010

2. Driving Forces

③ Government Policy

Tax Incentives

1. **Deduction for corporate tax or income tax**
   - 7% of acquisition cost of equipment
     (Upper limit : 20% of corporate tax or income tax)
   - only for Small & Medium Enterprises

   or

2. **Special depreciation**
   - Up to 30% of acquisition cost of equipment in addition to ordinary depreciation

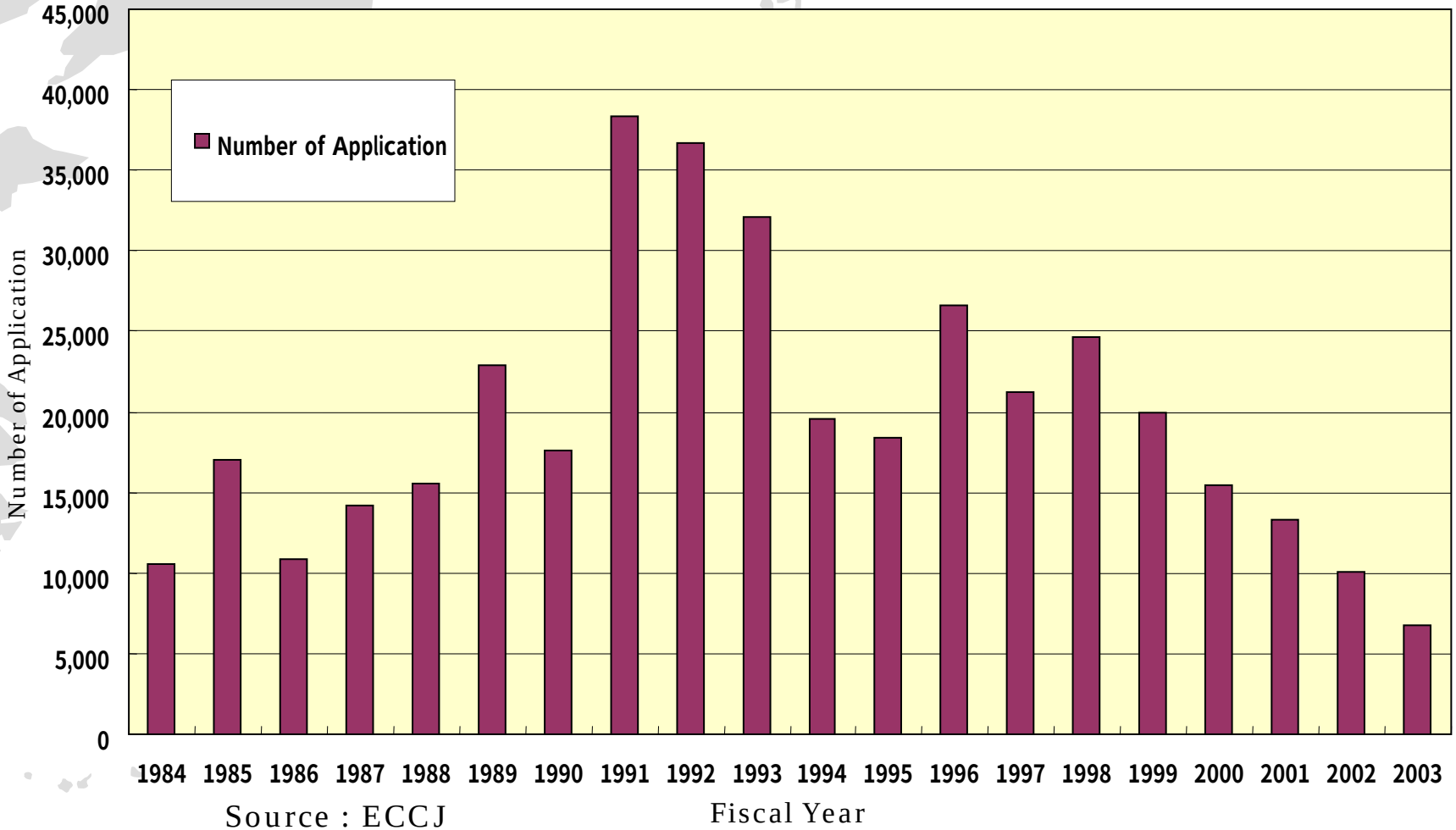
This program is applied to investment for 74 facilities promoting energy efficiency and new energy use.
(as of June 2005)

Source : ECCJ

2. Driving Forces

③ Government Policy

Trend of Energy Conservation Investments under the Financial Support of Tax Incentives



Source : ECCJ

2. Driving Forces

③ Government Policy

Supportive Measures

Subsidy

Subsidies are provided for enterprises who introduce high energy efficient facilities through NEDO.

(1) Industrial Sector
- Projects for installation of advanced energy efficiency facilities
  Large scale investment, High performance industrial furnace, etc.

(2) Housing and Building
- Projects for installation of high energy efficiency systems
  High efficiency hot water supply system
  Introduction of HEMS & BEMS (EMS: Energy Management System)
  High heat insulation houses and buildings

(3) Residential and Transportation Sector
- Promotion of model projects for reduction of CO2 emission

(4) R&D Projects for high energy efficient technologies and systems

NEDO : New Energy and Industrial Technology Development Organization (Japan)

Greening of Vehicle Taxes - Incentive Measures For Low-Emission Vehicles -

Green Tax Scheme (2004 and 2005)	Automobile Tax	Acquisition Tax	
Vehicles meeting 2010 fuel economy target values + 5% and "New ☆ ☆ ☆ ☆" vehicles	50% reduction	$3000 deductible from purchase price	"New ☆☆☆☆" : Motor vehicles whose emission values represent a greater than 75% reduction from 2005 regulatory levels for emissions.
Vehicles meeting 2010 fuel economy target values + 5% and "New ☆ ☆ ☆ " vehicles	25% reduction	$2000 deductible from purchase price	"New ☆☆☆": Motor vehicles whose emission values represent a greater than 50% reduction from 2005 regulatory levels.
Vehicles meeting 2010 fuel economy target values and "New ☆ ☆ ☆ ☆" vehicles	25% reduction	$2000 deductible from purchase price	

2. Driving Forces

③ Government Policy

Public R&D : Moonlight Program

1) MHD Power Generation

2) Waste Heat Utilization: Vacuum Heat Pump

3) High-efficient Gas Turbine: CCGT

4) New Type Batteries

5) Fuel Cell Batteries

6) Super Conductivity Electricity

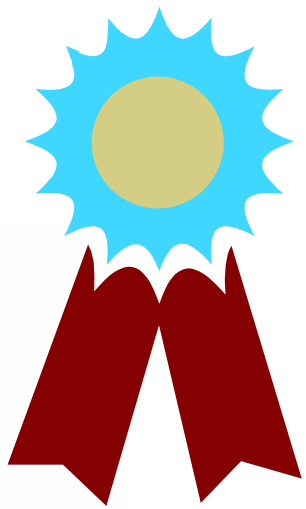
7) Ceramic Gas Turbine

2. Driving Forces

③ Government Policy

Public Awareness

Energy Conservation Award



2. Driving Forces

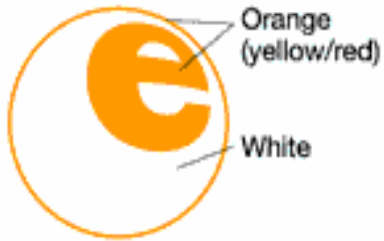
③ Government Policy

Public Awareness

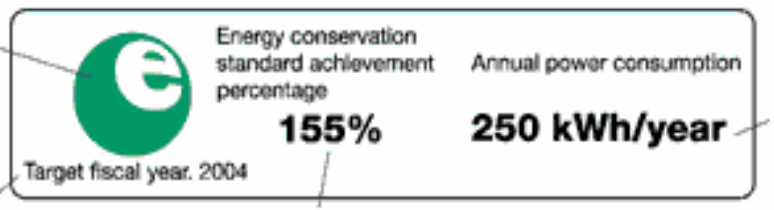
Labeling

Energy-saving symbol(Standard achieved)

Energy-saving symbol(Standard not achieved)



Label description(Specific energy-saving label image)



Energy-saving symbol

Target fiscal year

Indicates by when the product should achieve the standard. Target fiscal year is determined per product.

Energy conservation standard achievement percentage

Indicates by how much the product has achieved the standards.
Greater the value,
greater the enegy saving.
Target energy conservation standard values are set per product.

Energy consumption efficiency [Annual power conservation]

The numeric value is acquired using the measurement method prescribed per product.

2. Driving Forces

③ Government Policy

Public Awareness Campaign

Air conditioning at 28 degrees!!

“ Cool Biz ”

Energy Saving Effect: 210gwh（CO2　460kt）

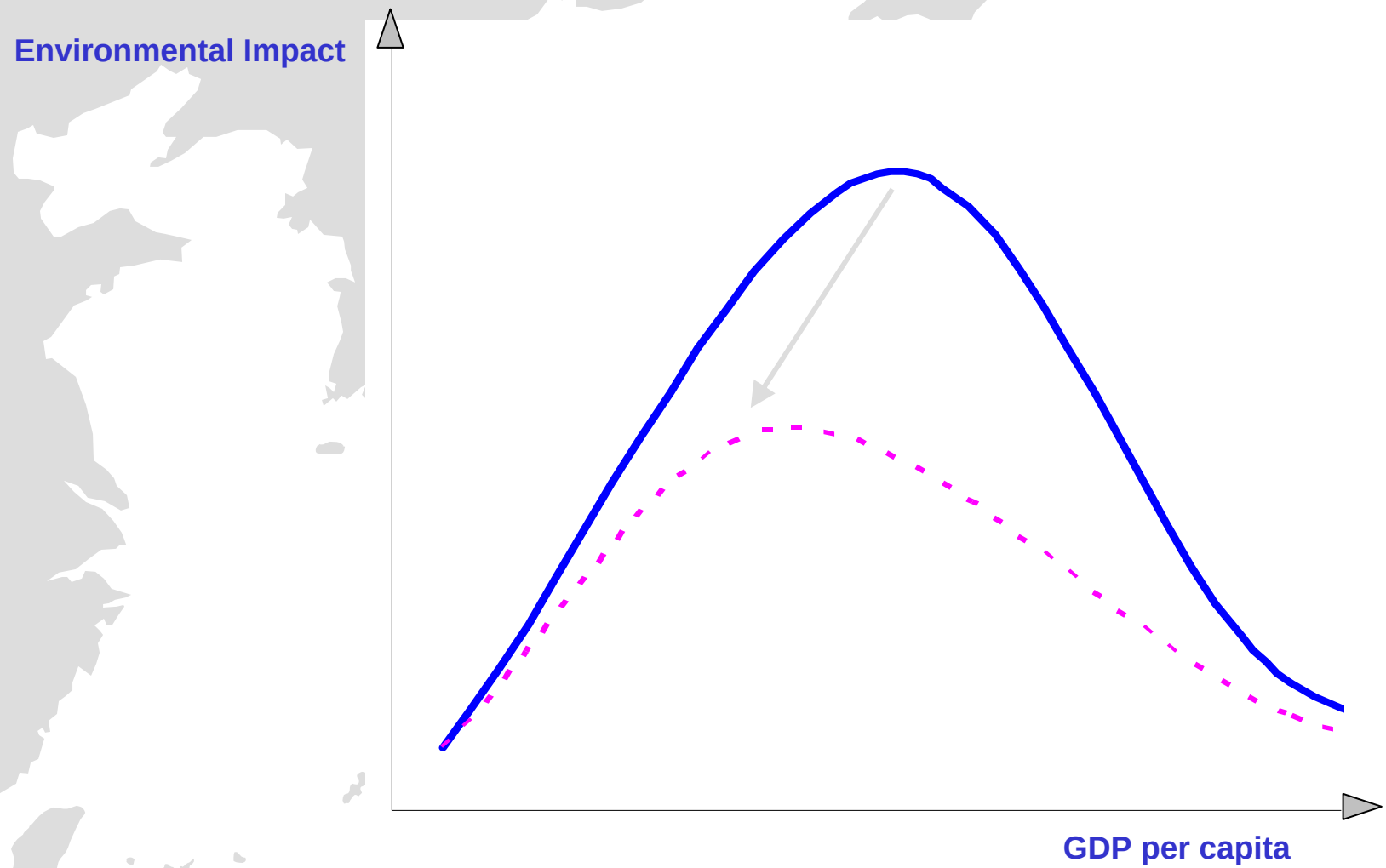
Financial measures to accelerate the introduction of energy efficient technologies/equipment

Target Projects	Organization	Interest rate
Energy conservation promotion projects for the industrial sector To reduce energy consumption by 100kL or more per year in terms of crude oil: (Effective energy use) (1) Equipment for collecting non-used energy, such as waste heat, or equipment for raising the efficiency of energy use, which will increase energy, use efficiency by 20% or more. (Promotion of the introduction of approved equipment for the industries of effective energy use type) (2) Enterprises approved under Article 4 of Energy Conservation Assistance Law install or improve approved equipment.	DBJ ODFC	Preferential rate 1
Energy conservation promotion projects for buildings (1) Repairing to improve in energy saving performance (exclusive to ESCO projects) (2) Enterprises approved under Article 4 of Energy Conservation Assistance Law, etc. constructed buildings , etc. (3) Buildings such as offices, department stores, hotels, etc. with mid-and- long-term plans according to Energy Conservation Law.	DBJ ODFC	Preferential rate 1
Energy conservation promotion projects for the consumer sector (1) Equipment which meets the Judgment Standard under the Energy Conservation Law, and projects which will meet the standard at an early stage	DBJ ODFC	Preferential rate 1
Improving Cogeneration Systems Cogeneration facilities with 60% or more of efficiency of primary energy use and 50kW or more output.	DBJ ODFC	Preferential rate 1

DBJ : Development Bank of Japan
ODFC: The Okinawa Development Finance Corporation

3. How Much Can Be Saved?

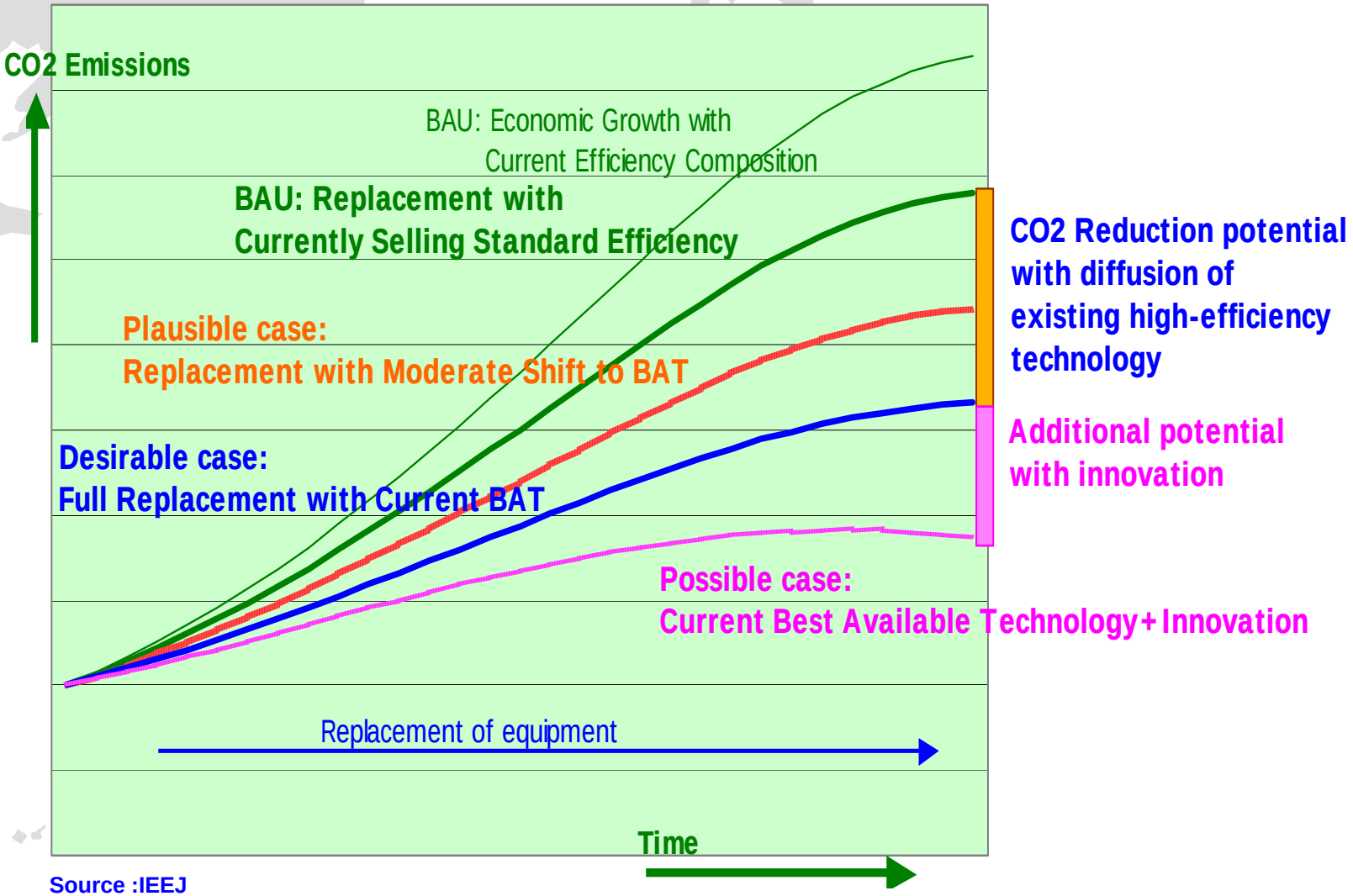
Environment Kuznetz Curve Should Be Challenged



3. How Much Can Be Saved?

How much can CO2 / energy consumption be saved?

Concept of Energy Conservation Potential with BAT



Source :IEEJ

3. How Much Can Be Saved?

How much can CO2 / energy consumption be saved?

Potential CO2 Reduction in 2020 (Plausible Case)

Unit: billion t-CO_2/year

Industry	Iron & Steel	.12
	Cement	.67
	Paper/Pulp	.14
EP	Coal	1.42
	Oil	.02
	Gas	.23
Transport	Personal Car	.54
Household	Refrigerator	.24
	Air-con	.15
	Lighting	.23
	Insulation	.07
Total		3.83

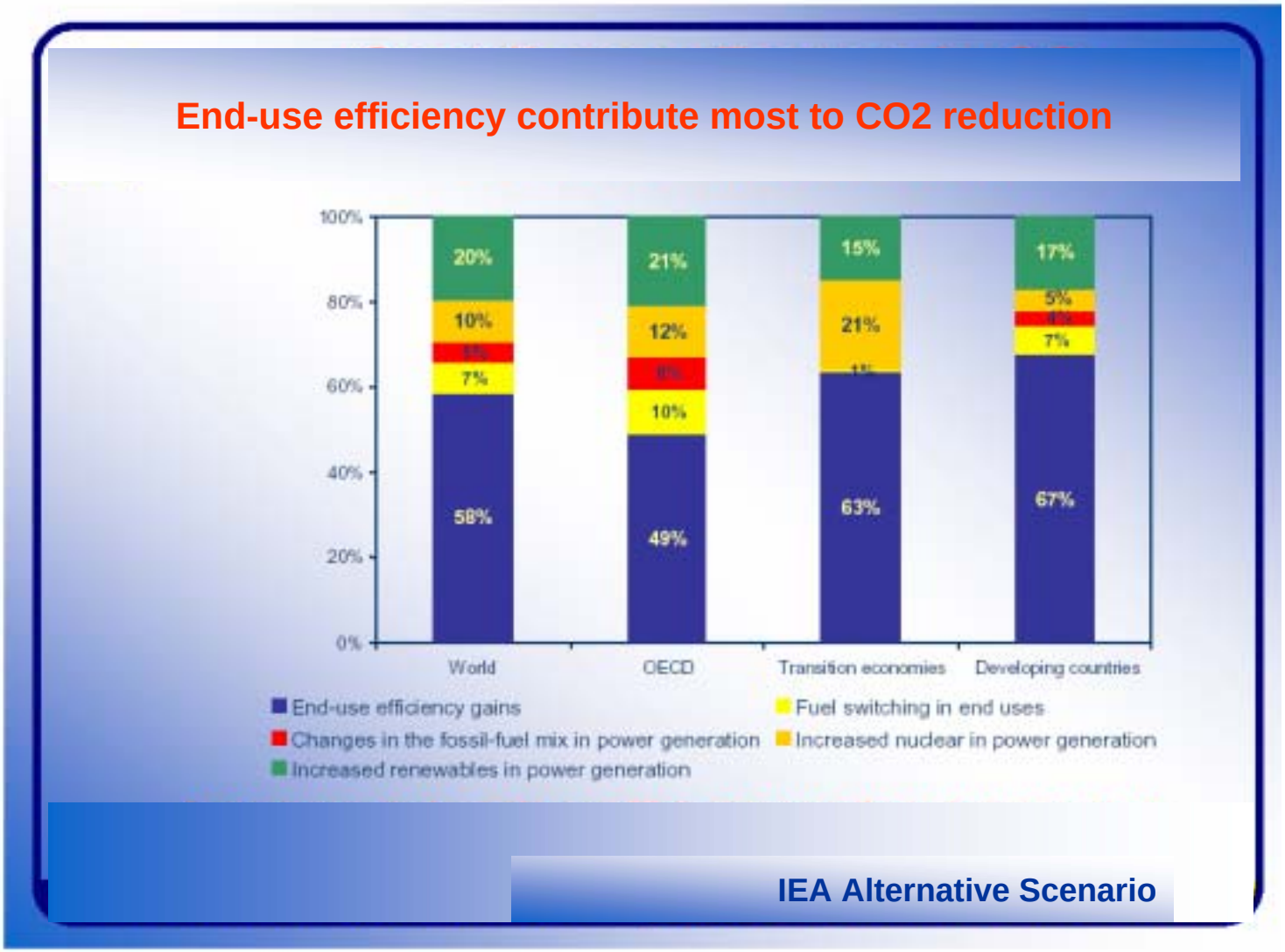
Reasonable efforts can Save 15% of world CO2 emission, comparable to size of Chinese CO2 emission

Source :IEEJ

3. How Much Can Be Saved?

How much can CO2 / energy consumption be saved?

IEA Alternative Scenario



Source : IEA

Japan – China Forum on Energy Saving and Environment

(May, 2006)

Agreements of Japan-China Energy Conservation and Environment Forum June, 2006

1. G-G base agreements

(1) Dialogue on energy conservation policy

- Japan: Ministry of Economy, Trade and Industry (METI), Agency for Natural Resources and Energy (ANRE)
- China: National Development and Reform Commission (NDRC)

(2) Cooperation for nurturing personnel for energy conservation

- Japan: METI/ANRE
- China: NDRC

(3) Training project for coal production and safety

- Japan: METI/ANRE
- China: National Safety Production Supervision Administration

2. B-B base agreements

(1) Joint venture to establish the Tianjin Binhai Energy & Development Co., Ltd.

- Japan: Yazaki Corporation
- China: Tianjin Economic-Technological Development Area Investment Co. (TEDA)

(Establishment of a joint venture for energy conservation diagnosis, technology service and management consultancy)

(2) Memorandum based on the consignment contract between the International Center for Environmental Technology Transfer (ICETT) and TEDA.

- Japan: ICETT
- China: TEDA (Training for treatment of drainage water and seminar for introducing environmental technology, etc.)

(3) Supply contract between Hitachi Appliances, Inc. and the Shenzhen Jialida Industrial Corporation, Ltd.

Japan: Hitachi Appliances, Inc

China: Shenzhen Jialida Industrial Corporation, Ltd.

(Supply contract for environmentally friendly air conditioning systems)

4. Conclusion (1)

Japanese Experience of Energy Conservation

1. Strong Policy Commitment
   - Law (regulation & promotion)
   - Incentives (subsidy, tax credit, soft loan)

2. Industry / Corporate Level Efforts
   - Energy Management
   - TQM (Kaizen)
   - Investment & Innovation in manufacturing process

3. Public Level Efforts
   - Education
   - Information

4. Conclusion (2)

Japan's Message : "*From Cool Japan to Cool Asia*"

- Asia should challenge the Environmental Kuznets Curve by introducing the best available technology

- Japan is ready to transfer experience and technology / know-how both on government and business levels