Results of the 6th Follow-up to the Keidanren Voluntary Action Plan on the Environment

(Measures against Global Warming; Industry-Specific Reports)

March 2004
Japan Business Federation (Nippon Keidanren)

Guide to Reading Sections on Specific Industries

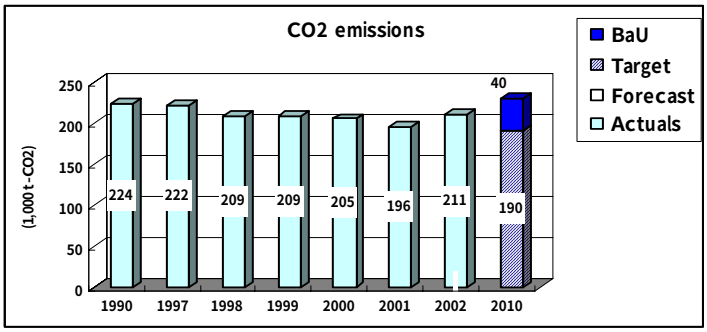
Industry Body

Target

1. Progress toward target

→ Graphical representation is given of progress being made by the industry toward its declared target. Where there are multiple targets, progress is depicted separately for each.

*BAU = increase in carbon dioxide emissions, energy consumption, carbon dioxide emissions intensity, or energy intensity expected in fiscal 2010, if fiscal 2003 Action Plans are not implemented as of fiscal 2003.



If no measures are taken, carbon dioxide emissions in 2010 will reach 2.3 million t-CO_2, or 400,000 t-CO_2 more than the target if measures are implemented.

●Reasons for adoption of target

→ Explains the reasons why the industry body adopted particular carbon dioxide emission, carbon dioxide emissions intensity, energy consumption, or energy intensity indices as its target.

2. Carbon dioxide emissions

→ Gives a graphical representation of carbon dioxide emissions in each industry. For industries that have defined their targets in terms of carbon dioxide emissions, the graphs appear under "Progress toward target," rather than here.

3. Steps taken to achieve targets

● Major

→ Describes major initiatives under each industry Action Plan to be implemented to achieve targets.

● Fiscal 2002 actual

→ Describes measures taken against global warming in fiscal 2002, the investment cost, and impact on carbon dioxide emissions.

4. Factors accounting for increases or decreases between fiscal 1990 and 2002

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

→ Results of quantitative analysis of factors accounting for increases or decreases in

carbon dioxide emissions in fiscal 2002 compared with fiscal 1990, divided into several elements. (Refer to p. 128 for method of factoral analysis)

● Reasons for variations in emissions in fiscal 2002
→ Main reasons why carbon dioxide emissions either rose or fell in fiscal 2002.

5. Reference data
→ Data other than the foregoing is given, disclosed by industry.

6. Other global warming initiatives
● Emissions from offices and in-house distribution
→ Describes carbon dioxide emissions and reduction initatives associated with activities other than core business, such as the use of head or branch office buildings, or on-site transport or other in-house distribution activities.

● Evaluation from an LCA perspective
→ Gives specific examples of initiatives that contribute to reducing carbon dioxide emissions from other sectors, through the provision of products that reduce carbon dioxide emissions when used.

● Greenhouse gases other than carbon dioxide
→ Gives examples of measures being taken to reduce substitute chlorofluorocarbons (HFC, PFC, SF_6), methane, and nitrous oxide.

● Kyoto Mechanism projects
→ Gives examples of Joint Implementation (JI), Clean Development Mechanism (CDM), and other activities that comply with the Kyoto Mechanism.

7. Environmental management and conservation in overseas business activities
→ Updates on ISO 14001 certification and international environmental conservation activities are given.

Footnotes:
→ Where necessary, information includes: basic industry data (principal products, percentage of companies participating in survey), an outline of adjustment of boundaries between industries, assumptions underlying fiscal 2010 targets and forecasts, and industry-specific methods for estimating carbon dioxide emissions (use of the demand-end figure rather than the power generation-end figure for carbon dioxide emission intensity for electricity, etc.).

Contents

- **Items in parentheses indicate the indices being used to define the goals of each industry**
- **E: Energy Converting Sector, I: Industrial Sector, O: Offices and Households Sector, T: Transport Sector**

{Carbon dioxide emission levels}

{Carbon dioxide emissions intensity}

{Energy consumption}

{Energy intensity}

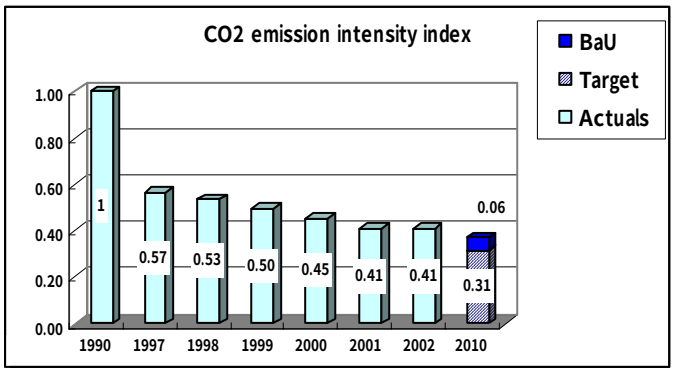
{Other}

{Reference Data}

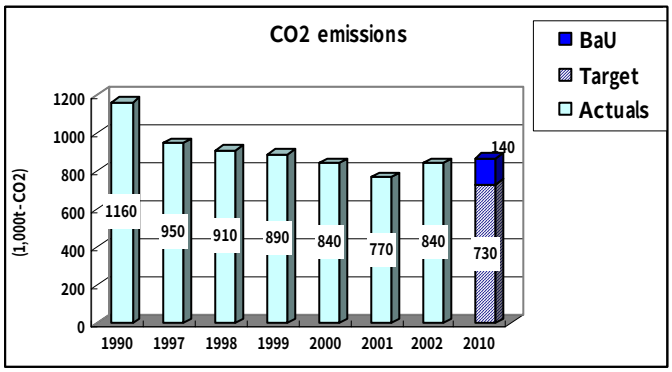
The Japan Gas Association

To reduce carbon dioxide emission in fiscal 2010 to 0.73 million t-CO_2 from 1.16 million t-CO_2 in fiscal 1990. To be accomplished by reducing carbon dioxide emission intensity per cubic meter of gas in city gas manufacturing and distribution to one-third of fiscal 1990 levels.

1. Progress toward target and carbon dioxide emissions



Note: A value of one (1) has been assigned to the fiscal 1990 intensity index.



Note: Emissions are the figures from manufacture and distribution of city gas.

Assigning a value of one (1) to the carbon dioxide emission intensity index for city gas manufacturing and distribution in fiscal 1990 gives: 0.57 in fiscal 1997; 0.53 in fiscal 1998; 0.50 in fiscal 1999; 0.45 in fiscal 2000; and 0.41 in fiscal 2001/2002. The industry has established a target of 0.31 for fiscal 2010. It has recorded the following carbon dioxide emissions: 1.16 million t-CO_2 in fiscal 1990; 950 thousand t-CO_2 in fiscal 1997; 910 thousand t-CO_2 in fiscal 1998; 890 thousand t-CO_2 in fiscal 1999; 840 thousand t-CO_2 in fiscal 2000; and 770 thousand t-CO_2 in fiscal 2001. With fiscal 2002 levels at 840 thousand t-CO_2, a 28% decline compared with fiscal 1990, the industry is on track to achieving its fiscal 2010 target of reducing emissions to 730 thousand t-CO_2 in fiscal 2010—37% less than the level in fiscal 1990.

If voluntary action plans were not implemented in the years following fiscal 2002, the industry forecasts that carbon dioxide emissions would be 870 thousand t-CO_2 in fiscal 2010, or 4% more than in fiscal 2002 and 25% less than in fiscal 1990.

●Reasons for adoption of target

Based on long-term forecasts of energy demand and supply, the industry estimates that manufacture of city gas in fiscal 2010 will approximately double, to 32 billion cubic meters, from 15.9 billion cubic meters in the fiscal 1990 level. The targets were therefore extrapolated from the pattern of manufacturing in fiscal 2010, which assumes all businesses will be supplying high-calorific gas.

3. Steps taken to achieve targets

- Major
  - City gas manufacturing was made more efficient by converting to high-calorific gas produced from natural gas.
    Less heating fuel was used by adopting highly efficient LNG (liquefied natural gas) gasification facilities in place of reforming facilities reacting naphtha or LPG at high temperatures.
  - Various energy-conserving measures were implemented at city gas manufacturing plants.

- Fiscal 2002 actual
  - City gas manufacturing was made more efficient by converting to high-calorific gas produced from natural gas.
  - A number of energy-saving initiatives were undertaken, including improvements in the use of LNG cryogenic energy at city gas manufacturing plants, introduction of gas pressure power generation, progress in achieving energy-saving operation, and the introduction of energy-efficient equipment.

4.Reasons for variations in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Analysis of the factors that have caused fiscal 2002 carbon dioxide emissions to fall 28% on 1990 levels is summarized in the following table.

The "amount attributable to direct industry influence" item in the table indicates the emissions calculated by the average coefficient of emission from all power sources (the average of all power sources). However in many cases these are not accurate. Usually under-evaluation arises from the use of the average coefficient, even though thermal power sources correspond to the change of purchased power. Therefore we indicate the variation in the “amount attributable to indirect industry influence” item.

An example from the following table would be that the differential in emissions as a result of reduction initiatives by the gas industry alone is –1.0 million t-CO_2 (total of fuel and power reductions), but what the figure shows is that actual reductions due to the effect of reduced power on reducing thermal power generation (the amount reduced in Japan overall as a result of power reduction by the gas industry) was assessed at –1.0 million t-CO_2 – 0.12 million t-CO_2 = –1.12 million t-CO_2.

Gas Industry Factorial Analysis (compared with fiscal 1990) (units: 1,000 t-CO_2)

	AMOUNT ATTRIBUTABLE TO DIRECT INDUSTRY INFLUENCE	
Carbon dioxide emissions in fiscal 1990	1160	
Carbon dioxide emissions in fiscal 2002	840	
Variation in carbon dioxide emissions	-320	
[1] Contribution from change in emission coefficient	+70	AMOUNT ATTRIBUTABLE TO INDIRECT INDUSTRY INFLUENCE
[2] Contribution from change in manufacturing volume	+610	+100
[3] Contribution due to industry initiatives	-1000	-120

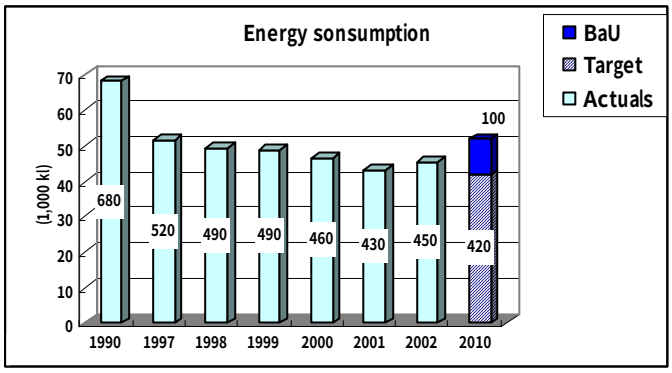
- Reasons for variations in emissions in fiscal 2002

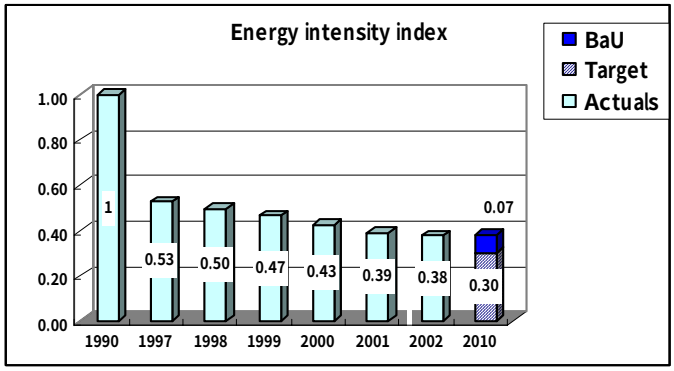
  Carbon dioxide emissions in fiscal 2002 declined from fiscal 1990 levels, but were up compared with the 0.770 thousand t-CO_2 recorded in fiscal 2001, to 840 thousand t-CO_2. Factorial analysis of fiscal 2001 in the same manner as shown in the earlier table gives the following table. The increase due to the largest increase in history in manufacturing volume (manufacturing volume went from 25.7 billion cubic meters to 27.9 billion cubic meters), and worsening of the emission coefficient of power (from 1.0 to 2.1 t-C/10,000 kWh) was greater than the reduction due to industry initiatives, resulting in an increase in emissions.

Gas Industry Factorial Analysis (compared to fiscal 2001) (units: 1,000 t-CO_2)

	AMOUNT ATTRIBUTABLE TO DIRECT INDUSTRY INFLUENCE	
Carbon dioxide emissions in fiscal 2001	770	
Carbon dioxide emissions in fiscal 2002	840	
Variation in carbon dioxide emissions	+70	
[1] Portion attributable to worsening in emission coefficient of power	+20	AMOUNT ATTRIBUTABLE TO INDIRECT INDUSTRY INFLUENCE
[2] Portion attributable to increase in manufacturing volume	+70	+20
[3] Portion attributable to industry initiatives	-20	-20

5. Reference data





Note: A value of one (1) has been assigned to the intensity index of fiscal 1990.

Actual energy consumption (in crude oil equivalents) was: 680 thousand kl in fiscal 1990; 520 thousand kl in fiscal 1997; 490 thousand kl in fiscal 1998; 490 thousand kl in fiscal 1999; 460 thousand kl in fiscal 2000; 430 thousand kl in 2001; and 450 thousand kl in fiscal 2002. The industry target for fiscal 2010 is 420 thousand kl—a reduction of 39% on fiscal 1990. If voluntary action plans were not implemented, energy consumption in 2010 would be 520 thousand kl, representing a 24% reduction on fiscal 1990. Finally, assigning a value of one (1) to the fiscal 1990 energy intensity index gives: 0.53 in fiscal 1997; 0.50 in fiscal 1998; 0.47 in fiscal 1999; 0.43 in fiscal 2000; 0.39 in fiscal 2001; 0.38 in fiscal 2002; and 0.30 in the target fiscal 2010.

6. Other global warming initiatives

- Emissions from offices and in-house distribution

  In the 1999, 2000, and 2001 fiscal years, the industry emitted 110 thousand t-CO_2 per year from offices and other locations, and 120 thousand t-CO_2 in fiscal 2002. In these fiscal years, it also emitted 10 thousand t-CO_2 per year from activities related to in-house distribution.

- Contributions to the consumer goods and transport sectors (impact on products and services)
  - The diffusion of energy-efficient gas equipment such as latent heat recovering hot water heaters and internal flame gas tables was encouraged.

- Carbon dioxide emissions were reduced through greater use of distributed generation energy systems, such as cogeneration or fuel cells.
- Emission of atmospheric pollutants was reduced through greater use of natural gas vehicles .
- Environmental education activities included eco-cooking, support for environmental studies in schools, and activities to promote the environment in regional areas.

- Kyoto Mechanism projects
  - Plantation projects in Australia
  - Implementation of feasibility studies into CDMs in Thailand, Indonesia, and Brazil, and a JI in Hungary, under the NEDO 2002 Basic Survey for Joint Implementation Project
  - A joint initiative with the Indonesian government to use VA mycorrhiza fungi in conservation of the global environment; the Project for the Practical Application of Afforestation Technology in Tropical Wastelands

7. Environmental management and conservation in overseas business activities

- Twenty-one firms obtained ISO14001 certification. The amount of gas manufactured at facilities operated by these firms accounted for approximately 85% of all gas supply nationwide.
- Companies are transferring technology to combat global warming and other environmental problems, primarily to developing nations. Examples include the following.
  a. A study concerning a project in the Philippines for a centralized district cooling and power supply system, and a feasibility study for a project to convert vehicles in the Manila Metropolitan Area to compressed natural gas (CNG)
  b. Transfer of technology relating to a catalytic wet oxidation process to the Yunnan High Technology Environment Protection Engineering Company in Yunnan Province, China
  c. Survey of introduction of LNG terminals in northern Taiwan and Macao, and participation in such projects

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Note 1: The principal product of the industry is city gas, and 100% of member companies (233) participated in the follow-up survey. Carbon dioxide emissions from offices and transport are a summation of figures provided by three main firms (accounting for 75% of gas supply nationwide).

Note 2: In calculating carbon dioxide emissions from the purchase of electricity, the industry has used demand-end figures.

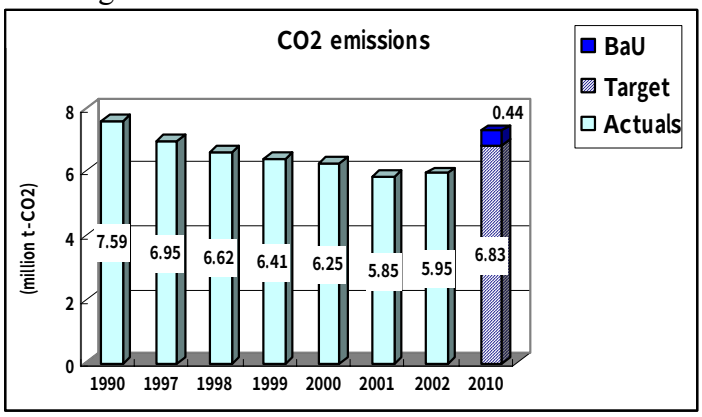
Note 3: Emissions in fiscal 2010 on a business-as-usual (BAU) basis if efforts were not made in the years following fiscal 2002 to reduce carbon dioxide were calculated by multiplying actual fiscal 2002 carbon dioxide emissions by the ratio of gas to be manufactured in fiscal 2010 to that manufactured in fiscal 2002. The difference in carbon dioxide emissions resulting from differences between the target amounts of electricity purchased and BAU electricity purchased was calculated using the average thermal power coefficient.

Note 4: City gas manufactured in fiscal 2002 totaled 27.9 billion m^3 (equivalent to 41,860 kJ/m^3), or approximately 1.7 times the amount manufactured in fiscal 1990. The industry forecasts that city gas production in fiscal 2010 will be roughly twice the amount produced in 1990 (32.0 billion m^3, based on forecasts of long-term energy demand).

Japan Automobile Manufacturers Association

To reduce total carbon dioxide emissions from automobile production plants operated by the 14 member companies of the Japan Automobile Manufacturers Association* to 90% of fiscal 1990 levels by fiscal 2010.

1. Progress toward target



Carbon dioxide emissions from the automobile manufacturing process* were: 7.59 million t-CO_2 in fiscal 1990; 6.95 million t-CO_2 in fiscal 1997; 6.62 million t-CO_2 in fiscal 1998; 6.41 million t-CO_2 in fiscal 1999; 6.25 million t-CO_2 in fiscal 2000; 5.85 million t-CO_2 in fiscal 2001; and 5.95 million t-CO_2 in fiscal 2002. From fiscal 2002 on, the forecast for carbon dioxide emissions*[4], should there be no new initiatives or changes in the makeup of new products, is 7.27 million t-CO_2 in fiscal 2010. The target for fiscal 2010 is 6.83 million t-CO_2—10% less than in fiscal 1990.

●Reasons for adoption of target

The products the industry produces are many and varied, and weight and shape vary according to product. As this makes it difficult to calculate intensity per unit production, total carbon dioxide emissions have been chosen as the index.

3. Steps taken to achieve targets

- Major
  - Energy conservation measures continue to be applied to all phases of production (specifically, energy supply and energy-consuming equipment).
  - Operation and control technology has been made more sophisticated (energy use is fine-tuned to production volumes).
  - Lighter materials have been used.

● Fiscal 2002 actual (figures in crude oil equivalents)

Initiatives taken		
1. Plant and equipment	(1) Improvements in supply side	11,000 kl
	(2) Improvements in consumption side	18,000 kl
2. Improved productivity	(1) Improvements in operational management	2,000 kl
	(2) Scrapping and amalgamating production lines	20,000 kl
3. Fuel conversion		8,000 kl

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Fiscal 2002 saw the steady emergence of the effects of the usual ongoing countermeasures and proactive implementation of further energy-saving measures.

In the longer term, a comparison with fiscal 1990 shows that production values rose 1.3%, but carbon dioxide emissions fell significantly, by 22%, to 5.95 million t-CO_2.

A year-on-year comparison also reveals that despite a 9% increase in production value, carbon dioxide emissions rose proportionately less than production value, being limited to a year-on-year increase of 1.7%.

Reduction Initiatives

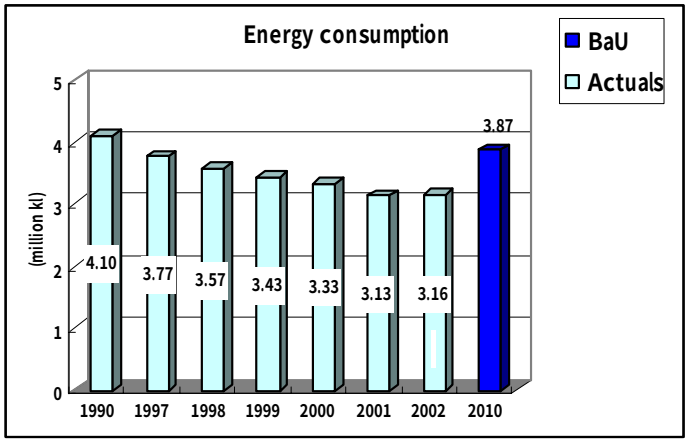
Supply side: introduction of cogeneration and upgraded compressors

Consumption side: Improved operational and management measures in relation to plant and equipment, such as the introduction of energy-efficient production lines; improvements in productivity through integration and scrapping of production lines; fuel conversion

Comparative analysis with fiscal 1990

Variation due to changes in power intensity*[3]	0	0%
Variation due to industry initiatives, changes in plant operating rates, etc.	-1.738 m t-CO_2	-22.9%
Variations due to changes in production activity	98,000 t-CO_2	1.29%
Total	-1.64 m t-CO_2	-21.6%

5. Reference data



The industry has consumed the following amounts of energy: 4.1 million kl in fiscal 1990; 3.77 million kl in fiscal 1997; 3.57 million kl in fiscal 1998; 3.43 million kl in fiscal 1999; 3.34 million kl in fiscal 2000; 3.13 million kl in fiscal 2001, and 3.16 million kl in fiscal 2002. BAU for fiscal 2010 is 3.87 million kl.

6. Other global warming initiatives

- Contributions to the transport and consumer goods sectors (impact on products and services)

The industry is seeking to increase automobile fuel efficiency. It is also seeking to develop the technology for, increase the choice of models, and encourage the acceptance of clean-energy vehicles, as well as to improve traffic flow by becoming proactive about Intelligent Transport Systems. The industry has committed maximum effort to achieving the government's carbon dioxide reduction target for 2010, particularly through improvements in vehicle fuel efficiency. It is also working toward the early introduction of vehicles that meet the fuel consumption standards defined in the revised Law Concerning the Rational Use of Energy. In fiscal 2002, approximately 70% of vehicles shipped domestically were compliant, and it is expected that by fiscal 2005, a figure of over 90% will be achieved.

- Greenhouse gases other than carbon dioxide
  - Operation of systems to recover and destroy designated fluorocarbons (CFC12 and HFC134a)

    To protect the ozone layer and slow global warming, the industry acted promptly to convert from CFC12 as the coolant for car air conditioning systems to HFC134a.

    The operation of a system of trade in and destruction of designated vehicular fluorocarbons, in accordance with the Law Concerning the Recovery and Destruction of Fluorocarbons (enacted on 1 October, 2002) resulted in 270 tons of CFC12 and 120 tons of HFC134a being destroyed by fiscal 2002.
  - Curbing emissions of HFC134a

    HFC134a, the coolant now used in car air conditioners, has one-sixth the impact on global warming of CFC12. Additional initiatives to decrease the amount of coolant used

and leakage, as well as to improve refilling methods, are considered to have further reduced the global warming effects of HFC134a over its lifespan, including when it is in use, to around one-fifteenth that of CFC12. The major steps being taken to limit emissions are: (1) development and introduction of coolant-conserving air conditioners; and (2) research into air conditioning systems that do not use HFC134a.

7. Environmental management and conservation in overseas business activities

In obtaining ISO14001 certification, Japan's automobile manufacturers are configuring systems that are more environmentally responsible.

Notes

*1 Some 100% of industry members participated in the follow-up survey (14 companies with domestic production facilities; the truck and bus division of Mitsubishi Motors Corporation was spun off as a separate company to form Mitsubishi Fuso Truck and Bus Corporation, while at the same time it became a member of the Association in its own right, bringing membership to 14 companies), representing 100% of the energy consumed in the motor vehicle manufacturing process.

*2 The principal products of the industry are Motor vehicles, Motor cycles and KD parts.

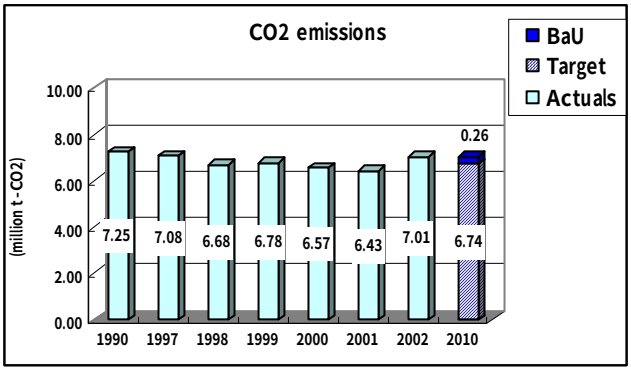
*3 The carbon dioxide coefficient for electricity has been fixed at the fiscal 1990 level of 0.104 kg-C/kWh, and carbon dioxide emissions were calculated from data aggregated from the plants for manufacturing 4- and 2-wheel vehicles and their parts, owned by the 14 member companies.

*4 Forecasts for fiscal 2010 are based on the economic growth rate (2% increase annually) given at the time of promulgation of the new Guidelines for Measures to Prevent Global Warming (2002).

Japan Auto Parts Industries Association

To reduce carbon dioxide emissions by 7% by fiscal 2010, compared with fiscal 1990 levels.

1. Progress toward target



Association member companies have emitted the following amounts of carbon dioxide: 7.25 million t-CO_2 in fiscal 1990; 7.08 million t-CO_2 in fiscal 1997; 6.68 million t-CO_2 in fiscal 1998; 6.78 million t-CO_2 in fiscal 1999; 6.57 million t-CO_2 in fiscal 2000; 6.43 million t-CO_2 in fiscal 2001; and 7.01 million t-CO_2 in fiscal 2002. Association member companies are aiming for a 7% reduction in emissions in fiscal 2010 compared with fiscal 1990, equaling 6.74 million t-CO_2. If voluntary action plans were not implemented, the forecast for carbon dioxide emissions in fiscal 2010 would be 7.01 million t-CO_2—3.4% lower than in fiscal 1990.

●Reasons for adoption of target

Carbon dioxide emissions were chosen as the index, in accordance with national reduction targets.

3. Steps taken to achieve targets

- Major
  - Methods of operation have been improved, including ending the practice of keeping machinery on during production downtime.
  - Equipment and machinery efficiency has been improved.
  - Processes have been rationalized.
  - Cogeneration and other approaches are being used to recover energy in the form of steam created from the combustion of fuels, for use in heating.
  - Energy is being converted.
  - Industry members are engaging in mutual awareness-raising and sharing of energy-saving technologies.

● Fiscal 2002 actual

The auto parts industry manufactures a diverse range of products, and their manufacturing processes are therefore all dissimilar. It is thus difficult to obtain a unified picture of the estimated value of investment and the actual effect of energy conservation examples. The Association has, however, surveyed its members to determine the status of a range of initiatives, asking questions about some 60 categories of energy-conservation initiatives. These fall under the headings of daily management, management of plant and equipment operation, production process improvements, introduction of energy-conserving equipment, heat source and fuel conversion, and heat recovery. The Association is also encouraging energy-conserving activity by sharing related information among its members, in association with the introduction of new technologies.

4. Reasons for variations in carbon dioxide emissions

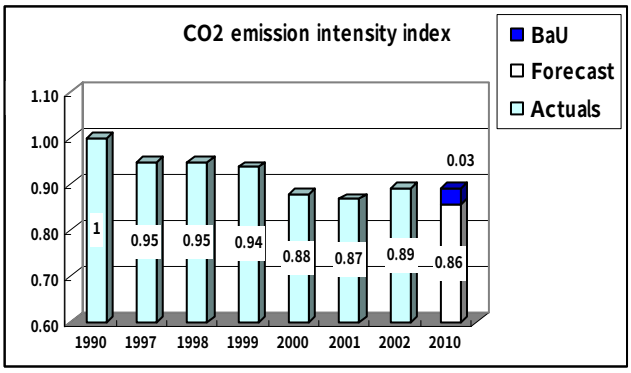
● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

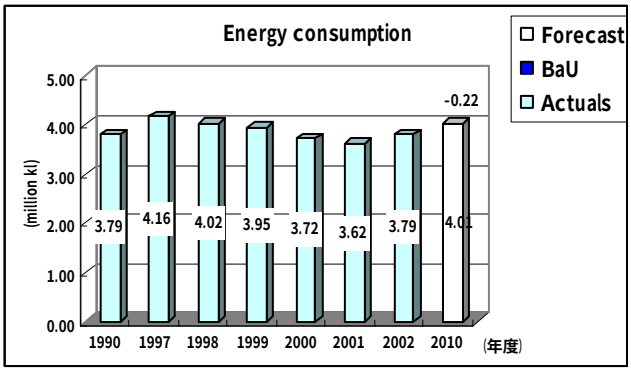
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	7,253	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	7,007	
Variation in CO_2 emissions	-246	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	56	0.8%
Contribution from production activity	579	8.0%
Contribution from emissions per unit of production activity	-881	-12.2%

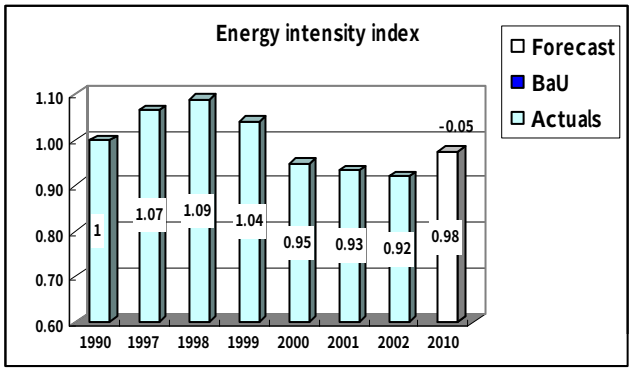
●Reasons for variations in emissions in fiscal 2002

Growth in production of motor vehicle parts caused a 6% year-on-year increase in the value of shipments of parts. As electricity accounts for approximately 70% (in crude oil equivalents) of all energy consumed, the 0.066 increase in the carbon dioxide emissions coefficient of electricity was a significant factor in the increase in carbon dioxide emissions. The fact that the increase in carbon dioxide emissions was limited to approximately 9% on a year-on-year basis is, however, the result of ongoing efforts by all member companies to conserve energy.

5. Reference data







Assigning a value of one (1) to the fiscal 1990 carbon dioxide emission intensity index gives 0.95 in fiscal 1997, 0.95 in fiscal 1998, 0.94 in fiscal 1999, 0.88 in fiscal 2000, 0.87 in fiscal 2001, and 0.89 in fiscal 2002. Association member companies are forecasting 0.86 in fiscal 2010.

Association member companies have recorded the following energy consumption figures: 3.79 million kl in fiscal 1990; 4.16 million kl in fiscal 1997; 4.02 million kl in fiscal 1998; 3.95 million kl in fiscal 1999; 3.72 million kl in fiscal 2000; 3.62 million kl in fiscal 2001; and 3,79 million kl in fiscal 2002. It is forecasting consumption of 4.01 million kl in fiscal 2010—5.8% higher than in fiscal 1990.

Assigning a value of one (1) to the fiscal 1990 energy intensity index gives 1.07 in fiscal 1997, 1.09 in fiscal 1998, 1.04 in fiscal 1999, 0.95 in fiscal 2000, 0.93 in fiscal 2001, and 0.92 in fiscal 2002. The industry is forecasting an index of 0.98 in fiscal 2010.

6. Other global warming initiatives

● Emissions from offices and in-house distribution

Carbon dioxide emissions associated with the use of offices in 2002 were approximately 140,000 t-CO_2, while emissions associated with in-house distribution were approximately 70,000 t-CO_2. Some 40% of companies reported by sector.

Initiatives to limit carbon dioxide emissions associated with office use included optimizing air conditioner operation, turning off unused lighting, limiting cooling and heating, and limiting the use of office automation.

Initiatives in the area of in-house distribution included more efficient distribution systems, better management of corporate fleet vehicles, and limits on the use of private vehicles for commuting.

● Evaluation from an LCA perspective

The industry is unstinting in its efforts to achieve lighter motor vehicle parts and materials, modular parts, and a reduction in the number of components. Manufacturers are individually engaged in LCA evaluation of various parts, but overall evaluation has yet to be achieved.

● Greenhouse gases other than carbon dioxide

CFC12, HFC134a: In relation to projects to recover and destroy car air conditioning coolants, the Association cooperated in projects run by the Japan Automobile Recycling Promotion Center.

HFC22, etc.: In relation to maintaining, servicing, and scrapping factory coolers and building air conditioners, the industry is actively recovering coolants in accordance with the Law Concerning the Recovery and Destruction of Fluorocarbons.

7. Environmental management and conservation in overseas business activities

The Association is encouraging members to acquire ISO14001 certification, by providing guidance in relation to “green” procurement. The Association continues to support training of consultants and internal auditors to advise on certification.

The Association is educating member companies to adopt environmental conservation initiatives in their overseas business activities, under the same system applied to domestic members.

Note: * The principal product of the industry is automobile parts. The participation rate by industry member companies in the follow-up survey was 180, representing approximately 80% of the industry’s total value of production. Those figures were the basis for estimates of figures for the industry.

* Motor vehicle parts comprise a wide variety of products. Many member companies therefore overlap with other industries. Effective this survey, the proportion of emissions attributable to member companies for which follow up reports to another association had been confirmed was excluded, and emissions were adjusted accordingly. The main industries affected included: electrical; electronic information technology; rubber; electric cable; motor vehicle bodies; industrial machinery; and bearings.

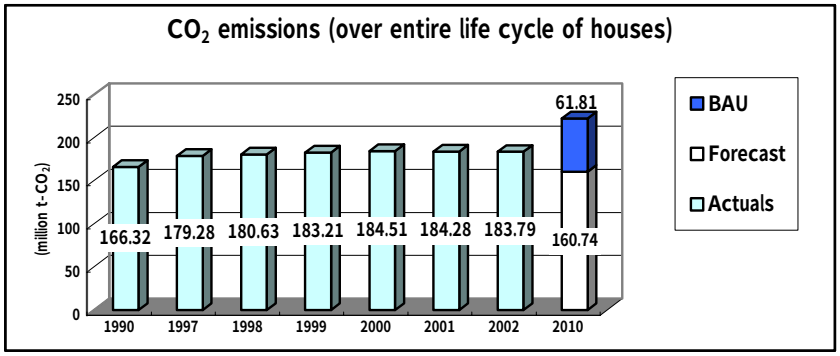
* To estimate fiscal 2010 targets and forecasts it was assumed that the total value of turnover into the future would vary around a central figure of 13 trillion yen, commensurate with fiscal 1990 levels.

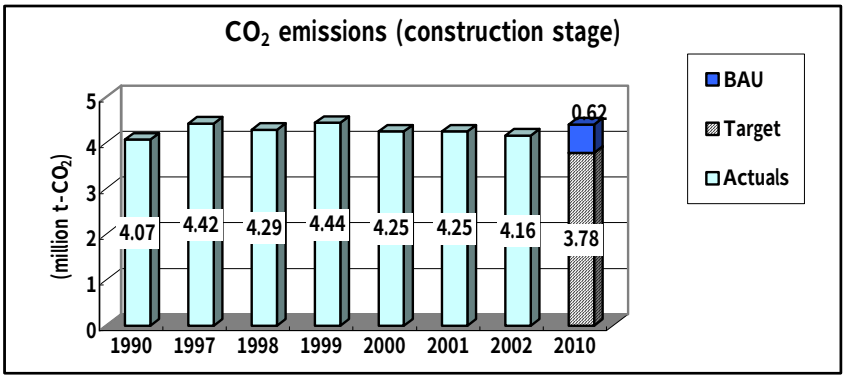
Japan Federation of Housing Organizations

To reduce carbon dioxide emissions at each stage of the housing life cycle, and, by fiscal 2010, to stabilize emissions over the entire life cycle of a house at fiscal 1990 levels. The target at the construction stage is to reduce emissions by 7% from fiscal 1990 levels.

1. Progress toward target

The housing industry estimates that carbon dioxide emitted over the entire house life





cycle was: 166.32 million t-CO_2 in fiscal 1990; 179.28 million t-CO_2 in fiscal 1997; 180.63 million t-CO_2 in fiscal 1998; 183.21 million t-CO_2 in fiscal 1999; 184.51 million t-CO_2 in fiscal 2000; 184.28 million t-CO_2 in fiscal 2001; and 183.79 million t-CO_2 in fiscal 2002. The industry forecasts emissions of 160.74 million t-CO_2 in fiscal 2010—a 3.3 % decline compared with fiscal 1990. If voluntary action plans were not implemented, carbon dioxide emissions in 2010 would be 222.55 million t-CO_2, or 34% higher than in fiscal 1990. One initiative in implementing voluntary action plans will be the development of guidelines that incorporate a description of the roles of people involved in the lifecycle of a house, and the points they should note. This information will then be compiled and published as “Environmental Guidelines for Housing.”

The industry estimates that it has emitted the following amounts of carbon dioxide during the construction of housing: 4.07 million t-CO_2 in fiscal 1990; 4.42 million t-CO_2 in fiscal 1997; 4.29 million t-CO_2 in fiscal 1998; 4.44 million t-CO_2 in fiscal 1999; 4.25 million

t-CO_2 in fiscal 2000; 4.25 million t-CO_2 in fiscal 2001; and 4.16 million t-CO_2 in fiscal 2002. Its goal for fiscal 2010 is 3.78 million t-CO_2—a 7% reduction compared with fiscal 1990. If voluntary action plans were not implemented, emissions in 2010 would be 4.40 million t-CO_2, or 8% more than in fiscal 1990.

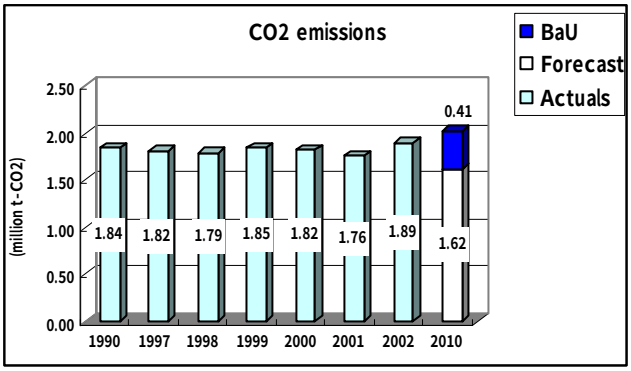
Note: The housing life cycle is divided into the stages of materials, construction, use, demolition, recycling, processing, and disposal. The following assumptions are built into the fiscal 2010 forecast. New housing starts will be: an average of 1.46 million per year from fiscal 1990 to 2000; 1.39 million per year from fiscal 2001 to 2005; 1.23 million per year from fiscal 2006 to 2010; and 860,000 per year from fiscal 2011 to 2020. The forecasts also assume that the scale of construction (floor space per dwelling) will sustain the same growth as for the most recent ten-year period (from fiscal 1986 to 1995), during which time floor space increased 1.14 times.

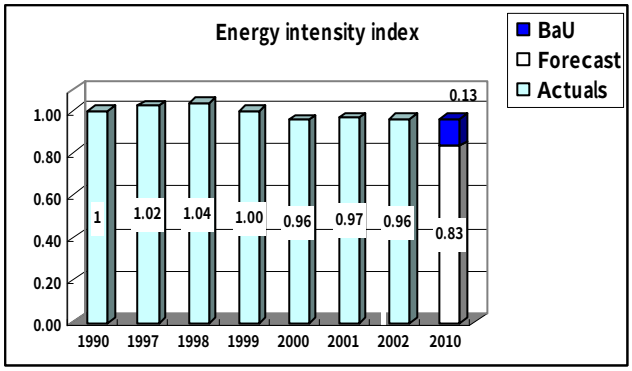
The Japan Rubber Manufacturers Association

For the immediate future, as a countermeasure to global warming, the Association has established the following target regarding the reduction of carbon dioxide emanating from fuel and power used in production activities, which it will strive to achieve. The Association also intends to apply Life Cycle Assessment (LCA) to future efforts to reduce carbon dioxide.

Total carbon dioxide emissions and energy intensity in fiscal 2010 will be maintained at fiscal 1990 levels.

1. Progress toward target





The industry has emitted the following amounts of carbon dioxide: 1.84 million t-CO_2 in fiscal 1990; 1.82 million t-CO_2 in fiscal 1997; 1.79 million t-CO_2 in fiscal 1998; 1.85 million t-CO_2 in fiscal 1999; 1.82 million t-CO_2 in fiscal 2000; and 1.76 million t-CO_2 in fiscal 2001. Carbon dioxide emissions in fiscal 2002 were 1.89 million t-CO_2—an increase of 130,000 t-CO_2 on the previous fiscal year, and an increase of 50,000 t-CO_2 on the benchmark year (fiscal 1990). The industry will continue its measures to achieve the target in fiscal 2010 of levels lower than those in fiscal 1990, and is expecting to be able to reduce carbon dioxide emissions to 1.62 million t-CO_2.

Assigning a value of one (1) to fiscal 1990 energy intensity index gives 1.02 in fiscal 1997, 1.04 in fiscal 1998, 1.00 in fiscal 1999, 0.96 in fiscal 2000, 0.91 in fiscal 2001, and 0.96 in fiscal 2002. In fiscal 2010, the industry expects an energy intensity of 0.83, through the achievement of the aforementioned goal.

- Reasons for adoption of target

The range of products is diverse, and weight and shape differ according to product. The industry has therefore adopted intensity per amount (weight) of new rubber consumed in products as the index, rather than intensity per number of units.

3. Steps taken to achieve targets

- Major steps

(i) Steps already taken

a. New and expanded co-generation

- Established new and expanded existing highly efficient co-generation capability by burning city gas

b. Introduction of high-efficiency equipment

- Installed highly efficient equipment in the form of fans, motors, and lighting

c. Implementation of conventional, basic energy- conserving activities

- Insulated or maintained the heat in heated plants and equipment, prevented leaks, and recovered heat
- Improved operational efficiency by limiting revolutions, operating intermittently, and miniaturizing

d. Greater efficiency through energy conversion

- Improved processes through measures such as the introduction of furnaces burning waste oil and gasified heating furnaces

e. More efficient air conditioning systems

- Introduced ice-storage or absorption refrigerators

f. Other

- Developed low-fuel tires with reduced rolling resistance, based on LCA for tires, in order to achieve a comprehensive reduction in carbon dioxide emissions (including in the product usage stage), and conducted a partial product release
- Conducted a review of operating styles across all operating sites, scrapped or amalgamated production processes and plant and equipment, and generally improved production efficiency

(ii) Steps to be taken

a. Continue traditional energy-conserving activities while becoming more proactive

- Continue traditional energy-conserving activities of the type described at (i) above while becoming more proactive

b. Conduct regular information-gathering activities

- As part of ongoing traditional activities, gather energy consumption data and examples of energy-conserving measures, and apply them to encouraging their uptake and further development within the industry

c. Convert fuel and effect changes in manufacturing processes toward enhanced energy efficiency, and target overall reductions in carbon dioxide emissions

d. Implement efforts to achieve innovative manufacturing methods

- Continue efforts at each operating site to develop innovative manufacturing methods that will substantially reduce the processes involved in tire manufacture

4. Reasons for variations in carbon dioxide emissions

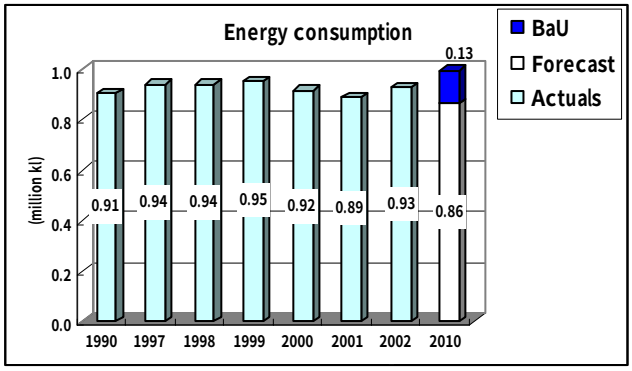
- Analysis of factors accounting for increases or decreases between fiscal 1990 and fiscal 2002

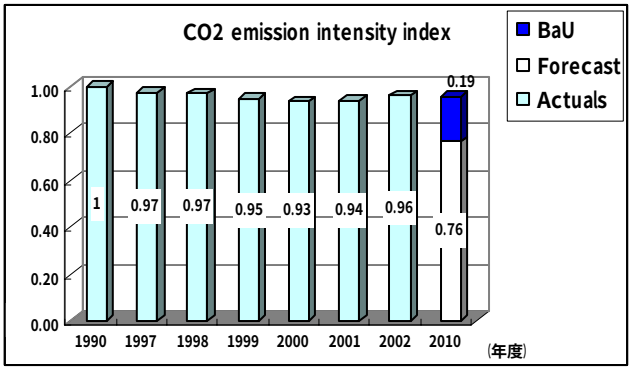
The following method (suggested by the Keidanren Secretariat) was used to analyze the factors in the increase of fiscal 2002 emissions compared with fiscal 1990.

Using the coefficient of carbon dioxide emissions from energy as a fixed value irrespective of each fiscal year, the emissions calculated are "fixed coefficient emissions." The difference between actual emissions and fixed coefficient emissions is the "contribution from changes in coefficient of carbon dioxide emissions." Assuming a relationship which is " fixed coefficient emissions = production activity × emissions per unit of production activity ", the amount of change in fixed coefficient emissions is broken down into "contribution from production activity" and "contribution from emissions per unit of production activity."

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (excluding industrial processes)	1,844	
Fiscal 2002 CO_2 emissions (excluding industrial processes)	1,894	
Variation in CO_2 emissions	50	
(Breakdown) Contribution from changes in coefficient of CO_2 emissions	11	0.6%
Contribution from production activity	124	6.7%
Contribution from emissions per unit of production activity	-85	-4.6%

5. Reference data





Energy consumption was 905,000 kl in fiscal 1990, 940,000 kl in fiscal 1997, 940,000 kl in fiscal 1998, 952,000 kl in fiscal 1999, 916,000 kl in fiscal 2000, and 889,000 kl in fiscal 2001. In fiscal 2002, it rose 42,000 kl on the fiscal 2001 figure, to 931,000 kl. Compared with the fiscal 1990 benchmark year figure of 905,000 kl, consumption increased 26,000 kl.

Assigning a value of one (1) to the fiscal 1990 carbon dioxide intensity index gives 0.97 in fiscal 1997 and fiscal 1998, 0.95 in fiscal 1999, 0.93 in fiscal 2000, and 0.94 in fiscal 2001.

The index was 0.96 in fiscal 2002—a 0.02 point increase on the previous fiscal year, and down 0.04 points on the benchmark year (fiscal 1990). The industry is forecasting a carbon dioxide intensity index of 0.76 in fiscal 2010, achieving the target levels lower than those in fiscal 1990.

Note: The principal products of the industry are rubber products. Some 23 companies participated in the follow-up survey, representing approximately 85% of production (based on consumption of new rubber) in the industry.

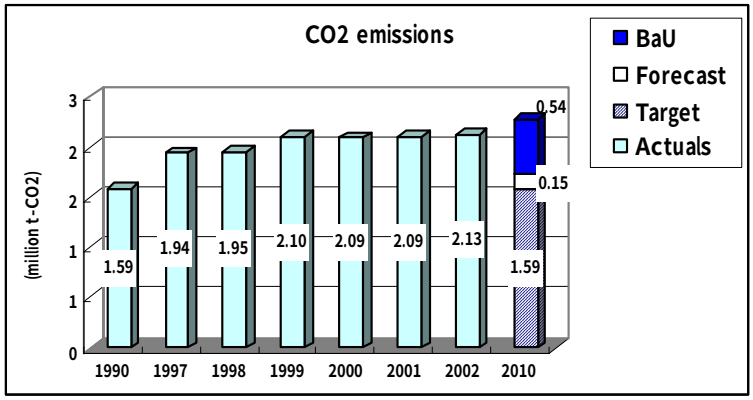
Boundaries have been adjusted. (Redundant data compiled by the Japan Urethane Foam Association dating back to fiscal 1990 (the benchmark year) was excluded from figures reported by this Association (The Japan Rubber Manufacturers Association).

Estimates of fiscal 2010 forecasts (implementation of countermeasures) were derived from forecasts surveyed from member companies. The BAU was calculated by multiplying the growth rate(*) of production (1.07%) to the individual energy consumption. (*)The growth rate was forecast for fiscal 2010 from the actual production of fiscal 2002.

The Federation of Pharmaceutical Manufacturers' Associations of Japan;
Japan Pharmaceutical Manufacturers Association

To keep the amount of carbon dioxide emitted in fiscal 2010 at less than fiscal 1990 levels. To reduce the amount of HFCs used in pharmaceutical aerosols by 25% of levels if plans were not implemented, in fiscal 2010.

1. Progress toward target



Carbon dioxide emissions in fiscal 2002 were 2.13 million t-CO_2, representing an increase of 33.8% over the level of 1990 (benchmark year). Assigning a value of 100 to fiscal 1990 carbon dioxide gives 132 in each of fiscal 1999, 2000 and 2001, and 134 in fiscal 2002, indicating that since fiscal 1999, carbon dioxide emissions have tended to remain roughly level, at approximately 2.10 million tons.

Assigning a value of one (1) to the fiscal 1990 correlation between carbon dioxide emissions and the value of production of pharmaceuticals gives 0.9 in fiscal 1999, and shows an improvement in production value intensity from fiscal 2000 to 2002, of 0.88 to 0.83.

Fiscal year	Carbon dioxide emissions (million t-CO_2)	Comparison to fiscal 1990	Value of production of pharmaceuticals (billion yen)	Comparison to fiscal 1990	Production value intensity
1990	1.590	100.0	4014.2	100.0	1.00
1997	1.939	121.9	5486.7	136.7	0.88
1998	1.954	122.9	5407.7	134.7	0.90
1999	2.101	132.1	5768.5	143.7	0.90
2000	2.091	131.5	5973.5	148.8	0.88
2001	2.092	131.6	6358.9	158.4	0.83
2002	2.128	133.8	6524.7	162.5	0.83

The forecast for carbon dioxide emissions in fiscal 2010 is 1.74 million t-CO_2, which will exceed the target by 150,000 t-CO_2. The BAU forecast is for 2.28 million t-CO_2.

- Reasons for adoption of target

In the research, development, and manufacture of pharmaceutical products, efficacy, safety, and product quality are protected by adherence to standards such as GLP*[1] and GMP*[2]. At the same time, it is difficult to reduce the energy consumed by the necessary air conditioning equipment. Reduction targets commensurate with the level of Keidanren's common goal for global warming countermeasures were adopted according to trends in the energy consumption of member companies, forecasts of their pharmaceutical production volumes, and voluntary action plans engaged in by member companies.

HFC targets were set at a level that could technically be achieved with some effort.

*[1] Good Laboratory Practice: Guidelines for achieving reliable test data from safety testing of pharmaceuticals
*[2] Good Manufacturing Practice: Criteria for achieving appropriate quality and production management in the manufacture of pharmaceuticals

3. Steps taken to achieve targets

- Major

It is reasonable to expect that domestic production in the pharmaceuticals industry will increase only marginally in the coming years, in the face of policies aimed at cutting medical expenses and lowering the cost of pharmaceuticals. The energy needed to maintain and operate the facilities required to satisfy advances in international standards relating to the efficacy, safety, and quality of pharmaceuticals is trending upwards, and radical energy-saving measures are necessary to achieve 2010 emissions targets. The main industry initiatives to achieve the target are as follows:

- Facilities and equipment are being converted to those that are energy-efficient.
- Cogeneration systems are being introduced.
- Waste heat is being recovered, and operations are being better managed to promote energy savings.
- Ways are being sought to improve the use of air conditioning systems and refrigeration and heating equipment, including starting, stopping, and hours of operation.
- Methods for controlling energy-supply equipment are being reviewed, and efficient operating systems are being introduced.
- Alternative energies are being introduced (solar power, fuel cells).
- The use of night-time power is being promoted (heat storage).

- Fiscal 2002 actual

In 2002 the industry invested ¥1.66 billion in plant and equipment for energy conservation and prevention of global warming. As a result, it achieved a reduction in carbon dioxide emissions of 14,995 tons. The energy-conserving effect in crude oil equivalents is estimated to have represented a reduction of 9,416 kl. Major energy conservation and global

warming prevention initiatives reported are as follows.

MOST NUMEROUS INITIATIVES	INVESTMENT (millions of yen)	PREVENTION OF GLOBAL WARMING ($t\text{-}CO_2$)
Adjustment of air conditioner operating conditions (35)	162	1612
Conversion to inverter technology (fans, agitators, and lighting) (14)	250	1993
Lighting (7)	5	39

MOST EXPENSIVE INITIATIVES	INVESTMENT (millions of yen)	PREVENTION OF GLOBAL WARMING ($t\text{-}CO_2$)
Introduction of total heat exchangers	50	133
Replacement at upgrade with high performance units (motors, etc.) (6)	109	59
Use of small boilers, restricted number of boilers, operational improvements (3)	135	514
Introduction of cogeneration (1)	25	45
Introduction of heat storage systems (3)	497	1562

4. Reasons for variations in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

An analysis of the factors that caused carbon dioxide emissions in fiscal 2002 to increase by 33.8% on fiscal 1990 levels is given below. The analysis was based on calculation of an estimate of emissions due to the fiscal 2002 level of activity when emissions per unit of production activity in fiscal 1990 are taken as fixed, and the difference between that figure and actual emissions was separated into the contribution from the power industry (change in coefficient of emissions per unit of power purchased) and industry efforts.

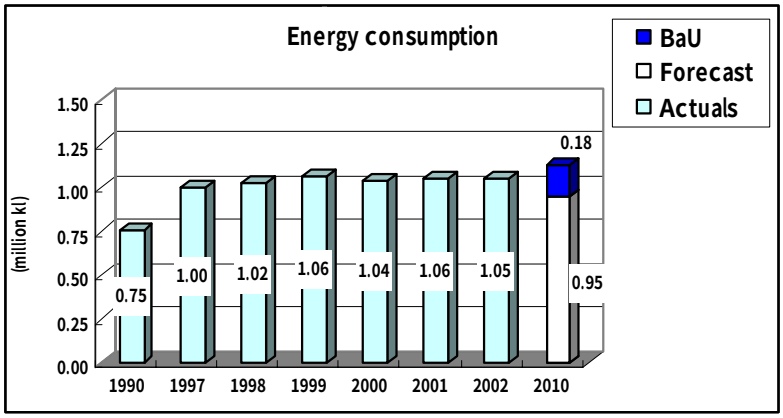
Proportion attributable to improved power intensity	-23 (‘000 $t\text{-}CO_2$)	-1.45%
Proportion attributable to industry effort	-433 (‘000 $t\text{-}CO_2$)	-27.2%
Increased production	994 (‘000 $t\text{-}CO_2$)	62.5%
Total	538 (‘000 $t\text{-}CO_2$)	33.8%

- Reasons for variations in emissions in fiscal 2002

Reason for increase	Increased production	Worsening energy efficiencies	Higher operating rates for plant and equipment	Expansion of in-house power generation	Climatic influences	Other (organizational reform, etc.)
Number of companies	29	1	16	1	4	13

Reason for decrease	Decreased production	Improved energy efficiencies	Lower operating rates for plant and equipment	Fuel conversion	Climatic influences	Other
Number of companies	11	18	2	6	2	4

5. Reference data



Since fiscal 1999, energy consumption has remained at around 1.05 million kl (in crude oil equivalents).

Energy consumption (crude oil equivalents: ‘000 kl)

	FY1990	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002
Other than power	376	518	526	571	569	568	570
Purchased power	377	483	497	492	470	487	477
Power consumed (%)	50.0	48.3	48.6	46.3	45.2	46.2	45.6

The proportion of purchased power in energy consumed appears to be declining. The trend is thought to be a result of the energy-saving effect of the conversion to inverters and introduction of cogeneration systems.

6. Other global warming initiatives

- Emissions from offices and in-house distribution

The total value of carbon dioxide emissions associated with energy consumption in offices was 84,000 t-CO_2, equal to 4.3% of total emissions of 1,937,000 t-CO_2 from factories and research facilities of the companies responding to this question (not all companies). Emissions of carbon dioxide from gasoline burned by vehicles used in business activities were estimated at 118,000 t-CO_2, 9% of total emissions. Progress on the introduction of low-fuel-consumption (low-pollutant) vehicles was made, with 25 of 70 respondent companies indicating they have already introduced such vehicles.

- Greenhouse gases other than carbon dioxide

The target of reducing the amount of alternatives to fluorocarbons (greenhouse gases, HFCs) used in metered-dose pharmaceutical sprays by 25% in 2010 from levels if initiatives were not taken has led to the commercialization of powder-based inhalants that do not use HFCs.

Already, five products have been converted from the use of fluorocarbons (CFCs, ozone depleting substances) to direct powder inhalants and are available on the market.

7. Environmental management and conservation in overseas business activities

- Some 43 companies and 104 operating sites have obtained ISO14001 certification (out of 79 member companies of Japan Pharmaceutical Manufacturers Association as of November 2002).
- Some 15 companies have 26 research facilities offshore, while 18 have 73 factories offshore (according to an activity survey from the Japan Pharmaceutical Manufacturers Association as of fiscal 2001).

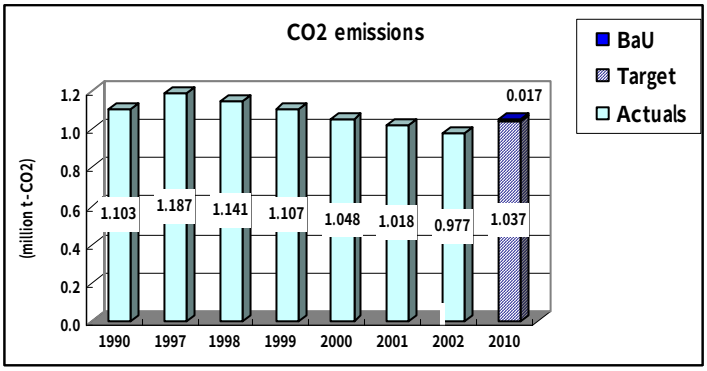
  In their overseas operations, companies as a matter of course comply with the rules and regulations of the countries in which they are investing. In line with the policy of voluntary action established by the Japan Pharmaceutical Manufacturers Association, member companies also adopt a global perspective in seeking to protect the environment. Inspections are also carried out in accordance with the same standards as within Japan.

Note: The principal product of the industry is pharmaceuticals. The rate of participation in the follow-up survey was 5.0% (70 out of 1,396), representing 97.8% of production value. Forecasts for fiscal 2010 are from individual company estimates.

Brewers Association of Japan

To reduce carbon dioxide emissions from beer production at breweries in fiscal 2010 to 94% of the fiscal 1990 level.

1. Progress toward target



The beer industry has emitted the following amounts of carbon dioxide: 1.103 million tons in fiscal 1990; 1.187 million tons in fiscal 1997; 1.141 million tons in fiscal 1998; 1.107 million tons in fiscal 1999; 1.048 million tons in fiscal 2000; 1.018 million tons in fiscal 2001; and 0.977 million tons in fiscal 2002—an 11.5% reduction on fiscal 1990 levels. The target for fiscal 2010 carbon dioxide emissions is a 6% reduction on fiscal 1990 levels to 1.037 million tons, but the latest forecasts are that if initiatives are ongoing, the actual will be 0.952 million tons, representing a 13.8% reduction on fiscal 1990 levels. If voluntary action plans were not implemented, emissions in fiscal 2010 would be 1.054 million tons, or 4.5% less than in fiscal 1990.

- Reasons for adoption of target

The forecast for fiscal 2010 is for a slight increase in manufacturing volume compared to fiscal 1990 actuals, and a decision was made to make a direct comparison with carbon dioxide emissions. (Refer to Reference Data for comparisons according to energy consumption, carbon dioxide intensity index, and energy intensity index.)

3. Steps taken to achieve targets

- Major

1. More efficient anaerobic wastewater processing equipment has been installed.
2. Cogeneration systems have been introduced.
3. Productivity has been improved by increasing the proportion of canned products.
4. High-efficiency boilers have been introduced.
5. Energy-saving activities are being encouraged.

- Fiscal 2002 actual
  - Factories and production lines were integrated, scrapped, and upgraded to achieve productivity improvements.
  - A greater proportion of products were produced in cans to achieve productivity improvements.
  - Efficiency was improved through the introduction of anaerobic wastewater processing equipment and cogeneration systems.

4. Reasons for variations in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between 1997 and 2002

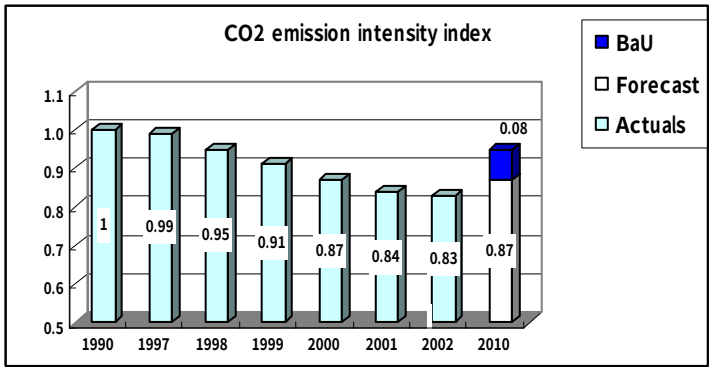
The factors accounting for the decline in actual emissions in 2002 compared with 1990 were analyzed using the following method.

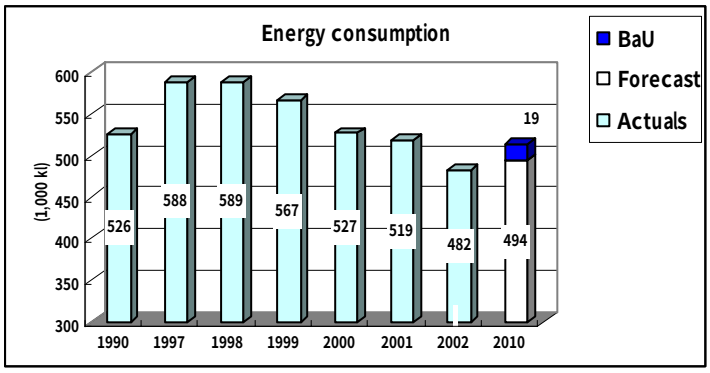
Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed "fixed coefficient emissions." The difference between actual emissions and fixed coefficient emissions is deemed the "contribution from changes in coefficient of carbon dioxide emissions." Assuming a relationship whereby fixed coefficient emissions = production activity x emissions per unit of production activity enables the amount of change in fixed coefficient emissions to be broken down into "contribution from production activity" and "contribution from emissions per unit of production activity."

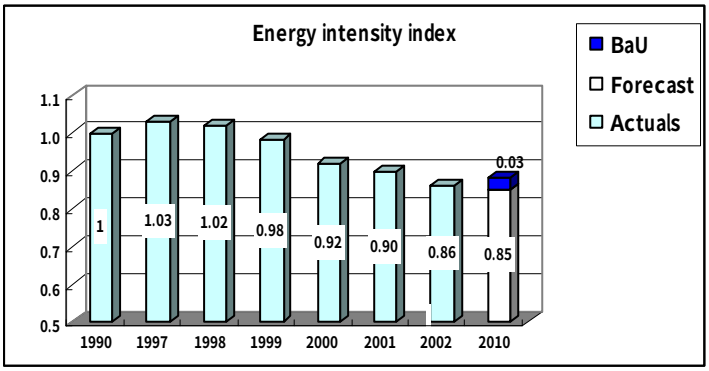
Such separation indicates that despite an increase in production volume, reductions in emissions per unit of production (-17.6%) have enabled a significant reduction in emission levels compared with those of fiscal 1990.

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including industrial processes)	1103	
Fiscal 2002 CO_2 emissions (including industrial processes)	977	
Variation in CO_2 emissions	-126	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	4	0.4%
Contribution from production activity	64	5.8%
Industry efforts	-194	-17.6%

5. Reference data







6. Other global warming initiatives

- Emissions from offices and in-house distribution

  The industry has adopted the following measures to reduce carbon dioxide in the consumer goods and transport sectors.

  - Using lighter packaging materials, such as lighter cans, bottles, and cardboard
  - Promoting the idea of turning off truck engines rather than leaving them idling
  - Reducing carbonic gas emissions by jointly delivering products and raw materials
  - Introducing larger delivery vehicles and low-pollutant vehicles (CNG vehicles)

- Greenhouse gases other than carbon dioxide
  - Installing freon-free equipment
  - Strict implementation of measures to recover unnecessary freon

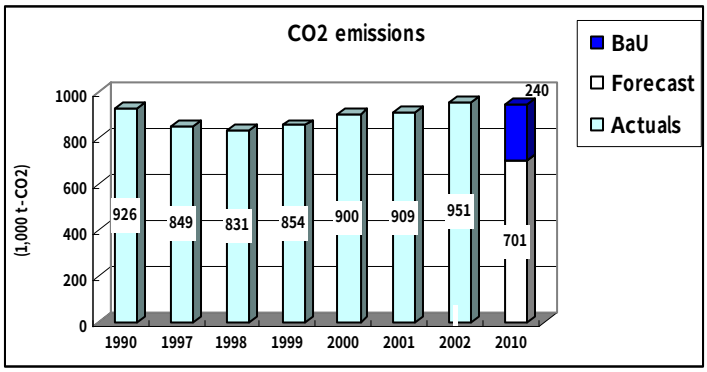
7. Environmental management and conservation in overseas business activities
    - Obtaining and maintaining ISO14001 certification for breweries
    - Disclosing information through ongoing publication of environmental reports, applying the principles of environmental accounting, environmental management, and environmental conservation in overseas business activities

Note: The principal product of the industry is beer (including low-malt *happoshu* beer substitutes). The participation rate in the follow-up survey was 80% (4 out of 5), representing 99% of sales. Figures on carbon dioxide emissions are aggregates of data provided by the four participating companies. In fiscal 2010, the industry is projecting a 10.0% increase in production compared with fiscal 1990, and is forecasting a decline in the emission intensity index of 21.9% (from improvements in productivity through integration, closure and upgrade of factories and production lines, an increase in the amount of canned products in total product mix, the introduction of anaerobic waste-water treatment and cogeneration facilities, and the encouragement of energy-saving activities).

Japan Auto-Body Industries Association

To reduce carbon dioxide emissions by 10% compared with fiscal 1990 by fiscal 2010.

1. Progress toward target



The auto-body industry has emitted the following amounts of carbon dioxide: 926,000 t-CO_2 in fiscal 1990; 849,000 t-CO_2 in fiscal 1997; 831,000 t-CO_2 in fiscal 1998; 854,000 t-CO_2 in fiscal 1999; 900,000 t-CO_2 in fiscal 2000; 909,000 in fiscal 2001; and 951,000 t-CO_2 in fiscal 2002. It is forecasting emissions of 701,000 t-CO_2 in fiscal 2010, representing a decline of 24.3% compared with fiscal 1990, and exceeding the reduction target of 10%. If voluntary action plans were not implemented, the industry would emit 941,000 t-CO_2 in fiscal 2010—a 1.7% increase.

3. Steps taken to achieve targets

- Major

  Sharing of case studies on a wide range of initiatives taken to limit global warming

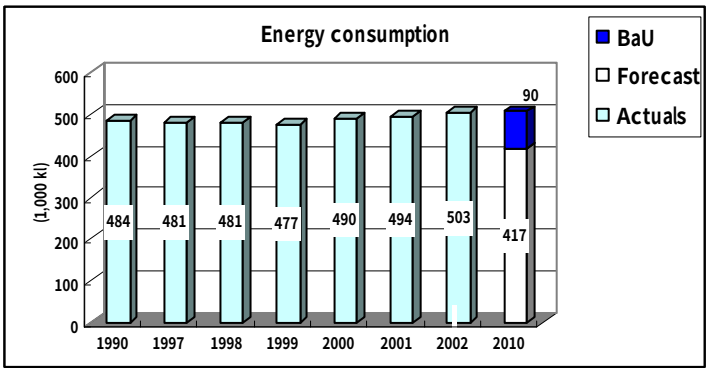
- Fiscal 2002 actual
  - Introduction of cogeneration facilities
  - Improved plant operating rates through integration of factories
  - Upgrades to equipment that is low in fuel consumption
  - Conversion of fuel to city gas
  - Introduction of new fabrication methods (sheet metal work and welding)

4. Reasons for variations in carbon dioxide emissions

●Reasons for variations in emissions in fiscal 2002

- Reductions due to changes in operating systems (two complete shifts to two continuous shifts), the effect of introduction of energy-saving equipment such as inverters, concentrated production, and additional cogeneration
- Increases attributable to higher sales

5. Reference data



The industry has recorded the following energy consumption: 484,000 kl in fiscal 1990; 481,000 kl in fiscal 1997; 481,000 kl in fiscal 1998; 477,000 kl in fiscal 1999, 490,000 kl in fiscal 2000; 494,000 in fiscal 2001; and 503,000 kl in fiscal 2002. It is forecasting consumption of 417,000 kl in fiscal 2010, representing a 13.8% decrease compared with fiscal 1990. If voluntary action plans were not implemented, industry would consume 507,000 kl of energy in fiscal 2010—an increase of 4.8%.

6. Other global warming initiatives

- Emissions from offices and in-house distribution
  - Reviewing temperature settings for office air conditioning
  - Conducting energy- and resource-saving activities under ISO14001
  - Raising awareness about energy conservation, and taking careful note of energy savings on a daily basis

- Greenhouse gases other than carbon dioxide
  - There is some use of other greenhouse gases (e.g. HFCs, PFCs, and SF_6), but no surveys have yet been conducted of initiatives being taken in relation to them.
  - Fluorocarbons and other greenhouse gases are being recovered and broken down in accordance with the Law Concerning the Recovery and Destruction of Fluorocarbons.

7. Environmental management and conservation in overseas business activities

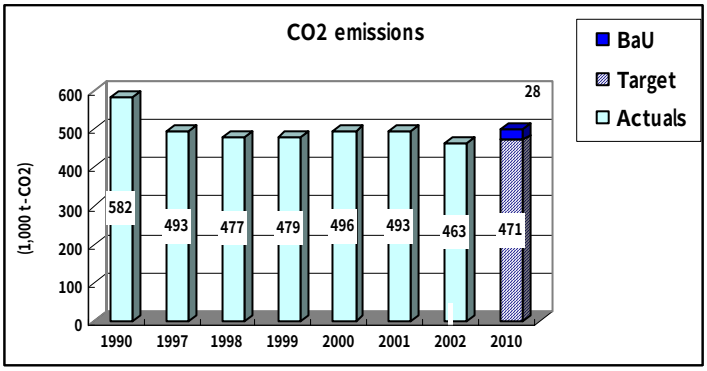
- The industry has formulated a Voluntary Action Plan on the Environment and is engaged in activities to reduce carbon dioxide. The Association publishes the results of carbon dioxide emissions surveys in the institutional journal, *Shatai News*. Through tabulating and publishing examples of initiatives to reduce emissions by turnover, it is encouraging member companies to engage in reduction activities.
- Many companies are engaged in the process of acquiring ISO14001 certification.

Note: The principal products of the industry are equipment and accessories for commercial vehicles. The coverage of the follow-up survey represented 90% of industry sales.
Fiscal 2010 targets and forecasts were formulated by the auto-body industry, on the basis of member company forecasts.

Japan Sugar Refiners' Association

To reduce industry emissions of carbon dioxide in fiscal 2010 by 20% compared with fiscal 1990.

1. Progress toward target



The sugar refining industry has recorded the following carbon dioxide emissions: 582,000 t-CO_2 in fiscal 1990 and 463,000 t-CO_2 in fiscal 2002. The target for fiscal 2010 is 471,000 t-CO_2—a 20% reduction on 1990. Assigning a value of one (1), therefore, to fiscal 1990, gives a value of 0.80 for fiscal 2002.

- Reasons for adoption of target

Carbon dioxide emissions were taken as the indicator, in accordance with Keidanren's Voluntary Action Plan on the Environment.

2. Steps taken to achieve targets

- Major
  - Fuel conversion
  - Setting of evaporator on a mechanical vapor recompression type
  - Setting of vacuum pans attached stirrers
  - Introduction of automatic boiling vacuum pan systems
  - Introduction of cogeneration facilities
  - Introduction of steam accumulators
  - Inverter control of motor revolutions
  - Recovery of waste heat from boilers
  - Turbo-driven compressors
  - Conversion to energy-saving transformers
  - Setting of air conditioning with absorption systems
  - Introduction of vacuum breakers
  - Keeping warm of steam pipes

3. Reasons for variations in carbon dioxide emissions

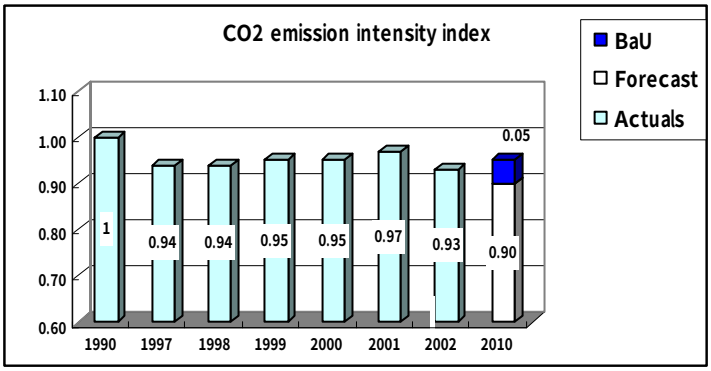
- Analysis of factors accounting for increases or decreases between 1990 and 2002

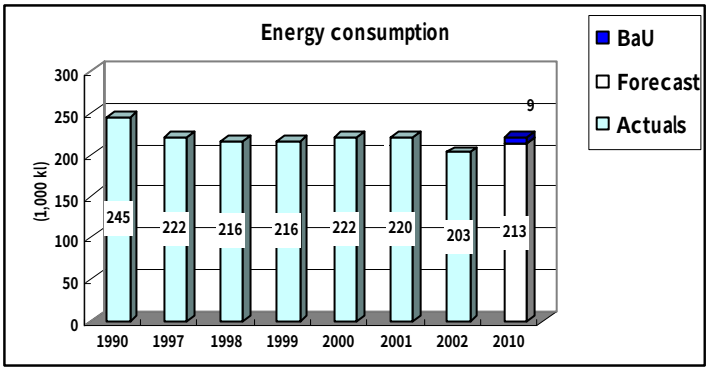
  Results of factorial analysis

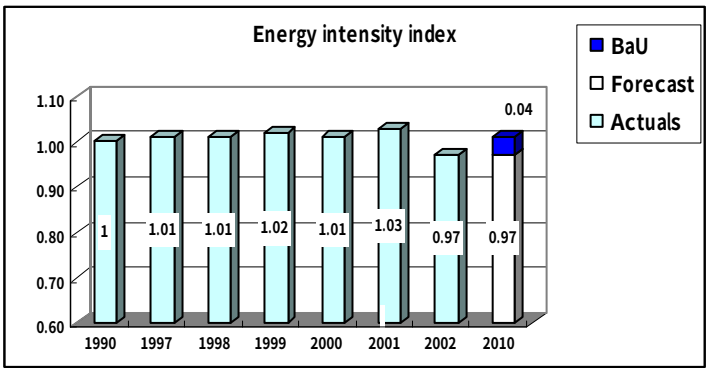
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	582	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	463	
Variation in CO_2 emissions	-119	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	0	0.1%
Contribution from production activity	-82	-14.0%
Contribution from emissions per unit of production activity	-38	-6.6%

(In accordance with the method proposed by the Keidanren Secretariat)

4. Reference data







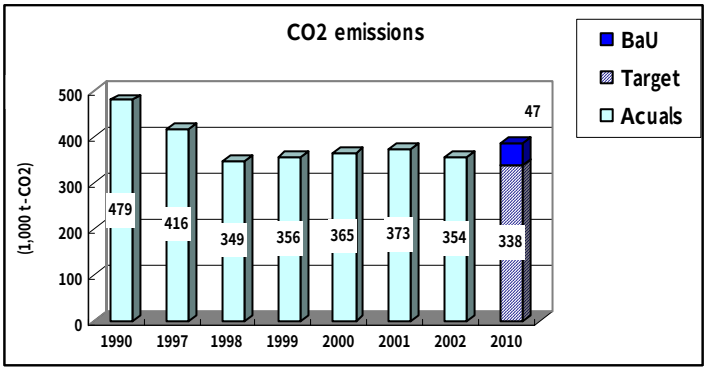
Assigning a value of one (1) to the actual fiscal 1990 carbon dioxide emission intensity gives 0.93 in fiscal 2002 and a forecast of 0.90 for fiscal 2010. Assigning a value of one (1) to actual fiscal 1990 energy consumption intensity gives 0.97 in fiscal 2002 and a forecast for 2010 of the same figure as that of fiscal 2002, at 0.97. Energy consumption in fiscal 1990 was 245,000 kl, and in fiscal 2002 it was 203,000 kl—already lower than the forecast for fiscal 2010, which is 213,000 kl.

Note: The primary product for the industry is sugars. The rate of participation in the follow-up survey was 93.8% (15 companies out of 16), representing 99.4% of industry production. In calculating its forecasts for fiscal 2010, it is considered that the industry assumed sugar consumption would remain stable through to fiscal 2010, and that production and energy efficiencies would improve.

Japan Sanitary Equipment Industry Association

To reduce the carbon dioxide emissions of production plants by 20% or more compared with fiscal 1990 by fiscal 2010.

1. Progress toward target



The industry has emitted the following amounts of carbon dioxide: 479,000 t-CO_2 in fiscal 1990; 416,000 t-CO_2 in fiscal 1997; 349,000 t-CO_2 in fiscal 1998; 356,000 t-CO_2 in fiscal 1999; 365,000 t-CO_2 in fiscal 2000; 373,000 t-CO_2 in fiscal 2001; and 354,000 t-CO_2 in fiscal 2002.

The target for fiscal 2010 is 338,000 t-CO_2, which represents a 29% reduction over fiscal 1990. Conversely, if voluntary action plans were not implemented, the figure would be 385,000 t-CO_2—a 20% decrease over fiscal 1990.

- Reasons for adoption of target

To achieve reductions in carbon dioxide emissions, total carbon dioxide emissions provides a clear and simple target, and therefore is probably the optimum indicator.

3. Steps taken to achieve targets

- Major
  - (i) Promoting fuel conversion
  - (ii) Introducing cogeneration
  - (iii) Improving production efficiency and defect rate
  - (iv) Converting to highly efficient equipment and energy-efficient inverters
  - (v) Undertaking effective use of energy, such as recycling waste heat from firing
  - (vi) Promoting the use of renewable energies, such as solar power generation
  - (vii) Giving a higher priority to energy-saving measures in environmental management systems
  - (viii) Improving individual awareness of energy saving, and undertaking incremental energy-saving activities

- Undertaking meticulous and thorough management of production plants and equipment
- Undertaking meticulous management of air conditioner temperatures and strict control of unnecessary lighting
- Implementing early detection and improvement regarding losses and waste

- Fiscal 2002 actual

In total the Association received eight reports of initiatives taken in fiscal 2002 to save energy. These include introducing solar power generation systems, introducing cogeneration, installing energy conserving units on air conditioning, installing inverter-driven fans, implementing conversion to inverter-fitted compressors, upgrading equipment to enable recycling of waste heat from firing to undercoat drying, and upgrading equipment to achieve improved production efficiency. These measures amounted to a total investment of ¥127 million, with a carbon dioxide reducing effect of 6,200 t-CO_2.

4. Reasons for variations in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed "fixed coefficient emissions." The difference between actual emissions and fixed coefficient emissions is deemed the "contribution from changes in coefficient of carbon dioxide emissions." Assuming a relationship whereby "fixed coefficient emissions = production activity x emissions per unit of production activity" enables the amount of change in fixed coefficient emissions to be broken down into "contribution from production activity" and "contribution from emissions per unit of production activity."

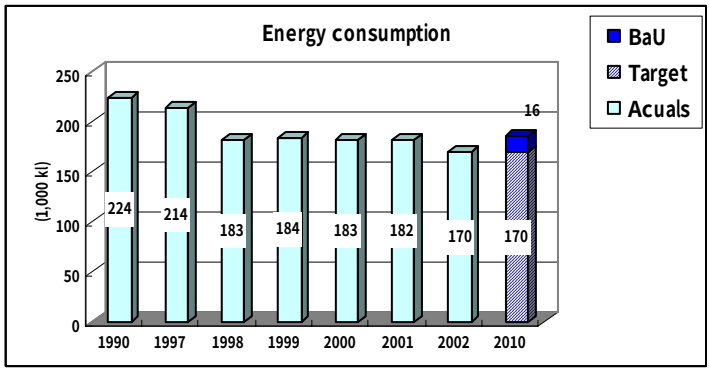
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including industrial processes)	479	
Fiscal 2002 CO_2 emissions (including industrial processes)	354	
Variation in CO_2 emissions	-124	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	1	0.3%
Contribution from production activity	-32	-6.7%
Contribution from emissions per unit of production activity	-94	-19.6%

- Reasons for variations in emissions in fiscal 2002

The effect of factors such as a shift in production offshore caused production value to decline approximately 7% on fiscal 1990 levels, with a resulting decline in carbon dioxide emissions. During that time, companies have also worked to convert fuel and to convert to highly efficient plants and equipment, to introduce cogeneration and energy-saving devices, and to improve both production efficiency and defect rates. As a result, compared with fiscal 1990, carbon dioxide emissions declined by approximately 26%, and energy consumption was also down by approximately 24%.

At the same time, in comparison with fiscal 2001 production value declined by approximately 2%, but the energy-saving efforts of companies achieved a reduction in carbon dioxide emissions of approximately 5%, and achieved a reduction in energy consumption of approximately 7%.

5. Reference data



The industry has recorded the following energy consumption: 224,000 kl in fiscal 1990; 214,000 kl in fiscal 1997; 183,000 kl in fiscal 1998; 184,000 kl in fiscal 1999; 183,000 kl in fiscal 2000; 182,000 kl in fiscal 2001; and 170,000 kl in fiscal 2002.

It is targeting consumption of 170,000 kl in fiscal 2010, representing a 24% decrease compared with fiscal 1990. At the same time, if voluntary action plans were not implemented, the industry would consume 186,000 kl of energy in fiscal 2010—17% less than in fiscal 1990.

6. Other global warming initiatives

●Emissions from offices and in-house distribution

Some companies have achieved a reduction in carbon dioxide emissions of 80 t-CO_2 per month by implementing an eco-drive with partner transport companies, such as turning off vehicle engines rather than letting them idle.

7. Environmental management and conservation in overseas business activities

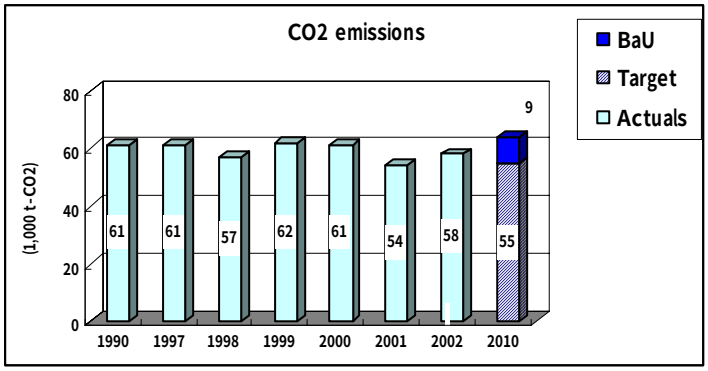
- ISO14001 certification has been acquired by 41 operating centers (including manufacturing group companies), and two companies have operating centers that are preparing for certification, or will achieve it within one to three years.
- One company has acquired ISO14001 certification for two of its production sites—one in China and one in Vietnam—and intends to achieve the same certification for all its offshore production sites in fiscal 2003. Another company has also acquired ISO14001 certification for some of its overseas production sites.
- As a general principle, some companies require their overseas plants to install, maintain, and manage the same environmental conservation equipment as that used in Japan.

Note: The principal products of the industry are sanitary wares, metal faucets, toilet seat with douche to wash anus with warm water, bathtubs, and bath unit for dwellings (some companies also produce ceramic tiles). The participation rate in the follow-up survey was 100% (7 companies out of 7). Energy consumption and carbon dioxide emissions were aggregated from the fuel consumption data (by type of fuel) provided by the seven respondents that operate production centers manufacturing the products listed. The fiscal 2010 forecasts are based on the following assumptions: (1) production volume will continue to increase at an average annual rate of 2% after fiscal 2002, and (2) after fiscal 2002, the energy consumption intensity of production will improve at an average annual rate of 1.5%, and the carbon dioxide emission intensity will improve at an average annual rate of 2%, due to the effect of voluntary efforts to conserve energy.

Japan Industrial Vehicles Association

To reduce fiscal 2010 carbon dioxide emissions from the manufacturing process by 10% compared with fiscal 1990 levels.

1. Progress toward target



Carbon dioxide emissions from the manufacture of industrial trucks were: 61,000 t-CO_2 in fiscal 1990; 61,000 t-CO_2 in fiscal 1997; 57,000 t-CO_2 in fiscal 1998; 62,000 t-CO_2 in fiscal 1999; 61,000 t-CO_2 in fiscal 2000; 54,000 t-CO_2 in fiscal 2001; and 58,000 t-CO_2 in fiscal 2002. The fiscal 2002 figures were 7% up on the previous year, and 5% down on fiscal 1990.

The forecast for emissions in fiscal 2010 is 55,000 t-CO_2, 10% down on fiscal 1990. If voluntary action plans were not implemented, it is predicted the result would be an increase on fiscal 1990 levels of 2%.

- Reasons for adoption of target

The Kyoto Protocol adopts country-specific total emissions targets. In its voluntary action plans the industry has therefore also adopted carbon dioxide emissions as its indicator.

3. Steps taken to achieve targets

- Major

Examples of major steps taken by industry member companies are as follows:

- Introducing and improving energy-saving production plants
- Improving production efficiency
- Adopting alternative energy sources, including fuel conversion initiatives

- Fiscal 2002 actual

Examples of the major steps taken by industry member companies are as follows:

- Fitting hot water cycle boiler pumps with inverters
- Upgrading transformers to achieve improved energy conservation
- Introducing monitoring devices to substations

- Converting a portion of fuel for on-site factory power plant from “Type A” heavy oil to city gas
- Opening skylights in ceilings to make use of natural light, and changing lighting from mercury lamps to metal halide lamps
- Fitting machine tools with power-saving circuit devices

4. Reasons for variation in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed “Fixed coefficient emissions.” The difference between actual emissions and fixed coefficient emissions is deemed the “Contribution from changes in coefficient of carbon dioxide emissions.” Assuming a relationship whereby “Fixed coefficient emissions = Production activity x Emissions per unit of production activity” enables the amount of change in fixed coefficient emissions to be broken down into “Contribution from production activity” and “Contribution from emissions per unit of production activity.”

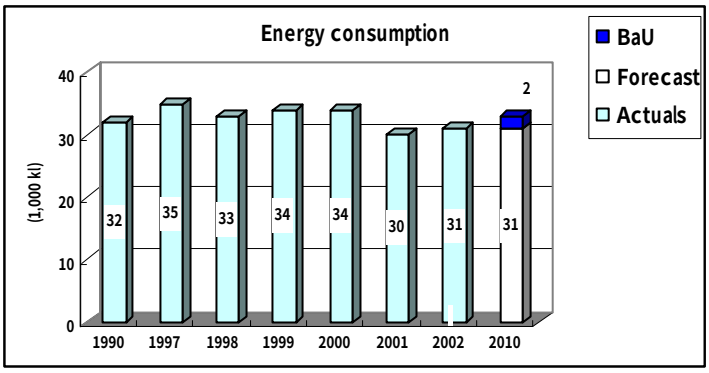
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions	61	
Fiscal 2002 CO_2 emissions	58	
Variation in CO_2 emissions	-4	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	0	0.5%
Contribution from production activity	-25	-40.6%
Contribution from emissions per unit of production activity	-21	-34.3%

- Reasons for variations in emissions in fiscal 2002

As previously indicated, the industry has worked to implement fuel conversion and to improve plant and equipment and production efficiency. Despite increased production due to an increase in the latter half of the year in exports, expanded production facilities, and the introduction of cooling equipment to improve the working environment, it has succeeded in limiting the amount of power purchased to a level that is effectively the same as that of the previous year. The coefficient of carbon emissions from power rose, however, contributing to an increase in fiscal 2002 carbon dioxide emissions compared with fiscal 2001.

The industry is committed to continuing to work to advance its efforts to reduce emissions, including introduction of cogeneration systems.

5. Reference data



Energy consumption in the manufacture of industrial trucks was 32,000 kl in fiscal 1990, 35,000 kl in fiscal 1997, 33,000 kl in fiscal 1998, 34,000 kl in fiscal 1999, 34,000 kl in fiscal 2000, 30,000 kl in fiscal 2001, and 31,000 kl in fiscal 2002.

The forecast for consumption in fiscal 2010 is 31,000 kl—down 3% on fiscal 1990. If voluntary action plans were not implemented, the result would be 33,000 kl—an increase of 6% on fiscal 1990 levels.

6. Other global warming initiatives

- Emissions from offices and in-house distribution

  Examples of major initiatives undertaken by several companies are as follows.
  - Efficient operation of office air conditioning, efficient use of lighting, and introduction of energy-efficient office automation
  - Replacement of internal combustion industrial trucks for use on site with electric industrial trucks
  - Promoting the practice of turning off engines when trucks that carry a product are standing on site, rather than leaving the engines idling

- Evaluation from an LCA perspective
  - The industry is promoting the development and uptake of products that contribute to initiatives against global warming:
    - Encouraging the take up of electric forklift trucks
    - Improving fuel consumption in internal combustion forklift trucks
    - Encouraging the use of internal combustion forklift trucks powered by compressed natural gas (CNG)

- Greenhouse gases other than carbon dioxide

  Examples of major initiatives undertaken by several companies are as follows.
  - Meticulous management of freon gas from air conditioners
  - Promoting the absence of freon from materials used in the production process

7. Environmental management and conservation in overseas business activities

A growing number of companies are seeking ISO14001 certification, including for their offshore plants.

Note: “Industrial vehicles” refers to the transport and luggage-carrying trucks used in plant sites and warehouses. On this occasion, the only sector of the industrial truck manufacturing industry surveyed was that involving the manufacture of forklift trucks. The reasons for this are as follows.

(i) According to a current survey of industrial production compiled by the Ministry of Economy, Trade and Industry, the value of production of forklift trucks accounts for two-thirds of the value of production of all industrial trucks.

(ii) Shovel trucks, which account for one-quarter of production value, are counted into the construction machinery manufacturing industry by operating centers, and cannot therefore be incorporated into this category.

The result is that from the perspective of production value, the survey has accounted for at least 91% of the total industry.

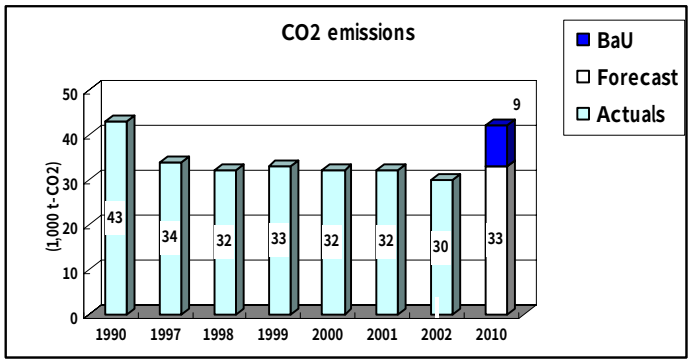
The follow-up survey provides figures aggregated from data from the manufacturing plants of all seven of Japan’s forklift truck manufacturers.

The formulation of the fiscal 2010 target assumed the same production levels as those in fiscal 2001.

Japan Association of Rolling Stock Industries

To reduce carbon dioxide emissions in fiscal 2010 by 10% compared with fiscal 1990.

1. Progress toward target



The rolling stock industry emitted 43,000 t-CO_2 of carbon dioxide in fiscal 1990, but in fiscal 2002 this amount fell 30% to 30,000 t-CO_2. This amount also represents a 6% reduction compared with emissions in fiscal 2001.

The forecast for emissions in fiscal 2010 is 33,000 t-CO_2—23% less than in fiscal 1990.

- Reason for adoption of target

Carbon dioxide emissions were taken as the target, given the unique nature of industry products and issues of conformity with figures reported to associated entities.

3. Steps taken to achieve targets

- Major

(i) Greater use of clean energy such as LNG, city gas, and solar power

(ii) Energy-saving such as adoption of very efficient machinery and equipment, and reduction of energy consumption

(iii) Appropriate management of energy use such as management of air conditioning and lighting, and prevention of air and steam leaks

(iv) Reducing the amount of waste products for incineration through recycling

- Fiscal 2002 actual

(i) A proportion of fuel was converted from crude oil to city gas.

(ii) Transformers, welders, and lighting equipment were converted to energy-saving models, and inverter control was adopted.

(iii) Engine idling while passenger vehicles and lifts are stopped was actively discouraged, and work was carried out to prevent power leakages.

(iv) Diligent recycling made it possible to scrap incinerators.

4. Reasons for variations in carbon dioxide emissions

●Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Results of factoral analysis (using the method proposed by the Keidanren Secretariat)

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (includes emissions from industrial processes)	43	
Fiscal 2002 CO_2 emissions (includes emissions from industrial processes)	30	
Variation in CO_2 emissions	-13	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	0	0.6%
Contribution from production activity	3	6.0%
Contribution from emissions per unit of production activity	-16	-37.8%

●Reasons for variations in emissions in fiscal 2002

There were a number of companies that withdrew from business in fiscal 2002, causing emissions to decline.

6. Other global warming initiatives

- Emissions from offices and in-house distribution

(i) Temperature management to rationalize air conditioning and turning off lights during lunch breaks
(ii) Maintaining and cleaning air conditioning equipment
(iii) Less frequent delivery of products

- Evaluation from an LCA perspective

(i) Reducing energy consumption by producing lighter products

- Greenhouse gases other than carbon dioxide

(i) Preventing leakage of and recovering chlorofluorocarbons

- Kyoto Mechanism projects

(i) Making progress on cleaner energy and fuel
(ii) Creating more green areas

7. Environmental management and conservation in overseas business activities

(i) Acquiring ISO14001 certification
(ii) Unified EMS operation, including affiliated companies
(iii) Encouragement of environmentally friendly production activities

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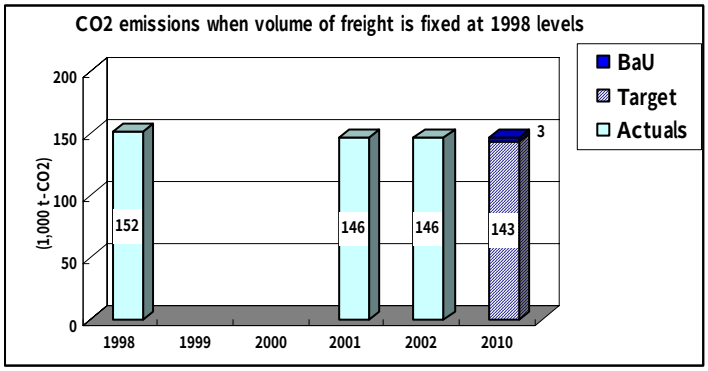
Note: Nature of business: manufacturing rolling stock
Degree of industry coverage: est. 60%
Number of companies participating: 5
The forecast for 2010 is an aggregation of individual forecasts from participating companies. Production volume is also based on current levels. BAU also assumes 1990 levels.

All Japan Freight Forwarders Association

To reduce carbon dioxide emissions in fiscal 2010 by 6% compared with fiscal 1998 given the same volume of freight, by amalgamating freight forwarding collection and delivery in larger vehicles

1. Progress toward target



Emissions of carbon dioxide assuming the same volume of freight as in 1998 were 152,000 t-CO_2 in fiscal 1998 and 146,000 t-CO_2 in 2002, and assigning a value of one (1) to 1998 gives 0.96 for 2002. The target for 2010 is a 6% reduction on 1998, to 143,000 t-CO_2.

- Reason for adoption of target

In order to exclude factors that are beyond the control of participating companies, the reduction target adopted involves the amount of carbon dioxide emissions for the same volume of freight forwarded as in 1998.

3. Steps taken to achieve targets

- Major

  Opened the Hanyu Off-Rail Station

  Introduced low emission vehicles (vehicles compliant with emission standards, CNG cars)

  Changed to larger vehicles

Note: The nature of the business of the industry is freight forwarding using freight trains. Some 180 companies took part in the follow-up survey, representing 64% of industry's energy consumption.

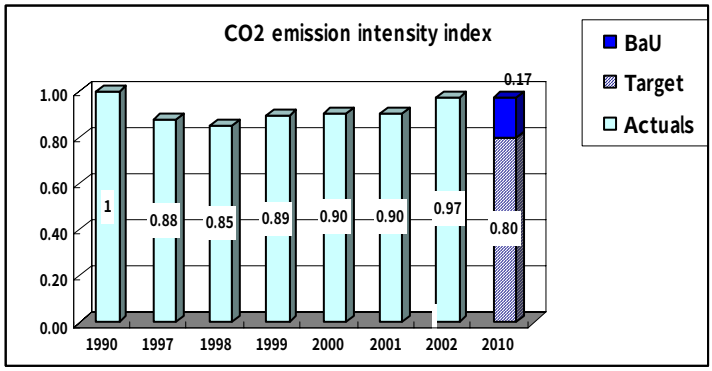
With the freight volume the same as in 1998, carbon dioxide emissions and diesel consumption have been derived from calculations using the number of vehicles actually in operation, tonnage transported, and kilometers traveled, based on the number of vehicles owned by each company with a carrying capacity of one, two, or three containers. The method of estimating 2010 targets was based on the 1998 freight volume levels, with the following changes in share: a 1.4% decrease in one-container cars; a 2.2% decrease in two-container cars; and a 3.5% increase in three-container cars.

[Share]: Percentage of one-, two- and three-container cars out of total cars owned

The Federation of Electric Power Companies of Japan

By fiscal 2010, the industry aims to reduce CO_2 emissions intensity by approximately 20% from the 1990 level, to about 0.34kg-CO_2/kWh.

1. Progress toward target

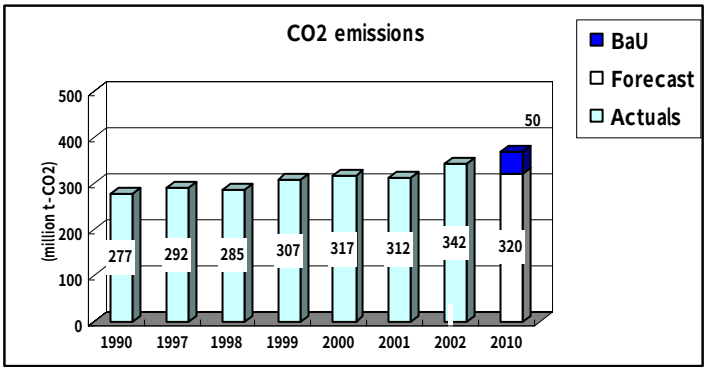


Carbon dioxide emissions intensity was: 0.421 kg-CO_2/kWh in fiscal 1990; 0.378 kg-CO_2/kWh in fiscal 2000; and 0.379 kg-CO_2/kWh in fiscal 2001. In fiscal 2000 and 2001, the figures represented a reduction of approximately 10% on fiscal 1990 levels. In fiscal 2002, however, the effect of the long-term shutdown of nuclear power stations associated with the incident involving falsification of in-house inspection records increased intensity to 0.407 kg-CO_2/kWh, the decline stopping at 3% less than in fiscal 1990.

●Reasons for adoption of target

Carbon dioxide emissions associated with the use of electricity can be calculated by multiplying the energy consumption of customers by the end-use carbon dioxide emissions intensity. As the energy consumption may vary due to a range of conditions beyond the control of the electricity supplier such as weather or particular customer electricity consumption factors, the industry has adopted an intensity target that has the capacity to reflect its own efforts.

2. Carbon dioxide emissions



Carbon dioxide emissions were 0.277 billion t-CO_2 in fiscal 1990, 0.317 billion t-CO_2 in fiscal 2000, and 0.312 billion t-CO_2 in fiscal 2001. In fiscal 2002 the figure was 0.342 billion t-CO_2, and while it fell initially in fiscal 2001, by fiscal 2002 it rose again. Power consumption showed a similar trend, which is reflected by the emissions results. In fiscal 2002, however, the effect of the long-term shutdown of nuclear power plants was cited as one factor in the increase.

3. Steps taken to achieve targets

- Major
  - Greater use of nuclear power generation
  - Greater improvements in the heat efficiency of thermal power generation and review of the manner of operation of thermal power sources
  - Initiatives to extend the use of natural energy
  - Advances in energy conservation
  - Initiatives to apply the Kyoto Mechanism
  - Development of technology associated with the issue of global warming

4. Reason for variations in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Results of analysis of the variation in carbon dioxide emissions between fiscal 1990 and 2002, using the Factor Analysis Worksheet (the calculation method proposed by the Keidanren Secretariat), are as follows.

Carbon dioxide emissions in fiscal 2002 increased by approximately 66 million t-CO_2 compared with fiscal 1990. A breakdown of the increase shows that the contribution from production activities (changes in power consumed) increased 76 million tons, and the contribution from emissions per unit of production activity (change in carbon dioxide emission intensity) declined by 10 million tons. This indicates that an increase in power consumed was the major factor in increased carbon dioxide emissions.

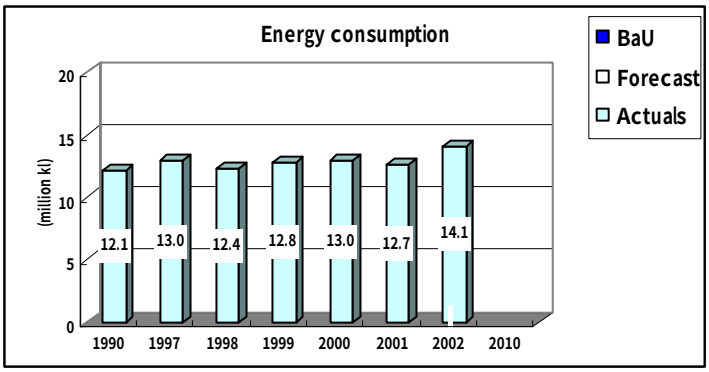
	million t-CO_2
Fiscal 1990 CO_2 emissions	277.8
Fiscal 2002 CO_2 emissions	343.3
Variation in CO_2 emissions	65.5
(Breakdown) Contribution from changes in CO_2 emissions coefficient	0
Contribution from production activity	75.5
Contribution from emissions per unit of production activity	-10.0

- Reasons for variation in emissions in fiscal 2002

Compared with fiscal 2001, carbon dioxide emissions rose in fiscal 2002 because the proportion of nuclear power among total power generated declined due to the effect of the long-term shutdown of nuclear power plants associated with the incident involving falsification of in-house inspection records. Another reason was that in order to supplement

this shortfall, the proportion of thermal power from oil or coal among total power generated rose, causing the carbon dioxide emission intensity to worsen. A further reason was that the volume of power consumed increased.

5. Reference data



- In-house power consumption and transmission and distribution loss were deemed to constitute power consumed on the electricity supply side, and such energy consumption has been depicted in crude oil equivalents.
- No data on fiscal 2010 forecasts exists.

6. Other global warming initiatives

- Emissions from offices and in-house distribution

In fiscal 2002, the volume of carbon dioxide emitted in the use of offices was 400,000 t-CO_2, and the volume emitted by company fleets was 70,000 t-CO_2.

The industry has sought to reduce emissions from office usage by operating air conditioning efficiently, diligently turning off lights during lunch hours and after hours, implementing a policy of using only every other light, using elevators less through encouragement of the use of stairs, conversion to energy-saving equipment in office automation and light fixtures and turning off power when such appliances are not in use, and introducing thermal storage HVAC systems and solar power generation to company-owned buildings.

Initiatives for reducing carbon dioxide emissions from the company fleet include the practice of turning off engines for safety purposes, rather than leaving them idling, encouraging fuel-efficient driving of company vehicles by restricting fast take offs and acceleration, introducing and making a priority the use of fuel-efficient or electric vehicles, driving with optimum tire pressure, educating vehicle users in energy conservation, and operating vehicles efficiently.

- Greenhouse gases other than carbon dioxide

The industry is putting significant effort into substantially limiting emissions of greenhouse gasses other than carbon dioxide through the measures described below.

- SF_6: Actively using gas recovery devices, and recycling recovered gas (reducing the proportion of emissions by fiscal 2005 to around 3% and to around 1% during device servicing and disposal, respectively)
- HFC: Preventing leakage and recovering and recycling gas during device installation or repair
- N_2O: Improving power generation efficiency

- Kyoto Mechanism projects

Examples of overseas projects to reduce or absorb carbon dioxide being implemented by electricity suppliers :

- Restoring thermal efficiency through operational improvements in a Thai thermal power station
- Technical cooperation on improving thermal efficiency in a thermal power station in China
- Installing solar power systems and small-scale hydroelectric power systems in Indonesia
- Developing recycling technology for tropical rain forests with Gajamada University in Indonesia
- Working with the Thailand Department of Marine and Coastal Resources to develop plantation technology for restoring mangrove ecosystems
- Plantation projects and joint research into afforestation in Australia
- Participation in the carbon funds of the World Bank and the European Bank for Reconstruction and Development

7. Environmental management and conservation in overseas business activities

- Improved in-house environmental management systems in line with the international standards of the ISO 14000 series, and acquisition by representative sites of ISO 14000 certification
- Introduction of environmental accounting and environmental audit
- Technical guidance and transfer through acceptance of overseas trainees, mainly from developing countries, and dispatch of technical experts from Japan.

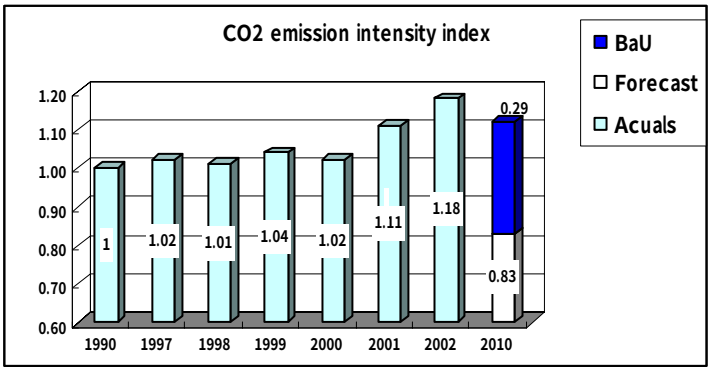
Note: The principal product of the industry is electricity. The proportion of companies participating in the follow-up survey was 100% (12 companies), representing 100% of the energy consumed by the industry.

- CO_2 emissions were calculated by totaling the volume of fuel burned by each company by fuel type to produce the electricity sold (including electricity purchased from cooperative thermal power companies or independent power producers and then resold), multiplying the totals for each fuel type by the CO_2 coefficient and the average calorific value, and then summing the results.
- The average calorific value of the fuel used and the average carbon emissions coefficient from the Ministry of the Environment's August 2002 Comprehensive Report on Results of a Study into Calculation of Greenhouse Gas Emissions were used for the carbon dioxide coefficient for each type of fuel.
- The electric power demand forecast for fiscal 2010 was estimated at 920 billion kW (an increase of 9% on fiscal 2002). It was also assumed that the industry would achieve its voluntary target of reducing end-use carbon dioxide emission intensity by around 20% of the fiscal 1990 level.

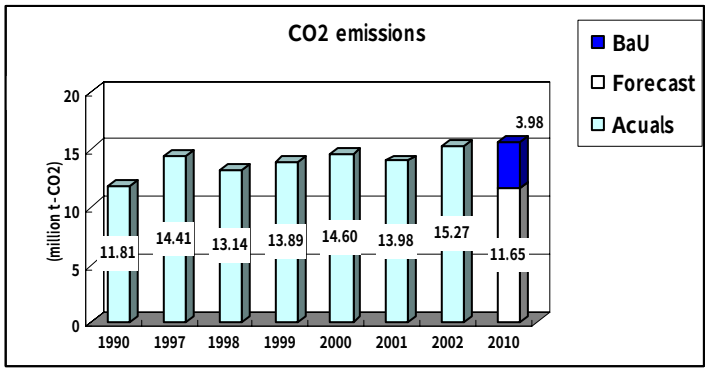
The Electrical and Electronics Industry:
The Japan Electrical Manufacturers' Association
The Japan Electronics and Information Technology Industries Association
The Communications and Information Network Association of Japan
The Japan Business Machine and Information System Industries Association

(Provisionally[1]) To improve the carbon dioxide intensity associated with production level by 25% by fiscal 2010, compared with fiscal 1990 levels.

1. Progress toward target



2. Carbon dioxide emissions



The electrical and electronics industries have undergone substantial structural change in the last decade, compared with their positions in fiscal 1990. Overall, they have changed from being industries involved in assembling heavy and domestic electrical appliances, with relatively low energy consumption, to being process industries requiring precise finishing

[1] To date, each industry association has established its own target.
- The Japan Electrical Manufacturers' Association: improve carbon dioxide intensity associated with production level by 25% in the manufacturing stage compared with fiscal 1990, by fiscal 2010
- Japan Electronics and Information Technology Industries Association, and Communications and Information Network Association of Japan: improve carbon dioxide intensity associated with production level by 25% compared with fiscal 1990, by fiscal 2010
- Japan Business Machine and Information System Industries Association: improve carbon dioxide intensity associated with production level by 25% in the manufacturing stage compared with fiscal 1990, by fiscal 2010
Each group has been conducting follow-ups in accordance with the targets established. Based on fiscal 2001 results, the overall outcomes of these follow-ups by the four electrical and electronics groups will be reported, and the provisional target of the four groups has become to improve the carbon dioxide intensity of production by 25% on fiscal 1990 levels, by fiscal 2010.

procedures, with an emphasis on the energy-intensive sectors associated with semiconductors and related devices. Factory infrastructure is new, which has further increased relative energy consumption over original estimates. Energy conservation efforts are ongoing, but the outcome is that carbon dioxide emissions are still increasing. In the last few years alone, while on the one hand there has been new factory infrastructure, the industrial structure has undergone dramatic change, with movement of production offshore, closures, mergers, and sales. Further, in recent years there has been a sudden increase in the development and production of energy-consuming liquid crystal and plasma displays.

- The status of carbon dioxide emissions and the carbon dioxide intensity of production in fiscal 2002

Carbon dioxide emissions: Up approximately 29% on fiscal 1990 (up 8% year-on-year)

- Production in the field of semiconductors and related devices, which accounts for approximately 60% of carbon dioxide emissions, rose 8% year-on-year, but efforts to conserve energy have been ongoing in all fields, and overall energy consumption was held to levels similar to those of the previous year.
- However, the carbon dioxide intensity (coefficient) of purchase power, which accounts for approximately 80% of the energy consumed, worsened by approximately 7% over the previous year, resulting in an increase in carbon dioxide emissions.

Carbon dioxide intensity of production: Up approximately 18% on fiscal 1990 (up 7% year-on-year)

- In addition to a production structure that makes it difficult to implement fundamental initiatives that would reduce the fixed energy portion, the effects of fiercer international competition and downward pressure on selling prices are contributing to a climate in which it is difficult to increase investments in energy conservation.
- Future forecasts indicate that current initiatives to conserve energy will be ongoing on an annual basis, and it is estimated that by assigning a value of one (1) to fiscal 1990, by the target fiscal 2010 an improvement in the order of 0.83 will have been achieved.

These circumstances have provided the context for significant change in the structure of the electrical and electronics industries compared with the time at which targets were set. For this reason, the associations have determined that there is a need for revision of the action plans to ensure that they are more appropriate to the current industry structure, from the perspective of ensuring the transparency of voluntary action plans and heightening the probability of achieving the targets. Relevant details are therefore being considered.[2]

- Reasons for adopting current voluntary action plan targets
  - The reasons that carbon dioxide intensity of production was adopted as the target were: to aim to achieve a medium- to long-term effort target (an annual average 1% improvement in energy intensity) in the context of factory standards for judgment under the Energy Conservation Law; and, with the objective of preventing global warming, and given that energy consumption and carbon dioxide emissions are roughly proportional, carbon dioxide emissions were taken as the numerator for calculating intensity. As a result, the proportion of improvement (an improvement of approximately 20% in 2010 compared with 1990 as per the voluntary action plans of the Federation of Electric Power Companies of Japan) in the carbon dioxide intensity of power (emission

[2] Review is underway, with the objective of amending targets in fiscal 2003.

coefficient) was taken into consideration.[3] To come up with a consistent denominator for intensity, given the diverse types of products involved, with their very different weights and shapes, the value of production was adopted.

3. Steps taken to achieve targets

- Major
  - Introduction of highly efficient plants and equipment (planned introduction to coincide with plant upgrades)
  - Introduction of highly efficient industrial furnaces, highly efficient light fittings, highly efficient freezers and air compressors, highly efficient heat pumps and boilers, automatically controlled air conditioning (inverters), and equipment fitted with sensors
  - Introduction of cogeneration systems, fuel cell power generation systems (introduced as cogeneration systems), photovoltaic power generation systems, and systems that use solar heat
  - Power from heavy oil, and energy conversion to city gas
  - Introduction of energy monitoring and control systems (central monitoring and control systems for heat and power consumed) and strict measurement and management
  - Late night use of power (cooperation with DSM initiatives and introduction of ice thermal storage systems)
  - Configuration of highly efficient production systems (conversion to manufacturing lines based on principles of high productivity)
  - Shorter development times, improved yield ratios, and improvements in production technology and quality control, such as those involving aging
  - Energy conservation initiatives in offices (use of very efficient light fittings, purchase of energy-saving office automation, and centralized control of room temperature management)

- Fiscal 2002 actual
  - A sampling survey revealed that the estimated investment value of fiscal 2002 energy-saving initiatives reached the order of ¥21.3 billion. The energy reduction effect of this investment was approximately 230,000 kl in crude oil equivalents. The average investment effect of sampling is estimated to be approximately 10.1 kl per million yen.

[3] The reasons why the target set included a portion attributable to improvements in the carbon dioxide intensity of power (emission coefficient) are as follows:

- The electrical industry has made significant contributions to reducing carbon dioxide emissions in the energy conversion sector through its efforts in developing and supplying power generation equipment for atomic power, new energies, and very efficient thermal power generation, as well as through configuring DSM systems.
- Approximately 70% to 80% of energy consumed is purchased power. In other words, the industry is utilizing the effectiveness of power as energy and there is little scope for conversion of fuels from heavy oil to city gas or the like.

Major initiatives	Energy savings (kl crude oil equiv.)	Investment value (million yen)
New and untapped energy	3,508.9	113.8
Cogeneration, heat storage	14,581.1	1,495.1
Introduction of very efficient machinery	17,296.4	7,747.4
Better management	45,454.7	709.5
Improvements in production processes or product quality	34,714.1	2,523.9
Improvements in control methods (e.g., automatic control)	32,712.2	2,091.6
Use of waste heat	4,758.1	1,140.4
Preventing loss (insulation, heat retention)	7,343.9	1,345.1
Fuel conversion	2,045.3	853.4
Other	68,061.5	3,281.1
Total	230,476.2	21,301.2

4. Reasons for variations in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002
  - Production rose 8% between fiscal 1990 and fiscal 2002. At the same time, carbon dioxide emissions increased 29%. The results of analysis using a method in which it was assumed that product selling price and function were the same in fiscal 2002 as in fiscal 1990 are given below.[4]

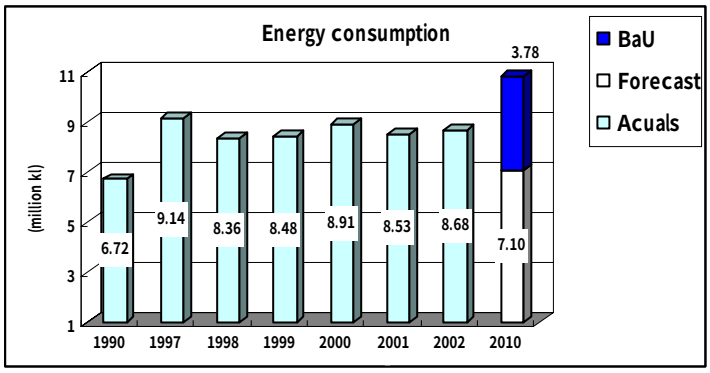
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions	11807	
Fiscal 2002 CO_2 emissions	15168	
Variation in CO_2 emissions	3361	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	140	1.2%
Contribution from production activity	1169	9.9%
Contribution from emissions per unit of production activity	2052	17.4%

Reductions in CO_2 emissions as a result of energy-saving initiatives (actual)

	FY1999	FY2000	FY2001	FY2002
Reduction in CO_2 for a single fiscal year (1,000 t-CO_2) Figures in brackets represent the proportion of the reduction to the total CO_2 emissions in the relevant fiscal year	203 (1.4%)	204 (1.4%)	292 (2.1%)	381 (2.5%)
Cumulative reduction in CO_2 for the period from 1990 to the relevant fiscal year Figures in brackets represent the proportion of the reduction to the total CO_2 emissions in the relevant fiscal year	2315 (16.5%)	2508 (17.1%)	2799 (20.0%)	3193 (21.5%)

[4]This method of analysis does not reflect reductions in carbon dioxide emissions (actual) due to actual industry efforts, nor does it reflect efforts to reduce the selling price of products or improvements in function, and should not be considered as a completely accurate evaluation of reality.

5. Reference data



6. Other global warming initiatives

- Emissions from offices and in-house distribution

  Reference: Fiscal 2002 actual

Consumer goods sector, including office buildings	1.82 million t-CO_2
In-house distribution sector	110,000 t-CO_2

  - In the electrical and electronics industries, a change in business structure has created a tendency for the "hard" side of the business (the manufacturing sector) to be relocated offshore, and for Japan to specialize in the "soft" sectors and the R&D sector. In this context, member companies are engaged in energy-saving initiatives in the consumer goods sector. These include measures related to offices, primarily concerning air conditioning and lighting, and those related to cogeneration, ice storage, and solar power generation systems. In the in-house distribution sector, fleet vehicles are being driven in a manner that keeps fuel consumption low, fuel-efficient vehicles are being introduced, and work is being done to make distribution more efficient.
  - In order to maximize the expertise and technological resources amassed to date, the industries are actively seeking to commercialize the energy service company (ESCO), building energy management system (BEMS), and home energy management system (HEMS).

- Evaluation from an LCA perspective
  - The electrical and electronics industries are actively engaged in developing and encouraging the uptake of machinery and services that contribute to energy savings and prevention of global warming in a wide range of fields. These include systems for the use of atomic power and sustainable energy sources (such as solar power generation, fuel cells, and wind power), heavy electrical equipment, domestic appliances, and information technology, all of which contribute significantly to limiting emissions of greenhouse gasses under Japanese energy policies. The reduction effect on carbon dioxide emissions of these efforts in terms, for example, of machinery that is the subject of "Top Runner Standards" under the Law concerning the Rational Use of Energy alone, such as refrigerators, TVs, air conditioners, and PCs, has been to approximately double the scale of carbon dioxide emissions in the manufacturing stage of

association members (Example 1). Semiconductors and liquid crystal displays represent technologies that are essential to achieving energy savings in many fields, and the industry as a whole is working to advance them. (Example 2)

Example 1: Reductions in carbon dioxide emissions in products and services (Source: Guidelines for Measures to Prevent Global Warming - 19.3.2002)

Reduction in carbon dioxide emissions from machinery that is the subject of "Top Runner Standards" under the Law concerning the Rational Use of Energy, such as refrigerators, TVs, air conditioners, and PCs	Approx. 30.4 million t-CO_2
Solar power generation, wind power, fuel cells, and other sustainable energy initiatives	Target in fiscal 2010 = reduction of approximately 34 million t-CO_2
Encouraging the uptake of the home energy management system (HEMS)	Target in fiscal 2010 = reduction in emissions of approx. 2.9 million t-CO_2
Promoting the building energy management system (BEMS) for managing business demand for energy	Target in fiscal 2010 = reduction in emissions of approximately 7.7 million t-CO_2
Total	Reduction in emissions of approx. 75 million t-CO_2

Example 2 Comparison of LCDs (liquid crystal displays) and CRT (cathode ray tubes) using the LCA method (Source: The Mechanical Social Systems Foundation and the Electronic Industries Association of Japan, Study Report of LCD Environmental Impact and Recycling Process, March 2000)

- Carbon dioxide emissions from LCDs have been reduced to approximately 60% of those from CRTs.

- Greenhouse gases other than carbon dioxide
- The Japan Electrical Manufacturers' Association

(i) HFCs: prevention of leaks during manufacture of domestic refrigerators (emissions to be less than 0.5% of HFCs used), prevention of leaks during use and repair (recover HFC coolants at time of repair, effective fiscal 2002), recovery, recycling, and breakdown of coolants from scrapped products (Under the Law for Recycling of Specified Kinds of Home Appliances, 100% of scrapped domestic refrigerators handed over to manufacturers are treated.)

(ii) Greater use of non-HFC based insulating foam in domestic refrigerators (increase proportion in use in 2010 from current 60% to 100%)

(iii) Development and delivery to market of freon-free refrigerators

(iv) SF_6: prevent leaks when manufacturing electrically insulated machinery; beef up gas recovery devices (both fixed and mobile); carry out upgrades to improve recovery rates at existing stages (The proportion of emissions at machinery

manufacture are to be limited in 2005 to less than 3% of net purchased volumes of gas, compared with 30% in 1995.)

- Electronics and Information Industries Association

(i) Liquid PFCs: Achieve a reduction in emissions from washing electronic components of better than 60% (in GWP equivalents) by 2010, using 1995 as a benchmark year.

(ii) PFCs, SF_6: Achieve a reduction in emissions from manufacture of semiconductors of better than 10% (in GWP equivalents) by 2010, using 1995 as a benchmark year.

(iii) PFCs, SF_6, NF_3: Achieve a reduction in emissions from liquid crystal manufacturing (in GWP equivalents) by 2010 to result in a lower level of emissions than in 2000.

- Kyoto Mechanism projects
- There have been few examples of projects specifically undertaken with the Kyoto Mechanism directly in mind. Rehabilitation and re-powering of thermal power plants, improvement in the efficiency of cogeneration plants, and the take-up of very efficient lighting are examples where the follow-up survey has had an effect, and it is hoped that Kyoto Mechanism projects will materialize in the future.

7. Environmental management and conservation in overseas business activities

- As at end January 2003, of 11,230 registrations for ISO 14001 assessment, the electrical and machinery industries accounted for the greatest share, with 1,546 registrations (13.7%) (Source: Japanese Standards Association).
- The acquisition of ISO14001 certification by offshore sites, or integrated certification for entire corporate groups, is becoming more common as environmental conservation initiatives are implemented at offshore sites to the same extent as within Japan.

Note:

1. Basic data

The main products of the electrical and electronics industries include heavy electrical equipment (for power generation, transmission, distribution, and industrial electrical equipment), consumer domestic appliances, light fittings, communications machinery and fittings, devices adapted for wireless use, consumer electronic appliances, parts and accessories for communications and electronic devices, electronic calculators and accessories, electronic application devices, electric meters, electronic parts and devices (electronic tubes, semiconductor elements, and integrated circuit boards), storage and dry batteries, and electronic office equipment. Member companies of the four electrical and electronics groups that participated in the follow-up survey numbered 366 (out of 548), representing an estimated 80% of the energy consumed in fiscal 1990 (in kl of crude oil equivalents) within the scope of the relevant industry classification from the Current Structural Survey of Energy Consumption). The proportion of production value captured is also estimated at approximately 80% (based on a comparison of the results of a survey of fiscal 2001 production values and the production values within the scope of the relevant industry classification from industrial statistics for that fiscal year).

2. Method of deriving data

Carbon dioxide emissions were arrived at by aggregating the fuel and power consumption of respondent companies (by type of fuel), and multiplying by individual carbon dioxide emission intensity indices. The carbon dioxide intensity (emission coefficient) of purchased power was taken from the demand-end intensity published by the Federation of Electric Power Companies of Japan.

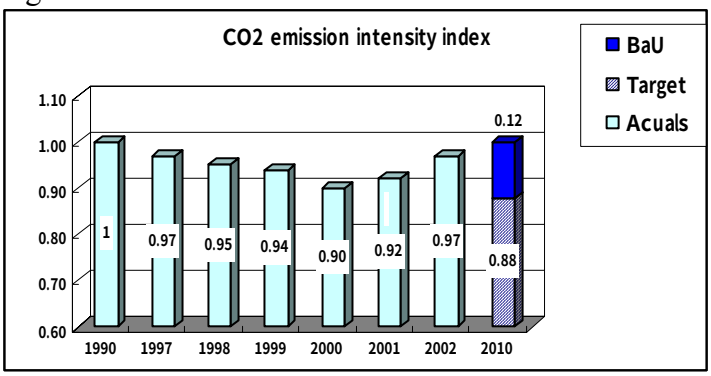
3. Method of estimating fiscal 2010 forecasts (calculation assumptions)

- Production volume: from fiscal 2003, the value of production will increase 1% per annum.
- Given their nature as process industries, it is estimated that for industries associated with semiconductors and related devices, which account for the major portion of energy consumption in the electrical and electronics industries, the ratio of fixed energy consumption within a plant to variable consumption will be generally 7:3 (the increase in BAU energy consumption will be 30% of the increase in production level). Upward or downward fluctuations associated with production will be due to variations in the energy component, and the fixed component will remain constant, irrespective of increases or declines in production.
- If production level increases, it is assumed that investment in energy savings will continue to be sustained at healthy levels. Amount of energy savings: initiatives will be sustained to result in energy saving on the same scale as in fiscal 2002, for every year through to fiscal 2010.
- The carbon dioxide intensity (emission coefficient) of electric power, which accounts for between 70% and 80% of energy consumed, will be subject to the adoption by the Federation of Electric Power Companies of Japan of voluntary action plans (in fiscal 2010, an improvement of approximately 20% on fiscal 1990).

Japan Federation of Construction Contractors;
Japan Civil Engineering Contractors' Association; Building Contractors Society

To endeavor to reduce the carbon dioxide generated during construction (on-site work) by 12% of the fiscal 1990 base year level in terms of the emission intensity per unit of construction volume by fiscal 2010.

1. Progress toward target

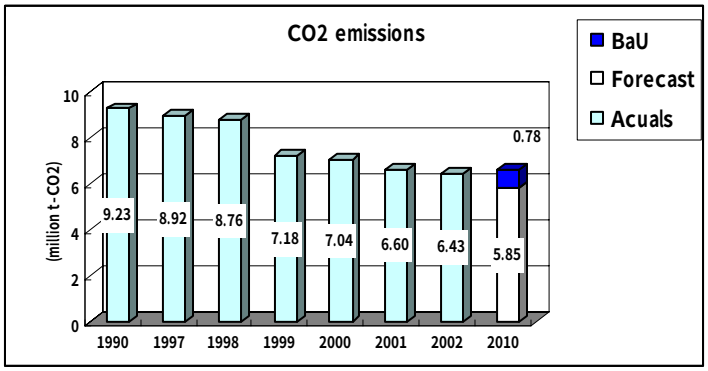


Assigning a value of one (1) to the fiscal 1990 carbon dioxide emission intensity index gives: 0.97 in fiscal 1997; 0.95 in fiscal 1998; 0.94 in fiscal 1999; 0.90 in fiscal 2000; 0.92 in fiscal 2001; and 0.97 in fiscal 2002. The fiscal 2010 target is a 0.12 point reduction on fiscal 1990, to 0.88.

- Reasons for adoption of target

Through voluntary action plans, the construction industry is conducting energy-saving and resource-saving activities throughout the entire life cycle of a structure. As an area that it is itself particularly able to control, the industry has focused on the construction (on-site work) stage, and has come up with specific quantitative targets for its efforts to reduce carbon dioxide. Where carbon dioxide emissions are set as the target, they can be substantially influenced by the scale of production activity (the amount of on-site work), and as it then becomes difficult to determine the realities of reduction activity, the intensity per unit of on-site work has been taken as the target.

2. Carbon dioxide emissions



The construction industry has recorded the following carbon dioxide emissions: 9.23 million t-CO_2 in fiscal 1990; 8.92 million tons t-CO_2 in fiscal 1997; 8.76 million t-CO_2 in fiscal 1998; 7.18 million t-CO_2 in fiscal 1999; 7.04 million t-CO_2 in fiscal 2000; 6.60 million t-CO_2 in fiscal 2001; and 6.43 million t-CO_2 in fiscal 2002—down 30.4% on fiscal 1990. The forecast for fiscal 2010 is for 5.85 million t-CO_2—36.6% less than in fiscal 1990.

3. Steps taken to achieve target

- Major
  - The amount of surplus soil generated from construction and the distance it is transported have been reduced.
  - Engines are turned off rather than idled, and drivers are being encouraged to drive in a fuel-efficient manner.
  - Proper servicing of heavy machinery and vehicles is being encouraged.
  - The use of construction machinery and vehicles that consume limited amounts of fossil fuels is being encouraged.
  - Greater use is being made of highly efficient on-site electrical equipment.
  - Energy saving is being encouraged in on-site offices.

- Fiscal 2002 actual

As an activity designed to reduce carbon dioxide emissions in the on-site phase of construction, the three construction industry associations this year repeated their "Fuel-Efficient Operation Workshops" for dump truck and hydraulic shovel operators.

<u>Dump trucks</u>

The workshops resulted in an average reduction of 20%.

<u>Hydraulic shovels (backhoes)</u>

Reductions were achieved of approximately 10% at the time of shoveling and 38% while driving.

<u>Activities undertaken by member companies</u>

- Promoting reductions in the amount of surplus soil generated from construction and transportation distances, by using planning and implementation documentation to promote utilization of recycled resources and the Surplus Construction Soil Information Exchange System
- Confirming that vehicles and heavy construction equipment are turned off, and counting them; for drivers, using workshops to promote the concepts of turning engines off rather than leaving them idling, and fuel-efficient operation
- Encouraging proper servicing of heavy machinery and vehicles through activities such as checking for regular inspection certificates thereof, and educating personnel to ban the introduction of sub-standard machinery to sites
- Adopting construction machinery and vehicles fitted with improved engines and encouraging improvements in fuel consumption by promoting fuel-efficient operation
- Using low-consumption electrical equipment (such as fluorescent lights for site lighting)
- Paying attention to turning off lights, such as during lunch hour in offices or workshops

- Setting the temperature of air conditioners to the government recommended setting
- Considering and implementing changes to methods of transporting surplus soil from construction of tunnels and other structures (changing from transportation by dump truck to conveyor belts)
- Considering and implementing round withdrawal for construction waste and changing to large vehicles (such as dump trucks fitted with trailers) for transport of construction waste
- Considering the carriage of construction sludge by ship
- Considering reduction of long-distance transport (such as considering conversion to PC production on site)

4. Reasons for variations in carbon dioxide emissions

●Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Carbon dioxide emissions were down 30.4% (2.8 million t-CO_2) on fiscal 1990 levels to 6.43 million t-CO_2. Of this reduction, the portion attributable to changes in production activity was 28.2% (2.59 million t-CO2), and the proportion attributable to carbon dioxide emission coefficients or industry efforts at reduction was 2.3% (210,000 t-CO_2).

●Reasons for variations in emissions in fiscal 2002

The volume of on-site work fell 5.9% on fiscal 2001, making changes in production activity the greatest factor in reduced carbon dioxide emissions for the second year in a row.

At the same time, an investigation of intensity per unit of on-site work reveals that the effect of reductions was seen in construction work. However, in civil works where carbon dioxide emissions per unit of work are high, intensity this financial year was up, and while overall carbon dioxide emissions were down, carbon dioxide emissions from civil works in fact rose.

6. Other global warming initiatives

- Emissions from offices and in-house distribution (company initiatives extracted from questionnaire responses)
  - The turning off of lights is encouraged (lights are meticulously switched off during lunch hour and when not needed).
  - Power switches on PCs and printers are rigorously switched off.
  - Use of elevators has been reduced.
  - Air conditioners are being operated at appropriate temperatures.
  - Reductions are being achieved in fuel use through the employment of light vehicles and low-pollutant vehicles as company cars.

- Evaluation from an LCA perspective
  - The industry is moving ahead with energy-saving design based on the energy-saving criteria for buildings proposed by the national government. (There are reports in member companies of reductions in carbon dioxide in fiscal 2002 of between 11,000 t-CO_2 and 15,000 t-CO_2 per year.)

- Using the Comprehensive Assessment System for Building Environmental Efficiency the industry is focusing on environmentally friendly design over the lifecycle of a structure.
- Member companies are working through their links with affiliate companies to develop technology that will reduce carbon dioxide emissions.
  - Examples
    - Fuel cell cogeneration systems
    - Use of photovoltaic power generation and other forms of natural energy
    - Lighting and air conditioning systems that leverage natural light and natural ventilation
    - Thermal storage systems
    - Ice thermal storage systems
    - Methods of structuring roof-top gardens and the like
- The three associations have submitted reports on activities to reduce carbon dioxide to the relevant authorities, and have conducted information exchange workshops, in an effort to garner understanding of carbon dioxide in the planning and design stages.

- Greenhouse gases other than carbon dioxide
  - The associations have been using in-house intranet and e-mail facilities to educate personnel in the significance of and responsibility for recovery of fluorocarbons, and are clearly promoting observance of the Law Concerning the Recovery and Destruction of Fluorocarbons.
  - Member companies have incorporated survey and diagnosis of greenhouse gases used in existing plants as a diagnostic and survey item. They are making suggestions to building owners about removal and upgrades in their reports.
  - In accordance with the management guidelines incorporated in the ISO 14001 system, the associations have set up a system that facilitates the appropriate on-site processing of freon and halon.
  - Quantitative records are being kept to determine the rate of recovery of freon and halon, and that data is being published in environmental reports.
  - The industry is investigating the wide use of non-HFC urethane foam insulation.
  - Association members are engaged to seek reduction of total volumes in light of niche segregation of the category of use of HFCs and substitutes.
  - Internally, companies are educating their personnel to do as much as they can to make use of products that are freon-free.
  - By exchanging information with manufacturers, association members are encouraging the use of insulation materials that employ alternative foams (carbon dioxide) to HFCs.
  - In equipment manuals, association members are briefing project owners on recovery, particularly from equipment that uses sulfur hexafluoride, and are working to make senior technicians fully aware of the use of relevant equipment.
  - In the design and construction of properties that incorporate high voltage receiving/transforming equipment, association members are recommending that methods of insulating equipment be used which do not incorporate sulfur hexafluoride.
  - Where equipment recommended for properties designed by other companies is found

to incorporate sulfur hexafluoride, member companies brief the architects on the industry objective to avoid the substance and seek specification changes.

- The associations are participating in a committee to survey CFC recovery and disposal from insulation materials established by the Japan Testing Center for Construction Materials under a contract with the Ministry of Economy, Trade and Industry, and a committee to investigate measures against CFCs in insulation materials for construction established by Institute for Building Environment and Energy Conservation under a contract with the Ministry of the Environment to ensure that they obtain the most up-to-date expertise.

● Kyoto Mechanism projects

The activities of the three construction industry associations do not include any Kyoto Mechanism projects, but it is apparent there are member companies that have received national and other assistance to implement JI and CDM projects offshore.

- Feasibility study on a power generation facility driven by methane gas from a waste disposal site on the outskirts of Bangkok (expected to have an annual estimated 50,000 t-CO_2 reduction effect in carbon dioxide equivalents)
- Feasibility study on a cogeneration plan for regional heating in the Ukraine, feasibility study on a plant to modernize a regional heat supply facility in Uzbekistan, and feasibility study on a project to make effective use of sewerage in China (with the annual estimated reduction effect of these three projects expected to be 181,000 t-CO_2)

● Environmental management and conservation in overseas business activities

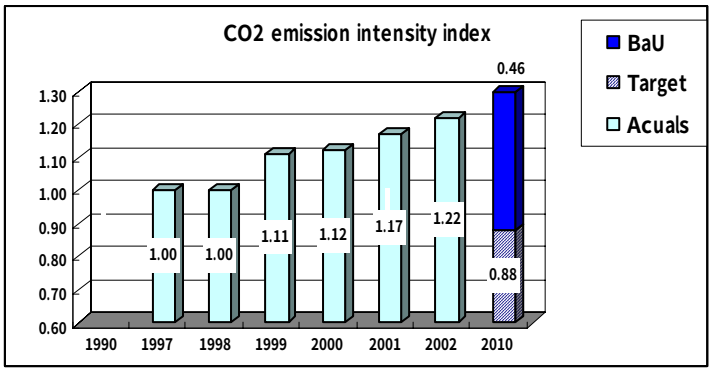
- Configuration of environmental management systems (1,249 operating centers with ISO 14000 certification as of October 2003)
- Production of educational resource materials: publication of "Using EMS to Reduce On-site Environmental Risk"
- Information dissemination: overseeing the "Fiscal 2003 Compendium of Environmental Conservation Laws and Regulations for the Construction Industry"
- Other activities: publication of "Green Procurement Guidelines in the Construction Industry"
- Other activities: publication of "Video and Manual for Fuel-Efficient Driving"

Note: The principal business of the industry is building and civil engineering construction. The participation rate in the follow-up survey was 0.03% (172 companies out of 550,000), but in terms of completed construction this figure represents 28% of the total.
Carbon dioxide emissions were estimated using the fiscal 1990 emission intensity per unit of on-site work as a benchmark and the volume of power, kerosene, and gas oil used on site each year derived from sampling surveys, to arrive at an estimate of the emission intensity per unit of on-site work.
The fiscal 2010 forecast assumes that construction volume will be sustained at this year's levels.

The Japan Society of Industrial Machinery Manufacturers

To endeavor to reduce carbon dioxide emission intensity for the production process by 1% or more per year.

1. Progress toward target

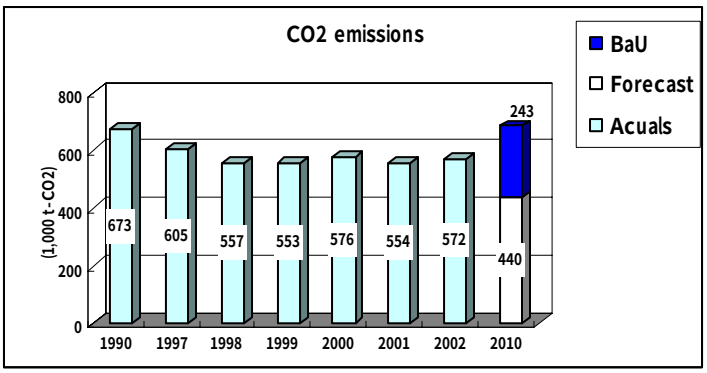


Assigning a value of one (1) to the carbon dioxide emission intensity index per unit of production value in fiscal 1997 gives: 1.00 in fiscal 1998; 1.11 in fiscal 1999; 1.12 in fiscal 2000; 1.17 in fiscal 2001; and 1.22 in fiscal 2002. The target is 0.84 in fiscal 2010.

● Reasons for adoption of target

Intensity is the optimum index of energy consumption efficiency in the manufacturing process, and is not subject to influence from survey population size or changes in production level. The fact that an annual reduction in intensity of 1% conforms with the Law Concerning the Rational Use of Energy was another reason for adoption of the target.

2. Carbon dioxide emissions



Actual industry emissions of carbon dioxide were: 673,000 t-CO_2 in fiscal 1990 (estimate); 605,000 t-CO_2 in fiscal 1997 (actual); 557,000 t-CO_2 in fiscal 1998 (actual); 553,000 t-CO_2 in fiscal 1999 (actual); 576,000 t-CO_2 in fiscal 2000 (actual); 554,000 t-CO_2 in fiscal 2001 (actual); and 572,000 t-CO_2 in fiscal 2002 (actual). The industry is forecasting emissions of 440,000 t-CO_2 in fiscal 2010. If voluntary action plans were not implemented, emissions in fiscal 2010 would be 683,000 t-CO_2.

3. Steps taken to achieve targets

- Major
  - Introduction of cogeneration systems
  - Conversion to inverter-enabled equipment
  - Operational efficiencies achieved through unit number control and aggregate control of compressors

- Fiscal 2002 actual

There were 185 initiatives taken, including environmental management, process improvement, operational management, energy conservation initiatives, operational management of compressor systems, management of electrical receptors, management of electrical transformers, management of capacity and operation of electrical motors, and operational management of lighting.

Total investment is estimated to have been ¥420 million, and the resulting reduction in carbon dioxide emissions is calculated at about 3,600 t-CO_2.

4. Reasons for variations in carbon dioxide emissions

●Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

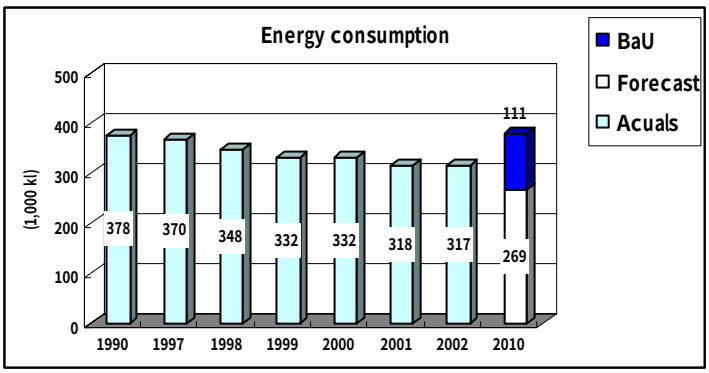
Carbon dioxide emissions in fiscal 2002 were down 15% in comparison with fiscal 1990. They were also down approximately 5% in comparison with fiscal 1997, the industry's benchmark year.

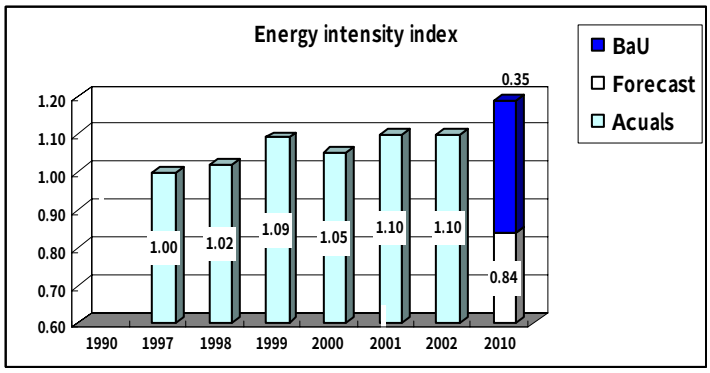
- Factors contributing to decreases: improvements in energy efficiency, improvements in production efficiency, etc.
- Factors contributing to worsening emission intensity: marked decline in production value

●Reasons for variations in emissions in fiscal 2002

Production value, which points to variations in production activity, was down slightly on the previous year, indicating that production activity was roughly static, but despite the fact that power consumption declined, because carbon dioxide emissions from power sources rose, emissions overall also rose. (Carbon dioxide emissions from energy sources other than electric power declined.)

5. Reference data





Energy consumption was: 378,000 kl in fiscal 1990 (estimate); 370,000 kl in fiscal 1997 (actual); 348,000 kl in fiscal 1998 (actual); 332,000 kl in fiscal 1999 (actual); 332,000 kl in fiscal 2000 (actual); 318,000 kl in fiscal 2001 (actual), and 317,000 kl in fiscal 2002 (actual). The forecast in fiscal 2010 is 269,000 kl. If voluntary action plans were not implemented, consumption of energy would be 381,000 kl in fiscal 2010.

Assigning a value of one (1) to the energy intensity index in fiscal 1997 gave 1.02 in fiscal 1998, 1.09 in fiscal 1999, 1.05 in fiscal 2000, 1.10 in fiscal 2001, and 1.10 in fiscal 2002.

6. Other global warming initiatives

- Emissions from offices and in-house distribution
  - Management of air conditioning temperature, turning off unnecessary lights, and management of on/off switches for office automation
  - Conversion to energy-saving office automation equipment
  - Turning off engines of fleet vehicles rather than leaving them to idle

- Other
  - Product initiatives (development and promulgation of very efficient boilers, development and promulgation of very efficient incineration systems in waste treatment facilities, and energy-saving considerations in plant and equipment development and design)

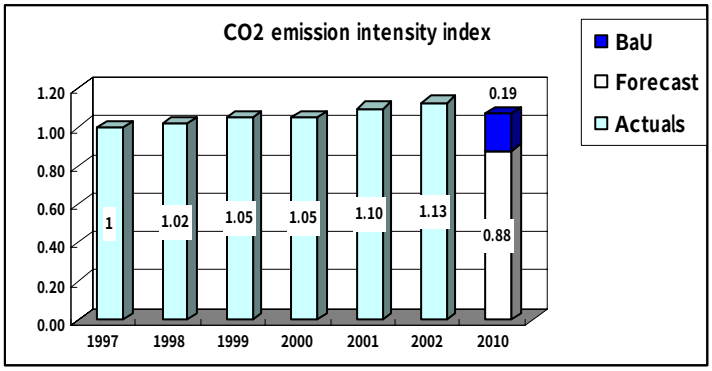
Note: The principal products of the industry are boilers, engines, mining machinery, chemical machinery, environmental devices, tanks, plastic manufacturing equipment, wind and water power equipment (pumps, compressors, ventilators), transportation equipment, power transmission devices, steel-making equipment, and commercial washing machines. Also included is engineering related to industrial machinery. The association surveyed 195 member companies and received responses from 139 entities in 108 companies (including specialist engineering entities). The follow-up survey response represents 98.9% of fiscal 2002 production value.

Forecasted production value in fiscal 2010 was calculated on the assumption that production value will continue to increase after fiscal 2002 through fiscal 2010 at a rate which is an average of predicted real growth rates announced by government. Energy consumption was calculated by applying the appropriate calorific coefficient to each substance, and summing the results. Forecast carbon dioxide emission intensity was calculated by assuming an annual improvement of 1% from the benchmark year (fiscal 1997). Carbon dioxide emissions were derived by multiplying the previously calculated carbon dioxide emission intensity forecast by the production value.

The Japan Bearing Industrial Association

To endeavor to reduce carbon dioxide emission intensity by 13% compared with fiscal 1997, by fiscal 2010

1. Progress toward goal

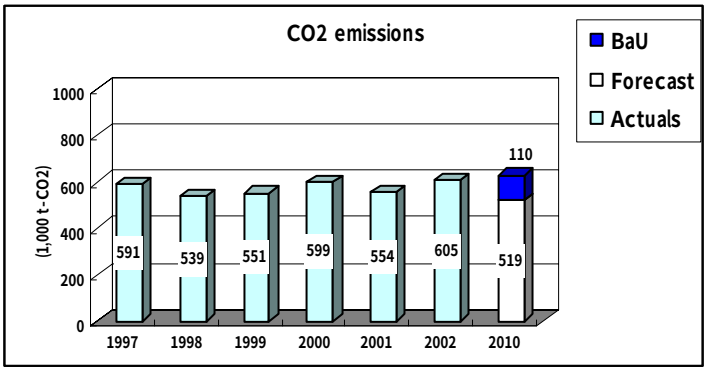


Assigning a value of one (1) to fiscal 1997 carbon dioxide emission intensity gives 1.13 in fiscal 2002. The industry is forecasting an index of 0.88 in fiscal 2010.

● Reasons for adoption of target

The industry formulated targets in fiscal 1998, but at that point in time there were a number of companies for which it was difficult to determine carbon dioxide emissions in fiscal 1990. The more recent fiscal 1997 was established as the benchmark year, and in view of the MITI notice in relation to the Law Concerning the Rational Use of Energy, which states that industry should strive to rationalize energy consumption with a target of reducing the energy consumption intensity of each business by an annual average of 1% or more, the target was set at a reduction of 13% on fiscal 1997 levels at the end of the 13 years to fiscal 2010.

2. Carbon dioxide emissions



The industry emitted 591,000 t-CO_2 of carbon dioxide in fiscal 1997, and 605,000 t-CO_2 in fiscal 2002. The industry is forecasting emissions of 519,000 t-CO_2 in fiscal 2010.

3. Steps taken to achieve targets

- Major
  - Measures to prevent leaks and reduce pressure in compressors
  - Use of other fuels in and waste heat from heat treatment facilities
  - Introduction of ice thermal storage air conditioning systems and gas heat pumps (GHP)
  - Introduction of highly efficient lighting
  - Turning off lights
  - Use of more efficient, inverter-enabled motors

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1997 and 2002

To carry out factoral analysis the carbon emission coefficient of power for each fiscal year was assumed to be constant (the 1.04 t-C/10,000 kWh carbon emission coefficient of power first used in formulating action plans was used for each fiscal year), and the results were derived to exclude factors attributable to changes in the coefficient in power equivalents. This gave total emissions of carbon dioxide in fiscal 2002 of 628,000 t-CO_2, as against 653,000 t-CO_2 in fiscal 1997, or 96.1% thereof; and intensity in fiscal 2002 of 101.2 t-CO_2 per 100 million yen, as against 95.7 t-CO_2 per 100 million yen in fiscal 1997, or 105.7 % thereof. Despite total emissions having declined, therefore, the result has been an increase in intensity.

The factors that have worked to push intensity up, despite member companies having worked to reduce carbon dioxide, are thought to be lower rates of plant operation due to the worsening business climate, energy consumption that is fixed and not linked to production activity, and declining product prices.

7. Environmental management and conservation in overseas business activities

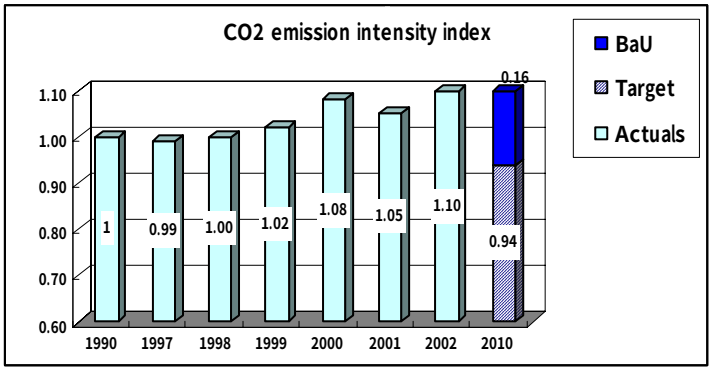
As of June 2003, member companies had obtained ISO 14001 certification at 51 factories and operating centers within Japan (15 companies) and at 52 sites overseas (seven companies).

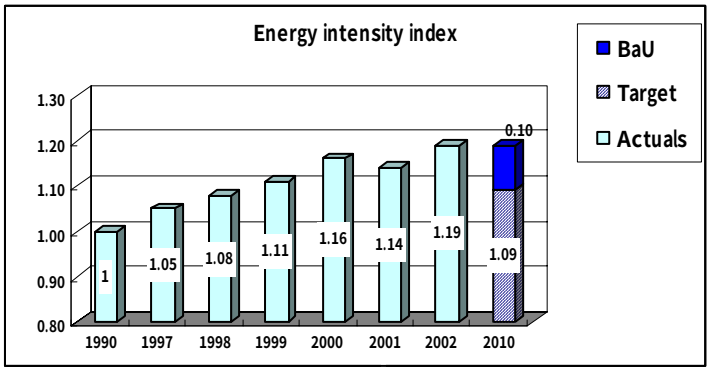
Note: The principal product of the industry is bearings. The participation rate in the follow-up survey was 83.3% (30 companies out of 36), representing 99.1% of fiscal 2002 production. The coverage rates of production levels for each fiscal year were extrapolated to calculate emissions. The forecast for fiscal 2010 was calculated on the assumption that the value of production would be the same as that in fiscal 1997.

The Japan Soft Drinks Association

To reduce carbon dioxide emission intensity in 2010 by 6% compared with 1990, and to keep energy consumption intensity in 2010 at the same level as in 1990.

1. Progress toward target





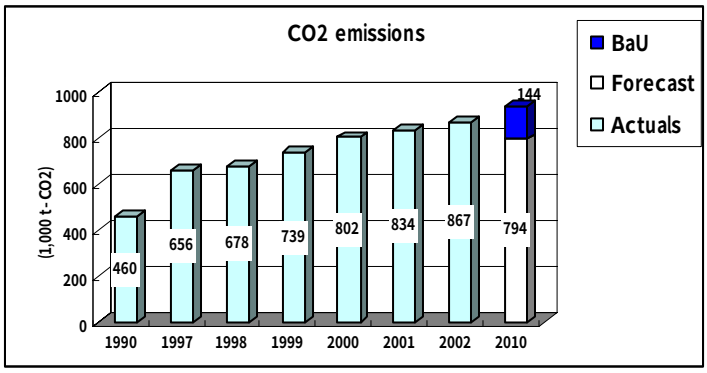
Assigning a value of one (1) to the fiscal 1990 carbon dioxide emission intensity index gives indices of 0.99 in fiscal 1997, 1.00 in fiscal 1998, 1.02 in fiscal 1999, 1.08 in fiscal 2000, 1.05 in fiscal 2001, and 1.10 in fiscal 2002. The industry is targeting an index of 0.94 in fiscal 2010.

Assigning a value of one (1) to the fiscal 1990 energy intensity index gives indices of 1.05 in fiscal 1997, 1.08 in fiscal 1998, 1.11 in fiscal 1999, 1.15 in fiscal 2000, 1.14 in fiscal 2001, and 1.19 in fiscal 2002. The industry is targeting an index of 1.00 in fiscal 2010, but forecasting an index of 1.09.

● Reasons for adoption of target

The adoption of intensity is the most appropriate way to accurately determine carbon dioxide emissions and energy consumption efficiency. Because capacity is used for statistical production data, intensity per unit production (kl) has been taken as the indicator. Emissions could also conceivably be a target, but from 1990 to 2002 production volume has grown by roughly 1.5 times, and no matter how efficient industry becomes, this makes emissions as a target difficult. Thus, intensity has been adopted as the indicator.

2. Carbon dioxide emissions



The industry has emitted the following amounts of carbon dioxide: 460,000 t-CO_2 in fiscal 1990; 656,000 t-CO_2 in fiscal 1997; 678,000 t-CO_2 in fiscal 1998; 730,000 t-CO_2 in fiscal 1999; 802,000 t-CO_2 in fiscal 2000; 834,000 t-CO_2 in fiscal 2001; and 867,000 t-CO_2 in fiscal 2002. Emission forecasts are for 794,000 t-CO_2 in fiscal 2010—an increase of 72.6% on fiscal 1990. If voluntary action plans were not implemented, emissions of carbon dioxide would be 939,000 t-CO_2 in fiscal 2010—up 104.1% on fiscal 1990.

3. Steps taken to achieve targets

- Introduced highly efficient electrical equipment (such as inverter-controlled devices)
- Achieved more efficient operation of electrical plant and equipment (such as devices to control number of units)
- Introduced cogeneration facilities
- Introduced anaerobic treatment into wastewater treatment facilities
- Effectively used methane gas generated from wastewater treatment facilities
- Encouraged the recovery of heat from drains and hot waste water
- Reduced loss of heat
- Converted to other types of fuel (to gas)
- Used new energy sources (such as fuel cells, solar power, and wind power)

- Fiscal 2002 actual

Examples	Investment	Effect
Greater efficiency in relation to generation of steam (more small through flow boilers, and improvement in temperature of water supplied)	¥42m	211 kl
Optimization through temperature control of hot water in pasteurizers	¥5m	65.6 kl
Recovery of waste heat from steam drains and pasteurizers and recycling to boilers	¥32m	164.1 kl
Optimization through introduction of inverters and control over number of compressors	¥53.25m	272.3 kl
Reduced power through introduction of anaerobic waste water treatment facilities	¥125m	65% reduction in power consumed
Repairs to steam pipes and steam traps	¥15m	36.1 kl
Conversion of fuel for boilers to natural gas	¥195m	(Amount of CO_2 reduced) 1,244 t

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Carbon dioxide emissions in fiscal 2002 increased by approximately 88.4% compared with fiscal 1990 levels.

An analysis of the factors that caused fiscal carbon dioxide emissions to increase 88.4% on fiscal 1990 levels gives the following (using the method suggested by the Keidanren Secretariat).

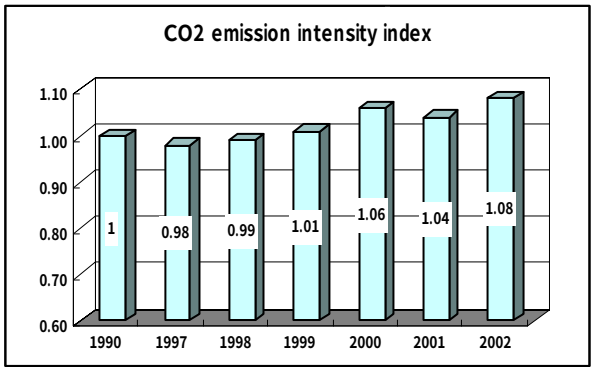
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	460	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	867	
Variation in CO_2 emissions	407	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	3	0.7%
Contribution from production activity	341	74.3%
Contribution from emissions per unit of production activity	62	13.5%

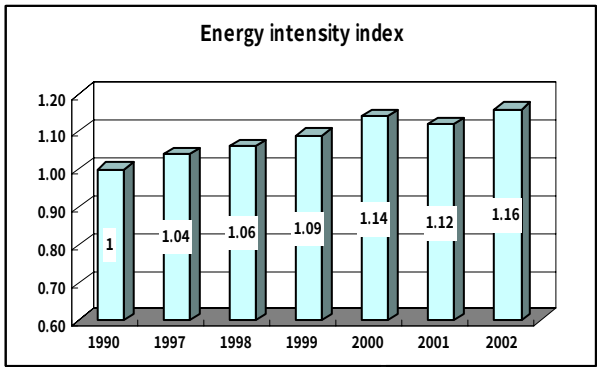
● Reasons for variations in emissions

(1) Increased production

(2) Internal manufacturing of a greater proportion of PET bottles (in-house production of containers)

(Ref.) Carbon dioxide intensity after excluding in-house manufacture of containers, Energy consumption intensity index





(3) Greater consumption of energy due to improvements in the production environment achieved through HACCP (Hazard Analysis Critical Control Point)

(4) Greater consumption of energy resulting from changes in soft drink product categories and changes in the structure of containers

(5) Greater consumption of energy resulting from production of more product categories in small lots

NB Items (2) to (5) are also factors in intensity increases.

7. Environmental management and conservation in overseas business activities

ISO 14001 certification status of 35 companies that participated in the follow-up survey:

Certification acquired	50 factories
Certification expected in FY 2003	1 factory
Certification expected after FY 2003	3 factories
Unknown	20 factories
Total	74 factories

* Aggregated from the number of factories operated by the 35 companies participating in the follow-up survey.

Note: (1) The principal product of the industry is soft drinks. There were 35 respondent companies to the follow-up survey, representing 53.9% of production.

(2) Three companies joined the Association this fiscal year, but their intensity was extremely high, and raised both 2001 and 2002 intensity indices by 0.01 compared with 1990. In the period from 1990 to about 1999, the share of production represented by these three companies among the total of 35 was small enough as to have almost no effect.

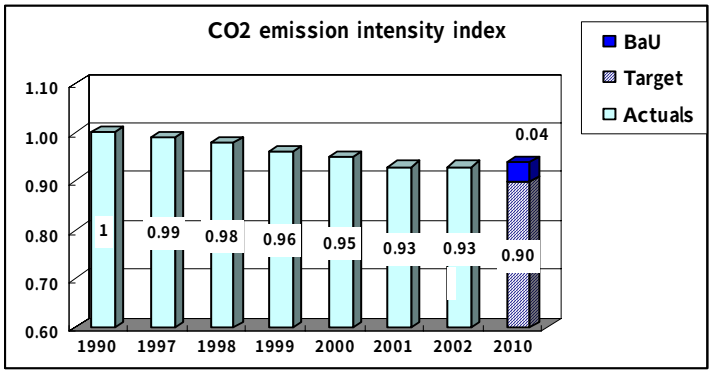
(3) Carbon dioxide emissions were calculated by aggregating data from the 35 member companies. The industry's forecasts for fiscal 2010 assume an annual increase in production of 1%.

Japan Trucking Association

To reduce by fiscal 2010 the carbon dioxide emission intensity of commercial trucks by 4% in the value forecast over the period from fiscal 1996 to fiscal 2010.

1. Progress toward target

Assigning a value of one (1) to the actual carbon dioxide emissions intensity index of commercial trucks (light oil) in fiscal 1996 gives an index of 0.93 in 2002.

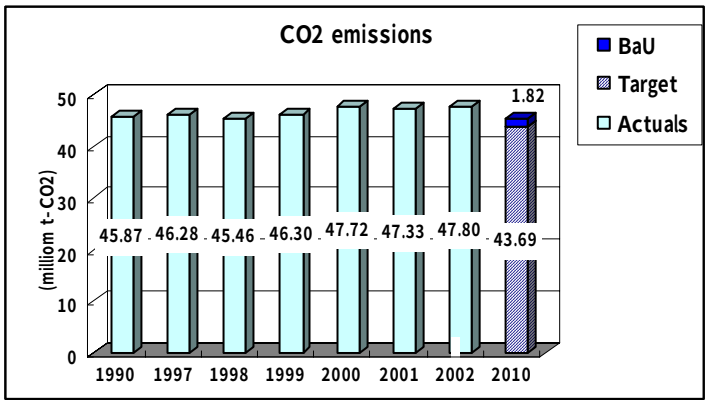


●Reasons for adoption of target

The volume of freight varies substantially with economic conditions, which means that the absolute volume of carbon dioxide emissions associated with trucking also varies. The industry's chosen target indicator is therefore carbon dioxide emissions intensity, which is within the effective range of industry effort.

Transported ton kilometers is a more accurate indicator of freight as an economic activity, and is derived by multiplying the weight of freight carried (in tons) by the distance each unit of freight is transported (in kilometers). Industry is using fuel consumption per transported ton kilometer as an indicator to calculate carbon dioxide emission intensity.

2. Carbon dioxide emissions



Actual carbon dioxide emissons were 45.87 million t-CO_2 in fiscal 1996, and 47.80 million t-CO_2 in fiscal 2002. The target for 2010 is 4.8% less than the fiscal 1996 level, or 43.69 million t-CO_2.

3. Steps taken to achieve targets

- Major steps
  - Initiatives to encourage the general practice of ecologically friendly driving, "Economic drive and energy saving drive"
  - Rigorous enforcement of the practice of turning off engines, rather than letting them idle, "Idling stop"
  - Measures to promote the introduction of low-emission vehicles
  - A forestation project
  - Measures to promote substitution of vehicles that comply with the latest regulations
  - Initiatives to enhance transpotation efficiency
  - Other environmental conservation initiatives
  - Activities to request member companies to contribute to measures against global warming

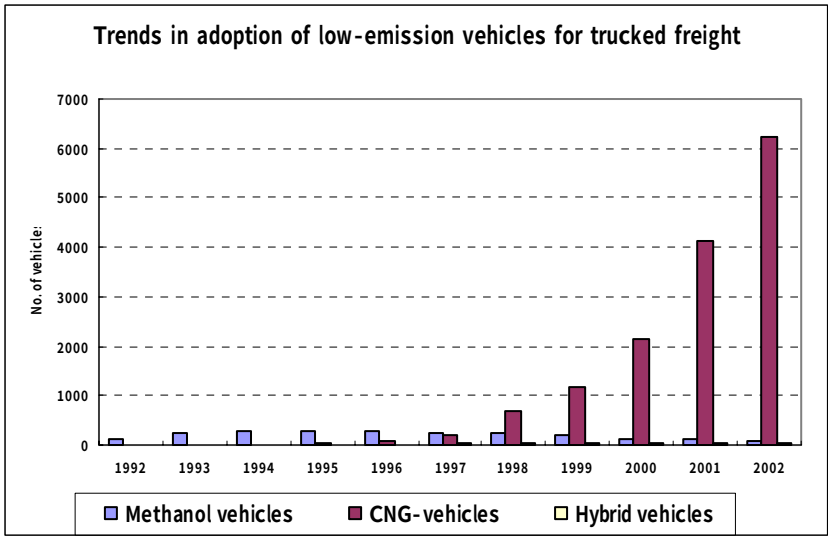
- A case study of measures against global warming taken in fiscal 2002, estimated amount of investment, and effects
  - Subsidies for the introduction of low-emission vehicles

    As of the end of fiscal 2002, the industry was operating 6,352 vehicles, of which 6,233 ran on CNG, 96 on methanol, and 23 on hybrid fuel.

    Estimated investment in fiscal 2002 was 11.528 billion yen.

    Basis for calculations: 2,096 vehicles x 5.5 million yen = 11.528 billion yen

    (Number of additional CNG vehicles in fiscal 2002) x (Assumed average unit price)



FY		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
No. of subsidized vehicles (units = vehicle)	Methanol Vehicles	127	240	270	271	274	259	243	192	137	115	96
	CNG Vehicles	0	0	16	39	73	222	669	1180	2162	4137	6233
	Hybrid Vehicles	0	0	0	0	0	21	21	21	21	21	23
	Total	127	240	286	310	347	502	933	1393	2320	4273	6352
	No. of CNG Vehicles per FY	0	0	16	23	34	149	447	511	982	1975	2096

- Subsidies for the introduction of heat storage mats and other forms of

energy-saving equipment

The Association provides subsidies toward the cost of acquiring heating and cooling equipment to be fitted to trucks that can be used for very long, continuous periods when engines are turned off while drivers rest or wait for loads (such as electric blankets, mats or beds, air or hot water heaters, and cold storage coolers).
The estimated investment in fiscal 2002 was 225.25 million yen.
Basis for estimate: 200 cold storage coolers x 200,000 yen = 40 million yen (A)
(Number of cold storage coolers for which subsidy was given in fiscal 2002) x (Assumed average unit price)
Basis for estimate: 6,175 thermal storage mats x 30,000 yen = 185.25 million yen. (B)
(Number of thermal storage mats for which subsidy was given in fiscal 2002) x (Assumed average unit price)
(A) + (B) = 225.25 million yen

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

The factors in the increase in carbon dioxide emissions since 1996 have been analyzed using the following method.

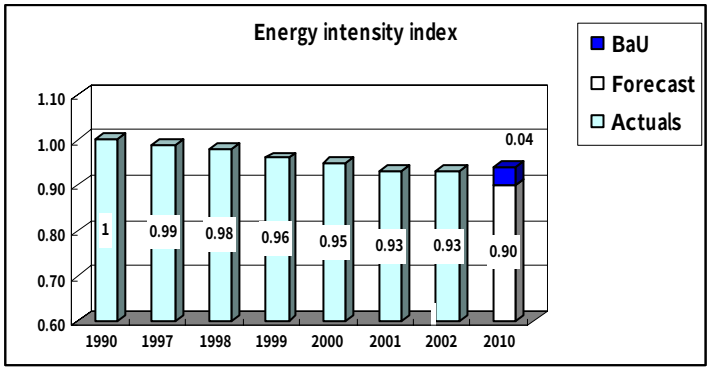
Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed "Fixed coefficient emissions." The difference between actual emissions and fixed coefficient emissions is deemed the "Contribution from changes in coefficient of carbon dioxide emissions." Assuming a relationship whereby "Fixed coefficient emissions = Trucking activity x Emissions per unit of trucking activity" enables the amount of change in fixed coefficient emissions to be broken down into "Contribution from trucking activity," and "Contribution from emissions per unit of trucking activity."

	million t-CO2	(Compared with fiscal 1996)
Fiscal 1996 CO_2 emissions	45.873	
Fiscal 2002 CO_2 emissions	47.798	
Variation in CO_2 emissions	1.925	4.2%
(Breakdown) Contribution from changes in CO_2 emissions coefficient	0	0%
Contribution from trucking activity	5.499	12.0%
Industry effort	-3.574	-7.8%

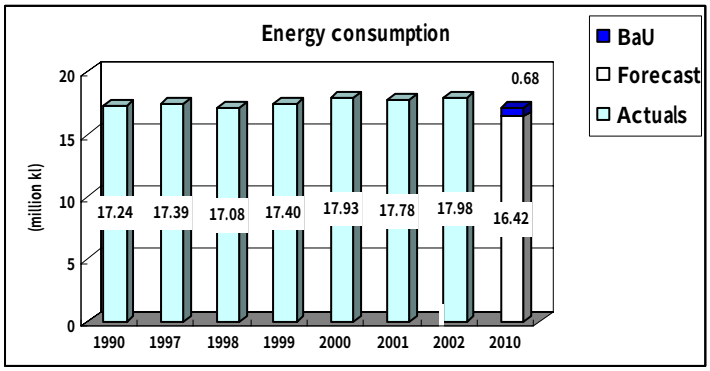
● Reasons for variations in emissions in fiscal 2002

The industry actively moved ahead with measures to promote ecologically friendly driving practices, to turn off rather than idle engines, and to substitute large commercial trucks with trailers. It has and also advanced measures to enhance transpotation efficiency, such as substituting 25-ton vehicles for 20-ton vehicles. Despite the aforementioned measures, transported ton kilometers increased, limiting improvement to an extent greater than that originally forecast.

5. Reference data



Assigning a value of one (1) to fiscal 1996 energy consumption intensity gives an index of 0.93 in fiscal 2002.



Energy consumption rose 720,000 kiloliters above fiscal 1996 levels in fiscal 2002.

6. Other global warming prevention initiatives

The industry is actively advancing its "Basic environmental preservation action", voluntarily formulated in February 2001 with the aim of promoting a symbolic relationship with society and of developing a trucking business.

7. Environmental management and environmental preservation initiatives in overseas business activities

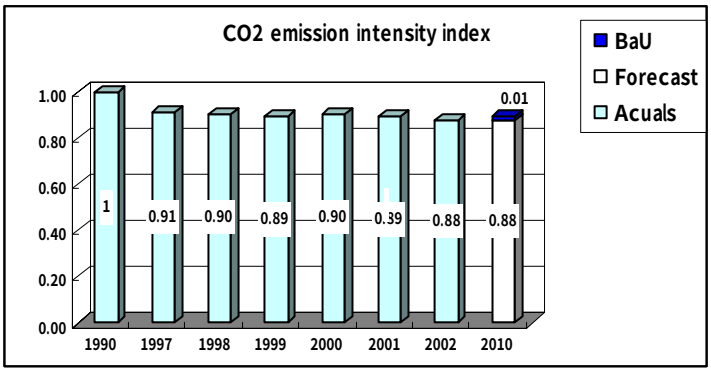
- Determining status of implementation of action plans
- Reviewing targets in accordance with progress of the plans
- Reviewing the plans themselves in response to dramatic changes in the transportation industry, and considering changes in their formulation, while continuing for present with existing plans.

Note: The main business of the industry is transportation of freight. Carbon dioxide emissions were calculated using consumption of light oil (in commercial trucks) from trends in motor vehicle fuel consumption (from the Ministry of Land, Infrastructure and Transport's "Summary of Transportation Statistics"). In forecasting 2010 levels it was assumed that mesaures to reduce NOx and introduce low polluting motor vehicles and substitute automobiles would progress, and that vehicle fuel consumption levels (with reference to light oil and commercial trucks) would be the same as in 1996. It is anticipated that promulgation of revised NOx and PM legislation and implementation of PM measures by Tokyo and other regional governments will affect level of business ownership of motor vehicles, causing dramatic change in the number of vehicles owned, which means that there is a danger that fuel consumption forecasts for 2010 could deviate significantly.

The Scheduled Airlines Association of Japan

To reduce carbon dioxide emissions generated from the use of aviation fuel by 10% per unit of production (available seat kilometer) by fiscal 2010 compared with fiscal 1990.

1. Progress toward target



Note: A value of one (1) has been assigned to the fiscal 1990 intensity index.

Assigning a value of one (1) to the fiscal 1990 carbon dioxide emission intensity index per available seat kilometer gives indices of 0.91 in fiscal 1997, 0.90 in fiscal 1998, 0.89 in fiscal 1999, 0.90 in fiscal 2000, 0.89 in fiscal 2001, and 0.88 in fiscal 2002—results which generally indicate a steady decline. The airline industry is forecasting an index of 0.88 in fiscal 2010.

● Reasons for adoption of target

Aviation is well established as a high-speed means of transportation, used regularly by the people of Japan, and the number of routes and flights is increasing steadily as passenger demand grows.

There is, however, no fuel that can be used in place of jet fuel. The aim is therefore to improve fuel consumption efficiency through equipment upgrades, and accordingly, the industry has opted to use intensity per available seat kilometer, which is an indicator that is representative of aviation company production volume.

3. Steps taken to achieve goals

- Major
  - Encouraging the introduction of new aircraft models with improved fuel efficiencies (23 new aircraft in service in fiscal 2002)
  - Establishing shorter routes and flying times and more precise operation, through introduction of the Communications, Navigation and Surveillance Systems for Air Traffic Management (CNS/ATM).

- Choosing optimum altitudes and speeds and the shortest possible routes for daily services
- Loading aircraft with optimum amounts of fuel, using lighter aircraft/cabin equipment and cabin servicing items, limiting use of Auxiliary Power Units, reducing on-board flight training and JCAB check time using flight simulators, and implementing shorter engine test times

● Fiscal 2002 actual

In fiscal 2002, the industry took 17 older aircraft out of service, replacing them with 23 new aircraft with improved fuel efficiency (the total investment was on the order of ¥240 billion).

4. Reasons for variation in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Air transport demand has increased in the last 12 years, which has in turn caused carbon dioxide emissions to rise. The aforementioned initiatives have nevertheless reduced the target emission intensity, and in contrast to an 80% increase in available seat kilometers, carbon dioxide emissions have grown by only 62% (including cargo flights and non-member airlines).

● Reasons for increases or decreases in 2002

Variations were due to a greater volume of aircraft transport.

6. Other global warming initiatives

● Emissions from offices and in-house distribution

Industry members have typically endeavored to conserve energy by managing air conditioner temperature settings and the timing and duration of supply, and by seeking to save electricity and water at operating centers. These activities are ongoing for further improvement. In relation to machinery and equipment, the industry has also made it a practice to introduce the most energy-efficient models available at a given time, and will continue to do so.

● Greenhouse gases other than carbon dioxide

The industry is limiting emissions of substitute fluorocarbons through conservation and recycling, and through preventing their leakage during servicing and repair of equipment that uses them (use of high performance conservancy equipment has facilitated a recovery rate of almost 100%).

7. Environmental management and conservation in overseas business activities

- Industry members are in the process of either acquiring ISO 14001 certification, or establishing environmental management systems based on ISO 14001 requirements. Companies that are already certified are pursuing further improvements.
- Industry members abide by the rules and regulations applicable at overseas airports, and satisfy the environmental requirements of each airport.

Note: The principal business of member companies of the Scheduled Airlines Association of Japan is providing regular air transport services over domestic and international routes. The participation rate in the follow-up survey was almost 100%; 14 member companies responded.

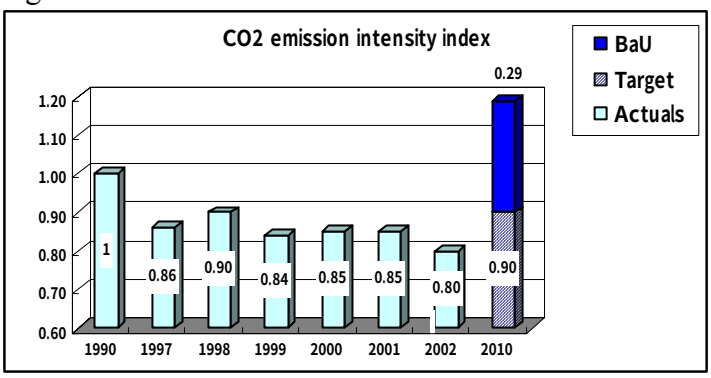
Fiscal 2010 forecasts assume annual growth in aviation demand on international routes of 4%, and on domestic routes of 3.1%, based on "Forecasts of Long-Term Transport Demand" published by the General Affairs Committee of the Council for Transport Policy dated June 2000.

The unit of production being used by the industry is seat kilometers (number of seats provided multiplied by distance flown), which is an indicator that is representative of the production volume of the aviation transportation business.

The Japanese Shipowners' Association

To reduce carbon dioxide emissions in 2010 on a per-unit transported basis by approximately 10% compared with 1990.

1. Progress toward target



Assigning a value of one (1) to the fiscal 1990 carbon dioxide emission intensity index gives 0.86 in fiscal 1997, 0.85 in fiscal 2000 and 0.80 in fiscal 2002. The unit of production on which carbon dioxide emissions are based is unit of cargo transported.

●Reasons for adoption of target

Volume of cargo transported is trending upwards year on year, and it is the responsibility of the maritime transport industry to respond to that demand. The industry has therefore chosen carbon dioxide emissions per unit transported as the target indicator, given the need for efficient transport.

3. Steps taken to achieve targets

- Major
  - Conversion to new, more efficient ships, and use of energy-efficient equipment
  - Research into and use of navigational aid systems to facilitate optimum route plotting
  - Research into and implementation of shipboard energy-saving operating technology, and strict compliance with energy-saving initiatives
  - Initiatives to improve fuel consumption, including research into and implementation of effective use of waste energy and more efficient propulsion
  - Ship design optimized for more efficient transport
  - Energy conservation initiatives in on-shore offices, including adjusting heating and cooling temperatures and running time, and use of energy-efficient office automation

- Fiscal 2002 actual
  - Measures to improve propulsion efficiency, such as regular ship cleaning and painting, and propeller grinding
  - Measures to improve main engine combustion efficiency, such as thorough maintenance of fuel and air bleed valves
  - Selection of optimum routes to reduce higher fuel consumption from external disturbances, and, where schedules permit, lowering cruising speed to reduce energy consumption

4. Reasons for variation in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Although carbon dioxide emissions have been increasing over the last 12 years due to growth in cargo volumes, the aforementioned initiatives are lowering the energy intensity as targeted. Cargo volumes are up 47.6% since fiscal 1990, but the increase in carbon dioxide emissions over the same period was just 18.3%.

- Reasons for increases or decreases in fiscal 2002

As a result of the aforementioned initiatives, reasons for variations may be ascribed to adoption of fuel-efficient machinery and equipment, proper maintenance of shipboard machinery and equipment, and selection of optimum routes using marine meteorology services. Further probable reasons are improved transport efficiency due to larger vessels, introduction of newly built ships, and smaller numbers of vessels in shipping fleets.

6. Other global warming initiatives

- Emissions from offices and in-house distribution

Energy conservation initiatives in on-shore operational centers will be ongoing, including adjusting air conditioning and heater settings and running times, and implementing energy conserving office automation**.**

- Greenhouse gases other than carbon dioxide
  - The industry will monitor development of refrigerants that have minimal global warming impact with a view to adopting them to replace chlorofluorocarbon substitutes such as HFCs used in air conditioning equipment, food warehouses, and reefer containers. It will also endeavor to prevent the escape of HFC gases into the atmosphere during servicing and repair work.

7. Environmental management and conservation in overseas business activities

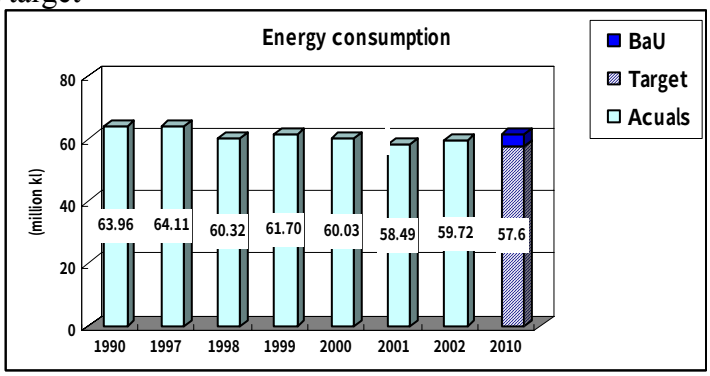
- Environmental management systems: the industry will continue in its endeavors to protect the environment, and will consider the introduction of environmental management systems, with a view to ISO 14000 certification (environmental management standards).

Note: The industry is involved in ocean shipping generally, but the targets in this report apply only to overseas shipping. The number of companies participating in the follow-up survey was 32, representing 881.38 million tons of freight (in fiscal 2002). Carbon dioxide emission intensity is the figure derived by dividing the total volume of fuel consumed (by the 32 companies that transported cargo by ocean liner) by the volume of cargo transported. Estimates of fiscal 2010 cargo volumes were drawn from the most recent five-year trends in freight volumes of the Japanese mercantile fleet (Source: Ministry of Land, Infrastructure and Transport). Carbon dioxide emissions vary with the distance that freight is transported, but for the purposes of the survey, carbon dioxide emission intensity was calculated using only freight volumes.

The Japan Iron and Steel Federation

Targets: To reduce the amount of energy consumed in 2010 by 10% from the fiscal 1990 base year. In an additional initiative, the industry will seek to recycle an amount of waste plastic equivalent to 1.5% of the energy consumed in fiscal 1990 in blast and other furnaces (assuming the establishment of a collection system).

1. Progress toward target

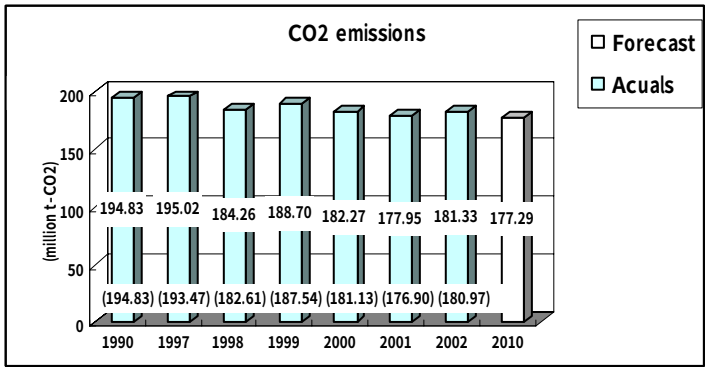


The steel industry has recorded the following energy consumption (in crude oil equivalents): 63.96 million kl in fiscal 1990; 58.49 million kl in fiscal 2001 (down 8.5% compared with fiscal 1990); and 59.72 million kl in fiscal 2002 (down 6.6% on the same benchmark).

● Reasons for adoption of target

At the time that the steel industry formulated its voluntary action plans, the carbon dioxide coefficient of emissions was ill-defined, and the industry took energy consumption as the indicator, as it could be determined using the Current Survey of Oil Consumption and other sources. Also, it decided that because the Japanese national target for global warming measures involves total carbon dioxide emissions rather than intensity, as a target, energy reductions could be more readily understood by wider society.

2. Carbon dioxide emissions



Note: The figures in parenthesis represent emissions that reflect carbon dioxide coefficients provided by the electric power industry each year.

The steel industry has recorded the following carbon dioxide emissions from energy sources (not including emissions from industrial processes): 194.83 million t-CO_2 in fiscal 1990; 177.95 million t-CO_2 in fiscal 2001 (down 8.7% compared with fiscal 1990); and 181.33 million t-CO_2 in fiscal 2002 (down 6.9% on the same benchmark).

The figures have been derived by taking as constant the fiscal 1990 carbon dioxide emissions intensity suggested by the Federation of Electric Power Companies of Japan (JISF method). If the carbon dioxide emissions intensity from power production for each fiscal year suggested by the Federation of Electric Power Companies of Japan and adopted by Keidanren are used, carbon dioxide emissions in fiscal 2002 become 180.97 million t-CO_2 (down 7.1% compared with fiscal 1990).

Carbon dioxide emissions from the non-energy sources—limestone and dolomite—are trending downwards due to improvements in the quality of sintered ore, and operational efforts to reduce slag, for example. They were 11.6 million t-CO_2 in fiscal 1990; 10.1 million t-CO_2 in fiscal 2001; and 10.3 million t-CO_2 in fiscal 2002.

3. Steps taken to achieve goals

- Major
  - Conducting initiatives to conserve energy in the steel production process
  - Making effective use of waste plastics
  - Making untapped energy available to local communities
  - Contributing to society's energy conservation through products and by-products
  - Contributing to energy conservation through international technical cooperation (including JI and CDMs)

- Fiscal 2002 actual

  The following are the key initiatives implemented in fiscal 2002.
  - Improving reheating furnace efficiency (including introducing regenerative burners and stronger insulation)
  - Improving recovery rates of waste energy from CDQ, TRT, sintering, and conversion furnaces
  - Establishing more efficient private power generation facilities and oxygen plants
  - Introducing control of motor revolutions in dust collectors
  - Consolidating facilities
  - Improving hot charge ratio
  - Improving efficiency in coal moisture control equipment
  - Recycling waste plastics into blast furnaces, coke ovens, and the like

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

To derive the proportion attributable to industry effort, the ratio of variation in energy intensity is used (corrected for scale of production).

Specific efforts engaged in by the steel industry that represented the greatest factors in variations in emissions were the aforementioned energy-saving initiatives, which resulted in reductions in carbon dioxide emissions. (In the steel industry, carbon dioxide emission levels are broadly linked to energy consumption.)

		FY1990	FY2002	FY02/90 (%)	
CO_2 emissions (Note 1)	million t-CO_2	194.826	180.969	-7.11	①
CO_2 emissions (Note 2)	million t-CO_2	194.826	181.332	-6.93	②
Energy intensity index for the steel industry	FY90=100	100	93.90	-6.10	③

			FY02-90	FY02/90 (%)	
Variation in CO_2 emissions attributable to efforts in relation to power	million t-CO_2		-0.363	-0.19	④=①-②
Variation in CO_2 emissions attributable to steel industry efforts	million t-CO_2		-11.884	-6.10	③
Economic and other influences	million t-CO_2		-1.610	-0.83	⑤=①-④-③
Total	million t-CO_2		-13.857	-7.11	①

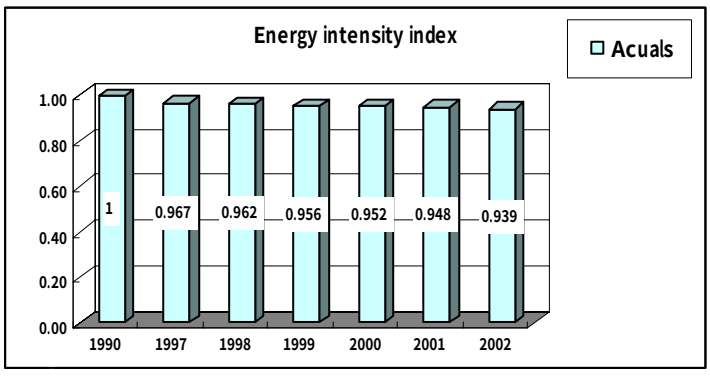
Note 1: If the carbon dioxide emissions intensity for power production proposed by the Federation of Electric Power Companies of Japan is used
Note 2: If the carbon dioxide emissions intensity for power production is fixed at 0.1019 kg-C/kWh (FY90).

● Reasons for variations in emissions in fiscal 2002

Compared with fiscal 1990, the reductions in carbon dioxide emissions attributable to industry effort were 11.88 million t-CO_2, while the reductions attributable to efforts in relation to power were 360,000 t-CO_2.

Comparison with fiscal 2001 reveals that the reason carbon dioxide emissions increased is that, while in the relevant fiscal year a substantial number of energy-saving initiatives were implemented, outcomes were affected by a 7.6% increase in crude steel production.

5. Reference data



Assigning a value of one (1) to the fiscal 1990 energy intensity index gives 0.948 in fiscal 2001 and 0.939 in fiscal 2002.

6. Other global warming initiatives

- Evaluation from an LCA perspective

  The industry has been proactive in developing high-performance steel products that exploit steel's metallic attributes, such as high-strength steel sheets for automobiles, electrical steel sheets for transformers, and ultra-thin steel sheets for cans. Through their use, each is making a significant social contribution to energy conservation. In the period from fiscal 1990 to fiscal 2000, there were 6 typical high-performance steel products that were manufactured (wide-flange shapes for buildings construction, heat-resistant steel tubing for boilers, high-strength steel sheets for automobiles, high-strength steel plates for ships, electrical steel sheets for transformers, and stainless steel sheets for electric trains). It is estimated their social contribution during application as of fiscal 2000, in terms of limiting carbon dioxide emissions, has been approximately 6.5 million t-CO_2.

- Projects implemented regarding the Kyoto Mechanism
  - Work has been completed on eleven "Green Aid Plan" model projects for the efficient use of energy in China and Thailand since 1995, and a further one is underway in India. Additionally, four of the model projects—two each in China and Thailand—were agreed upon with the respective countries as Activities Implemented Jointly (AIJ), and therefore had official recognition at a national level. (The estimated annual energy saving effect achieved from completed model projects is 356,400 t-CO_2 per year.)
  - To explore the feasibility of future JI or CDMs, the industry has evaluated a number of national (NEDO) projects since fiscal 1998 (Basic Survey Project for Joint Implementation, etc.). The industry was commissioned to conduct seven project studies in fiscal 1998, 15 in fiscal 1999, six in fiscal 2000, eight in fiscal 2001, and six in fiscal 2002. (The Basic Survey Project for Joint Implementation, etc. estimated that carbon dioxide reductions achieved were 10.78 million t-CO_2 in fiscal 1998, 4.624 million t- CO_2 in fiscal 1999, and 1.521 million t- CO_2 in fiscal 2000.)

7. Environmental management

The steel industry has for some time positioned environmental problems as an important management issue, and has been proactive in the pursuit of solutions. The industry is engaged in waste and recycling initiatives in its voluntary action plans, in connection with global warming.

Note: There were 69 participating companies, including those in the steel industry and those involved in manufacturing steel products. For non-participating companies, designated statistics (The Current Survey of Oil Consumption) were used to calculate energy consumption volumes, in order to achieve 100% coverage from both participating and non-participating companies.

The Association liaised with the secretariats of the Federation of Electric Power Companies of Japan, the Japan Chemical Industry Association, the Japan Cement Association, and the Japan Lime Association, to ensure there was no overlap of boundaries for power, coke, cement and limestone.

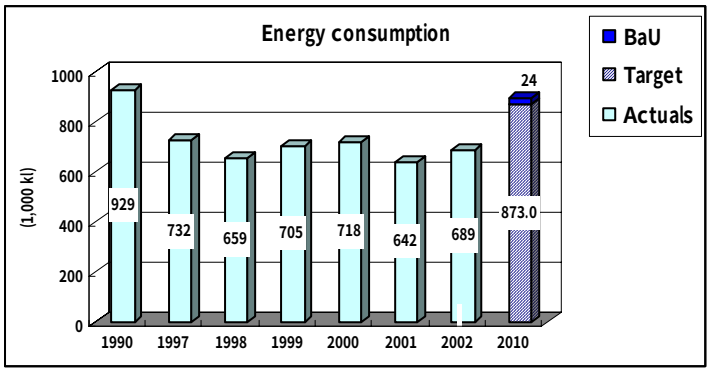
The forecast in fiscal 2010 has assumed crude steel production on the order of 100 million tons.

The fiscal 1990 carbon dioxide emission intensity figure for electricity (0.1019 kg-C/kWh) has been used for the period fiscal 1997 to 2010.

Japan Lime Association

To consume 6% less energy in lime manufacturing in fiscal 2010 than in fiscal 1990.

1. Progress toward target

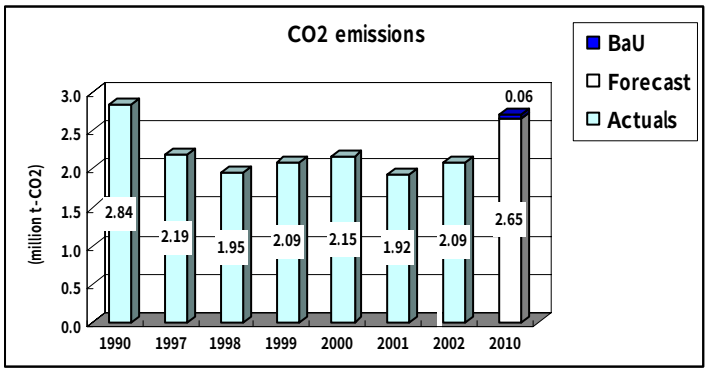


The amount of energy consumed in lime manufacturing was: 929,000 kl in fiscal 1990; 732,000 kl in fiscal 1997; 659,000 kl in fiscal 1998; 705,000 kl in fiscal 1999; 718,000 kl in fiscal 2000; 642,000 kl in fiscal 2001; and 689,000 kl in fiscal 2002. The fiscal 2010 target is 873,000 kl—a 6% reduction from fiscal 1990 levels. If initiatives were not implemented, energy consumed in fiscal 2010 would be 898,000 kl, a reduction of 3.4%, and the target seems to be difficult to achieve.

●Reasons for adoption of target

The rate of reduction established by the Kyoto Protocol (6% reduction in emission of global warming gases) was considered in establishing the target. For each product, production process, manufacturing capacity, energy consumption, and other factors are different and their comparison is difficult on an energy consumption unit basis. Total energy consumed was therefore chosen as the target.

2. Carbon dioxide emissions



Carbon dioxide emissions were: 2.84 million t-CO_2 in fiscal 1990; 2.19 million t-CO_2 in fiscal 1997; 1.95 million t-CO_2 in fiscal 1998; 2.09 million t-CO_2 in fiscal 1999; 2.15 million t-CO_2 in fiscal 2000; 1.92 million t-CO_2 in fiscal 2001; and 2.09 million t-CO_2 in fiscal 2002. Factors in the emission increase in fiscal 2002 were higher

production levels (up 7.8% on fiscal 2001) and an increase in the carbon emission coefficient of purchased power (from 0.921 t-c/10,000 kWh in FY2001 to 0.987 t-c/10,000 kWh in FY2002). The forecast for fiscal 2010 is 2.65 million t-CO_2, down 6.7% from fiscal 1990. If voluntary action plans were not implemented, emissions would be 2.71 million t-CO_2 in fiscal 2010: 4.6% less than in fiscal 1990.

Carbon dioxide emissions from the non-energy sources of raw materials, both limestone and dolomite were: 4.97 million t-CO_2 in fiscal 1990; 4.37 million t-CO_2 in fiscal 1997; 4.02 million t-CO_2 in fiscal 1998; 4.27 million t-CO_2 in fiscal 1999; 4.36 million t-CO_2 in fiscal 2000; 4.04 million t-CO_2 in fiscal 2001; and 4.36 million t-CO_2 in fiscal 2002.

3. Steps taken to achieve targets

● Major undertakings

- Best efforts to convert to recycled fuel
- Achieved higher efficiency by upgrading of plants and equipment
- Applied inverter control to fans and compressors

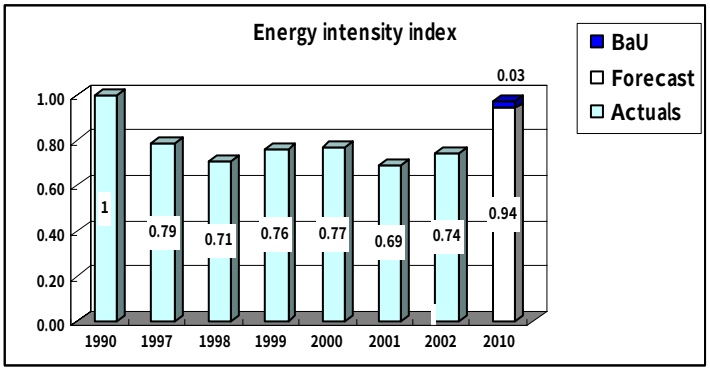
4. Reasons for variations in carbon dioxide emissions

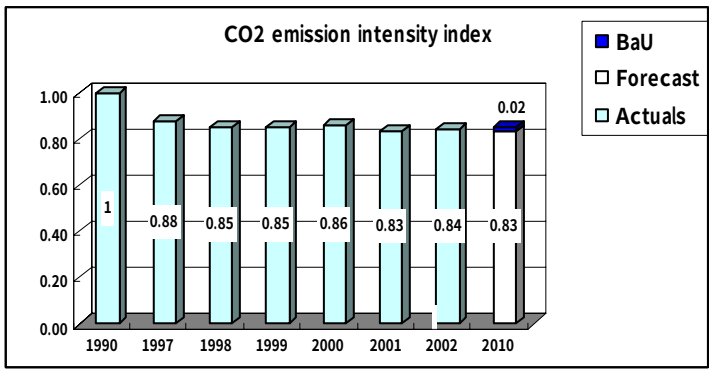
● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

	1,000 t-CO_2	Proportion contributed
Fiscal 1990 CO_2 emissions	2844	
Fiscal 2002 CO_2 emissions	2091	
Variation in CO_2 emissions	-753	
→(Breakdown) Contribution from changes	7	0.9%
→in CO_2 emissions coefficient		
→Contribution from production activity	-360	-47.8%
→Contribution from emissions per unit	-400	-53.1%
→of production activity		

(In accordance with method proposed by Keidanren Secretariat)

5. Reference data





Note: A value of one (1) has been assigned to the fiscal 1990 intensity index.

Assigning a value of one (1) to the fiscal 1990 energy consumption index gives: 0.79 in fiscal 1997; 0.71 in fiscal 1998; 0.76 in fiscal 1999; 0.77 in fiscal 2000; 0.69 in fiscal 2001; and 0.74 in fiscal 2002. The forecast for fiscal 2010 is 0.94.

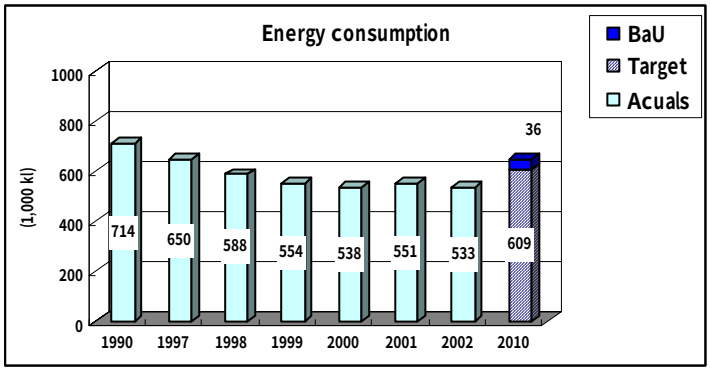
Assigning a value of one (1) to the fiscal 1990 index of carbon dioxide emissions intensity gives: 0.88 in fiscal 1997; 0.85 in fiscal 1998; 0.85 in fiscal 1999; 0.86 in fiscal 2000; 0.83 in fiscal 2001; and 0.84 in fiscal 2002. The forecast for fiscal 2010 is 0.83.

Note: The main products of the industry are quick lime, slaked lime, dolomitic quicklime, and hydrated dolomite. The proportion of companies participating in the follow-up survey was 97% (90 out of 93 companies). The forecast for fiscal 2010 of quick lime produced (112%) was derived by using the variations in each fiscal year in energy intensity and the forecast of economic growth rate in fiscal 2010.
. The target for energy consumption is considered to be achievable, by the reason that fuel conversion and other efforts should result in a index of 0.94 in fiscal 2010.

Flat Glass Manufacturers Association of Japan

To reduce the amount of energy used in the production process by 14% of the amount consumed in fiscal 1990 by fiscal 2005, and by 15% by fiscal 2010.

1. Progress toward target

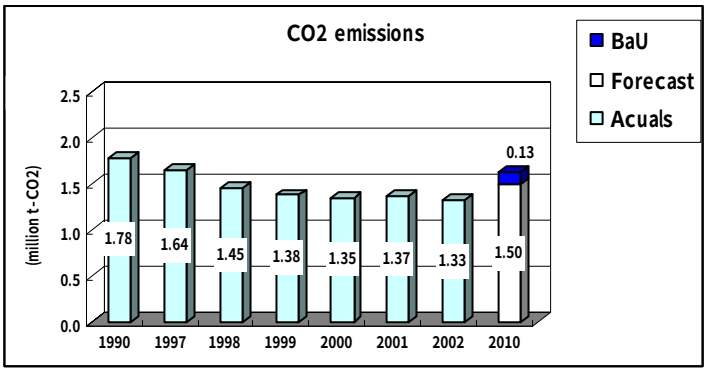


The flat glass industry consumed 714,000 kl in fiscal 1990 and 533,000 kl in fiscal 2002. It is forecasting consumption of 609,000 kl in fiscal 2010—a 15% decline compared with fiscal 1990.

●Reasons for adoption of target

Energy consumption is a figure that is easily defined on a daily basis, and was therefore judged to be appropriate for purposes of target management.

2. Carbon dioxide emissions



Note: The figures do not include emissions originating from raw materials.

The industry recorded carbon dioxide emissions of 1.78 million t-CO_2 in fiscal 1990 and 1.33 million t-CO_2 in fiscal 2002 (not including carbon dioxide emissions from industrial processes).

3. Steps taken to achieve targets

- Major
  (1) Initiatives implemented, or ongoing
    a. More efficient production achieved by scrapping and consolidating flat glass manufacturing plants and equipment (glass melting furnaces)
    b. More efficient heat recovery achieved through regular melting furnace maintenance (cold repair)
    c. Production consolidated to reduce losses per melting furnace from color and product changes
  (2) Initiatives requiring long-term investigation
    a. Development and introduction of new, energy-efficient combustion technology

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

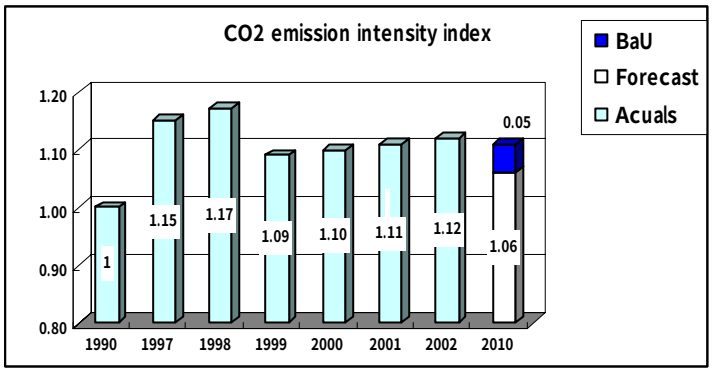
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	2,070	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	1,510	
Variation in CO_2 emissions	-560	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	140	6.8%
Contribution from production activity	-600	-29.1%
Industry effort	-100	-4.8%

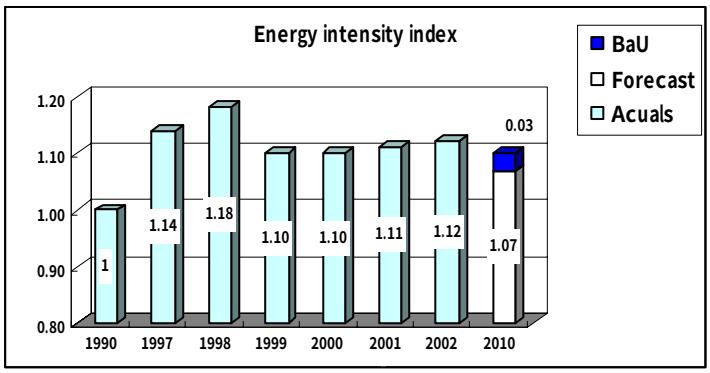
(In accordance with method proposed by Keidanren Secretariat)

●Reasons for variations in emissions in fiscal 2002

Emissions in fiscal 2002 fell 27.1% on fiscal 1990 levels (including industrial processes). The single biggest factor was that production volumes in fiscal 2002 were down 33.4% on fiscal 1990. Carbon dioxide emission intensity was slightly worse, despite the implementation of energy conservation and production efficiency initiatives.

5. Reference data





Assigning a value of one (1) to fiscal 1990 energy consumption intensity gives 1.12 in fiscal 2002. Assigning a value of one (1) to fiscal 1990 carbon dioxide emission intensity gives 1.12 in fiscal 2002.

6. Other global warming initiatives

● Evaluation from an LCA perspective

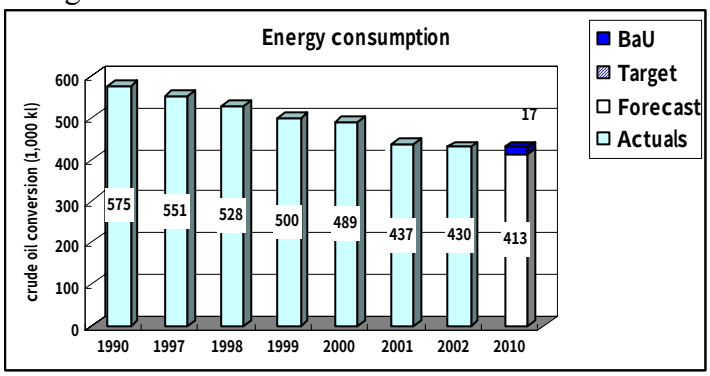
Encouraging the use of sealed insulating glass, with the objective of promoting energy-saving through improved insulation performance from openings in buildings

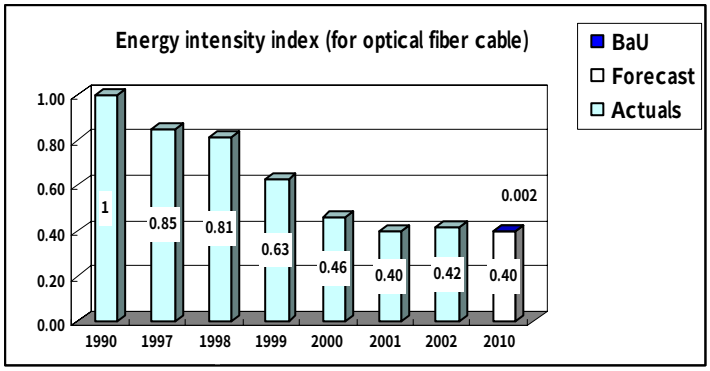
Note: The principal product of the industry is flat glass. The rate of participation in the follow-up survey was 100% (3 companies out of 3), representing 100% of the energy consumed by the industry (in production only). Carbon dioxide emissions were calculated by compiling fuel consumption values listed under "Flat Glass" in the *Yearbook of Ceramics and Building Materials Statistics* (Ministry of Economy, Trade and Industry), and for each type of fuel, multiplying consumption by the carbon dioxide coefficient given as the standard by Keidanren, and summing the amounts. The forecast and target for fiscal 2010 were calculated based on the assumption that production in fiscal 2010 will remain at 1995 levels.

The Japanese Electric Wire & Cable Makers' Association

1. Energy-savings targets for copper and aluminum wire
   To keep energy consumed in copper and aluminum wire production plants in fiscal 2010 at fiscal 1990 levels.
2. Energy-savings targets for optical fiber cable
   To reduce the energy intensity per unit of length produced in optical fiber cable production plants in fiscal 2010 by 35% compared with fiscal 1990.

1. Progress toward target



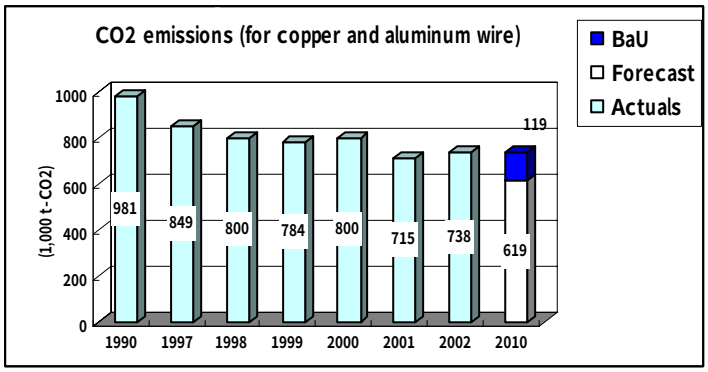


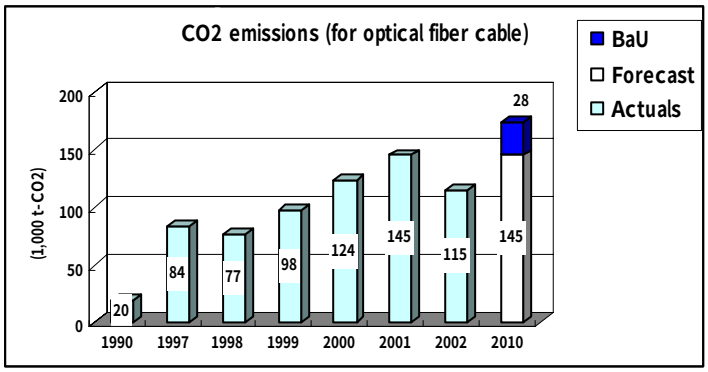
Energy consumption in copper and aluminum wire production plants was: 575,000 kl in fiscal 1990; 437,000 kl in fiscal 2001; and 430,000 kl in fiscal 2002. The industry is forecasting consumption of 413,000 kl in fiscal 2010—a 28.2% decline compared with fiscal 1990, and is on track for the fiscal 2010 target. If voluntary action plans were not implemented, the forecast for consumption in fiscal 2010 would be 430,000 kl—25.2% less than in fiscal 1990. Similarly, assigning a value of one (1) to the fiscal 1990 energy intensity index for optical fiber cable gives 0.40 in fiscal 2001 and 0.42 in fiscal 2002. The forecast intensity for fiscal 2010 is 0.40, and improvements are steadily being made toward achievement of the fiscal 2010 target. The intensity if voluntary action plans were not implemented would have been 0.402.

● Reasons for adoption of target

The copper and aluminum wire industries are mature, and as future growth is not therefore expected, energy consumption was set as the target. Substantial growth can be expected in the optical fiber cable market, however, and intensity forecasts were set as the target. The industry also adopted energy consumption as a target, which is unaffected by the electric power energy equivalence index.

2. Carbon dioxide emissions





Carbon dioxide emissions attributable to copper and aluminum wire production were 981,000 t-CO_2 in fiscal 1990 and 738,000 t-CO_2 in fiscal 2002. The industry is forecasting emissions of 619,000 t-CO_2 in fiscal 2010, representing a 36.9% reduction compared with fiscal 1990. Carbon dioxide emissions from optical fiber cable production were 20,000 t-CO_2 in fiscal 1990 and 115,000 t-CO_2 in fiscal 2002. The forecast is for emissions of 145,000 t-CO_2 in fiscal 2010.

3. Steps taken to achieve targets

- Major
  - Upgrade to energy-saving plants and equipment
  - Undertake initiatives to reduce energy consumption
  - Undertake initiatives to improve manufacturing processes

- Fiscal 2002 actual

The Association conducted quarterly checks of energy consumption as part of its effort to promote global warming initiatives by member companies

4. Reasons for variations in carbon dioxide emissions

- Analysis of factors accounting for increases or decreases between 1990 and 2002

- Results of factors contributing to copper and aluminum wire figures

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions	982	
Fiscal 2002 CO_2 emissions	738	
Variation in CO_2 emissions	-244	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	7	0.7%
Contribution from production activity	-325	-33.1%
Contribution from emissions per unit of production activity	-74	7.6%

- Results of analysis of factors contributing to optical fiber cable figures

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions	20	
Fiscal 2002 CO_2 emissions	115	
Variation in CO_2 emissions	94	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	1	6.4%
Contribution from production activity	174	860.4%
Contribution from emissions per unit of production activity	-81	-399.1%

- Reasons for variations in emissions in fiscal 2002
  - Copper or aluminum wire: Lower production levels caused carbon dioxide emissions in fiscal 2002 to drop compared with fiscal 1990 levels.
  - Optical fiber cable: Growth in production in fiscal 2002 resulted in a rise in carbon dioxide emissions compared with fiscal 1990 levels.

5. Other global warming initiatives

- Emissions from offices and in-house distribution

Energy consumption associated with in-house distribution in the electrical wire and cable industry was 63,000 kl in fiscal 1996 and 44,000 kl in fiscal 2002. The goal for fiscal 2010 is 43,000 kl.

- Greenhouse gases other than carbon dioxide

The industry has implemented initiatives to prevent leakage of SF_6 and HFCs during servicing and repair, and to recover and recycle gases.

6. Environmental management and conservation in overseas business activities

To ensure member commitment to voluntary action and continuous improvement in relation to environmental problems, companies are endeavoring to either introduce or configure environmental management systems. As of August 2003, 63 of the Association's 143 member companies had obtained ISO14001 certification.

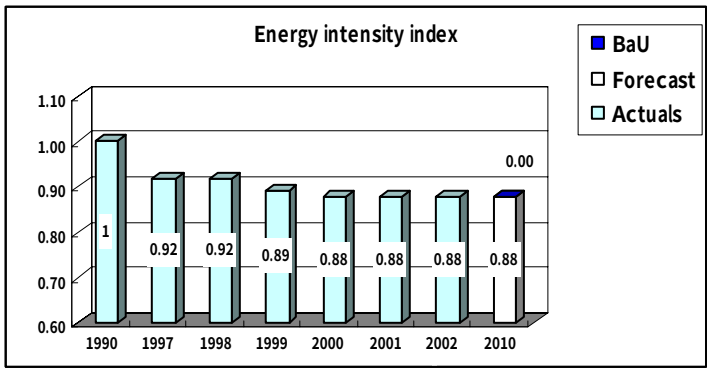
As a matter of course, companies strive to comply with local environmental standards applicable to their overseas business activities, in addition to meeting the requirements of the "Ten-Points-Environmental Guidelines for the Japanese Enterprises Operating Abroad," in the Nippon Keidanren Global Environmental Charter. Japanese environmental and other standards provide further guidelines for initiatives to protect the environment.

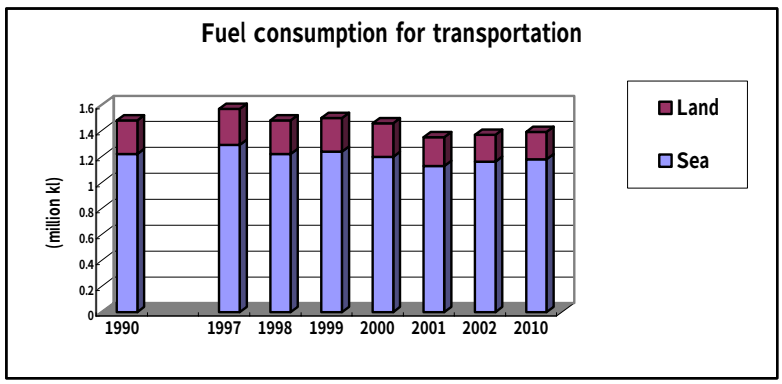
Note: The principal products of this industry are copper, aluminum, and optical fiber cable. The participation in the follow-up survey was 97% (138 companies). It has been assumed that production of copper and aluminum wire to fiscal 2010 will remain steady after fiscal 2002, and that the annual rate of improvement in energy intensity will be 0.5%. Production of optical fiber cable has been assumed to increase at an annual rate of 5.7 % from fiscal 2002, and its energy intensity will improve at a rate of 0.5% per annum.

Petroleum Association of Japan

Production and transport:
Targets for energy conservation in fiscal 2010 compared with fiscal 1990:
- A 10% reduction in energy consumption intensity at oil refineries
- A 9% reduction in fuel used to transport petroleum products

Consumption:
An annual energy saving of 1.4 million kl through greater use of cogeneration





1. Progress toward target

Assigning a value of one (1) to the energy intensity index of oil refineries in fiscal 1990 gave 0.88 in fiscal 2002. The industry is forecasting an index of 0.90 in fiscal 2010 (a 10% reduction compared with fiscal 1990), and will continue to work to sustain current levels.

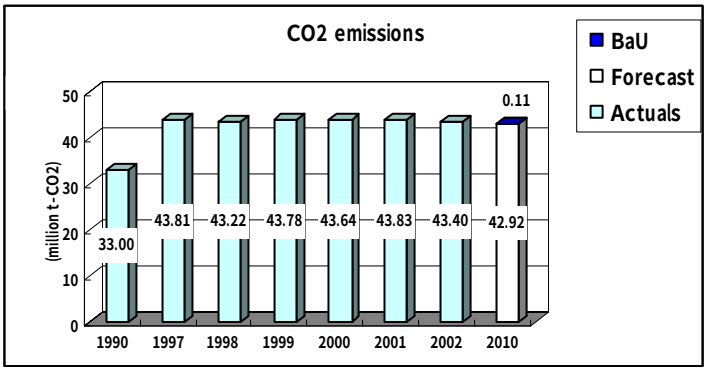
In transport by both land and sea, the industry consumed 1.51 million kl in fiscal 1990 and 1.39 million kl in fiscal 2002. The fiscal 2010 target is 1.37 million kl (a 9% reduction compared with fiscal 1990).

● Reasons for adoption of target

Generally, energy intensity is adopted as a means of evaluating energy savings in industries in the manufacturing and energy conversion sector. In the case of oil refining, however, the nature of crude oil and the structure of product demand vary the operating rates of desulfurization and cracking facilities. Energy intensities must therefore be corrected to reflect the same conditions to enable comparisons,

and an intensity corrected using the logical means widely applied at refineries around the world (refinery energy consumption intensity) has been taken as the indicator.

2. Carbon dioxide emissions



Carbon dioxide emissions from oil refineries were 33.0 million t-CO_2 in fiscal 1990 and 43.4 million t-CO_2 in fiscal 2002. Production volumes and energy consumed by secondary processing equipment are both increasing due to greater product demand and the shift toward lighter products in the demand structure, as well as environmentally responsible product quality initiatives, but carbon dioxide emissions have remained roughly level. The factors contributing to the drop were efforts to conserve energy and the integration and closure of oil refineries. The forecast is for 42.92 million t-CO_2 in fiscal 2010 (up 30% on fiscal 1990). If voluntary action plans were not implemented, carbon dioxide emissions in fiscal 2010 would be 43.03 million t-CO_2 (a 30.4% increase compared with fiscal 1990).

3. Steps taken to achieve targets

- Major
  - Energy conservation initiatives at oil refineries (sophisticated management of energy conservation, use of less steam, recovery of waste heat, and development and introduction of new technology)
  - More efficient distribution in the transport sector (use of larger tanker lorries and inland route tankers, improvements in loading rates, integration and amalgamation and sharing of tank depots, and elimination of congested transportation by locally exchanging products)
  - Conservation initiatives in the consumption sector (promotion of petroleum cogeneration)

- Fiscal 2002 actual

Refinery energy consumption intensity was maintained at roughly the same level on a year-on-year basis by the implementation of comprehensive energy-saving initiatives, including the following:

- Sophisticated management of energy conservation (highly optimized

machinery operation achieved through computerized control)

- Less steam (reduction of amount used, better management of pressure)
- Recovery of waste heat

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

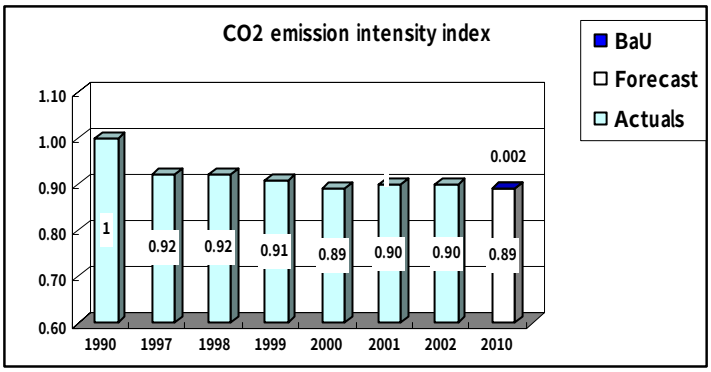
Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed "Fixed coefficient emissions." The difference between actual emissions and fixed coefficient emissions is deemed the "Contribution from changes in coefficient of carbon dioxide emissions." Assuming a relationship whereby "Fixed coefficient emissions = Production activity x Emissions per unit of production activity" enables the amount of change in fixed coefficient emissions to be broken down into "Contribution from production activity" and "Contribution from emissions per unit of production activity."

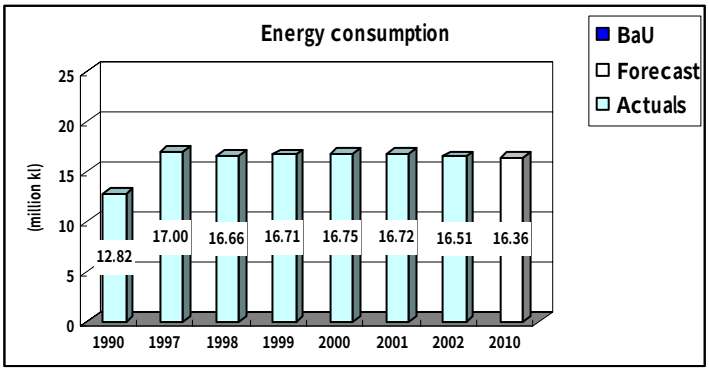
	million t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	33.005	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	43.403	
Variation in CO_2 emissions	10.398	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	0.074	0.2%
Contribution from production activity	14.613	44.3%
Contribution from emissions per unit of production activity	-4.289	-13.0%

● Reasons for variations in emissions in fiscal 2002

Refinery energy consumption intensity is declining as per target, but energy consumption in secondary processing devices is rising due to factors such as greater demand, lighter products, and environmentally responsible quality initiatives, all of which caused carbon dioxide emissions to rise. Compared with fiscal 2001, however, there has been a decline of approximately 400,000 tons. The contributing factor is conjectured to be a decline in the operating rates of secondary processing equipment due to an increase in production of fuel oil for electric power, reflecting the power situation (greater operation of oil burning power generation plants due to shutdown of nuclear power generation capability).

5. Reference data





Assigning a value of one (1) to the index of carbon dioxide emission intensity in fiscal 1990 gives 0.896 in fiscal 2002. The industry is forecasting 0.894 in fiscal 2010, and if voluntary action plans were not implemented, in fiscal 2010 the index would be 0.896 (FY 2002 BAU). Energy consumption (in crude oil equivalents) was 12.82 million kl in fiscal 1990 and 16.51 million kl in fiscal 2002. The industry is forecasting energy consumption of 16.36 million kl in fiscal 2010—an increase of 29% compared with fiscal 1990.

6. Other global warming initiatives

- Contributions to the consumer goods and transport sectors (impact on products and services)
  - By promoting the uptake of petroleum cogeneration the industry expects to achieve energy savings of 1.4 million kl (in fuel-oil equivalents) each year through to fiscal 2010
  - Initiatives to achieve supply of sulfur-free motor vehicle fuel (available everywhere in 2008; partially available in 2005)

    Supply of sulfur-free motor vehicle fuel (gasoline containing less than 10 ppm of sulfur, and gas oil) will technically make it easier to improve vehicle fuel consumption. This is therefore expected to have the effect of limiting carbon dioxide emissions as a result of the use of vehicles with improved fuel efficiency.

- Evaluation from an LCA perspective
  - As above

- Greenhouse gases other than carbon dioxide
  - The industry does not use HFCs or PFCs
  - SF_6 is used in breakers found in power receiving equipment, and when released, it is recovered in a closed environment
  - Approximately 0.02 tons (in carbon dioxide equivalents) of CH_4 is emitted annually through evaporation from tanks
  - 15.7 tons (in carbon dioxide equivalents) of N_2O is emitted annually from oil refining equipment

- Kyoto Mechanism projects
  - Participation in the World Bank Community Development Carbon Fund (two companies, 600 million yen), and a CDM in Vietnam (scheduled)
  - Participation in the Ministry of Economy, Trade and Industry's Emission Rights Trading Trial Business Committee of Review (five companies and the Petroleum Association of Japan), regarding which some proposals have been adopted (three companies, five proposals).

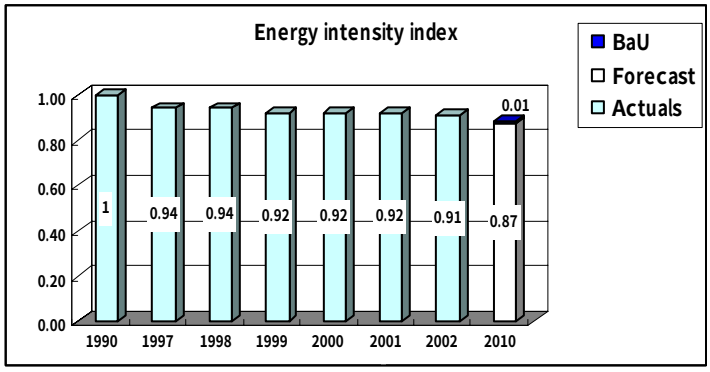
7. Environmental management and conservation in overseas business activities
  - As of the end of March 2002, 74 plants and other operational sites had obtained either ISO 14001 certification or recognition through an equivalent system of environmental management.
  - Through NEDO (New Energy and Industrial Technology Development Organization), JCCP (Japan Cooperation Center, Petroleum) and other similar organizations, the industry is engaged in the transfer overseas of technology in energy and environmental conservation.
  - The industry is further engaged in activities to achieve marine environmental conservation both inside and outside Japan, such as creation of a system of preparedness for accidents accompanied by oil spills, including storage and rental of oil spill response equipment (PAJ Oil Spill Cooperative, The Major Oil Spill Response Program)

Note: The industry's principal products include gasoline, gas oil, LPG, jet fuel, naphtha, kerosene, fuel oil, and asphalt.
All of the companies in the industry, including non-members of the Association, participated in the survey (22 companies out of 22), representing 100% of oil refining companies (excepting lubricant manufacture).
Carbon dioxide emissions and energy consumption were calculated by aggregating the consumption of fuel by type, the energy consumption intensity at oil refineries, and the production volume of oil refineries (35), which are required under the Law concerning the Rational Use of Energy to submit regular reports.
The assumptions underlying the fiscal 2010 forecast of 219.255 million kl of crude oil processed (down 6.8% on fiscal 2002) were based on the Ministry of Economy, Trade and Industry FY2003-2007 Forecast of Internal Demand for Petroleum Products (The figures for FY2007 from the same source were used for demand in fiscal 2010).

Japan Chemical Industry Association

(1) To endeavor to reduce energy intensity to 90% of 1990 levels, by 2010.
(2) To endeavor to develop the chemical industry's own unique catalytic technology, biotechnology, and environmentally responsible process technology.
(3) To contribute to initiatives to limit emission of carbon dioxide in developing nations, in conjunction with transferring environmental conservation technology and energy-saving technology developed within the chemical industry in the course of expanding the industry's offshore business.

1. Progress toward target

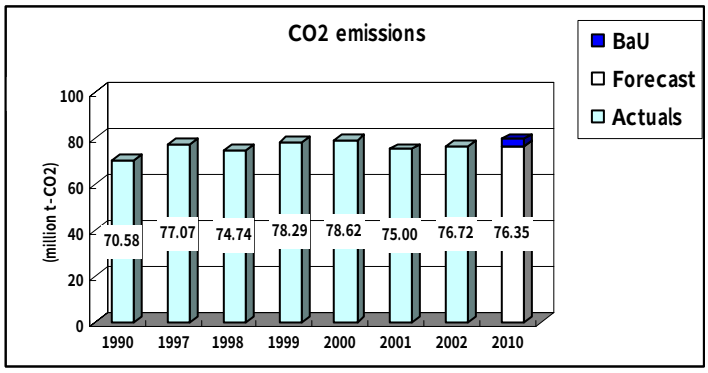


For three years from 1999, energy intensity was level, but with a 1-point improvement made in 2003, it was only a single point away from the target.

In fiscal 2010, further effort is expected to bring industry energy intensity to 87, or 3 points past the target.

● Reasons for adoption of target
- Energy intensity is a figure that companies can control, and was thought to be one that with effort could be improved.
- Technological development is the key factor in carbon dioxide reductions and was thought to be something that companies should undertake in conjunction with energy conservation efforts.
- Transferring technology to developing countries was also thought to be something that companies could do to contribute to reducing carbon dioxide on a global scale.

2. Carbon dioxide emissions



Carbon dioxide emissions since 1997 have continued to move in a "one step forward, two steps back" manner. In fiscal 2002, the carbon emission coefficient of purchased power rose significantly as a result of the reduced operation of nuclear power plants, leading to a slight increase on 2001 levels.

Forecasts for 2010 are based on expectations of increased production compared with 2002, but improvements in energy intensity will mean that increases in energy consumption will be miniscule. An increase is expected in both the carbon emission coefficient of power and the amount of nuclear power generated, leading to expectations that carbon dioxide emissions will be slightly less than in 2002.

3. Steps taken to achieve targets

- Major
  (i) Improvements in plant and machinery efficiency
  (ii) Improvements in operating methods
  (iii) Recovery of waste energy
  (iv) Process rationalization

- Fiscal 2002 actual
  (i) Some 522 reports were received on energy-saving initiatives implemented in fiscal 2002, representing investment of 37.0 billion yen. The energy saving effect of those initiatives amounted to 256,000 kl in crude oil equivalents.
  (ii) Of those initiatives, 195 related to improvements in the efficiency of plant and machinery, representing 37% of the total, and 129 related to improvements in operating methods, or 25%. Other initiatives were recovery of waste energy and process rationalization.
  (iii) The major energy-saving initiatives are as follows.

No.	Energy-saving initiative	Investment value (m yen)	Effect (crude oil equiv. kl pa)	Industry
1	Boiler fuel conversion	300	11,000	Organic chemicals
2	Installation of in-house power generation equipment using waste gas	1,200	7,000	Inorganic chemicals
3	More efficient large-scale drives and motors	490	6,440	Organic chemicals
4	Introduction of cogeneration equipment	360	5,920	Organic chemicals
5	Higher efficiency through upgraded turbines	570	5,900	Organic chemicals
6	Reducing differential pressure between compressor stages	50	5,786	Organic chemicals
7	Ethylene cracking heaters fitted with ultra-high efficiency reaction tubes	1,900	5,610	Organic chemicals
8	Process refurbishment for MDI reactions	100	4,300	Organic chemicals
9	Energy-savings through multiple operation of raffinate distillation columns in BTX equipment	12	3,948	Organic chemicals
10	Upgrades to very efficient devices	1,900	3,500	Inorganic chemicals

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Analysis of the factors contributing to the 9% increase in carbon dioxide emissions in 2002 compared with 1990 has revealed the following.

Portion attributable to chemical company efforts (reductions due to energy conservation and the like)	-8.8%
Proportion attributable to improved carbon dioxide intensity for purchased power	-0.5%
Proportion due to increased production	18.0%
Total	8.7%

(Method of calculation: FY 2000-designated Keidanren method*)

● Reasons for variations in emissions in fiscal 2002

(i) Compared with 2001, energy consumption increased 337,000 kl and carbon dioxide emissions also increased 1.714 million t-CO_2.

(ii) The increase in energy consumption was primarily attributable to increased production (production index up 2 points). An improvement in energy intensity, however, made it possible to hold energy consumption within a 1-point increase.

(iii) Compared with 2001, energy intensity improved 1 point to 91, a figure just below the target.

(iv) The reason that carbon dioxide emissions rose 3 points compared with 2001, in addition to the increase in energy consumption, was the fact that the carbon dioxide emission coefficient of purchased power worsened due to reduced operation of nuclear power plants.

6. Other global warming initiatives

- Evaluation from an LCA perspective

  The products produced by the chemical industry are many and varied, making it difficult to conduct LCA-type analyses. Several examples have been selected from other industry sectors and the consumer goods sector, relating to the contribution of chemical products to residential applications where such contribution is significant. Using these, quantitative calculations have been completed.

  (i) Photovoltaic power generation

  Photovoltaic power generation is expected to be a growth area, given that it is a new form of energy. In fiscal 2010, 4.84 million kW (1.18 million kl in crude oil equivalents) are expected to be generated, and national government policy is targeting the uptake of 1 million units for residential power generation.

  The industry is supplying photovoltaic power generation systems in the form of full roof modules made up of very efficient thin film amorphous silicon photovoltaic cells.

  (ii) Resin window frames

  If aluminum window frames (single-layered glass) are replaced with highly insulating resin window frames (double-layered glass), there is a 40% saving in heating and cooling energy, which represents potential reductions in carbon dioxide of 2.7 tons per house. If such window frames could be applied to 30 million houses across Japan, the savings would be 81 million tons.

  The 6% reduction that Japan is required to achieve under the Kyoto Protocol amounts to 74 million tons. If there is no change in other emissions, therefore, just the uptake of resin window frames alone would have sufficient impact to achieve the 6% reduction stipulated in the Kyoto Protocol.

  In fiscal 2002, the industry shipped 1.01 million resin window frames.

  (iii) Insulation

  Clever use of residential insulation is said to be capable of reducing the cost of cooling and heating by 30%. Expected energy savings per residence could be 1000 kWh per year, which if applied to the 30 million residences throughout Japan works out to 30 x 10^9 kWh, a figure so large that it equates to the total power purchased in a single year by the chemical industry.

- Green house gases other than carbon dioxide

  The Association has separately set voluntary targets for and is implementing voluntary action plans to reduce emissions of PFCs (perfluorocarbon) and SF_6 (sulfur hexafluoride).

7. Environmental management and conservation in overseas business activities

Through promotion of responsible care activities the chemical industry is actively engaged in the protection of human safety and health and conservation of the global environment, with member companies formulating voluntary action plans for environmental

conservation and occupational safety. The Association publicizes the outcomes and promotes communication with society. Members of the Japan Responsible Care Council, launched in 1995, originally numbered 74 companies, but today that number has grown to 114.

In growing their business overseas, member companies as a matter of course comply with host country legislation and standards relating to the environment, safety, and health, but are also working to transfer the latest in Japanese energy-saving technology, process technology, and highly efficient machinery and equipment.

Member companies also accept trainees from their overseas affiliates, deliver education in responsible care, and provide guidance on acquisition of ISO 14001 certification.

The following main examples of energy-saving developments overseas conducted in fiscal 2002 are taken from the survey results.

- Began continuous reporting of environmental performance indicators from overseas subsidiaries
- Introduced energy-efficient electrolytic plant and compressor facilities
- Converted boiler fuel from coal to natural gas
- Dispatched production technicians overseas to supervise and instruct in environmental safety, set medium term targets, and checked progress toward achievement

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Note:

Principal products, business activity, rate of coverage, and number of participating companies

248 participating companies	Principal products Chemical fertilizers, inorganic industrial chemical products, (industrial soda products, inorganic pigments, inorganic chemicals, high pressure gas), organic industrial chemical products (olefins, petroleum based aromatics, synthetic dyes, synthetic rubber, synthetic resin, organic chemicals), chemical fibers, processed oils and fats, paints, printing inks, cosmetics, photosensitive materials
Coverage of energy used	Estimated at approx. 90%.

- Method of estimating fiscal 2010 targets and forecasts

  2010 targets: aggregated from survey responses from participating companies

  2010 forecasts: aggregated from expected consumption by fuel type from participating companies

  (The total 2010 production activity used as the premise for estimates by each company represented an increase of approximately 8% on fiscal 2002)

- Outline of adjustment of boundaries between industries

  (1) The Japan Lime Association became independent this fiscal year, and developed its own voluntary action plan. The Association compiled energy consumption data and submitted it directly to Keidanren. The data from the 17 companies under the umbrella of the Japan Lime Association that had been included in the Japan Chemical Industry Association's reports was excluded.

  (2) There were some chemical companies commissioned by steel makers to manufacture coking coal, but the carbon dioxide emitted in the manufacture of coking coal is counted by the chemical companies and there was no doubling up in terms of accounting with the steel makers.

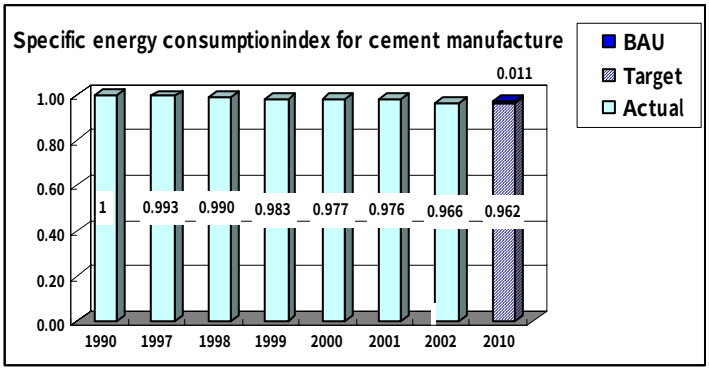
- Factoral analysis method

  Emissions from fiscal 2002 activity were calculated, assuming fixed emissions per unit of production activity in fiscal 1990, and the difference between that figure and actual emissions was divided into the contribution from the power industry (change in emission coefficient per unit of power for purchased power) and the portion attributable to industry effort.

Japan Cement Association

To reduce specific energy consumption for cement manufacturing (cement manufacturing + in-house power generation + purchased power) in fiscal 2010 by about 3% of the fiscal 1990 level.
(Note 4)

1. Progress toward target



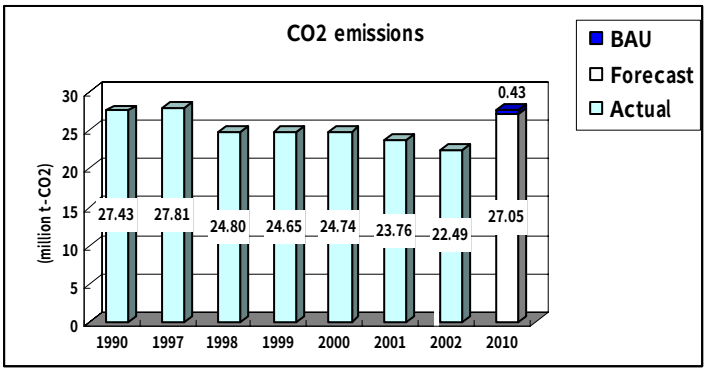
If a specific energy consumption index of 1.0 is assigned for cement manufacturing in fiscal 1990, the index value for fiscal 2002 is 0.966 .

● Reasons for adoption of target

Cement production levels are significantly influenced by the economy and government policy, making future predictions difficult. The industry therefore adopted an indicator for which it can take responsibility — the specific energy consumption for cement manufacturing.

2. Carbon dioxide emissions

(1) Energy-based sources (Note 4)



The cement industry recorded carbon dioxide emissions of 27.43 million t-CO_2 in fiscal 1990 and 22.49 million t-CO_2 in fiscal 2002. The industry is forecasting emissions of 27.05 million t-CO_2 in fiscal 2010 — a 1.4% decline on fiscal 1990.

(2) Non-energy sources

Carbon dioxide emissions from limestone (a raw material) were 41.14 million t-CO_2 in fiscal 1990, 40.59 million t-CO_2 in fiscal 1997, 36.02 million t-CO_2 in fiscal 1998, 35.53

million t-CO_2 in fiscal 1999, 35.63 million t-CO_2 in fiscal 2000, 34.75 million t-CO_2 in fiscal 2001, and 33.07 million t-CO_2 in fiscal 2002.

3. Steps taken to achieve targets

- Major
  - Promotion of the introduction of energy-efficient equipment
  - Increase in use of industrial wastes as fuel
  - Greater use of other industrial waste materials
  - Increased proportion of blended cements

- Fiscal 2002 actual

The Association received 109 reports of investments implemented in fiscal 2002 to reduce the generation of greenhouse gases, representing a total investment of approximately ¥8 billion. The hoped-for reduction in energy consumption deriving from the investments is approximately 100,000 kl in crude oil equivalents.

Initiative	Investment (¥billion)
• Promotion of the introduction of energy-efficient equipment	0.2
• Increase in use of waste as fuel	5.0
• Greater use of waste in general	3.0

4. Reasons for variations in carbon dioxide emissions (from energy sources only)

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

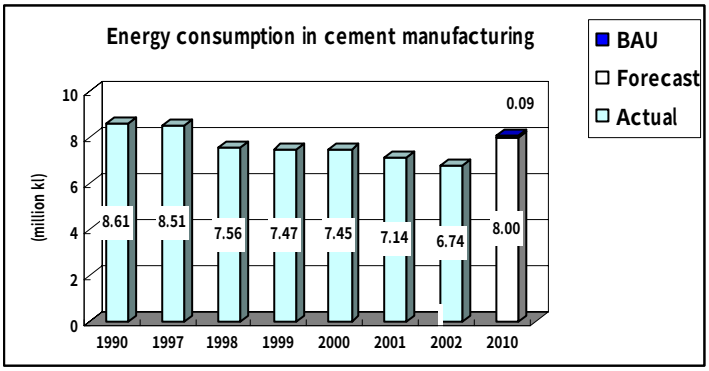
The change in carbon dioxide emissions was calculated from changes in the coefficient of purchased power, production levels, the specific carbon dioxide emissions from sources of thermal energy for manufacturing, and specific carbon dioxide emissions from power sources.

Factor	Variation (10^3t-CO_2)	Proportion contributed (%)	Proportion of variation (%)
Contribution from change in carbon emissions coefficient of purchased power	-30	0.6	-0.1
Portion attributable to industry effort	-1280	26.0	-4.7
Increase in proportion of internally generated power	1570	-31.7	5.7
Reduction in production level	-5190	105.2	-18.9
Total	-4940	100.0	-18.0

● Reasons for variations in emissions in fiscal 2002 compared with fiscal 2001

During the year, operating rates of plant and equipment declined, the proportion of internally generated power increased, and the carbon emissions coefficient of purchased power reduced (all negative factors). However, at the same time, production levels fell and the specific energy requirement for cement manufacturing improved (both positive). The net effect was that carbon dioxide emissions decreased approximately 1.27 million t-CO_2, or –5.3%, compared with fiscal 2001 level.

5. Reference data



Energy consumption in cement manufacturing (in crude oil equivalents) was 8.61 million kl in fiscal 1990 and 6.74 million kl in fiscal 2002.

6. Other global warming initiatives

● Evaluation from an LCA perspective

In fiscal 2002, 27 million tons of waste and by-products from industry and households were used as alternative raw materials and fuel. This not only generated savings of natural resources, but also alleviate ~~ding~~ the shortage of landfill sites and contributed to reducing the environmental burden arising from incineration and landfill of waste and the ongoing environmental burden associated with managing and maintaining landfill sites.

7. Environmental management and conservation in overseas business activities

As of end of March 2003, 35 of the 36 factories operating in Japan had acquired ISO 14001 certification.

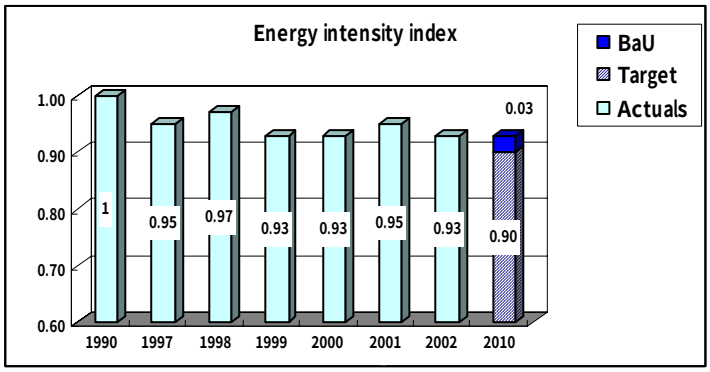
Note

1. Basic data: The principal product of the industry is cement. The participation rate in the follow-up survey was 100% (20 companies out of 20), representing 100% of both production and energy consumed in the manufacture of cement by the industry.
2. Calculation method: Carbon dioxide emissions (other than those for purchased power) were calculated by adding the energy consumption of individual companies (by type of energy) and multiplying the total of each by the appropriate carbon dioxide emission coefficient. The totals for each type of energy were then summed up.
3. The level of activity estimated for fiscal 2010 was based on the average production level of the latest five years and economic indicators suggested by Keidanren.
4. Types of energy used in cement manufacture were coal, heavy oil, petroleum coke, city gas, and purchased power.
5. The energy value of coal, heavy oil, and petroleum coke were taken from "fiscal year-average calorific-value data" researched by the Japan Cement Association.

Japan Paper Association

By 2010 reduce fossil energy intensity per product by 10% of the 1990 level.

1. Progress toward target



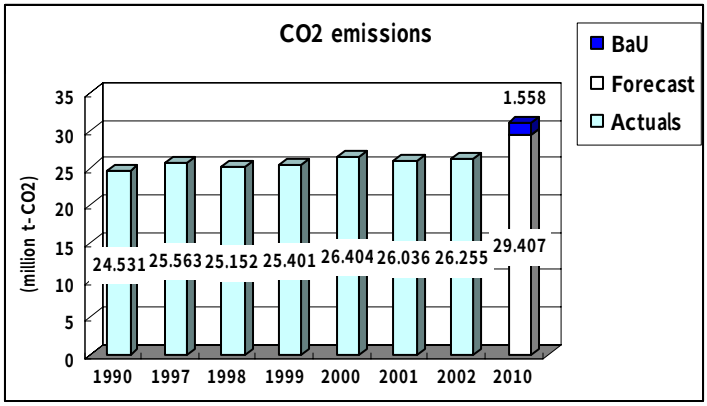
Note: A value of one (1) has been assigned to the fiscal 1990 intensity index.

Assigning a value of one (1) to the fiscal 1990 index of fossil energy intensity gives 0.93 in fiscal 2002.

● Reasons for adoption of target

Carbon dioxide emissions are linked to production level which is influenced by economic growth and determined by user demand. Producers should work to reduce carbon dioxide (CO_2) emissions through improved efficiency. Energy per product was therefore chosen as the objective. The Pulp and Paper industry, which uses a large amount of energy, has made efforts towards energy conservation since the oil crisis occurred in 1973. By 1990, fossil energy per product has reduced to 72% of the benchmark level of 1981 when the Japanese government launched the Current Survey of Oil Consumption. This means there was little possibility for the industry to further reduce it in the future. Nevertheless, the industry set the target that it should reduce by 10% compared to the 1990 level by 2010, judging that it could reduce with great efforts.

2. Carbon dioxide emissions



Production in fiscal 2002 grew 10% on 1990 levels, but as a result of improved intensity, carbon dioxide emissions increased only 7.3% compared with 1990.

3. Steps taken to achieve targets

- Major
  - Introduce energy-saving plant and equipment (i.e. heat recovery facilities, fitting of inverters)
  - Introduce highly efficient plants and equipment (i.e. high temperature high pressure recovery boilers, highly efficient washing units, low differential pressure cleaners)
  - Revise processes (i.e. shorten processes, integrate processes)
  - Convert from fossil energy to biomass energy and waste-product-derived energy
  - Implement improved management (i.e. revise management indicators, lessen variation)

- Fiscal 2002 actual
  - Respondent companies 22
  - Investment initiatives 956
  - Investment value ¥14.842 billion
  - Energy savings 290,183 kl per year (in crude oil equivalents)

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Analysis of the factors contributing to the 7.3% increase in carbon dioxide emissions in 2002 compared with the1990 level has revealed the following.

In conducting the analysis, emissions from fiscal 2002 activity were calculated, assuming fixed emissions per unit of production activity in fiscal 1990, and the difference between that figure and actual emissions was divided into the contribution from the power industry (change in emission coefficient per unit of power for purchased power) and the proportion attributable to paper industry effort.

	million t-CO_2	%
Fiscal 1990 CO_2 emissions	24.525	
Fiscal 2002 CO_2 emissions	26312	
Variation in CO_2 emissions	1.787	7.3
(Breakdown) Contribution from production activity	2.402	9.8
Contribution from power industry	-0.07	-0.3
Proportion attributable to paper industry effort	-0.546	-2.2

Further analysis of the contribution from the Pulp and Paper industry reveals the following.

Changes between FY1990 and FY2002 (increase of 2,390,510 t)

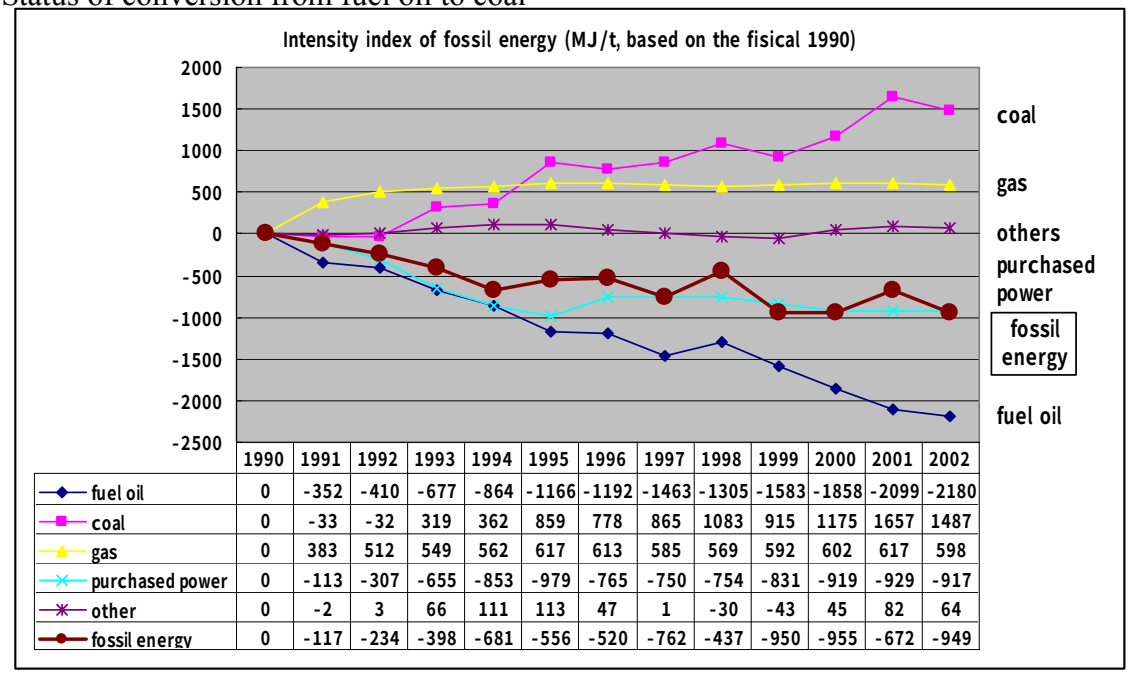
	Increase in production	Contribution from paper industry		Contribution from power industry	Total
		Energy saving	Change in fuel mix		
CO_2 emissions (t-CO_2)	2,402,368	-545,997		-69,688	1,786,684
		-1,862,430	1,316,433		
CO_2 intensity (t-CO_2)	0	-0.021		-0.003	-0.023
		-0.070	0.049		
Fossil fuel energy (TJ)	34,398	-25,424		0	8,974
		-25,424	0		
Fossil fuel intensity (MJ/t)	0	-949		0	-949
		-949	0		

In terms of fuel mix, carbon dioxide has increased. See below for the reasons.

● Reasons for variations in emissions in fiscal 2002

The target of fossil energy per product improved 1.9% year-on-year, and improved to 93.4% compared with fiscal 1990 levels. The significant improvement was mainly thanks to great advance in the use of paper sludge as fuel, progress of the use of waste products as Refuse Paper & Plastic Fuel (RPF) and waste tires as fuel, and improvement in efficiencies led by increase in production. The industry has invested 20-40 billion yen annually since fiscal 1990, which led to the decrease in fossil energy per product to 93.4% of the fiscal 1990 level. Carbon dioxide emissions per product reduced by 1.7% compared with the previous year and to 97.5% of the fiscal 1990 level, which means it hasn't improved like fossil energy per product. The cause lies in progress in the conversion of fuel from fuel oil to coal, given that such a move was more cost beneficial, and was in line with government guidance away from petroleum for reasons of energy security (refer to data given below).

* Status of conversion from fuel oil to coal



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
fuel oil	0	-352	-410	-677	-864	-1166	-1192	-1463	-1305	-1583	-1858	-2099	-2180
coal	0	-33	-32	319	362	859	778	865	1083	915	1175	1657	1487
gas	0	383	512	549	562	617	613	585	569	592	602	617	598
purchased power	0	-113	-307	-655	-853	-979	-765	-750	-754	-831	-919	-929	-917
other	0	-2	3	66	111	113	47	1	-30	-43	45	82	64
fossil energy	0	-117	-234	-398	-681	-556	-520	-762	-437	-950	-955	-672	-949

* Investment in energy conservation and its effect

	(No. of respondent companies)	FY 97 (39 co's)	FY 98 (32 co's)	FY 99 (39 co's)	FY 00 (29 co's)	FY 01 (27 co's)	FY 02 (22 co's)
Total	(i) Investment value (m yen)	41,784	35,745	19,494	23,066	16,926	14,842
	(ii) Effect (kl/yr)	222,682	206,761	140,454	176,280	192,756	290,183
	(ii)/(i) (kl/m yen)	5.53	5.78	7.20	7.64	11.39	19.55

As indicated in the table, every year the industry has invested between 20 billion and 40 billion yen—including major investments—and achieved between 140,000 and 220,000 kl per year in energy savings. This volume of energy equates to between 1.4% and 2.2% of recent fossil energy consumption levels (approx. 10 million kl/yr).

Every year the industry has achieved these levels of energy saving, but actual improvement in fossil energy intensity for the period from 1997 to 2002 involved a five-year average of 0.3%, and from 1990 to 2002 a 12-year average of 0.6%. That fact that only a 0.4% effect was achieved from a 1.8% investment in intensity improvement indicates that there is a major factor that is wiping out the effect of investment in energy conservation. This reduction in energy savings is a result of energy increases due to environmental and quality initiatives.

Examples of environmental initiatives are: in the area of water regulation, application of stricter control of Chemical Oxygen Demand (COD) under the Total Pollutant Load Control program (phases three to five) and initiation of control over phosphorus and nitrogen; in the area of measures against dioxin, introduction of oxygen bleaching, upgrades and enhancement of incineration facilities, stronger measures against dust (fitting bag filters to incineration furnaces), and introduction of ECF (ozone bleach, enhanced ClO_2); and in the area of initiatives against odor in waste water, introduction of odor stripping equipment.

Quality initiatives typically involve enhanced screens and cleaners (smaller slit width) enabling greater use of low grade recovered paper (increase in use of DIP(De-inked pulp)), enhanced size presses and beating enabling greater use of fast-growing eucalypts (with more sap vessels that result in paper dust), conversion to on-top paper machines, and greater use of two-stage coating. The foregoing examples of initiatives are representative only, giving an indication of the great variety of energy increasing factors.

6. Other global warming initiatives

- Emissions from offices and in-house distribution
  - (i) The industry is using larger trucks to transport products and changing to freight trains or cargo vessels (initiating a modal shift), in its efforts to reduce carbon dioxide emissions.
  - (ii) Carbon dioxide emissions were reduced 13% by upgrading the centralized air conditioning and heating equipment in the research institute building (eight stories), improving efficiency, and converting to gas for fuel.
  - (iii) Transport efficiency has been improved by making tissues more compact. Boxes were reduced in size from a thickness of 83 mm to 65 and 50 mm, resulting ultimately in an estimated 35% improvement in carbon dioxide emission intensity.
  - (iv) The industry is working to make packaging lighter, and to recover and recycle pallets.

- Greenhouse gases other than carbon dioxide

  The industry worked to prevent leakage of designated chlorofluorocarbon gases and to

recover gases when removing machinery from closed factories. The industry has also sought to prevent gas leakage when upgrading or installing coolers (in product facilities) and air conditioners.

- Kyoto Mechanism projects

(i) Within the industry's voluntary action plan was the objective to move ahead with aforestation both within and outside Japan, and by 2010 to extend ownership or management to 550,000 hectares. The area is growing steadily and as of the end of 2002 totaled 466,000 hectares at home and abroad, up 191,000 hectares on fiscal 1990. The area is now at 85% of the targeted 550,000 hectares. The industry is extremely active in offshore plantations, and as of the end of 2002 such projects had achieved coverage of 345,000 hectares in nine countries: Brazil, Australia, Chile, New Zealand, Papua New Guinea, Vietnam, South Africa, China, and Ecuador. There activities have received very high acclaim outside Japan and some member companies have received awards from nations where they have practiced forest plantations for their achievements and successes.

(ii) The following are examples of cooperation between industry, government, and academia.

- The Association participated in the Feasibility Study on Reduction of CO_2 Emissions by Introducing Energy-saving Equipment in a Pulp and Paper Mill in Myanmar, set up by NEDO as a public subscription project. It submitted a report in which it estimated the annual reduction in carbon dioxide emissions that could be achieved would be 36,530 t-CO_2.
- The Association participated in a project undertaken by the Tsukuba University Center for Tsukuba Advanced Research Alliance, and is participating in development of the next generation of technology for limiting global warming. The project aims to prevent warming through reduced use of wood chips made possible by achieving high yield rates in the Kraft pulp manufacture process, reduced use of chemicals, and reduced waste water burden.
- Jointly with the Tokyo University Institute of Industrial Science and an aerial imaging survey company, the Association is engaged in research into measurement of plantations using remote sensing. The objective of the research project is to determine the volume of forest timber in a plantation from aerial photographs and to establish a method of calculating the carbon content. It is also to establish an internationally recognized method of evaluating forest absorption of carbon dioxide from seedlings through rearing to felling in a large-scale plantation.

7. Environmental management and conservation in overseas business activities

(i) Environmental management systems

Of the 96 factories that responded to the survey, 71 (74%) have already acquired ISO

14001 certification, and 15 (16%) intend to acquire certification. A further 89 plants (93%, including those already certified) manage their operations in accordance with ISO14001 guidelines, which indicates the high level of environmental awareness within the industry.

Note:

(i) The Japan Paper Association

This is an organization of paper and paperboard manufacturing and selling companies. (The survey did not include the secondary processing industry associated with paper containers and cardboard.)

The survey was applied to 39 companies that are full members (excluding two companies that have a higher proportion of other business activities) and responses were received from 35. (The share of production of the 35 companies represents 99.2% of full member production.)

(ii) Method of arriving at data

Calorific values for fuel and carbon emission coefficients were from Keidanren stipulated figures. Analysis of factors contributing to variations in carbon dioxide emissions were achieved using the same calculation method as in the last financial year.

(iii) Assumptions underlying fiscal 2010 forecasts and BAU

- Fiscal 2010 production levels were based on the conditions at the time of formulation of the 1997 voluntary action plan.

  Fiscal 2010 demand was forecast using the real growth rate of GDP from fiscal 1990 to 1995 and the elasticity of demand for paper and paperboard, and actual national demand in fiscal 1995. The 2010 demand figure was then corrected for fiscal 2010 trade forecasts, to arrive at a forecast national production level of 36.9 million tons. This was multiplied by the share of national production of members to arrive at a figure of 31.6 million tons (up 29.5% on fiscal 1990, and up 18% on fiscal 2002).

  The fossil energy intensity target is assumed to be achievable by fiscal 2010, and was set at 90% of fiscal 1990 intensity. The mix of fuel types and the proportion of purchased power was assumed to be the same as in fiscal 2002.
- BAU assumes fiscal 2002 fossil energy intensity and mix of fuel types would be unchanged, and production levels only were set at 31.6 million tons.

(iv) Other points to note

- Up until the last fiscal year, industry survey data was used as a reference, and energy consumption volumes and paper and paperboard production volumes were taken from government data. That data included figures from non-members (outsiders). On this occasion, for the first time member data was used to carry out analysis. The amount of materials was therefore scaled down to reflect the proportion of national coverage attributable to members.

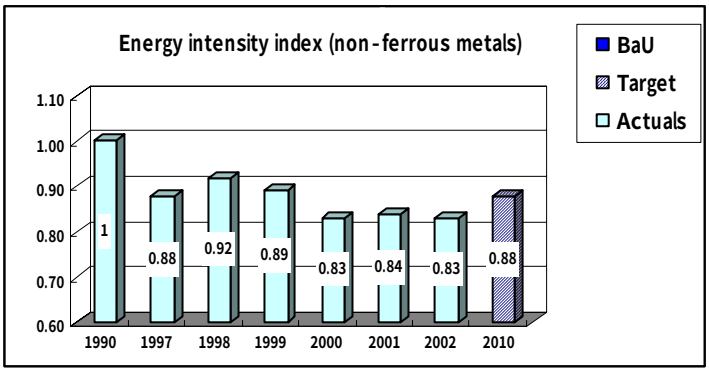
Japan Mining Industry Association

Compared with fiscal 1990, to reduce fiscal 2010 energy intensity as follows:

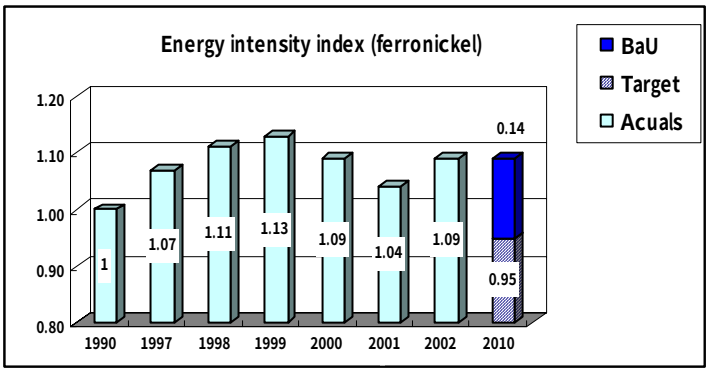
- by 12% in non-ferrous metals (copper, lead, zinc, nickel)
- by 5% in ferronickel

1. Progress toward target

Non-ferrous metals



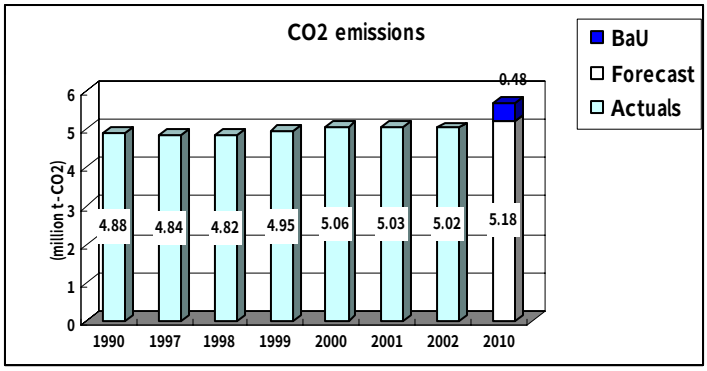
Ferronickel



● Reasons for adoption of target

For the Japanese non-ferrous industry to survive the tough international competitive environment, it must increase its production to a degree, while at the same time improving its productivity. Energy intensity is also an appropriate indicator of energy conservation efforts in the face of varying production levels.

2. Carbon dioxide emissions



Assigning a value of one (1) to the fiscal 1990 energy intensity index for production of non-ferrous metals (copper, lead, zinc, nickel) gives indices of 0.84 in fiscal 2001 and 0.83 in fiscal 2002. The industry forecast is 0.88 in terms of fiscal 2010, which means that the target has been achieved this fiscal year. Again, assigning a value of one (1) to the fiscal 1990 energy intensity index for ferronickel production gives 1.04 in fiscal 2001 and 1.09 in fiscal 2002. The industry is forecasting 0.95 in fiscal 2010, indicating that the target was again not achieved this fiscal year, either.

The energy intensity index for production of non-ferrous metals in fiscal 2002 was substantially level with the fiscal 2001 figure due to the result of the same level of production, and while energy saving efforts are steadily being made, they have been insufficient to make a change to the index.

The intensity index in ferronickel production was up slightly on fiscal 2001, but a declined ore grade had a significantly negative impact on energy intensity.

3. Steps taken to achieve targets

- Major
  - Reduction of electrolytic power consumption
  - Reduction of fossil fuel through combustion of waste products
  - Recovery of heat from converters in the sulfuric acid plant
  - Reduction of power consumption in the distilling furnaces through better process control
  - Increase of on site power generation using excess steam
  - Improvements of combustion efficiency in rotary kilns

- Fiscal 2002 actual

Reports were received regarding 55 energy saving initiatives, which were implemented in fiscal 2002, to the amount of a total investment of ¥3.5 billion. These initiatives have resulted in energy savings of 36,000 kl in crude oil equivalents.

Initiative	Investment (millions of yen)	Energy saved (kl/year; crude oil equiv.)
Construction of industrial furnaces enabling implementation of a thermal recycling from shredder dust	2945	10,000
Intensive operation of sulfuric acid plants	0	2,700
Reduction of coal with use of petroleum cokes ash	0	2,700
Reduction in fuel oil through increased rates of oxygen enrichment	0	800
Use of waste plastic as an alternative fuel	0	3,400
Low temperature kiln operation	0	2,300
Other	560	13,900

4. Reasons for variations in carbon dioxide emissions

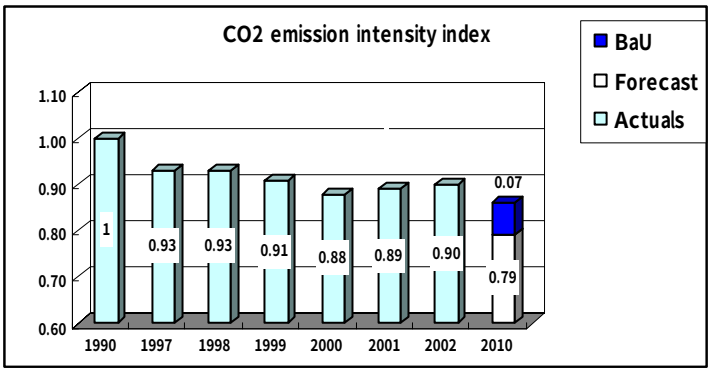
● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

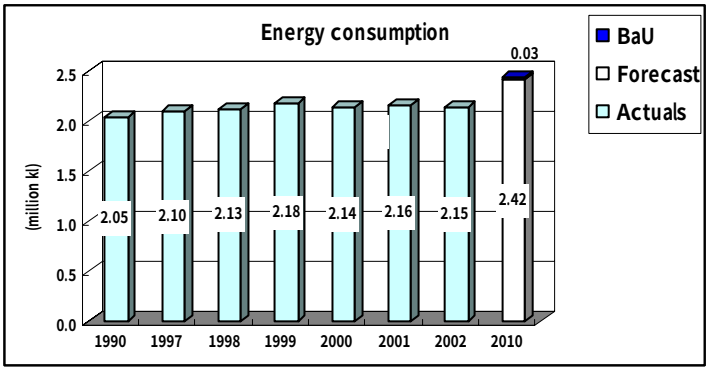
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions	4879	
Fiscal 2002 CO_2 emissions	5023	
Variation in CO_2 emissions	144	2.95%
(Breakdown) Contribution from power intensity	21	0.4%
Contribution from production activity	674	13.8%
Proportion attributable to industry effort	-551	-11.3%

● Reasons for variations in emissions in fiscal 2002

Actual carbon dioxide emissions in fiscal 1990 were 4.88 million t-CO_2 and 5.03 million t-CO_2 in fiscal 2001, while in fiscal 2002 they were 5.02 million t-CO_2—generally level with fiscal 2001. Compared with fiscal 1990, fiscal 2001 carbon dioxide emissions increased, but the increase was due to increased production. Total production in fiscal 1990 was 2.325 million tons, with 2.667 million tons produced in fiscal 2002, indicating a rate of growth in production of 15%. In contrast, the rate of increase of carbon dioxide was 3.0%, giving a result from energy conservation efforts lower than the rate of increase in production. The forecasts for thr future are for 5.18 million t-CO_2 in fiscal 2010—a forecast increase of 6% from fiscal 1990 levels. Conversely, were voluntary action plans not implemented, carbon dioxide emissions in 2010 would be 5.66 million t-CO_2—a 16% increase from fiscal 1990.

5. Reference data





Assigning a value of one (1) to the fiscal 1990 carbon dioxide intensity index gives an index of 0.90 in fiscal 2002, indicating a decline. This decrease reflects the efforts made by the

industry and the power generation sector. The industry is forecasting an index of 0.79 for fiscal 2010.

The non-ferrous metals processing industry consumed 2.05 million kl of energy (in crude oil equivalents) in fiscal 1990 and 2.15 million kl in fiscal 2002. This increase represents 4.5%, which is lower than the rate of increase in production (15%). The industry is forecasting consumption of 2.42 million kl in fiscal 2010—18% more than in fiscal 1990. Conversely, if voluntary action plans were not implemented, consumption would be 2.45 million kl in fiscal 2010—19% more than in fiscal 1990.

7. Environmental management and conservation in overseas business activities

- The environmental protection technology and expertise amassed over many years by member companies is the basis for industry's efforts to put in place and enhance a system of voluntary environmental management system, which will improve the industry's level of environmental management (for example, publishing an annual environmental report or acquiring ISO14001 certification).
- The industry has also put in place environmental management systems in its overseas operations as has domestically been done in Japan. It intends to implement the best possible measures to protect the environment, and to do this, the industry is actively transferring and building technology and expertise amassed in Japan in other countries.

Note:

● The 2010 BAU was calculated by the following process:
  - Production level: Compared with the fiscal 2002 actual of 2.67 million tons, the estimate for 2010 is 3.112 million tons.
  - Energy consumption was calculated proportionately using 2002 actuals as a base.
  - In relation to energy intensity, with production of items with smaller intensities (copper) expected to increase, overall intensity, even at the BAU stage, will improve from 0.804 (kl/t) in 2002 to 0.786 (kl/t) in 2010.

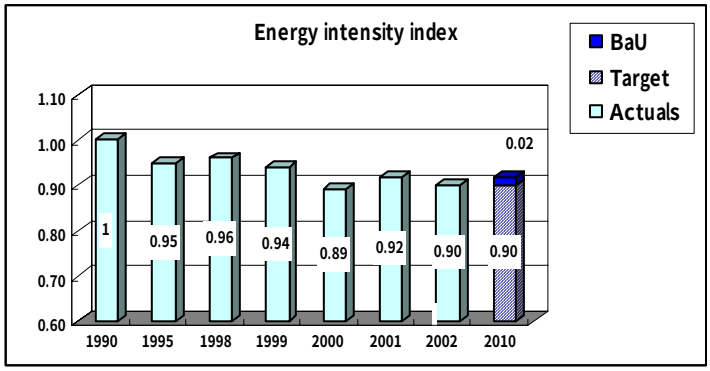
● The principal products of the industry are copper, lead, zinc, nickel, ferronickel ingots, and others. The follow-up survey represented almost 100% of the energy index of companies manufacturing these principal products (energy consumption levels of participating companies divided by total energy consumption of companies manufacturing the principal products).

● Energy consumption was calculated by aggregating data for the non-ferrous metals sector from designated product categories in the Monthly of the Current Survey of Energy Consumption (issued by the Ministry of Economy, Trade and Industry), and data for the ferronickel and nickel sectors from respondent companies.

Japan Aluminium Association

Target: To achieve a 10% improvement in energy intensity in fiscal 2010 compared with fiscal 1995.

1. Progress toward target



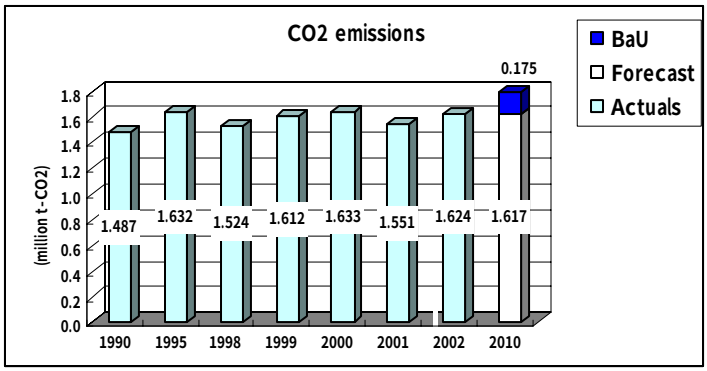
Assigning a value of one (1) to the fiscal 1995 energy intensity index gives 0.90 in fiscal 2002.

● Reasons for adoption of target

The industry target is based on the expectation that future aluminum production will undergo substantial growth. For that reason, the target that was chosen was not carbon dioxide emissions, but energy intensity.

The main products of the industry are rolled aluminum products (rolled and extruded products). The weight and shape of products vary, and in particular flat rolled products exhibits a wide range of thickness, precluding an appropriate evaluation on the basis of intensity per unit of production. The indicator chosen, therefore, is the intensity per unit of rolled product where the production level has been corrected based on the manufacturing LCI data.

2. Carbon dioxide emissions



The industry emitted 1.487 million t-CO_2 in fiscal 1990 and 1.624 million t-CO_2 in fiscal 2002. Due to higher production, it is forecast that 1.617 million t-CO_2 will be emitted in fiscal 2010—an increase of 8.8% compared with fiscal 1990.

3. Steps to be taken to achieve targets

● Major tasks to be pursued

- Achieving more efficient energy use through energy-saving operation and process improvements (including better yields)
- Promoting improvements in equipment to enhance energy recovery and efficiency
- Publicizing successful case studies in energy conservation, and encouraging their emulation across the industry (posted on member only website)

The industry also expects the following initiatives to contribute to preventing global warming.

- Actively promoting aluminum recycling (on a global scale)
- Supporting moves toward down-weighting of automobiles and rolling stock through greater use of aluminum (within Japan)

● Main measures implemented in fiscal 2002

There were reports on 47 energy conservation initiatives undertaken in fiscal 2002, representing a total investment of ¥900 million. The resulting energy-saving effect was 7,700 kl in crude oil equivalents.

Initiative	Investment (millions of yen)	Energy saved (kl/year; crude oil equiv.)
Power savings by operating of all utility equipment with variable power supply	270	2,500
Power savings by adapting AC power supply on hot rough rolling mills	400	930
Refurbishment of waste heat boilers	90	618

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors causing increases or decreases between fiscal 1990 and 2002

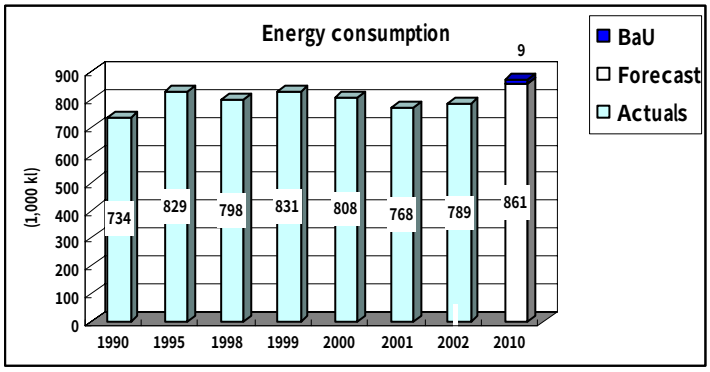
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	1486	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	1623	
Variation in CO_2 emissions	137	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	7	0.5%
Contribution from production activity	193	13.0%
Portion attributable to industry efforts	-63	-4.2%

(In accordance with method proposed by Keidanren Secretariat)

● Reasons for variations in emissions in fiscal 2002

The target energy intensity fell as an index, from 0.95 (fiscal 1990) to 0.90 (fiscal 2002), but an increase in production volumes caused energy consumption to increase, which also led to an increase in carbon dioxide emissions.

5. Reference data



The industry recorded 734,000 kl of energy consumed in fiscal 1990 and 789,000 kl in fiscal 2002.

6. Other global warming initiatives

● Emissions from offices and in-house distribution

- Electricity savings were achieved by fitting office lighting apparatus with inverters (investment value: one million yen; reduction effect: 1 kl per yr in crude oil equivalents).

● Evaluation from an LCA perspective

- Better fuel consumption in automobiles through the greater use of aluminum to reduce vehicle weight (representing an annual reduction of approximately 1.8 million t-CO_2 since fiscal 1990)
- Energy savings through use of aluminum in rail cars such as bullet trains and subways (representing a reduction of approximately 1.28 million t-CO_2, calculated on the assumption approximately 100 t-CO_2 per car for the whole life of car multiplied by 12,800 cars).

● Greenhouse gases other than carbon dioxide

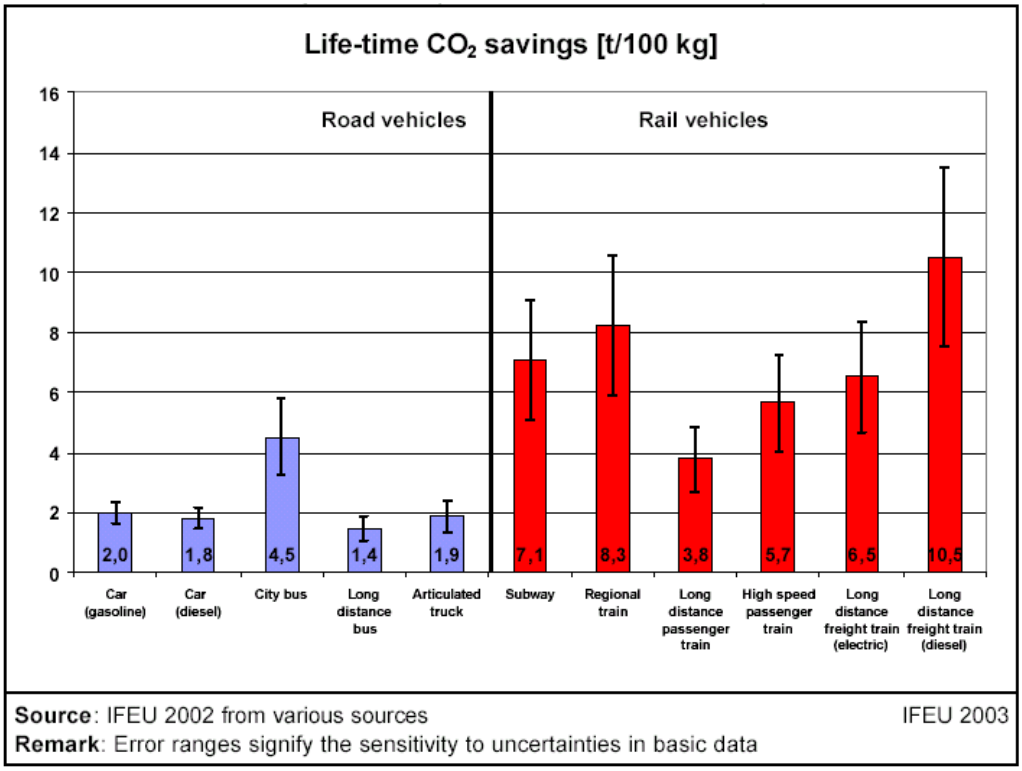
The industry makes almost no use of any greenhouse gases other than carbon dioxide.

● Projects being carried out taking into account the Kyoto Protocol

- One innovative technological program for preventing global warming was the adoption of developing Sophisticated Processing and Forming Technology for Aluminum Alloys for manufacturing Lighter weight Automobiles. And under a five year project starting in 2002, the Japan Research and Development Center for Metals (JRCM), as a central body, is now making progress in technological development of

(i) highly moldable sheet material, (ii) porous aluminum, and (iii) aluminum-steel hybrid bonding.

- The International Aluminum Association (IAI) has specifically calculated the amount of carbon dioxide emissions which were reduced by down-weighting of automobiles and railway cars. The Japan Aluminium Association helps publicize this IAI report.



The carbon dioxide reduction effect over the life of a car (in tons) if, during use, the weight of each car were reduced by 100 kg.

7. Environmental management / Conservation in overseas business activities

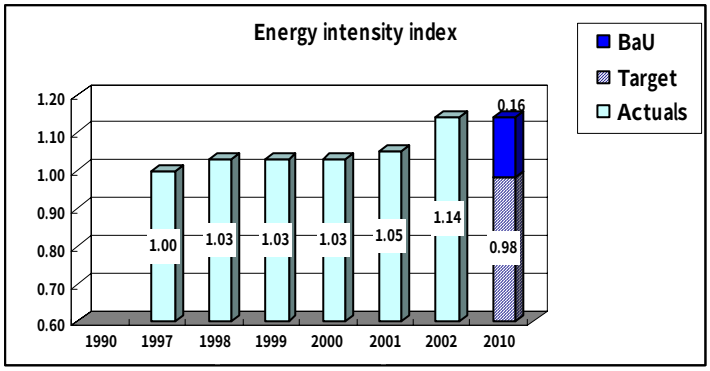
Of the 16 operating plants for seven companies participating in the survey, 13 operating plants had acquired ISO 14001 certification before the end of fiscal 2002, while another two were scheduled to acquire the certification during fiscal 2003. Nevertheless almost all operating plants are expected to obtain certification. Although the industry has few offshore aluminum rolling operations, there are only some finished products operations overseas. They receive instruction from the head offices with regard to the environmental protection.

Note: The principal products of the industry are rolled aluminum (sheets and extrusions). The proportion of companies participating in the follow-up survey was 12% (7 companies out of 60), representing 64.2% of industry production. In this context, energy intensity refers not simply to the amount of energy consumed per unit of production output, but to the amount of energy consumed per unit volume of rolled product, a concept that takes energy loads required for the rolling process into account. The forecast for production in fiscal 2010 assumes an annual rate of growth of 1% for the 20-year period from fiscal 1990 to fiscal 2010 (based on demand forecasts made by the Nonferrous Metals Division of the Ministry of Economy, Trade and Industry at the time of drafting the fiscal 1998 report on a survey of strategic technology measures in the nonferrous metals industry). Carbon dioxide emissions were calculated using energy consumption data from the seven major rolled aluminum manufacturers.

Japan Dairy Industry Association

To reduce energy intensity by 0.5% annually, with fiscal 2000 as the benchmark year.

1. Progress toward target

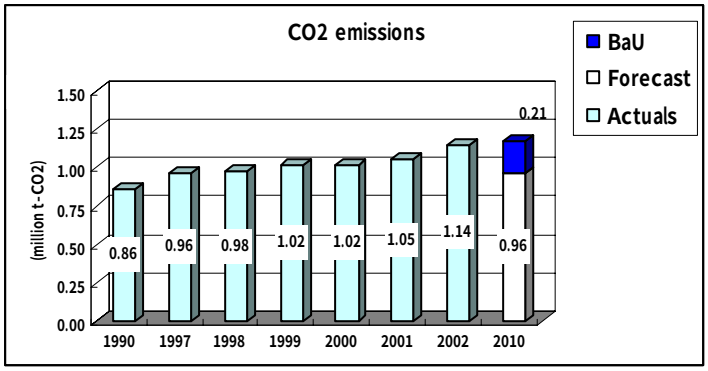


Assigning a value of one (1) to 1997 gives actuals of 1.03 for each of fiscal 1998, 1999, and 2000, 1.05 in fiscal 2001, and 1.14 in fiscal 2002, with a target of 0.98 in fiscal 2010.

● Reasons for adoption of target

From this fiscal year the number of companies involved in the environmental voluntary action plan increased from 7 to 12, which precipitated a review of targets. To maintain continuity with the previous target ("To reduce energy intensity by 0.5% annually on the fiscal 1997 base year in the five years to fiscal 2002, and by 1.0% per year over the eight-year period from fiscal 2003 to fiscal 2010 (assuming annual growth in production of 1.0%)"), energy intensity was established as the target. Further, in fiscal 2002 the industry underwent major restructuring, and the fact that there was a change in the number of participating companies also contributed to the selection of intensity in preference to absolutes. The fact that there was a structural change with regard to quality and safety in fiscal 2000, and that the oldest data of newly joined companies that was traceable was that of fiscal 2000, caused fiscal 2000 to be selected as the benchmark year.

2. Carbon dioxide emissions



The industry has emitted and will emit the following amounts of carbon dioxide.

860,000 tons in fiscal 1990

960,000 tons in fiscal 1997

980,000 tons in fiscal 1998

1.02 million tons in fiscal 1999 and 2000 respectively

1.05 million tons in fiscal 2001

1.14 million tons in fiscal 2002

960,000 tons in fiscal 2010(estimated amount) : 11.6% higher than in fiscal 1990

If voluntary action plans were not implemented, emissions amount would be 1.17 million tons in fiscal 2010 : 36.9% higher than in fiscal 1990.

3. Steps taken to achieve targets

- Major steps

The following principal steps to achieve targets have been implemented.

・industry level restructuring and integration of dairy product plants

・restructuring the transportation methods for raw milk and dairy products

・quality and transportation control to reduce quantity of inferior and disposal dairy products

・reassessing high-frequency and/or small quantity deliveries

On an individual level, to improve energy efficiency, technical measures such as process improvements, expansion of plants and equipments, fuel conversion and introduction of cogeneration system are being explored.

- Fiscal 2002 actual

	Investment	Effect
Reducing loss through optimal boiler ignition		
Fitting boilers with fan inverters		
Changing boiler blow rate settings		
Reducing pasteurizer waiting time		
Changing dryer air circulation time		Reduced 11.12 m^3/day

Changing dryer hot water temperature		Reduced 28%
Improving dryer air sealing		
Reducing dryer heating operation		
Eliminating steam leaks		
Maintaining steam traps		
Introducing ammonia freezers	46 m yen	
Recovering heat from concentrators for use in milk powder air conditioners		
Shortening fermentation chamber start-up time		
Stopping conveyors and other equipment waiting on mix		Reduced 18,960 kW/yr on paper
Installing air chamber tanks		Reduced 83,100 kW/yr on paper
Improving cooling efficiency by blowing liquid nitrogen into external air conditioning units		Reduced 55,698 kW/yr on paper
Stopping to use inlet tank that do not require waste water treatment		Reduced 47,064 kW/yr on paper
Upgrading to high efficient boilers	48.782 m yen	4.5% improvement
Recovering condensate (11 years)	27.7 m yen	
Repairing steam drain pipes	1.05 m yen	Drain recovery
Installing additional high pressure boilers	18.8 m yen	Very efficient boilers
Leveling power consumption day and night	6.6 m yen	Using night-time power
Using power capacitors	3.85 m yen	Energy savings
Using hot water from waste heat recovery for CIP	4.621 m yen	
Installing recycling equipment for process water and recovering recycle water	3 m yen	
Insulating pipes and machineries	23.05 m yen	
Fitting waste water treatment equipment with inverters	520,000 yen	Reduced 23,000 kWh/yr
Changing compressor operation to manual stoppage of one unit at night		Reduced 115,400 kWh/yr
Turning off lights in ice hardening chamber when unoccupied		Reduced 600 kW/yr
Introducing cogeneration systems to three factories	Approx. 500 m yen	Reduced carbon dioxide 2,727 t/yr

In addition, industry members progressed fuel conversion from heavy oil to gas, and introduced high efficient power transformers.

The following is a case of energy saving in change of milk-powder manufacturing process.

By making changes in the milk powder manufacturing process, reductions were achieved in all forms of energy used in manufacturing.

Estimated investment value: 300 million yen

Effect (Reductions were calculated by making changes in process, based on actual energy used in fiscal 2001)

	Reduction	Carbon dioxide equivalent
Power	1.1167 m kWh	403.76 t
C heavy oil	225.2 kl	672.76 t
B heavy oil	25.9 kl	73.6 t
Total (expected annual)		1,150.12 t

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for variations between fiscal 1990 and 2002

The following method was used to analyze the factors that caused fiscal 2002 carbon dioxide emissions to increase on fiscal 1990 levels (suggested by the Keidanren Secretariat).

Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed “Fixed coefficient emissions.” The difference between actual emissions and fixed coefficient emissions is deemed the “Contribution from changes in coefficient of carbon dioxide emissions.” Assuming a relationship whereby “Fixed coefficient emissions = Production activity x Emissions per unit of production activity” enables the amount of change in fixed coefficient emissions to be broken down into “Contribution from production activity” and “Contribution from emissions per unit of production activity.”

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	857	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	1136	
Variation in CO_2 emissions	278	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	5	0.6%
Contribution from production activity	163	19.0%
Contribution from emissions per unit of production activity	111	12.9%

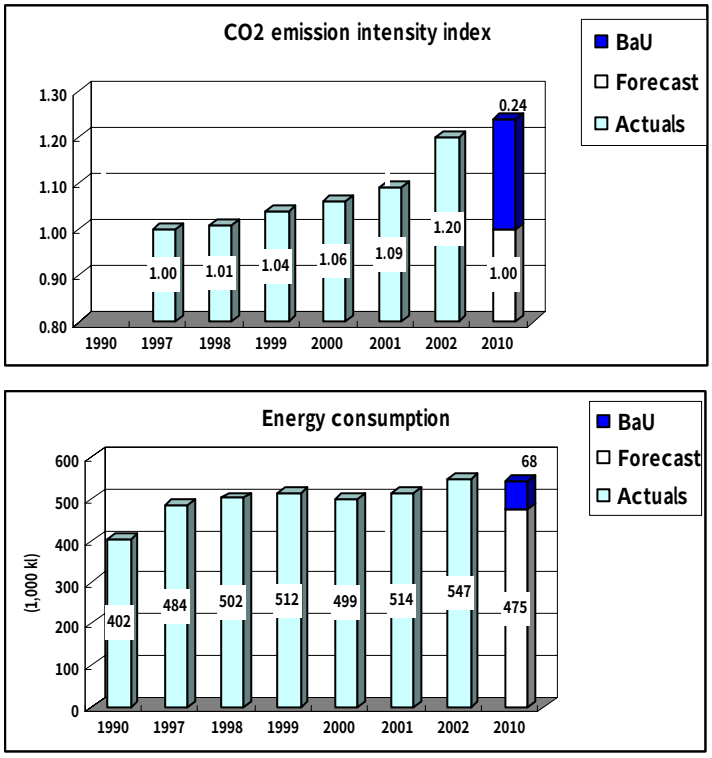
● Reasons for variations in emissions in fiscal 2002

The industry underwent a major restructuring in fiscal 2002, and factories were amalgamated and scrapped as major companies were split up or merged. The number of companies participating in the milk industry's voluntary action plan therefore changed from the original 7 to 12. As a result of integration and/or closing factories, production and sales were less than the previous year.

The following reasons contributed to higher energy consumption and carbon dioxide emissions.

- Since the incident happened in 2000, increase of costs to improve quality and safety of production.
- The growth of production like yogurt that involve consumption of large amounts of energy.
- The growth of small quantity and various kinds of production.

5. Reference data

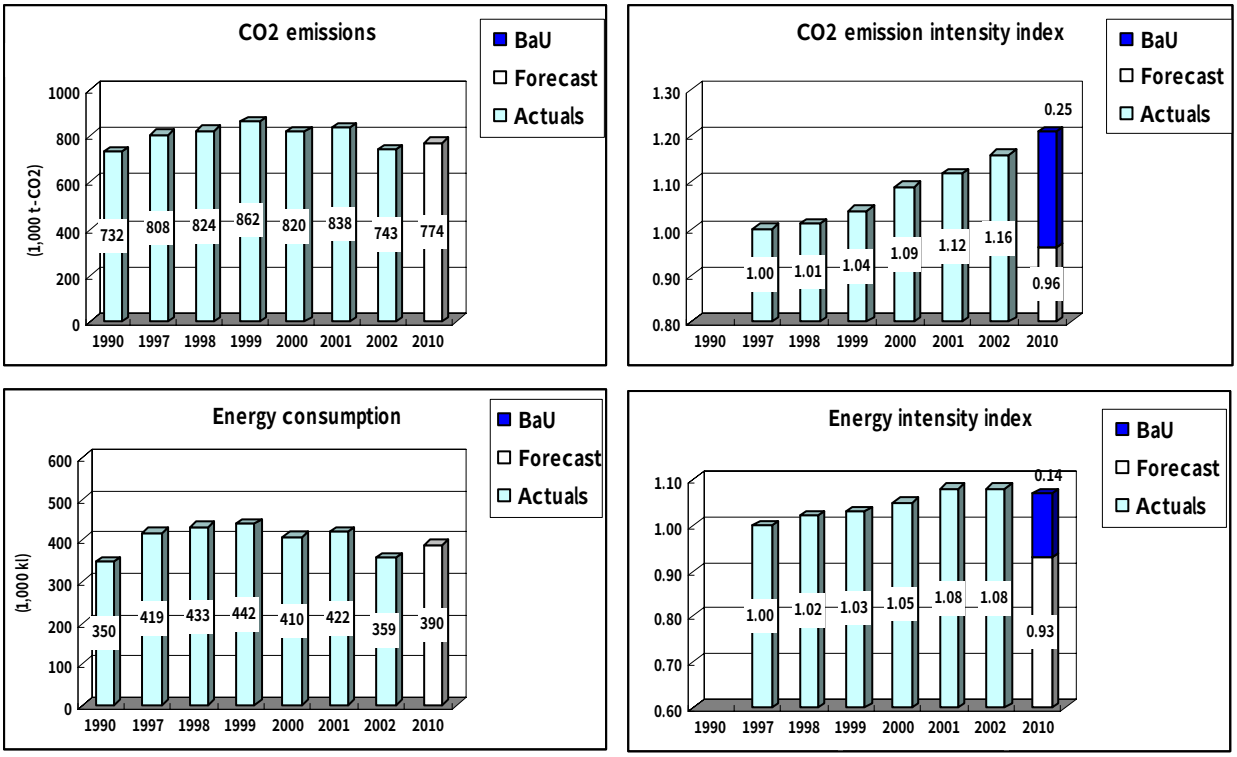


Assigning a value of one (1) to the fiscal 1997 carbon dioxide emission intensity index gives 1.01 in fiscal 1998, 1.04 in fiscal 1999, 1.06 in fiscal 2000, 1.09 in fiscal 2001, and 1.20 in fiscal 2002, and the forecast for fiscal 2010 is 1.00. If voluntary action plans were not implemented, the index would be 1.24.

The industry has recorded the following energy consumption (in crude oil equivalents): 402,000 kl in fiscal 1990; 484,000 kl in fiscal 1997; 502,000 kl in fiscal 1998; 512,000 kl in fiscal 1999; 499,000 kl in fiscal 2000; 514,000 kl in fiscal 2001; and 547,000 kl in fiscal 2002. The forecast for 2010 is 475,000 kl, which represents an 18% increase over

fiscal 1990. If voluntary action plans were not implemented, energy consumption would be 543,000 kl in fiscal 2010, or 35% higher than in fiscal 1990.

The aggregated results of the companies participating through to last year are given below.



During fiscal 2002 participating companies underwent mergers or were split up and factories were restructured and integrated. Carbon dioxide emissions and energy consumption fell with reduced production, the carbon dioxide emissions intensity index rose, and energy consumption intensity was steady.

6. Other global warming initiatives

- Emissions from offices and distribution
  - Substantial reductions in carbon dioxide by adopting a modal shift
  - Containerization of cardboard distribution
  - Introduction of low-emission vehicles (11)
  - Reduction in number of trucks for distribution (reduced by 10)
  - A shareholding company was set up to manage related distribution and sales sector companies. This has resulted in national efficiencies in distribution, which should produce energy savings and limit carbon dioxide emissions.

- Evaluation from an LCA perspective

The Association participated in a survey activity administered by the Ministry of the Environment to assess lifecycle of container and packaging, and is proceeding assessment the

lifecycle of glass bottles and paper cartons which are considered as milk containers. On an individual basis, members are seeking to introduce light bottles and reduce weight of plastic containers.

7. Environmental management and conservation in overseas business activities

- Increase in the number of factories with ISO 14001 certification from 4 (total number of factory: 127) in 1998 to 44 (total number of factory: 105) in 2002
- Staging seminars for ISO 14001 certification
- Construction and operating environmental management systems at all factories (two factories have ISO certification)
- Undertaking environmental inspections at all factories (one company)
- Focusing environmental conservation activities on energy conservation at the factories of associated offshore companies (Guangzhou in China, Thailand, Indonesia)
- Acquisition of ISO 14001 certification by factory of an associate company in Thailand

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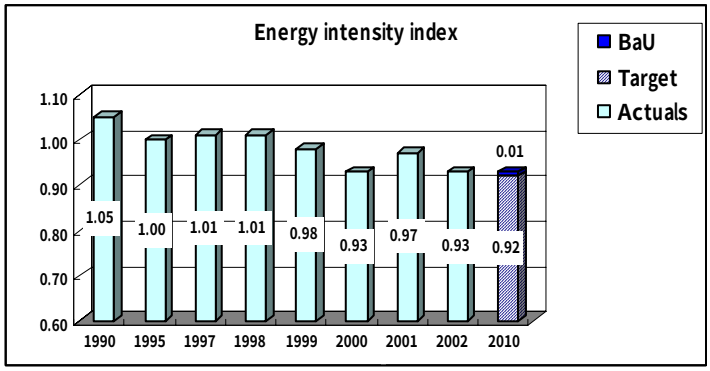
Note: The principal activity of the industry is the manufacture and sale of foodstuffs for which milk and dairy products are the basic ingredients. A total of 12 industry companies participated in the follow-up survey, representing 62% of total industry sales.
Boundaries between industries were adjusted to confirm that there was no overlap with other industries.
Carbon dioxide emissions were calculated by aggregating the fuel consumption of individual companies (by fuel type), and then multiplying consumption by the carbon dioxide coefficient for each fuel type.
Assumptions for the fiscal 2010 forecast were that production would be maintained at current levels, and that energy intensity of production would improve 0.5% per annum with fiscal 2000 as the benchmark year.

Japan Copper and Brass Association

To reduce the energy intensity of manufacturing by 7.5% compared with fiscal 1995, by fiscal 2010.

1. Progress toward target



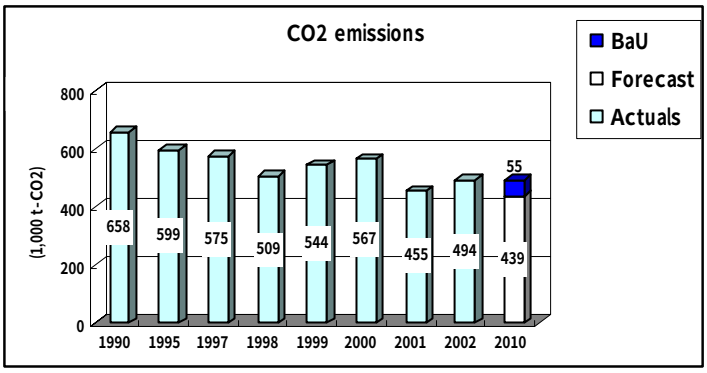
Assigning a value of one (1) to manufacturing energy intensity in 1995 gave a result in fiscal 1997 of 1.01 that was worse due to a decline in production volume. As energy saving activities became more common from fiscal 1999 on, the index moved to 0.98 in fiscal 1999, 0.97 in fiscal 2001 when production levels declined substantially, and 0.93 in fiscal 2002 when there was a slight restoration in terms of production levels.

The fiscal 2010 target is 0.92.

● Reasons for adoption of target

The Association adopted fiscal 1995 as the benchmark year when the list of participating companies was fixed as is today. Since the oil crisis, energy saving initiatives have included capital investment in energy conservation (where the returns from recovery of energy have been appropriate), which is now almost complete, and, as action on plant and equipment where rates of energy recovery were relatively poor subsequently became unavoidable, manufacturer estimates were used to develop a target for industry effort derived from an annual reduction of 0.6% on fiscal 1995 levels (approximately 3,000 kl annually in crude oil equivalents). (However, the assumption was made that production levels would tend to be the same as in fiscal 1995.)

2. Carbon dioxide emissions



The brass industry has emitted the following amounts of carbon dioxide: 658,000 t-CO_2 in fiscal 1990; 575,000 t-CO_2 in fiscal 1997; 509,000 t-CO_2 in fiscal 1998; 544,000 t-CO_2 in fiscal 1999; 567,000 t-CO_2 in fiscal 2000; and in fiscal 2001 the figure fell to 455,000 t-CO_2 due to a substantial decline in production. The figure in fiscal 2002 was 494,000 t-CO_2. The industry is forecasting emissions of 439,000 t-CO_2 in fiscal 2010—a 33% decline compared with fiscal 1990. If voluntary action plans were not implemented, emissions in fiscal 2010 would decline 25%.

3. Steps taken to achieve targets

- Major
  - Promoting uniform action at all operational sites (introducing energy-efficient lighting and initiatives to stop air leaks from air compressors, cutting off transformer power on holidays, conducting energy conservation patrols, cutting off localized cooling when not needed, adjusting the temperature of coolers, isolating lighting circuits, and turning off coolant water on holidays).
  - Installing, upgrading, and improving plant and equipment (fitting electric motors with inverters, installing boilers driven by waste heat from power generation, and converting power transformers to low loss transformers).
  - Undertaking improvements in process and production controls and operational management (reducing power for maintaining temperature, optimizing the diameters of induction heater coils, enhancing insulation on annealing furnaces, extending the life of refractories, improving the heat absorption rate of areas subjected to heating, improving furnace wall radiation rates inside the furnace, preventing no-load running of air compressors, fitting inverters to exhaust fan motors, controlling the revolutions of motors in roll coolant systems, implementing more efficient operation of in-line hydraulic pumps, and not permitting production lines to run empty when down or idling).
  - Integrating equipment and installing larger equipment (upgrading older equipment and improving power intensity through intensive operation of extruders).

● Fiscal 2002 actual

The industry implemented 65 initiatives that had a relatively significant impact, in which principal investments were aimed at better control over power supply systems on production lines. The total investment was ¥320 million, which, combined with energy saving activities, resulted in an annual reduction of 10,231 kl in crude oil equivalents.

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

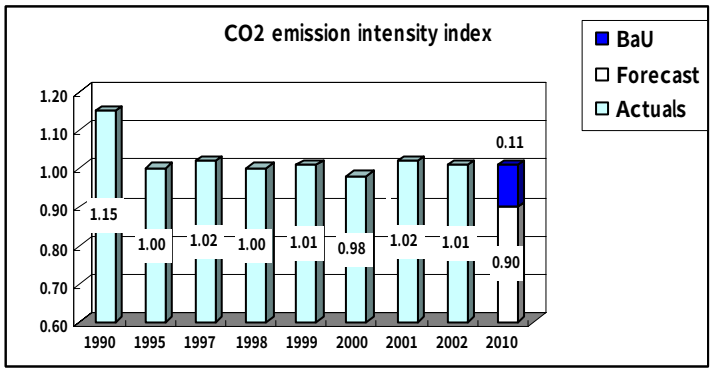
Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed "Fixed coefficient emissions." The difference between actual emissions and fixed coefficient emissions is deemed the "Contribution from changes in coefficient of carbon dioxide emissions." Assuming a relationship whereby "Fixed coefficient emissions = Production activity x Emissions per unit of production activity" enables the amount of change in fixed coefficient emissions to be broken down into "Contribution from production activity" and "Contribution from emissions per unit of production activity."

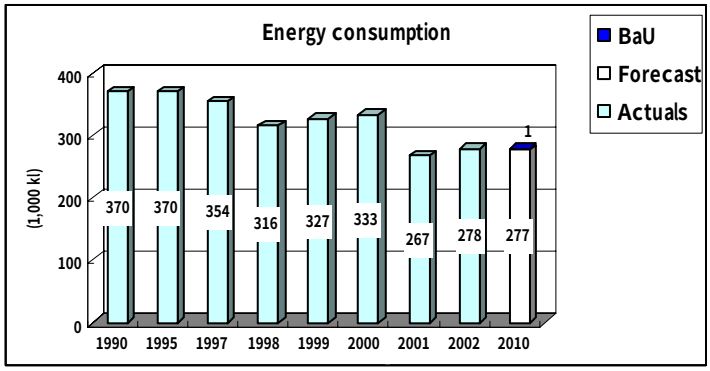
	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	658	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	494	
Variation in CO_2 emissions	-164	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	4	0.6%
Contribution from production activity	-92	-13.9%
Portion attributable to industry effort	-77	-11.7%

● Reasons for variations in emissions in fiscal 2002

Compared with fiscal 2001, production levels improved approximately 6%, which in turn resulted in an improvement in plant operating rates. The reductions of 10,231 kl in crude oil equivalents achieved came with the fiscal 2002 investment in energy savings of 320,000 yen, along with other reductions due to normal energy saving activities. These allowed the industry to hold intensity to the same level as in fiscal 2001, although production levels rose.

5. Reference data





6. Other global warming initiatives

Through the activities of the Promotion of Energy-Saving Committee, members exchange information about examples of initiatives to save energy, and seek to improve the level of energy saving across industry. It is this work that provides the motive force for reducing carbon dioxide.

7. Environmental management and conservation in overseas business activities

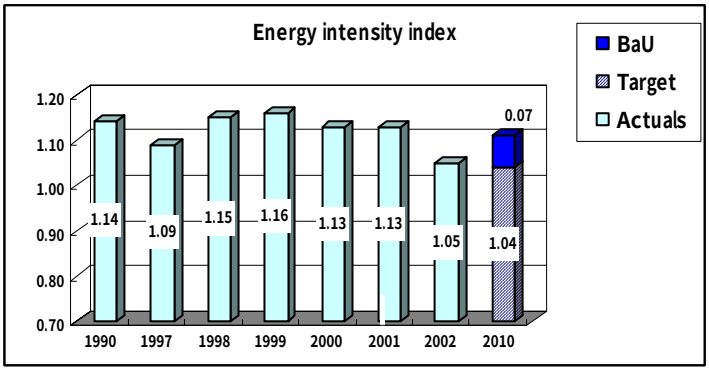
The number of operation sites with ISO 14000 certification in fiscal 2003 reached 13.

Note: The principal products of the industry are sheets, strips, rods, wire, and tubes made of copper and copper alloys. The proportion of respondents to the follow-up survey represented 19% of the industry (12 companies), accounting for 74% of energy consumed by the industry and production and sales levels.
Method of calculating data: Carbon dioxide emissions were calculated by aggregating individual company fuel consumption (by type of fuel), and multiplying the carbon dioxide emissions coefficient for each fuel by consumption volume.
Assumptions underlying fiscal 2010 targets: Production and energy consumption levels will be the same as in fiscal 2002, but it has been assumed that consumption of A-type fuel oil will be reduced 50%.

Limestone Association of Japan

To reduce the energy intensity of gas oil and electricity consumed in the limestone production process in fiscal 2010 by 6%.

1. Progress toward target

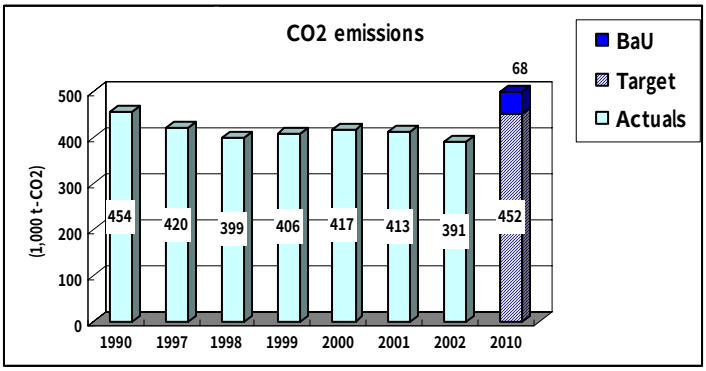


Energy intensity (for gas oil and power) was 1.14 l/t in fiscal 1990, 1.09 l/t in fiscal 1997, 1.15 l/t in fiscal 1998, 1.16 l/t in fiscal 1999, 1.13 l/t in fiscal 2000, 1.13 l/t in fiscal 2001, and 1.05 l/t in fiscal 2002. The fiscal 2010 target is 1.04 l/t.

● Reasons for adoption of target

The lime industry has adopted gas oil and electricity regarding its energy reduction targets for the purposes of carbon dioxide reduction measures, given that reduction of energy consumption is easy to manage.

2. Carbon dioxide emissions



The industry has emitted the following amounts of carbon dioxide: 454,000 t-CO_2 in fiscal 1990; 420,000 t-CO_2 in fiscal 1997; 399,000 t-CO_2 in fiscal 1998; 406,000 t-CO_2 in fiscal 1999; 417,000 t-CO_2 in fiscal 2000; 413,000 t-CO_2 in fiscal 2001; and 391,000 t-CO_2 in fiscal 2002. The decline in carbon dioxide emissions in fiscal 2002 may be attributed to lower limestone production and improved energy efficiency. The target for fiscal 2010 is the fiscal 1990 level of 452,000 tons. If voluntary action plans were not implemented, emissions would be 530,000 t-CO_2 in fiscal 2010—a 14.5% increase on fiscal 1990.

3. Steps taken to achieve targets

- Major
  - Promoting carbon dioxide absorption (implementation of greening projects)
  - Conducting waste disposal initiatives (ongoing zero emission policy)
  - Reducing gas oil consumption (encouraging use of efficiency-enhancing additives, developing and introducing environmentally-friendly diesel engines, using heavy equipment that is larger and matched to its task, and implementing innovations in mining technology)
  - Reducing electricity consumption (developing energy-efficient production equipment and shortening production processes)
  - Introducing cogeneration
  - Implementing more effective mine site cost councils (debate on energy conservation)

- Fiscal 2002 actual
  - Initiatives against global warming are ongoing, but there were no new initiatives in fiscal 2002, and therefore no estimate of investment or effect.

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Carbon dioxide emissions in fiscal 2002 declined approximately 14% on fiscal 1990 levels.

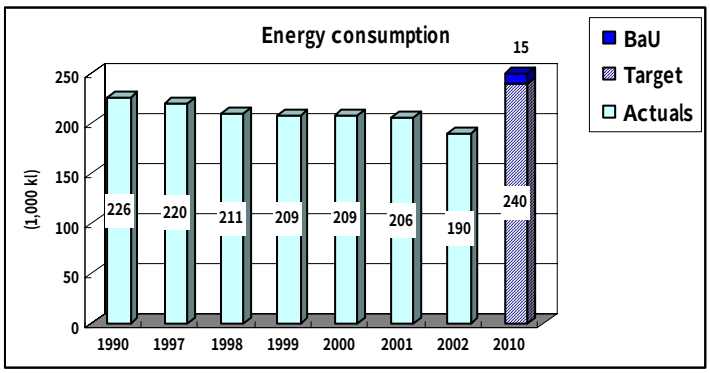
Analysis of factors contributing to the approximately 14% decline in carbon dioxide emissions in fiscal 2002 compared with fiscal 1990 gives the following.

	1,000 t-CO_2	
Contribution from changes in CO_2 emissions coefficient	3	0.6%
Contribution from production activity	-40	-8.7%
Contribution from emissions per unit of production activity	-26	-5.8%
Total	-63	-13.9%

● Reasons for variations in emissions in fiscal 2002

Carbon dioxide emissions in fiscal 2002 fell overall by approximately 14% due to a fall of approximately 9% in production of limestone compared with fiscal 1990. Efficient operation and management of heavy machinery, improved and rationalized quarry plants, and other ongoing efforts contributed to the decline in carbon dioxide emissions.

5. Reference data



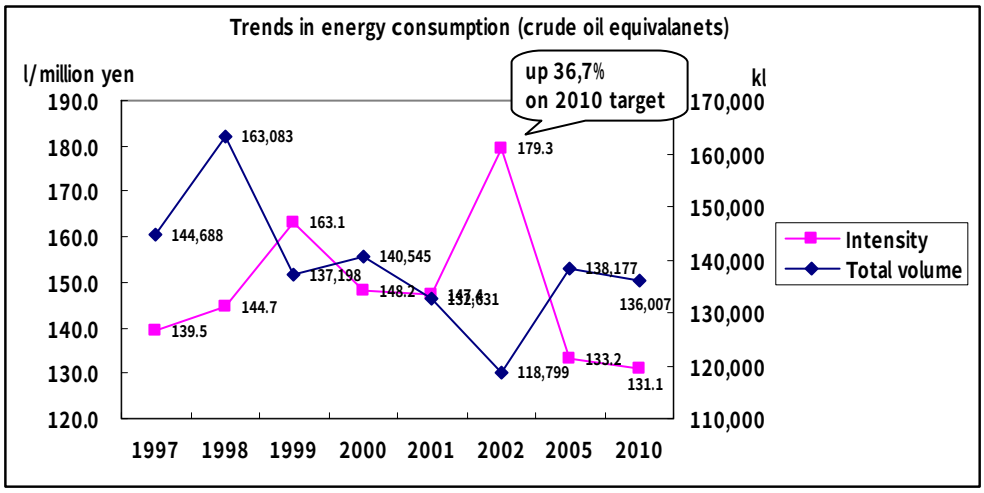
The limestone industry has recorded the following energy consumption (after conversion to crude oil equivalents): 226,000 kl in fiscal 1990; 220,000 kl in fiscal 1997; 211,000 kl in fiscal 1998; 209,000 kl in fiscal 1999; 209,000 kl in fiscal 2000; 206,000 kl in fiscal 2001; and 190,000 kl in fiscal 2002. The target for fiscal 2010 is 240,000 kl—a 6% increase compared with fiscal 1990.

Note:
The principal activities of the industry are the production and sale of limestone.
The Association has 97 member companies representing 86% of industry production.
All 97 member companies participated in the survey. There are 238 companies in the industry.
Forecasts for limestone production which form the basis for targets and BAU in 2010 are 231 million tons (up 28% compared with fiscal 2002 actuals). (From documentation prepared by the Limestone Mining Industry Study Society of the Agency for Natural Resources and Energy)

Japan Machine Tool Builder's Association

- To reduce the amount of energy consumed in 2010 on a value-of-production of basis with reference to machine tools (liters per million yen in crude oil equivalents) by 6% compared with 1997 (intensity target).
- To reduce the energy consumed in 2010 by 6% compared with 1997 (total volume target).

1. Progress toward target

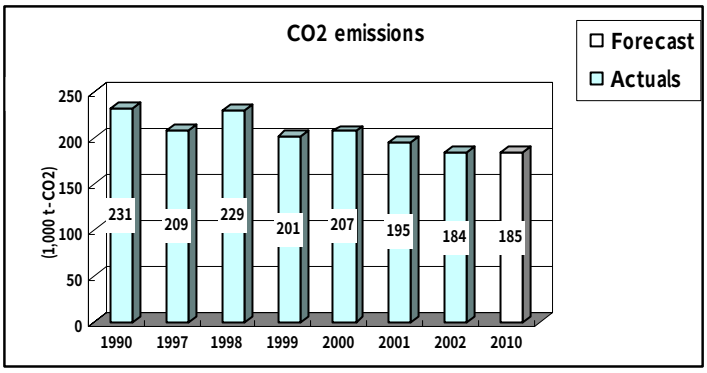


Total volume fell 18% on the 1997 benchmark year, due to a decline in the value of production as a result of the recession (down 16.4% year-on-year), falling well below the target (a reduction of 6% compared with 1997). The other target—intensity—was nevertheless up 28.5% compared with 1997. To achieve the intensity target will require not only further energy conserving effort, but it will also be essential that factory operating rates increase with increased production and that production becomes more efficient.

● Reasons for adoption of target

Japan's target for reducing greenhouse gases as stipulated in the Kyoto Protocol (a 6% reduction compared with 1990) was used as a reference for members of the machinery-related industries, including the Japan Machine Tool Builder's Association, and the Association's Environmental Safety Committee made the decision.

2. Carbon dioxide emissions



Total carbon dioxide emissions in 2002 were down 12% on 1997, the benchmark year, while total energy was down 21%, representing results that are lower than the 2010 targets. The result is nevertheless substantially attributable to a decline in the value of production as a result of the recession, irrespective of energy-saving efforts by member companies.

3. Steps taken to achieve targets

● Major

The Association's Environmental Safety Committee formed a working group comprising individuals directly engaged in management and operation of factories, in order to work towards achievement of the targets. The working group has gathered together the knowledge and experience of members in the forefront of environmental work, and has compiled an Environmental Activity Manual, which has been distributed to all members. The Manual provides detailed explanations of energy-saving and waste reduction activities. It is sprinkled with real-world examples of environmental activities engaged in by forward-acting members. The case studies of environmental activities in particular are presented with accompanying information on investment value and cost reduction results and the number of years taken to recover investment, to enable members to immediately apply the examples. The Manual also describes basic steps to take, such as how to lodge information with government authorities, and outlines environment-related legislation and regulations, given the likelihood that regulatory requirements will become increasingly stringent.

● Fiscal 2002 actual

Category of use	Actual method	Total reduction kWh/year	Total investment 1,000 yen	Total cost reduction 1,000 yen/year
Air conditioning	Adopting inverter-fitted compressors	231,877	14,370	2,269
	Installing insulating boards in factory walls	121,120	141,980	1,675
	Using sunlight and heat radiation blocking film	39,500	7,430	472
	Changing and optimizing the control of temperature settings	1,662,660	1,000	17,048

	Fitting inverters to air conditioners and fans	155,998	12,600	6,909
	Reducing the number of cool and hot water generating devices in operation	24,000	0	5,207
	Introducing gas-absorbing large temperature differential cold and hot water supply and generation systems	857,000	10,000	6,000
	Improving the efficiency of gas-absorbing hot water supply and generation systems	352,700	80,000	20,960
	Linking air conditioning fans and freezers	1,508	2	15
	Turning off factory air conditioning on holidays	32,000	0	320
	Fitting fans to bring fresh air in	25,344	600	291
	Optimizing operation of air conditioning (such as switching off during lunch hours)	61,334	0	834
	Turning off Dirivent fans during cooler operation	93,000	0	1,200
	Using ice thermal storage	733,000	650,000	11,000
	Changing to localized heaters	2,050		
	Fitting inverters to coolant water pumps	112,800	1,960	1,128
	Making coolant water pumps very efficient	3,854		
	Converting air conditioning to gas		140,000	14,500
	Changing from centralized to individually isolated air conditioners		30,000	1,200
	Limiting compressor time	84,000	4,300	770
	Conducting timer operation of coolant water in air conditioners	18,000	35	261
Lighting	Conducting appropriate management of light switches	2,166,283	1,020	32,973
	Undertaking conversion of mercury lamps and others to very efficient lights	1,769,386	97,466	22,943
	Turning off lights by fitting canopy switches	108,880	183	1,128
	Changing transformers	11,500	1,250	138
	Turning off every other light	26,032	6,000	328
	Reducing the number of lights by changing the height at which they are fitted	32,000	50	416
	Changing the globes in all-night lights	30,000	0	390
	Changing mercury lamps to inverter-fitted fluorescent lights	134,000	1,600	1,742
	Changing lighting methods and globe types	23,000	0	299
	Introducing automatic lighting adjustment systems	150,000	26,000	1,500
	Changing stabilizers	29,400	3,840	458
	Installing annual timers to external lighting (mercury lamps)	12,950	250	130
	Reducing the length of time that lighting on advertising towers is on	18,980	0	190

Compressors	Fitting inverters to motors	543,904	28,700	6,468
	Turning power off when not in use	2,658,979	220	34,973
	Reducing fan pressure	160,200	0	3,308
	Controlling number of compressors	3,191,160	34,840	43,543
	Using small compressors during temporary or night work	727,332	275	10,359
	Changing to power-saving (inverter-fitted) compressors	276,000	10,289	3,437
	Checking for and monitoring air leaks	24,500	0	705
	Introducing automatic power source switch-off devices	15,000	1,000	150
	Fitting inverters to coolant water pumps	108,024	4,450	1,080
	Looping air pipes	214,000	1,900	2,982
	Eliminating unnecessary air blowing and fitting control valves	156,000	100	2,340
	Using waste heat in heating			
	Reducing number of compressors by reviewing plumbing systems	40,000	600	400
Power sources	Changing to amorphous transformers	1,225,656	103,050	13,390
	Changing transformers	692,000	407,000	59,961
	Turning power off when not in use	78,000	0	1,100
	Adjusting number of transformers operating during light load operation	3,600	0	1,100
	Combining transformers used	35,000	50	508
	Shutting down unused transformers	25,380	0	254
Casting	Conducting intermittent operation of dust collectors	56,200	70	562
	Switching power off when dust collectors are not in use	196,700	0	1,311
	Changing method of introducing hot water	374,400	0	3,744
	Mixing pig iron into starting blocks	148,000	0	222
Mechanical finishing	Management of and shorter operating times for off-cut recovery devices	199,553	6,500	2,346
	Fitting inverters to electric motors in dust collectors	126,700	0	1,267
	Reducing equipment and machinery	645,570	0	9,476
	Turning off power to checking units when not in use	4,892	0	43
	Eliminating warming-up operation of machinery by installing heaters	22,500	0	225
	Conducting intermittent operation of chip conveyors	18,000	2,403	305
	Achieving shorter finishing time through design changes	45,961	1,700	5,810
	Conducting changes in processes	15,000	0	1,150
	Upgrading to very efficient machinery	134,956	6,000	4,994
	Reviewing finishing methods	858,300	0	8,583
	Implementing electricity-saving circuits	130,500	0	1,305
	Setting calendar timers for washing unit heaters	23,000	0	300
	Fitting inverters to coolant pumps	117,444	6,081	4,634

	Turning power to machinery off when not in use	4,360	0	0
	Increasing cutting speed	38,000	0	380
	Fitting electric motors to hydraulic forming machines	51,000	0	510
	Changing the heat source of washing machines and surface treatment machines (from electricity to LPG)	140,000	2,500	1,400
	Upgrading exhaust fans and changing ducts	54,000	2,100	540
Painting	Shutting down one painting booth fan and one block at a time	230,000	15	2,446
	Reducing number of fans by centralizing them	41,712	0	667
	Reducing amount of air consumed by using static electric paint	4,500		
	Fitting inverters to fan motors	2,160		
Assembly	Undertaking more efficient distribution (such as forklift operation)	2,000		
	Refurbishing coolant tanks for test use	9,216		478
	Changing processes	38,000		380
	Reviewing time spent adjusting operations	117,700	0	1,177
	Automatically switching off power after completion of test operation	74,000	0	1,100
	Changing equipment using compressed air to vacuum pump operation	224,400	4,000	2,244
	Reducing proportion of defective formed products	16,000	0	160
	Using MQL to eliminate use of hydraulic pumps for cutting during test operation	2,800		
Distribution	Conducting more efficient distribution (such as forklift operation)	4,000		
	Turning power to cranes off when not in use	13,360	0	240
	Replacing crane operation with forklift trucks	901	7,200	14
	Turning off lights under crane garters	25,200	0	252
Operational management	Establishing no-overtime and no-work days	137,452	0	2,450
	Conducting demand control	577,822	13,739	15,050
	Reducing the number of automatic vending machines	43,571	0	676
	Changing hot water supply temperature settings	10,000	500	3,761
	Leaving lights on automatic vending machines off	1,752	0	18
	Using smaller automatic vending machines and turning off lights	15,000	0	200
	Conducting complete power shut down over long holidays	204,000	0	3,060
	Shutting down air conditioning during overtime periods	48,000	0	

Other	Improving operation of cooling pumps for production	371,160	37,700	4,466
	Adopting cogeneration systems			15,000
	Using solar energy	465,250	69,523	1,993
	Fitting inverters to snow clearing pumps and changing to highly efficient pumps	15,000	3,000	150
	Automating snow clearing pumps and installing snow fall detectors	6,000	0	60
	Reviewing operating periods for localized exhaust units	2,610	0	30
	Improving water transmission pumps for production	3,108	90	47
	Scrapping rack warehouses and automatic transport	141,460		1,913

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

The reasons for carbon dioxide emissions in fiscal 2002 being 12% less than in 1997 are as shown in the following table.

The figure in the table relating to the "Portion attributable to indirect industry influence" represents the shortfall arising from under-evaluation of the industry's contribution. The under-estimate occurs because emission levels are derived from the average emission coefficient of total power sources (the average of all power sources), even though when the industry increases or decreases purchased power the power source that is actually affected is, for operational reasons, a thermal one. And the amount corresponding to the shortfall is assigned to other customers than those of the machine tool industry. As in the example of the following table, the difference in actual emissions between change in production value and machine tool industry efforts to reduce emissions alone is a reduction of 44,000 t-CO_2 (total of reductions in fuel and power). If, however, the actual reduction achieved in power generated from thermal sources as a result of power reductions (the amount reduced in Japan overall as a result of power reduction by the machine tool industry) is evaluated, it is apparent that the outcome was (–44,000) t-CO_2 + (-17,000) t-CO_2 = (-61,000) t-CO_2.

The machine tool industry is one that is substantially affected by changes in the business climate, and its peaks and troughs are substantial. The value of production in 2002 fell substantially compared with 1997, by 36.2%, making it extremely difficult to analyze the portion attributable to industry effort. For this reason, in the factoral analysis "Changes in production value" and "Portion attributable to industry effort" have been assessed together.

Factoral analysis of machine tool industry

	Portion attributable to direct industry influence	1,000 t-CO_2
Fiscal 1997 CO_2 emissions	209	Portion attributable to indirect industry influence
Fiscal 2002 CO_2 emissions	184	
Variation in CO_2 emissions	-25	
Contribution from changes in emissions coefficient	19	
Contribution from changes in production value and industry effort	-44	-17

● Reasons for variations in emissions in fiscal 2002

Emissions in 2002 fell 10,000 t-CO_2 compared with 2001. If analysis of contributing factors is carried out just as in the previous table, the following table results.

Factoral analysis of machine tool industry (compared with 2001)

	Portion attributable to direct industry influence	1,000 t-CO_2
Fiscal 2001 CO_2 emissions	194	Portion attributable to indirect industry influence
Fiscal 2002 CO_2 emissions	184	
Variation in CO_2 emissions	-10	
Contribution from changes in emissions coefficient	15	
Contribution from changes in production value and industry effort	-25	-10

6. Other global warming initiatives

● Evaluation from an LCA perspective

The Association is engaged in research into technical issues and user needs for the purposes of encouraging the use of energy-saving machine tools.

● Greenhouse gases other than carbon dioxide

Fluorocarbons are used as media in cooling units used in machine tools, and when the tools are scrapped, the user must have the CFCs recovered by a specialist service provider. Manufacturers are also required to advise users of that necessity (Law Concerning the Recovery and Destruction of Fluorocarbons). Components manufacturers are responsible for manufacturing cooling units, which means that machine tool manufacturers do no have a direct obligation to notify users. As an ethical obligation, however, the Association has urged members to actively notify users through web sites and letters, and many members are acting accordingly.

7. Environmental management and conservation in overseas business activities

The Association publishes an Environmental Activity Status Diagnosis which every year evaluates members on a scale of 100 in relation to their ISO 14001-based environmental management activities, to enhance awareness. As a result, the number of companies acquiring ISO 14001 certification is rising every year, and the forecast is that by 2005 approximately 40 companies will be certified.

Note: Basic data

Principal products: machine tools

Coverage rate: over 90% of industry's value of production

Participating companies: 66 of 80 machine tool manufacturers

Method of estimating fiscal 2010 targets and forecasts

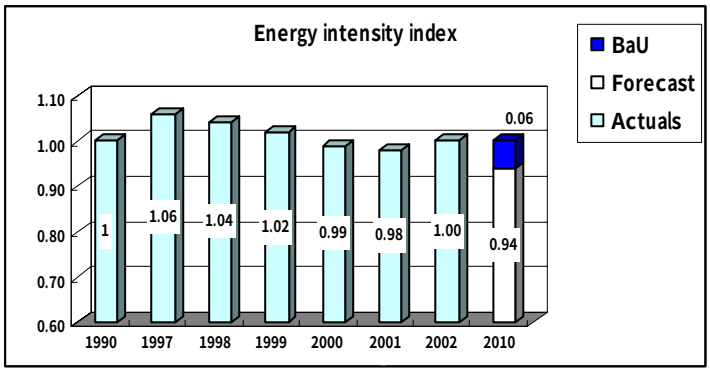
Assuming that there will be no change in the 2010 value of machine tool production from 1997 levels, and that industry will attain its energy use target (a 6% decline compared with 1997), then total energy consumption (in crude oil equivalents) in 2010 is estimated at 135,958 kl (target 131.11 x 1997 value of production of 1,037,053 million yen).

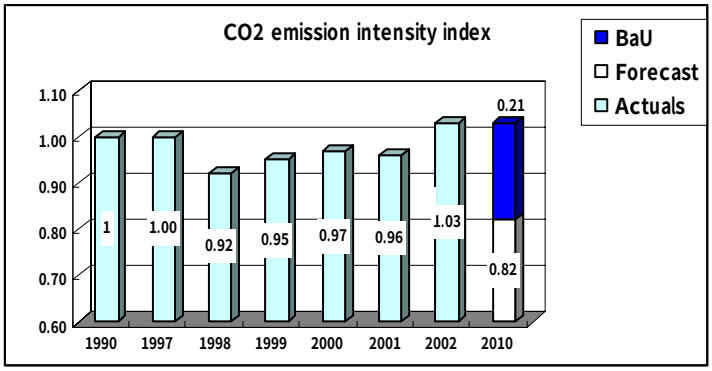
In addition, assuming that the fuel mix for energy consumed in 2010 will remain unchanged from 1997 (electricity 84.3%, C fuel oil 11%, LPG 1%, city gas 3.7%), figures were aggregated by fuel type and c arbon dioxide was calculated.

Flour Millers Association

On a 1990 base year, by fiscal 2010:
(1) To reduce the energy consumption intensity by more than 2%.
(2) To reduce carbon dioxide emission intensity by more than 5%.

1. Progress toward target



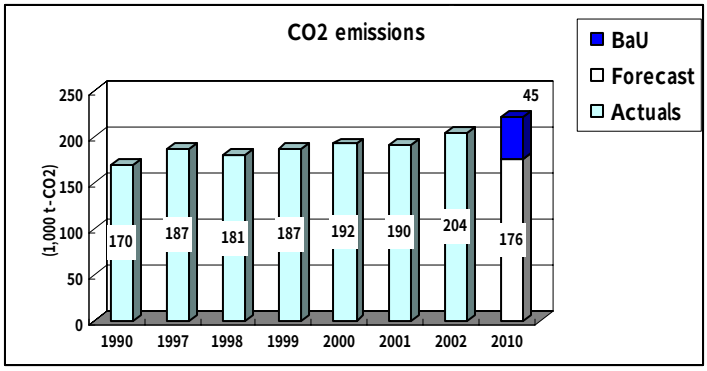


Assigning a value of one (1) to the index of energy intensity in fiscal 1990 gives: 1.06 in fiscal 1997; 1.04 in fiscal 1998; 1.02 in fiscal 1999; 0.99 in fiscal 2000; 0.98 in fiscal 2001; and 1.00 in fiscal 2002. The flour industry is forecasting 0.94 in fiscal 2010. Assigning a value of one (1) to the index of carbon dioxide emission intensity in fiscal 1990 gives: 1.00 in fiscal 1997; 0.92 in fiscal 1998; 0.95 in fiscal 1999; 0.97 in fiscal 2000; 0.96 in fiscal 2001; and 1.03 in fiscal 2002. The forecast for fiscal 2010 is 0.82.

● Reasons for adoption of target

Consumption of energy and carbon dioxide emissions are substantially influenced by variations in consumption of wheat as a raw material. Energy intensity (energy consumption per ton of raw wheat used) and carbon dioxide emissions intensity (carbon dioxide emissions per ton of raw wheat used) were therefore adopted as the evaluation indicators. Each target was formulated using actual data from member companies of the Flour Millers Association.

2. Carbon dioxide emissions



The industry has emitted the following amounts of carbon dioxide: 170,000 t-CO_2 in fiscal 1990; 187,000 t-CO_2 in fiscal 1997; 181,000 t-CO_2 in fiscal 1998; 187,000 t-CO_2 in fiscal 1999, 192,000 t-CO_2 in fiscal 2000; 190,000 t-CO_2 in fiscal 2001; and 204,000 t-CO_2 in fiscal 2002. It is forecasting emissions of 176,000 t-CO_2 in fiscal 2010—a 3% increase over fiscal 1990. If voluntary action plans were not implemented, emissions would be 221,000 t-CO_2 in fiscal 2010—30% higher than in fiscal 1990.

3. Steps taken to achieve targets

- Major
  - Integrating factories to achieve high rates of operation
  - Introducing cogeneration systems
  - Using high-efficiency electric motors
  - Introducing speed controllers and high-efficiency ventilators
  - Introducing pressure-optimizing systems for air compressors, and systems to control the number of compressors running
  - Introducing new forms of energy

- Fiscal 2002 actual

Nearly 93% of the energy used by the industry is electricity. Companies have therefore concentrated primarily on electricity-saving initiatives. The following are the more widely implemented.

- Introducing high-efficiency transformers
- Introducing high-efficiency compressors
- Using high-efficiency motors and inverters
- Introducing energy-efficient air conditioners
- Adjusting summer operating schedules, which is made possible by the achievement of high rates of operation
- Implementing improvements in pneumatic conveying systems

4.Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

The target of energy consumption intensity did not increase, but increased production caused carbon dioxide emissions intensity and carbon dioxide emissions to rise. In fiscal 2002 also, carbon dioxide emissions rose approximately 20% in comparison with 1990, and analysis

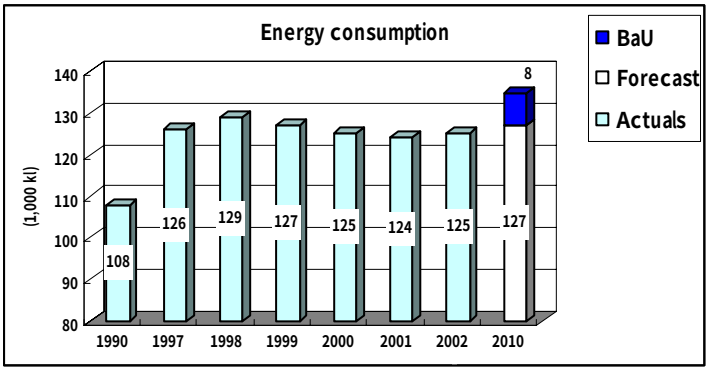
of the contributing factors reveals the following (using the method proposed by the Keidanren Secretariat).

	1,000 t-CO_2	
Contribution from changes in CO_2 emissions coefficient	2	1.3%
Portion attributable to industry effort	28	16.4%
Economic expansion (such as changes in production level)	3	1.9%
Total	33	19.6%

● Reasons for variations in emissions in fiscal 2002

The volume of raw wheat consumed fell year-on-year, but an increase in the carbon equivalent coefficient and increased and improved plants associated with product safety initiatives caused carbon dioxide emissions to rise.

5. Reference data



The industry has consumed the following amounts of energy: 108,000 kl in fiscal 1990; 126,000 kl in fiscal 1997; 129,000 kl in fiscal 1998; 127,000 kl in fiscal 1999; 125,000 kl in fiscal 2000; 124,000 kl in fiscal 2001; and 125,000 kl in fiscal 2002. It is forecasting consumption of 127,000 kl in fiscal 2010—representing an 18% increase over fiscal 1990. If voluntary action plans were not implemented, consumption would be 135,000 kl in fiscal 2010—a 25% increase over fiscal 1990.

6. Environmental management and conservation in overseas business activities

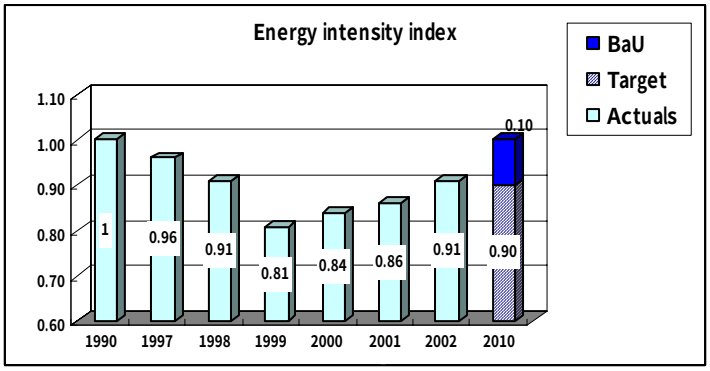
A large number of companies have established in-house environmental conservation groups, and as they work towards obtaining ISO 14001 certification, they are making progress with energy conservation and reduction of waste.

Note: The principal products of the industry are flour and wheat bran. The participation rate in the current follow-up survey was 26% (31 companies out of 118), representing 90% of raw wheat consumption. Carbon dioxide emissions were calculated by summing per-source energy consumption data. Projections for 2010 were made based on the assumption that there would be a yearly growth of 1%.

The Shipbuilders' Association of Japan

To reduce the energy intensity by approximately 10% of the 1990 base year level, by 2010.

1. Progress toward target



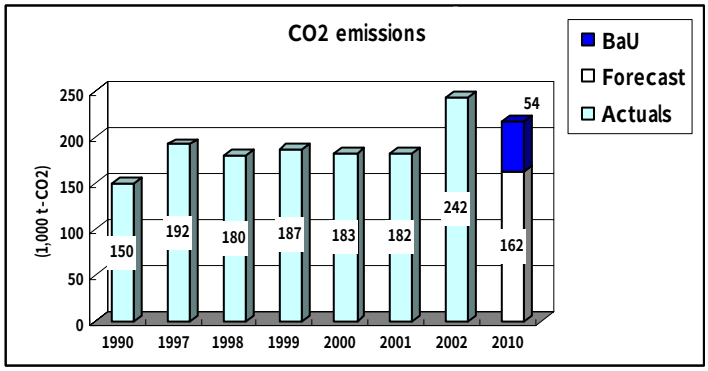
Note: A value of one (1) has been assigned to the fiscal 1990 intensity index.

Assigning a value of one (1) to the index of energy intensity in fiscal 1990 gives 0.96 in fiscal 1997, 0.91 in fiscal 1998, 0.81 in fiscal 1999, 0.84 in fiscal 2000, 0.86 in fiscal 2001, and 0.91 in fiscal 2002. The fiscal 2010 target is 0.90.

● Reasons for adoption of target

Shipbuilding is based on made-to-order production, and it is therefore an industry in which there are significant peaks and troughs in production level. Depending on the type of vessel, construction periods may also be protracted. For both those reasons, the industry deemed it appropriate to use energy consumption per unit weight of finished steel as the energy consumption index.

2. Carbon dioxide emissions



Note: The figures for fiscal 2000 to fiscal 2002 represent the total of the actual emission amounts of members of the Shipbuilders' Association of Japan and members of the Cooperative Association of Japan Shipbuilders.
The figures for fiscal 1990–1999 and 2010 are estimated amounts for the entire shipbuilding industry, including the amounts for the Cooperative Association of Japan Shipbuilders.

The shipbuilding industry has emitted the following amounts of carbon dioxide: 150,000 t-CO_2 in fiscal 1990; 192,000 t-CO_2 in fiscal 1997; 180,000 t-CO_2 in fiscal 1998; 187,000 t-CO_2 in fiscal 1999; 183,000 t-CO_2 in fiscal 2000; 182,000 t-CO_2 in fiscal 2001; and 242,000 t-CO_2 in fiscal 2002. The forecast is for emissions of 162,000 t-CO_2 in fiscal 2010—a 7% increase over fiscal 1990.

3. Steps taken to achieve targets

The primary industry initiative is investment in automated equipment, with the aim of achieving greater production efficiency and sophistication.

4. Reasons for variations in carbon dioxide emissions

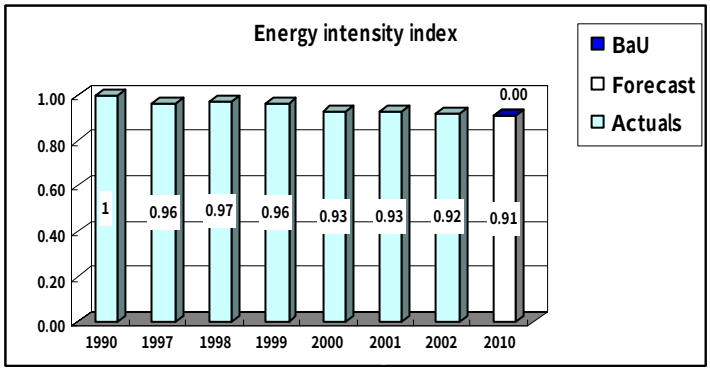
Compared with the previous year, in fiscal 2002 the weight of finished steel rose approximately 20% along with other increases in operational volumes, the result of which was an increase in carbon dioxide emissions.

- The fiscal 2000, 2001, and 2002 figures are the totals of actual emissions generated by members of the Shipbuilders' Association of Japan (SAJ) and the Cooperative Association of Japan Shipbuilders. Together the two associations represent almost the entire shipbuilding industry.
- The figures for fiscal 1990-1999 and fiscal 2010 are estimates for the entire shipbuilding industry, including the Cooperative Association of Japan Shipbuilders.
- The fiscal 2010 forecast assumes that the tonnage produced by Japan in that year will be similar to the fiscal 2002 level.

Japan LP Gas Association

To reduce energy consumption intensity (kWh/LPG-ton) at LPG storage and distribution facilities (import terminals, secondary terminals) in fiscal 2010 by more than 7% compared with the fiscal 1990 level. (Relevant terminals are those owned by importers and primary distributors of LPG, and the terminals of users in other industry sectors are specifically excluded.)

1. Progress toward target



Note: A value of one (1) has been assigned to the fiscal 1990 intensity index.

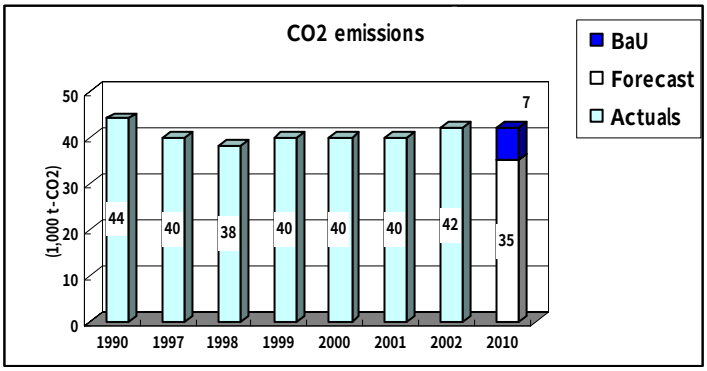
Assigning a value of one (1) to the index of energy consumption intensity in fiscal 1990 gives indices of 0.96 in fiscal 1997, 0.97 in fiscal 1998, 0.96 in fiscal 1999, 0.93 in fiscal 2000, 0.93 in fiscal 2001, and 0.92 in fiscal 2002. The fiscal 2010 target of 0.93 or less has already been substantially achieved, but the industry will continue to integrate and shut down LPG terminals and rationalize manufacturing processes, to ensure the achievement and seek to better it.

● Reasons for adoption of target

Reducing power consumed at LP gas storage and shipment terminals will be the means to reduce the amount of carbon dioxide generated from power generation.

The amount of LP gas supplied changes with economic and social circumstances. The industry therefore selected carbon dioxide emissions intensity as its target indicator, given that it is within the scope of influence of industry effort.

2. Carbon dioxide emissions



The industry has recorded the following carbon dioxide emissions: 43,600 t-CO_2 in fiscal 1990; 39,900 t-CO_2 in fiscal 1997; 38,100 t-CO_2 in fiscal 1998; 40,100 t-CO_2 in fiscal 1999; 40,400 t-CO_2 in fiscal 2000; 40,500 t-CO_2 in fiscal 2001; and 41,800 t-CO_2 in fiscal 2002. It is forecasting emissions of 34,500 t-CO_2 in fiscal 2010—a 20.8% reduction compared with fiscal 1990. If voluntary action plans were not implemented, emissions in fiscal 2010 would be 41,900 t-CO_2—a reduction of only 3.8% compared with fiscal 1990.

3. Steps taken to achieve targets

- Major
  - Reducing total consumed energy (electricity) intensity in LPG terminals through rationalization; integrating and closing down LPG terminals across the country (including rationalizing distribution and engaging in joint deliveries and shipments among LPG firms)
  - Reducing total consumed energy (electricity) intensity through rationalization of manufacturing processes at LPG terminals

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002 (using the method proposed by the Nippon Keidanren Secretariat)

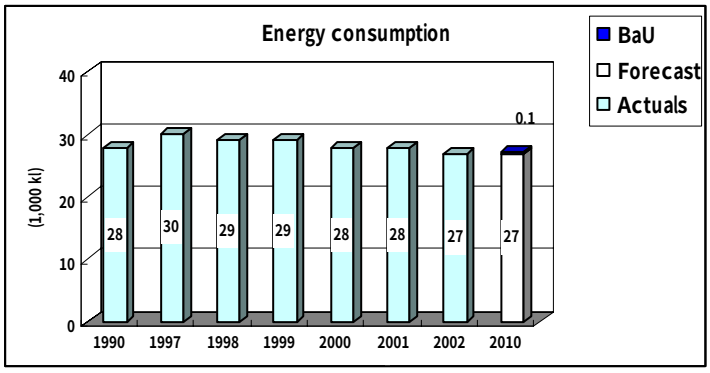
Results of factoral analysis

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emissions from industrial processes)	44	
Fiscal 2002 CO_2 emissions (including emissions from industrial processes)	42	
Variation in CO_2 emissions	-2	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	1	1.2%
Contribution from production activity	1	3.0%
Contribution from emissions per unit of production activity	-4	-8.4%

● Reasons for variations in emissions in fiscal 2002

The target indicator (the energy consumption index) declined, and carbon dioxide emissions fell 2,000 t-CO_2 below 1990 levels.

5. Reference data



The industry has recorded the following energy consumption: 28,300 kl in fiscal 1990; 29,700 kl in fiscal 1997; 29,300 kl in fiscal 1998; 29,200 kl in fiscal 1999; 27,800 kl in fiscal 2000; 27,800 kl in fiscal 2001; and 26,800 in fiscal 2002. It is forecasting consumption of 26,800 kl in fiscal 2010—5.3% less than in fiscal 1990. If voluntary action plans were not implemented, emissions in fiscal 2010 would be 26,900 kl.

6. Other global warming initiatives

- Emissions from offices and in-house distribution

Energy consumed at a terminal includes that consumed at the offices associated with a given terminal. Data on energy consumption at head or branch offices or at sales outlets is not presently available.

- Greenhouse gases other than carbon dioxide

The industry does not handle the relevant greenhouse gases.

- Kyoto Mechanism projects

There is no united industry action underway at this point in time.

7. Environmental management and conservation in overseas business activities

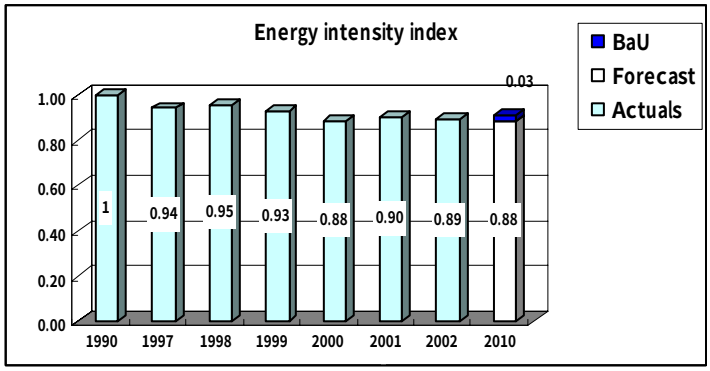
The four LPG distributor organizations have engaged in activity to educate about and promote awareness of the environment, in the form of publication and distribution of "The LPG Book," and their cooperation in the production of side readers on energy issues for students issued by the Japan Productivity Center for Socio-Economic Development. The Association is also engaged in a variety of activities to promote the adoption of LPG motor vehicles, which embody a level of environmental friendliness equivalent to that of natural gas. The Association has also taken opportunities to exchange technology and information about LPG with the nations of Asia, and to advise on and support environmental initiatives using LPG.

Note: The industry is engaged principally in the import and distribution of LPG (liquefied petroleum gas). The participation rate in the follow-up survey was 75% (15 LPG terminal owners out of a total 20 member companies), but the survey was aimed at covering 100% of terminals. Carbon dioxide emissions were calculated from the average emission intensity of all sources of electricity, based on the results of monitoring electricity consumption intensity at some 72% of respondent import terminals and 63% of respondent secondary terminals, having determined overall power use from total LPG imports. The fiscal 2010 forecast assumes that the amount of LPG handled at terminals will rise by 0.4% of fiscal 2002 volume by fiscal 2010.

Japan Association of Refrigerated Warehouses

To reduce annual electric power consumption per ton of facility capacity (kWh/facility-ton) by 8% of fiscal 1990 levels, by fiscal 2010.

1. Progress toward target

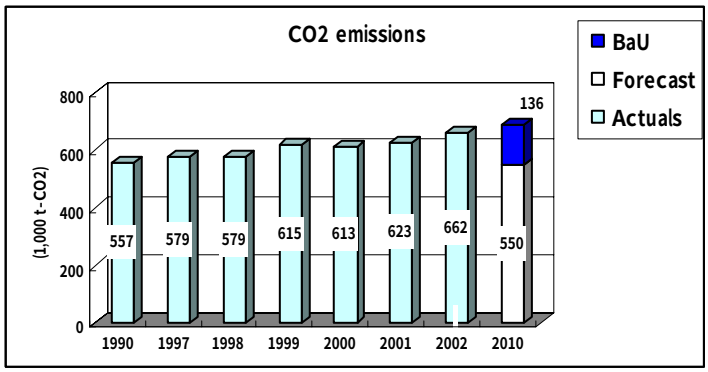


Assigning a value of one (1) to the index of energy consumption intensity in fiscal 1990 gives 0.94 in fiscal 1997, 0.95 in fiscal 1998, 0.93 in fiscal 1999, 0.88 in fiscal 2000, 0.90 in fiscal 2001, and 0.89 in fiscal 2002. The industry is forecasting an index of 0.88 in fiscal 2010. Warehouses are ageing, and when warehouses are re-built the focus of construction is on energy savings, enabling the industry to predict that the 8% reduction target is achievable.

● Reasons for adoption of target

The capacity of refrigerated warehouses changes every year. The energy used for freezing is electrical, and as it is inversely proportional to variations in warehouse capacity, to ensure energy conservation effort is reflected, the industry has selected energy intensity expressed in terms of power consumed per ton of equipment.

2. Carbon dioxide emissions



The refrigerated warehouse industry has emitted the following amounts of carbon dioxide: 557,000 t-CO_2 in fiscal 1990; 579,000 t-CO_2 in fiscal 1997; 579,000 t-CO_2 in fiscal

1998; 615,000 t-CO_2 in fiscal 1999; 613,000 t-CO_2 in fiscal 2000; 623,000 t-CO_2 in fiscal 2001; and 662,000 t-CO_2 in fiscal 2002. It is forecasting emissions of 550,000 t-CO_2 in fiscal 2010—representing a 1.3% decline compared with fiscal 1990. If voluntary action plans were not implemented, carbon dioxide emissions in fiscal 2010 would be 686,000 t-CO_2—a 23% increase compared with fiscal 1990.

3. Steps taken to achieve targets

● Major

- Installing energy-efficient equipment (using static capacitors to improve motor power rates, improving the rate of take-up of electronic expansion valves, improving the rate of take-up of demand control devices. promoting the use of energy-efficient lighting, promoting the use of highly efficient compressors and heat-exchangers, and promoting the use of highly efficient transformers)
- Undertaking energy-conservation measures arising from improvements in plant and equipment (enclosing loading platforms, preventing incursion of external heat through greater use of insulation, and preventing leakage of cold air through heat-proof doors)
- Achieving energy conservation through daily operational management practices (maintaining refrigerators at temperatures appropriate to products being stored and ensuring cleanliness of heat-transfer tubing in condensers)
- Undertaking other initiatives (making known the existence of an energy conservation manual, encouraging comprehensive compliance therewith by members, and convening seminars and workshops on energy conservation)

4. Reasons for variations in carbon dioxide emissions

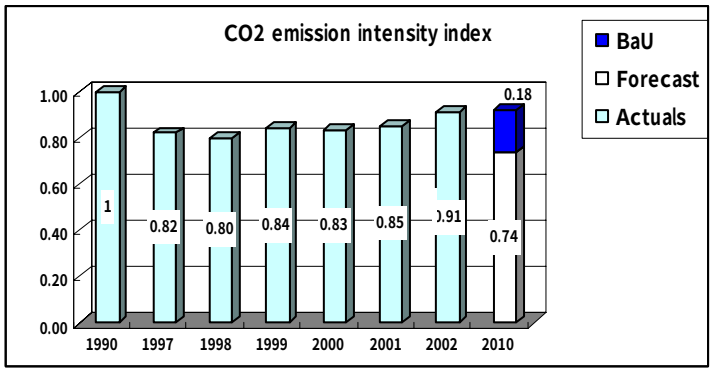
● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

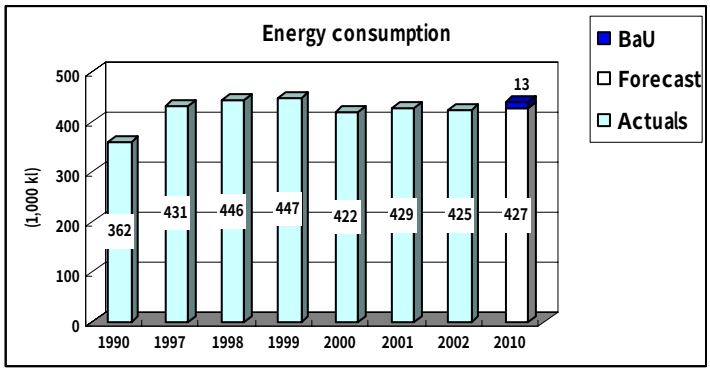
- Energy intensity is falling in broad terms, but the decline is subject to variations in the carbon emissions coefficient.

● Reasons for variations in emissions in fiscal 2002

- Energy intensity declined 0.6% year-on-year due to a year-on-year increase in the carbon emissions coefficient of 7%.

5. Reference data





The industry has consumed the following amounts of energy (in crude oil equivalents): 362,000 kl in fiscal 1990; 431,000 in fiscal 1997; 446,000 kl in fiscal 1998; 447,000 kl in fiscal 1999; 422,000 kl in fiscal 2000; 429,000 kl in fiscal 2001; and 423,000 kl in fiscal 2002. It forecasts consumption of 440,000 kl in fiscal 2010 if voluntary action plans are not implemented—21.5% higher than in fiscal 1990. Assigning a value of one (1) to the index of carbon dioxide emission intensity in fiscal 1990 gives 0.83 in fiscal 1997, 0.80 in fiscal 1998, 0.84 in fiscal 1999, 0.83 in fiscal 2000, 0.85 in fiscal 2001, and 0.91 in fiscal 2002. The industry is forecasting an index of 0.74 in fiscal 2010, and if voluntary action plans were not implemented, the forecast for fiscal 2010 would be 0.92—a decline of 8% on fiscal 1990.

6. Other global warming initiatives

- Greenhouse gases other than carbon dioxide

Approximately 80% of industry warehouses use HCFC22 as a refrigerant. Maximum care is therefore taken to prevent leakage of coolant during operations and maintenance.

- Emissions from offices and in-house distribution

In conjunction with consignment agents and trucking companies, the industry is using computerized systems, among other means, to improve the efficiency of distribution in general.

7. Environmental management and conservation in overseas business activities

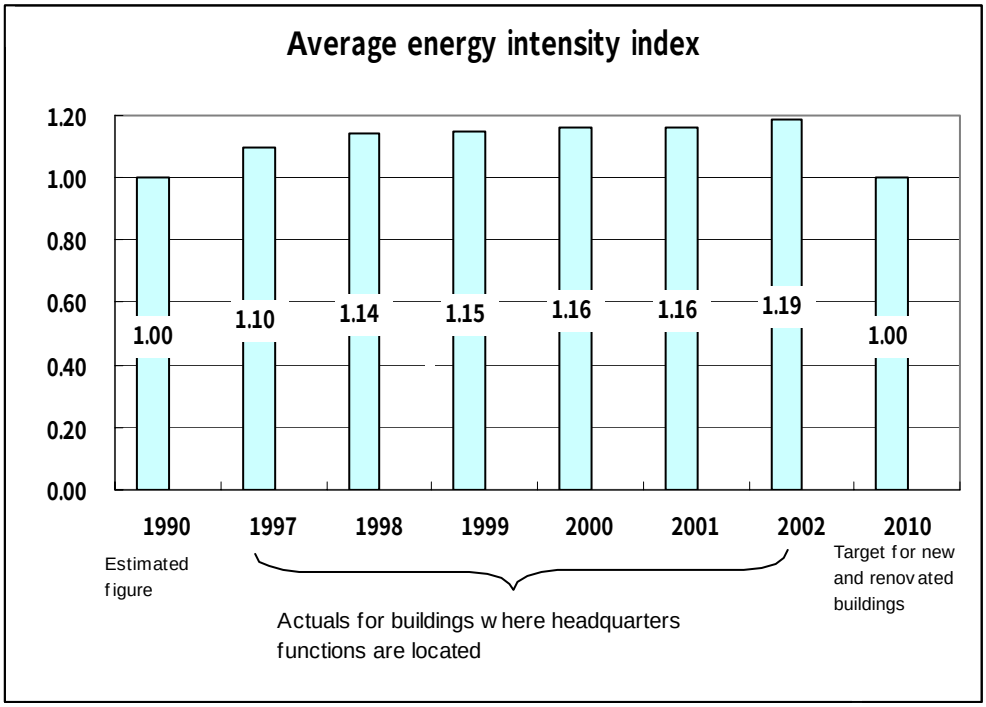
The Association is educating members in environmental management through such activities as distribution to all member operation sites of pamphlets relating to the Green Management Manual, a guide to environment-friendly management compiled by the Ministry of Land, Infrastructure and Transport.

Note: The industry's principal business is providing storage in refrigerated warehouses. The participation rate in the follow-up survey was 54% (approximately 650 companies out of 1,200), and findings were extrapolated to achieve 100% industry coverage. A power consumption survey was conducted of 820 of 1,500 sites operated by member companies (55%), and results were extrapolated to give carbon dioxide emissions for the industry as a whole.

The Real Estate Companies Association of Japan

As of 2001, member companies of the Real Estate Companies Association of Japan will seek to offer renovated, rebuilt, or new buildings for which energy consumption per unit of floor area (energy consumption intensity) does not exceed fiscal 1990 levels. This will be achieved by promoting energy-saving and long-life design and by introducing energy-efficient equipment and machinery, and the member companies will encourage tenants in energy-efficient behavior.

1. Progress toward target (actuals for existing buildings; targets for renovated, rebuilt, or new buildings)



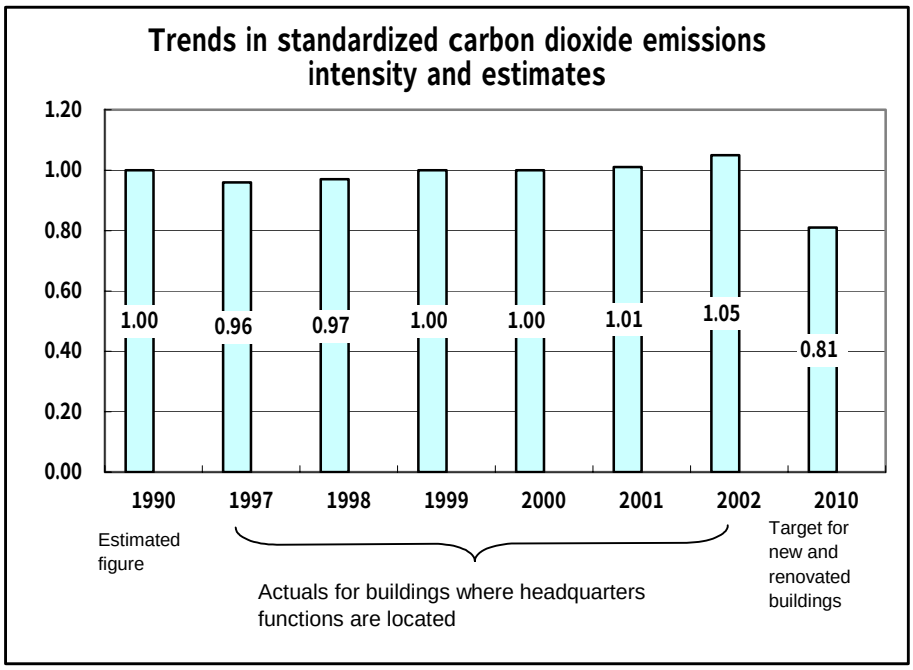
Assigning a value of one (1) to the fiscal 1990 energy intensity index gives 1.10 in fiscal 1997, 1.14 in fiscal 1998, 1.15 in fiscal 1999, 1.16 in fiscal 2000 and 2001, and 1.19 in fiscal 2002. The fiscal 2010 target for renovated, rebuilt, or newly constructed buildings is 1.00—the same as in fiscal 1990.

Factors that may contribute to changes in actuals are climatic effects, increased use by tenants, and changes in vacancy rates.

● Reasons for adoption of target

In this industry the proportion of power consumption in carbon dioxide emissions is high and most of the buildings use electricity from electric power companay. Thus the carbon dioxide emissions coefficient of electricity affects the amount of carbon doxide emission in this industry. For that reason, reduction of actual energy consumed was made the target, rather than carbon dioxide.

2. Carbon dioxide emissions (reference data: actuals for existing buildings, and forecasts for renovated, rebuilt, or new buildings)



Assigning a value of one (1) to the fiscal 1990 carbon dioxide emissions intensity index gives 0.96 in fiscal 1997, 0.97 in fiscal 1998, 1.00 in fiscal 1999, 1.00 in fiscal 2000, 1.01 in fiscal 2001, and 1.05 in fiscal 2002. The industry is forecasting an index of 0.81 in fiscal 2010 for renovated, rebuilt, and new buildings.

3. Steps taken to achieve targets

● Major

● Reduction in carbon dioxide emissions from owner-occupied and rental buildings

(i) Undertaking energy-saving and carbon dioxide initiatives in constructing and renovating owner-occupied and rental buildings

(ii) Selecting construction materials and air conditioning systems with due regard for the reduction of HFCs

(iii) Promoting energy conservation in the management and maintenance of rental buildings and properties

(iv) Promoting energy conservation in day-to-day in-house office activities

Reference: Energy conservation initiatives in residential subdivisions

(i) Energy-efficient and low-carbon-dioxide-emission design and machinery

(ii) Design of long-life buildings (ensuring freedom of choice in renovations and upgrades and implementing countermeasures against structural deterioration)

(iii) Design that takes account of reuse of construction waste (e.g., using eco=materials)

● Fiscal 2002 actual

A summary of energy-saving examples in office buildings built in 2002 is given below. Air conditioning and window treatment energy-saving measures were particularly effective.

Table: Energy-saving initiatives and examples of effects

Stage	Item	Initiative	Energy-saving effect*	Notes
New building Refurbishing	Air conditioning	Isolate units	Approx. 10% reduction	Generally applied energy-saving initiative
		Full heat exchanger		
		Optimum control		
		VAV		
	Lighting	Conversion to Hf lighting	Approx. 3% reduction	
		Automatic light adjustment		
	Elevators	Fit inverters	Less than 1% reduction	
		Group control		
	Pumps	Fit inverters	-	
New building	Window treatments	Air barriers	Approx. 12% reduction	Infrequently applied energy-saving initiative
		Window heat insulation		
		Install visors		
		Cooling using external air		
	Roofs	Greening	-	
Operations		Operational initiatives	-	-
		Lobby tenants		

* The Energy-Saving Effect represents the degree to which savings can be achieved on the overall energy consumed in a standard building. If all the above initiatives were implemented, compared with a standard building there would be an energy consumption saving of in excess of 20%.

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

The spread of office automation equipment is pushing building energy consumption levels up, which would suggest that carbon dioxide would be following the same trend.

●Reasons for variations in emissions in fiscal 2002

Fiscal 2002 showed the same pattern as in the past, with a year-on-year increase. Carbon dioxide increased to a greater extent than the proportional increase in energy consumption intensity, due in part to the influence of an increased carbon dioxide emission coefficient for electricity. Likely factors in the increase in energy consumption include climatic effects, increased use by tenants, and changes in vacancy rates.

7. Environmental management and conservation in overseas business activities

Initiatives relating to ISO 14001

Mitsui Fudosan, Tokyo Tatemono, Mitsubishi Estate, Tokyo Gas Urban Development, Toden Real Estate, Hitachi Life, Hankyu Realty, Nissho Iwai Real Estate, Sumisho Tatemono, The Japan General Estate Co., Sohgoh Real, Nice Corporation, Matsushita Investment and Development, Chuo Shoji, Toshin Building, and Kokusai Kogyo have acquired the ISO 14001 certification. At least another ten companies are considering certification.

Note. The principal activities of members of the Real Estate Companies Association of Japan are the leasing, management, and maintenance of buildings and other properties, and subdivision development. A total of 98 companies participated in the follow-up survey (the association has 230 members, 167 of which deal primarily in real estate), and energy consumption data referenced was supplied by 11% of the real estate companies (19 companies out of 167). The total floor area of the 19 buildings surveyed (approx. 1.71 million m^2) represents 0.2% of total office building floor area in Japan[1] (772 million m^2). Figures for energy intensity and carbon dioxide emission intensity were determined from annual data from the 19 companies for the period fiscal 1997 to 2002. The energy source mix in fiscal 2010, the target year, is assumed to be the same as that for fiscal 2002. The fiscal 1990 energy source mix was estimated from trends in the data between fiscal 1997 and 2002. Intensity of district heating and cooling was derived from data supplied by the Environment Agency (now the Ministry of the Environment).

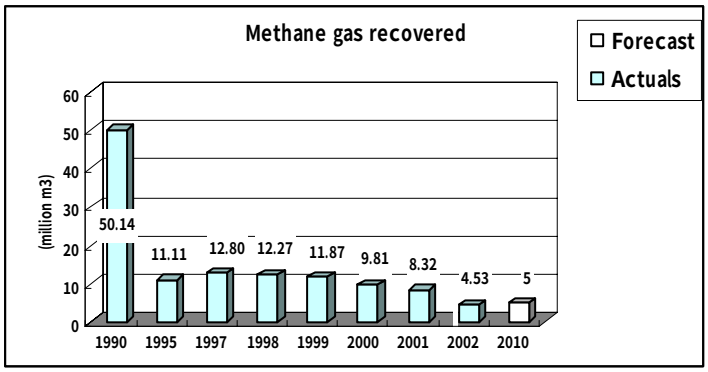
[1] As of 1 January, 2002, "Summary Report on Prices, etc. of Fixed Assets," Ministry of Public Management, Home Affairs, Posts and Telecommunications

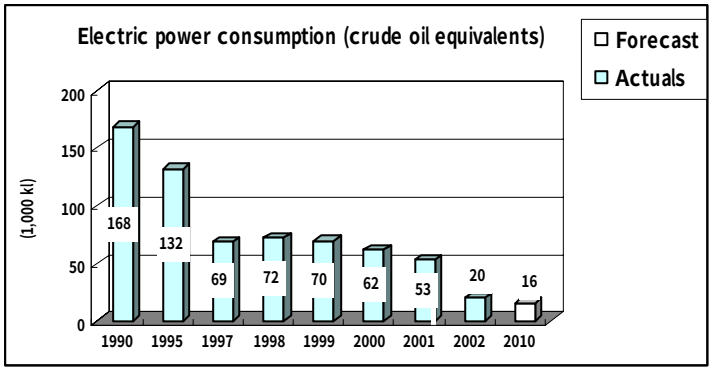
Japan Coal Energy Center

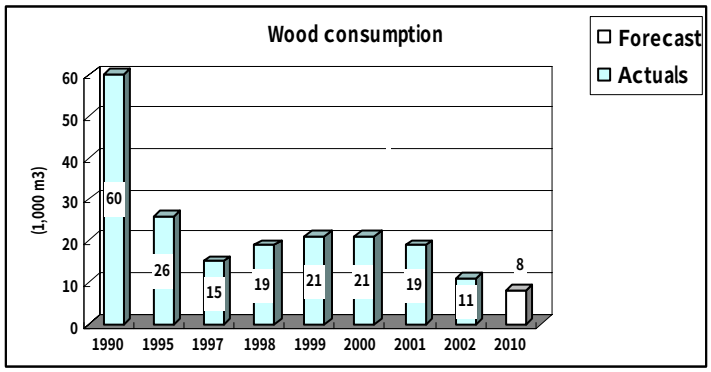
The industry's targets for fiscal 2010, compared with fiscal 1995, are as follows:

- To increase the amount of methane gas recovered from coal mining processes by 44%
- To reduce electric power consumption by 58%
- To reduce wood consumption by 71%

1. Progress toward target







The coal industry has recovered the following amounts of methane gas from its coal mining activities: 50.14 million m^3 in fiscal 1990; 11.11 million m^3 in fiscal 1995, 12.80 million m^3 in fiscal 1997; 12.27 million m^3 in fiscal 1998; 11.87 million m^3 in fiscal 1999; 9.81 million m^3 in fiscal 2000; 8.32 million m^3 in fiscal 2001; and 4.53 million m^3 in fiscal 2002. Its

forecast for fiscal 2010 is 5.0 million m^3.

The industry has consumed the following amounts of electric power (in crude oil equivalents): 168,000 kl in fiscal 1990; 132,000 kl in fiscal 1995; 69,000 kl in fiscal 1997; 72,000 kl in fiscal 1998; 70,000 kl in fiscal 1999; 62,000 kl in fiscal 2000; 53,000 kl in fiscal 2001; and 20,000 kl in fiscal 2002. It is forecasting consumption of 16,000 kl in fiscal 2010—88% less than in fiscal 1995.

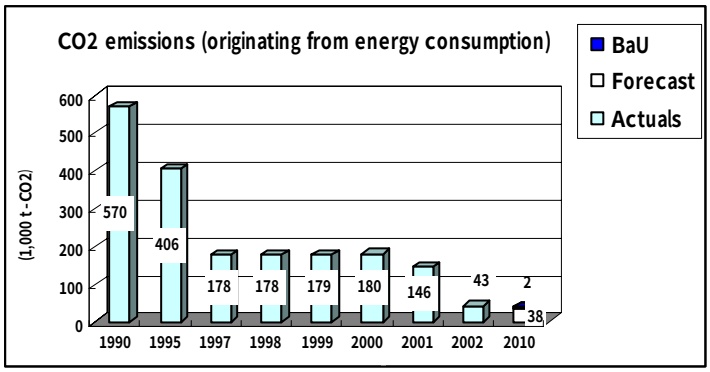
The industry has consumed the following amounts of timber: 60,000 m^3 in fiscal 1990; 26,000 m^3 in fiscal 1995; 15,000 m^3 in fiscal 1997; 19,000 m^3 in fiscal 1998; 21,000 m^3 in both fiscal 1999 and 2000; 19,000 m^3 in fiscal 2001; and 11,000 m^3 in fiscal 2002. The industry is forecasting usage of 8,000 m^3 in fiscal 2010—71% less than in fiscal 1995.

● Reasons for adoption of target

A feature of the coal industry is that large volumes of methane gas contained in the coal seams and near layers are released during mining. Methane gas has 21 times the global warming effect of carbon dioxide. It is therefore important to promote the recovery of methane generated, and to limit its release into the atmosphere. The greater proportion of energy consumed by the coal industry is for electric power, which also necessitates energy conservation of power used. In the context of mining, timber is used to support the underground roadway, which means that from the perspective of protecting the forests, which absorb carbon dioxide, it is also necessary to reduce the amount of timber consumed.

Given these factors, the coal industry has established recovery of methane gas, power consumption, and timber consumption as the targets in its measures against global warming.

2. Carbon dioxide emissions



The industry has emitted the following amounts of carbon dioxide in association with its consumption of energy: 570,000 t-CO_2 in fiscal 1990; 406,000 t-CO_2 in fiscal 1995; 178,000 t-CO_2 in fiscal 1997; 178,000 t-CO_2 in fiscal 1998; 179,000 t-CO_2 in fiscal 1999; 180,000 t-CO_2 in fiscal 2000; 146,000 t-CO_2 in fiscal 2001; and 43,000 t-CO_2 in fiscal 2002. It is forecasting emissions of 38,000 t-CO_2 in fiscal 2010—93% less than in fiscal 1990. If voluntary action plans were not implemented, emissions in fiscal 2010 would be 40,000 t-CO_2—93% less than in fiscal 1990.

Data on carbon dioxide emissions that includes methane gas emitted is given in "5. Reference Data."

3. Steps taken to achieve targets

- Major
  - Methane: Promoting methane recovery through gas drainage drilling (introduction of ultra-long hole drilling machines) and making effective use of recovered methane
  - Electricity: Reducing the scale of and integrating operating sites and achieving greater efficiency from technical development and improvements in mining equipment
  - Timber: Reducing use of timber through improved mining methods, including replacing wooden tunnel supports with steel, and making more general use of concrete shafts

4. Reasons for variations in carbon dioxide emissions

● Analysis of factors accounting for increases or decreases between fiscal 1990 and 2002

Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions from energy are deemed "Fixed coefficient emissions." The difference between actual emissions and fixed coefficient emissions is deemed the "Contribution from changes in coefficient of carbon dioxide emissions." Assuming a relationship whereby "Fixed coefficient emissions = Production activity x Emissions per unit of production activity" enables the amount of change in fixed coefficient emissions to be broken down into "Contribution from production activity" and "Contribution from emissions per unit of production activity."

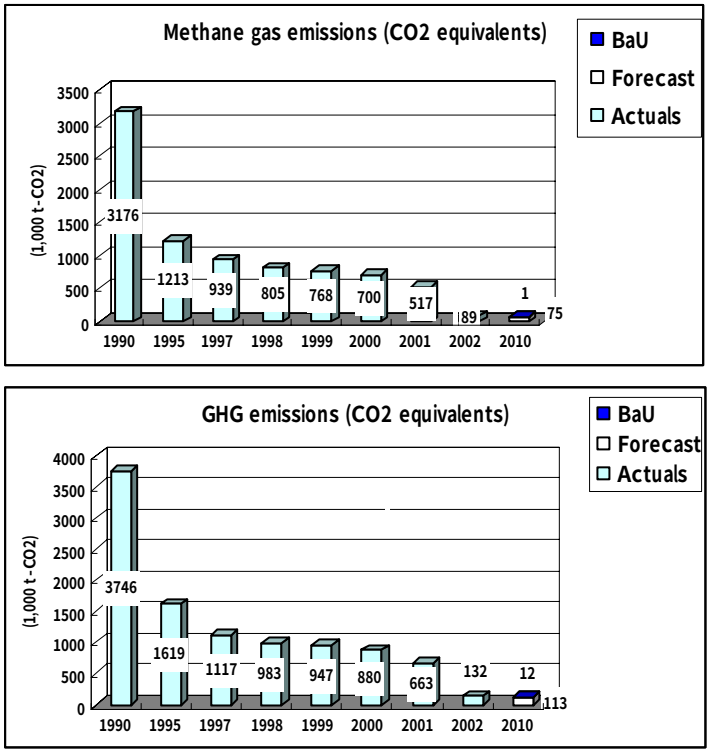
Results of factoral analysis

	1,000 t-CO_2	(Compared with fiscal 1990)
Fiscal 1990 CO_2 emissions (including emitted methane)	3746	
Fiscal 2002 CO_2 emissions (including emitted methane)	131	
Variation in CO_2 emissions	-3615	
(Breakdown) Contribution from changes in CO_2 emissions coefficient	-5	-0.1%
Contribution from production activity	-2306	-61.6%
Contribution from emissions per unit of production activity	-1305	-34.8%

● Reasons for variations in emissions in fiscal 2002

Carbon dioxide emissions declined when lower production resulted in lower emissions of methane gas in mining shafts, less electric power and better rates of recovery of generated methane gas, and when coal, with its high levels of carbon dioxide emissions, was replaced as a fuel by recovered methane gas.

5. Reference data



Through its coal producing activities the industry has emitted the following amounts of methane gas (in carbon dioxide equivalents): 3.176 million t-CO_2 in fiscal 1990; 1.213 million t-CO_2 in fiscal 1995; 939,000 t-CO_2 in fiscal 1997; 805,000 t-CO_2 in fiscal 1998; 768,000 t-CO_2 in fiscal 1999; 700,000 t-CO_2 in fiscal 2000; 517,000 t-CO_2 in fiscal 2001; and 89,000 t-CO_2 in fiscal 2002. It is forecasting emissions of 75,000 t-CO_2 in fiscal 2010—98% less than in fiscal 1990.

Total greenhouse gas emissions, comprising methane gas and carbon dioxide emissions from energy consumption, were: 3.746 million t-CO_2 in fiscal 1990; 1.619 million t-CO_2 in fiscal 1995; 1.117 million t-CO_2 in fiscal 1997; 984,000 t-CO_2 in fiscal 1998; 947,000 t-CO_2 in fiscal 1999; 881,000 t-CO_2 in fiscal 2000; 663,000 t-CO_2 in fiscal 2001; and 132,000 t-CO_2 in fiscal 2002. Emissions of greenhouse gases declined substantially in fiscal 2002 due to a decline in emissions from methane generated inside mining shafts, and energy consumption. The industry is forecasting greenhouse gas emissions of 113,000 t-CO_2 in fiscal 2010—97% less than in fiscal 1990. If voluntary action plans were not implemented, the industry forecasts that emissions of greenhouse gases in 2010 would be 125,000 t-CO_2—93% less than in fiscal 1990.

6. Other global warming initiatives

●Greenhouse gases other than carbon dioxide

A greenhouse gas other than carbon dioxide released as a result of coal production is methane, and the industry is working to recover and make effective use of it as an energy source. (Amounts were released and recovered as aforementioned.)

●Kyoto Mechanism projects

- Industry members are engaged in transferring technology to overseas coal-producing nations concerning the recovery and use of methane gas associated with mining, and in turning such activity into CDM projects.
- Plantation projects at former open-cut mining sites are being implemented.

Note: The principal product of the industry is coal. One major mine participated in the follow-up survey, representing 100% of the energy consumed by the industry. Compared with the 21 mines that were in operation as at the end of fiscal 1990, only 12 remained in production at the end of fiscal 2002. Between fiscal 1990 and fiscal 2002, the number of major mines declined from six to one. The industry is forecasting annual production of 700,000 tons from the major mine, 5% less than in fiscal 2002. Carbon dioxide emissions are in part derived from the data of the participating company.

3. Steps taken to achieve targets

● Major

(1) Using resources efficiently

A banking industry is , from its nature, a particularly large consumer of resources such as paper and electric power. The industry is therefore working to move forward with initiatives to conserve both resources and energy. In relation to paper resources, for example, by promoting a paperless environment, the industry will reduce paper consumption. In relation to electric power, by conserving energy, the industry will similarly reduce power consumption, and will strive to contribute to the reduction of carbon dioxide emissions.

(2) Building a recycling society

The industry will work to promote recycling, with a view to reducing the burden it imposes on the environment.

Specifically, in relation to paper resources, for example, internal bank stationery, notepad, business cards, and copying paper, the industry will actively encourage the use of recycled paper, and will strive to contribute to the further promotion of re-use of paper resources by implementing separate recovery of used paper.

In relation to other waste products, by continuing to diligently separate out waste products for recovery, for example, the industry will work to re-use resources.

(3) Educating and enlightening

The industry will implement more actively in-house education designed to improve awareness of environmental problems.

The Japanese Bankers Association will continue to stage seminars on environmental problems for its member banks, in an effort to improve the awareness of environmental problems of member banks.

(4) Making social contributions

The industry will work harder to participate in activities for environmental conservation in the community, and will seek further progress in the creation of an organizational support system for such activities.

(5) Developing business that responds to heightened customer awareness of the environment

The industry will work to develop its business in a way that responds to heightened customer awareness of the environment, by creating and providing financial products that have an environmental aspect.

(6) Providing environmental information to customers

By brokering information about the environment between companies, the industry will seek to contribute to practical applications of environmental technology. By making available both domestic and international information about environmental problems to customers, the industry will also seek to contribute to the improvement of customer awareness of environmental problems.

● Fiscal 2002 actual

- Efforts for power saving: Some 97% of respondent banks are engaged in efforts to save electric power through such initiatives as: appropriate management of air

conditioning temperature or implementation of shorter air conditioner operating times; restrictions on or a disciplined approach to the use of elevators to nearby floors; and turning on only every other electric light or limiting the number turned on.

- Efforts to reduce gasoline and other fuel consumption: Some 50% of respondent banks use low-emission vehicles. Some 48% of the banks have changed their marketing fleet to involve more fuel-efficient light vehicles, and some 43% of the banks have reduced their number of vehicles for business.
- Efforts in developing Financial products and services: Some 50% of respondent banks are responding to environmental problems from a financing perspective, and specifically, 55% of them have a system of offering favorable interest terms on loans for the purchase of low-emission vehicles. Some 33% of respondent banks offer products that respond to global environmental concerns in manners other than financing, and some 50% of the banks provide information on environmental issues to their customers.

7. Environmental management and conservation in overseas business activities
   - There are 19 banks that hold ISO 14001 certification (up three since the previous year).
   - Some 61% of respondent banks participate in activities that respond to global environmental protection, and some 73% of the banks organizationally support volunteer activities that respond to global environmental protection.

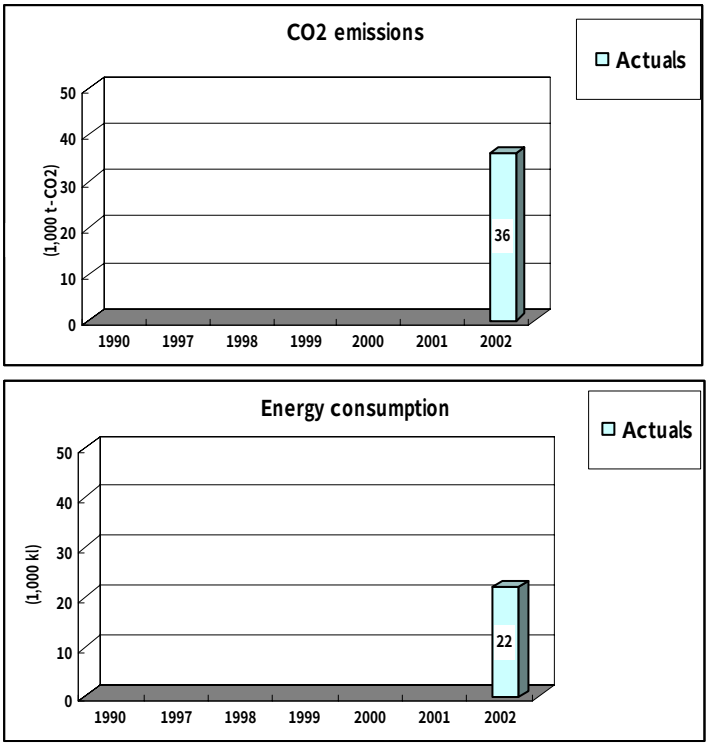
The General Insurance Association of Japan

The nature of the general insurance industry is such that it is a large consumer of resources in the form of paper and electric power. The industry will therefore work harder to conserve both resources and energy. In that spirit, the industry will implement the following initiatives.

- Member companies will advance initiatives to further reduce the use of paper resources and the industry will seek to reduce paper consumption to below current levels.
- The industry will reduce the use of energy resources such as electric power and gas for offices.

(Taken from the Non-Life Insurance Industry Action Plan for the Preservation of the Environment (December 2000), "Measures to prevent global warming" section)

2. Carbon dioxide emissions



An internal industry questionnaire surveyed actual consumption of energy in the form of electricity and gas in head offices effective last financial year (fiscal 2002).

3. Steps taken to achieve targets

From the Non-Life Insurance Industry Action Plan for the Preservation of the Environment (December 2000)

- Activities through insurance business

  The industry will engage in a broad range of initiatives through the general insurance business to protect the global environment, including measures against increasingly complex and severe environmental risk. In this spirit, the industry will actively advance the development and uptake of products associated with environmental problems and service-based initiatives. At the same time, it will conduct activities such as its campaign to make use of recycled parts and parts repair, for the purposes of promoting recycling and reducing waste products from motor vehicles.
- Information dissemination amongst the general public

  To contribute to global environmental protection the industry will proactively expand its activities for transmitting information to society at large. In this spirit, the industry will actively transmit information by making available its diverse expertise in environmental problems. Specific examples include staging seminars and public fora on the environment, publishing newsletters and books, and providing consulting services.
- Measures to prevent global warming

The nature of the general insurance industry is such that it is a large consumer of resources in the form of paper and electric power. The industry will therefore work harder to conserve both resources and energy. In that spirit, the industry will implement the following initiatives.

- Member companies will advance initiatives to further reduce the use of paper resources and the industry will seek to reduce paper consumption to below current levels.
- The industry will reduce the use of energy resources such as electric power and gas for offices.

- Establishment of an efficient recycling system

  The nature of the general insurance industry as an office-based industry enables it to undertake the following initiatives designed to build a recycling economy and society.

  (1) Improve the rate of use of recycled paper
  (2) Improve the rate of re-use of waste products emitted from offices
  (3) Reduce the amount of waste products emitted from offices that go through to final disposal
  (4) Recycle consumables from office automation equipment
  (5) Promote, under the Green Purchasing principle, the active purchase of products that reduce the burden on the environment and contribute to environmental conservation (such as products carrying the ecomark logo)
- Education and awareness raising within the company

  In relation to environmental conservation, the industry will become more actively engaged in in-house education, including in-service training of new recruits, and in-service training by staff level. In addition, it will engage in the establishment of an in-house system that supports staff participation in voluntary environmental activities.
- Establishment of an environmental management system and its ongoing review

  As an effective means of moving forward with specific action on and giving practical effect to items (1) to (5) above, the industry will leverage ISO and other environmental management systems.

6. Other global warming initiatives

● Emissions from offices and in-house distribution

The following are examples of initiatives undertaken by member companies.

- Reduce power consumed at headquarters in fiscal 2003 by 3% on fiscal 2002 levels
- Reduce power consumed at the office center in fiscal 2003 by at least 15% on fiscal 2002 levels, with the office center independently reducing its greenhouse gas emissions in fiscal 2004 by 8% on fiscal 2002 levels
- Schedule the introduction of 42 designated low-emission vehicles to the Tokyo operational center vehicle fleet between fiscal 2001 and fiscal 2005
- Reduce power consumption by 2% year-on-year
- Establish year-on-year targets for consumption for each building and implement reductions
- Formulate plans for initiatives and promote conservation measures within feasible limits in daily operations, to limit electricity consumption in the main building and to reduce it by the end of fiscal 2004 to the same level as in fiscal 2001
- Reduce electric power use by the end of fiscal 2003 to 4.3% less than in fiscal 2001
- Reduce power consumption by 5%
- Establish upper and lower limits for air conditioning temperatures
- Reduce consumption of electricity, gas, and mains water by 5% on the fiscal 2000 benchmark year

7. Environmental management and conservation in overseas business activities

The general insurance industry has formulated the Non-Life Insurance Industry Action Plan for the Preservation of the Environment, and in accordance with that plan, member companies are moving forward with environmental initiatives. In addition to individual company efforts, the industry has established a specialist committee (the Environmental Working Group) within the General Insurance Association of Japan. It is the focus of vigorous activity designed to lift the overall industry level, including surveying and publicizing the state of play of each company's initiatives, and staging study sessions and seminars.

Over half the companies have management guidelines relating to the environment that apply to their entire company (13 of 25 companies), and 9 of 25 companies (over a third) transmit information on their environmental activities beyond the company.

Among the 25 companies, 6 have ISO 14001 certification, and 2 are currently working towards it.

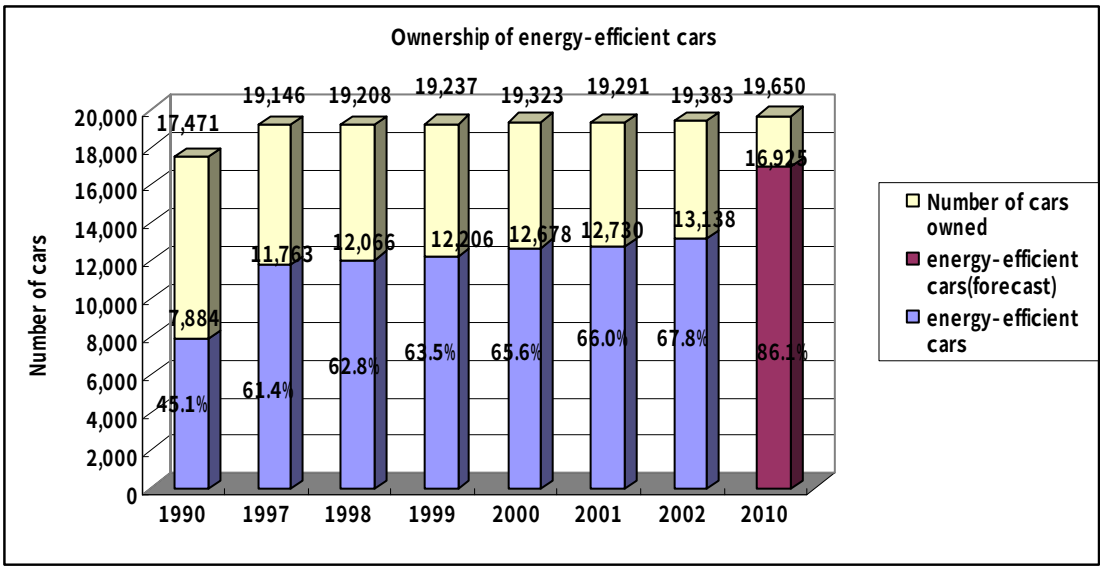
Note:
The business of the industry is general insurance. The proportion of industry participants participating in the follow-up survey was 100% of member companies and industry bodies (25 companies).

The Association of Japanese Private Railways

The industry forecasts that its ownership of energy-efficient cars will be 86%* by fiscal 2010, compared with 45% in fiscal 1990.
(This will cause carbon dioxide emissions in the private railway sector to fall 8%.)

* Aggregate value based on estimates for 2010 submitted by companies participating in the follow-up survey, as the industry does not have a shared target.

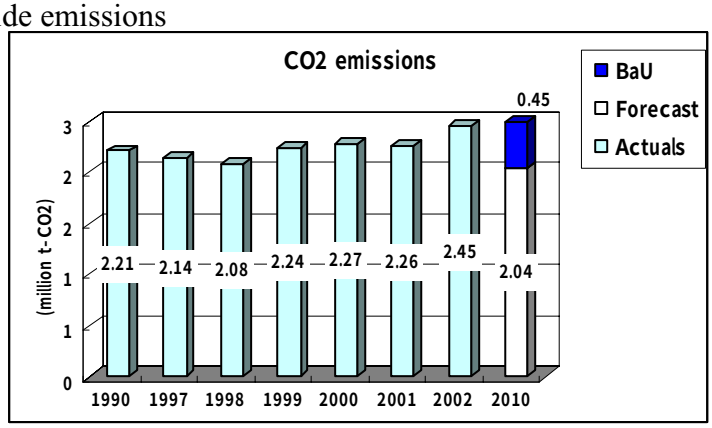
1. Progress toward target



The proportion of energy-efficient cars among all cars owned by Association members was: 45.1% in fiscal 1990; 61.4% in fiscal 1997; 62.8% in fiscal 1998; 63.5% in fiscal 1999; 65.6% in fiscal 2000; 66.0% in fiscal 2001; and 67.8% in fiscal 2002.

The industry is forecasting ownership of 86.1% in fiscal 2010, and will strive to introduce energy-efficient cars when supplementing or upgrading rolling stock.

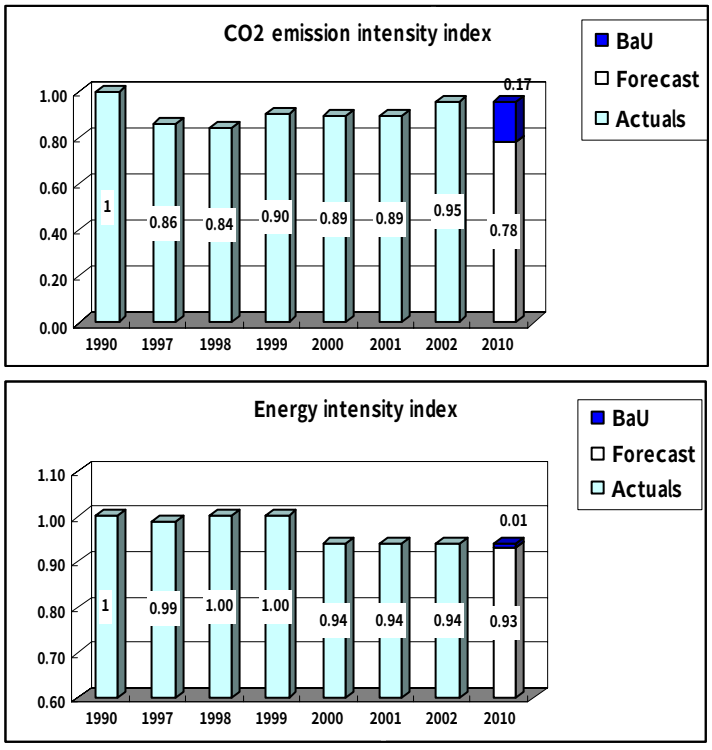
2. Carbon dioxide emissions



Carbon dioxide emissions were: 2.21 million tons in fiscal 1990; 2.14 million tons in fiscal 1997; 2.08 million tons in fiscal 1998; 2.24 million tons in fiscal 1999; 2.27 million tons in fiscal 2000; 2.26 million tons in fiscal 2001; and 2.45 million tons in fiscal 2002.

The industry is forecasting 2.04 million tons of carbon dioxide emissions in fiscal 2010, which is a reduction of 450,000 tons compared with BAU, and 8% less than in fiscal 1990.

5. Reference data



Note: The intensity index assumes a value of one (1) for fiscal 1990 actuals.

Assigning a value of one (1) to the fiscal 1990 carbon dioxide emissions intensity index gives 0.86 in fiscal 1997, 0.84 in fiscal 1998, 0.90 in fiscal 1999, 0.89 in fiscal 2000, 0.89 in fiscal 2001, and 0.95 in fiscal 2002. The industry is forecasting an index of 0.78 in fiscal 2010, a reduction of 0.17 proportional to BAU.

Assigning a value of one (1) to the fiscal 1990 energy intensity index gives 0.99 in fiscal 1997, 1.00 in fiscal 1998, 1.00 in fiscal 1999, and 0.94 in each of fiscal 2000, 2001, and 2002. The industry is forecasting an index of 0.93 in fiscal 2010, a reduction of 0.01 proportional to BAU.

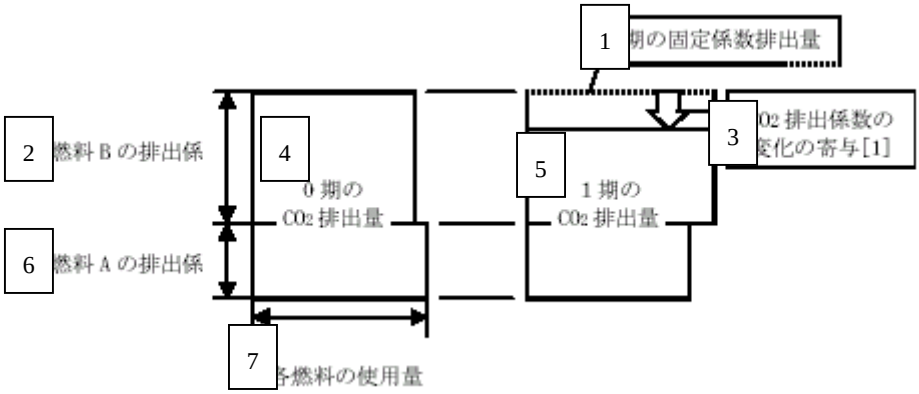
Note:
The Association of Japanese Private Railways promotes enhanced transport capability and safe transport, and undertake projects designed to encourage the healthy development of the railway business.
The proportion of companies participating in the follow-up survey was 84% (62 electrically operated companies out of 74 member companies).

Method used by participating industries to analyze contributing factors

(Unless otherwise indicated, each industry uses this method)

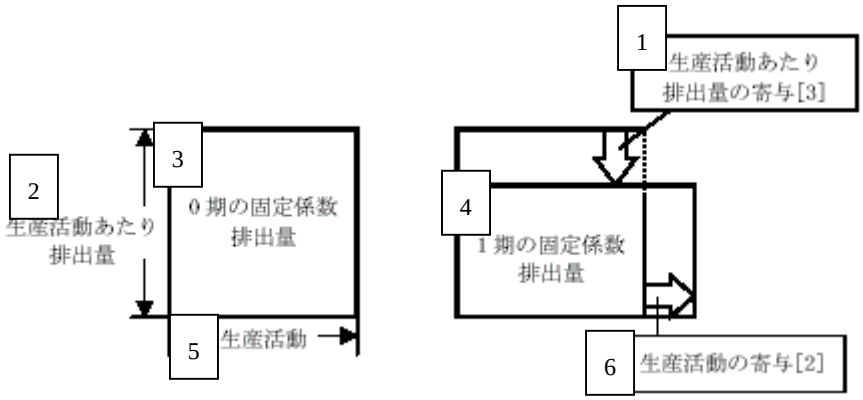
Carbon dioxide emissions are separated into the following contributing factors [1] to [3].

Emissions calculated assuming a fixed value irrespective of year for the coefficient of carbon dioxide emissions per calorific unit of energy are deemed “Fixed coefficient emissions,” and the difference between actual emissions and fixed coefficient emissions is deemed the “Contribution from changes in coefficient of carbon dioxide emissions [1].”



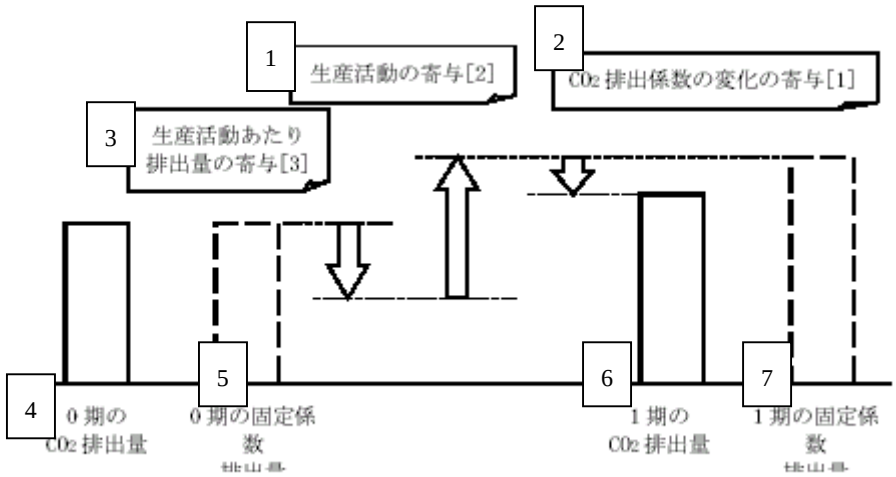
1. Fixed coefficient emissions for period 1
2. Emission coefficient of fuel B
3. Contribution from changes in coefficient of carbon dioxide emissions [1]
4. Carbon dioxide emissions in period 0
5. Carbon dioxide emissions in period 1
6. Emission coefficient of fuel A
7. Amount of each fuel consumed

Assuming a relationship whereby “Fixed coefficient emissions = Production activity x Emissions per unit of production activity” enables the amount of change in fixed coefficient emissions to be broken down into “Contribution from production activity [2]” and ”Contribution from emissions per unit of production activity [3].” (There will be a portion that cannot be confirmed by calculation (the confounding term). It will be allocated equally between “Contribution from production activity [2]” and “Contribution from emissions per unit of production activity [3].”)



1. Contribution from emissions per unit of production activity [3]
2. Emissions per unit of production activity
3. Fixed coefficient emissions in period 0
4. Fixed coefficient emissions in period 1
5. Production activity
6. Contribution from production activity [2]

Change in carbon dioxide emissions = Contribution from changes in coefficient of carbon dioxide emissions [1] + Contribution from production activity [2] + Contribution from emissions per unit of production activity [3]



1. Contribution from production activity [2]
2. Contribution from changes in coefficient of carbon dioxide emissions [1]
3. Contribution from emissions per unit of production activity [3]
4. Carbon dioxide emissions in period 0
5. Fixed coefficient emissions in period 0
6. Carbon dioxide emissions in period 1
7. Fixed coefficient emissions in period 1

Reference: Further examples of calculations in the analysis of contributing factors by participating industries

In analyzing contributing factors relating to electrical power, where variations in a particular power source (for example, a thermal power source) are thought to have been due to variations in the power purchased by an industry, the carbon dioxide emissions coefficient of electric power is the average of all power sources, and a portion of the variation in carbon dioxide emissions attributable to variations in the power purchased by the industry can be allocated outside the industry. The effect of making such an allocation outside the industry is added to the factoral analysis described in "Method of analyzing all contributing factors in the industrial and energy-conversion sectors," is deemed the "Portion attributable to indirect influences on the industry," and is calculated and appended as follows.

	Portion attributable to indirect influences on the industry
Contribution from changes in coefficient of carbon dioxide emissions [1]	
Contribution from production activity [2]	$(P_1 - P_0) \times C_0 \times (b^*_0 - b_0)$
Contribution from emissions per unit of production activity [3]	$P_0 \times (C_1 - C_0) \times (b^*_0 - b_0)$
Other (Confounding term)	$(P_1 - P_0) \times (C_1 - C_0) \times (b^*_0 - b_0)$

Symbol usage is as follows.

	Period 0	Period 1
Power purchased by industry	E_0	E_1
Industry production level	P_0	P_1
Production intensity of electrical power portion	$C_0 = E_0 / P_0$	$C_1 = E_1 / P_1$
Emissions coefficient of electrical power	b_0	b_1
Emissions coefficient of particular power source	b^*_0	b^*_1

Model case

	Period 0	Period 1
Power purchased by industry	80	60
Industry production level	1000	1500
Production intensity of electrical power portion	0.08 (80/1000)	0.04 (60/1500)
Emissions coefficient of electrical power	0.4	0.3
Emissions coefficient of particular power source	0.7	0.6

	Portion attributable to indirect influences on the industry
Contribution from changes in coefficient of carbon dioxide emissions [1]	
Contribution from production activity [2]	(1500-1000) x 0.08 x (0.7-0.4) = 12
Contribution from emissions per unit of production activity [3]	1000 x (0.04-0.08) x (0.7-0.4) = -12
Other (Confounding term)	(1500-1000) x (0.04-0.08) x (0.7-0.4) = -6

Note: Figures of "[2] Contribution from production activity" and "[3] Contribution from emissions per unit of production activity" are those before allocation of the confounding term.

Economic indicators assumed in fiscal 2010 estimates

In conducting the fiscal 2003 follow-up survey, the economic indicators used as premises by each industry in estimating fiscal 2010 targets and forecasts (where measures are implemented) and fiscal 2010 forecasts (BAU) are as follows.

(In some instances, however, estimates have been based on other indicators at the discretion of the participant industry).

	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2010
Real rate of growth (%)	0.9	0.6	0.9	1.3	1.5	1.6	1.9
Nominal rate of growth (%)	-0.6	-0.2	0.8	1.8	2.2	2.6	3.3
Nominal GDP (trillion yen)	449.6	498.6	502.4	511.2	522.4	536.1	587.7
Rate of rise in cost of living (GDP deflator) (%)	-1.5	-0.9	-0.1	0.4	0.7	1.0	1.3
Full unemployment rate (%)	5.4	5.6	5.7	5.6	5.4	5.2	4.4
Nominal long term interest rate (%)	1.2	1.3	1.5	1.8	2.2	2.5	3.1
Difference between savings and investment (% of GDP)							
Government in general	-8.0	-8.3	-7.1	-6.3	-5.8	-5.5	-4.2
Private sector	10.6	10.9	9.9	8.9	8.1	7.9	6.5
International	-2.7	-2.7	-2.8	-2.6	-2.4	-2.4	-2.3

Source: Reference material from the Council on Economic and Fiscal Policy, 20 January 2003, compiled by the Cabinet Office. The material contained two scenarios: where the proportion of the basic pension borne by the National Treasury is one third, and where the proportion of the basic pension borne by the National Treasury is one half. The latter scenario has been used in the figures above.