What JR East Group is doing to prevent global warming

In our efforts to reduce CO_2 emissions, the JR East Group pursues the efficient use of energy and the effective use of renewable energy. We also promote intermodal transportation with the aim of reducing CO_2 emissions from all forms of transportation.

Measures to prevent global warming

Current state of energy supply and consumption

The electricity consumed by JR East for train operations as well as lighting and air conditioning at stations and in offices is supplied from two sources: JR East's own power plants and electric power companies. Besides electricity, we also use diesel fuel and kerosene for diesel train operation and air conditioning at stations and in offices. Although our transportation volume is on the rise year after year, our energy consumption has remained at about the same level.

CO_2 emissions and reduction measures

Our CO_2 emissions in fiscal 2006 amounted to 2.13 million tons, a significant decline from the level of fiscal 2005. The principal reason was that the hydroelectric plant that was damaged in the Niigata-Chuetsu Earthquake in October 2004 was restored to operation in March 2006.

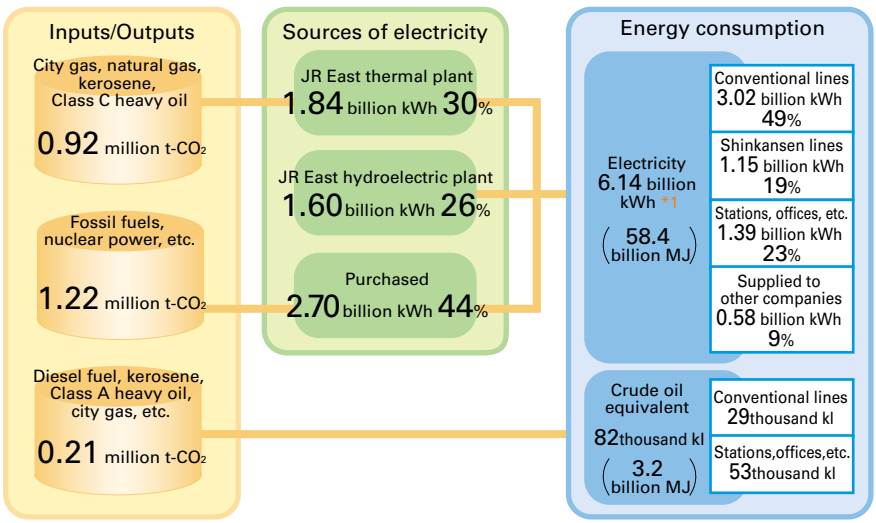
Partial replacement of kerosene by natural gas in June 2006 in the fuel we consume at our own thermal power plant and several other measures we took, were additional factors in this reduction.

Also, water flow in the rivers used by our hydroelectric plant was larger, and this resulted in greater power output. External factors like this may have had an impact.

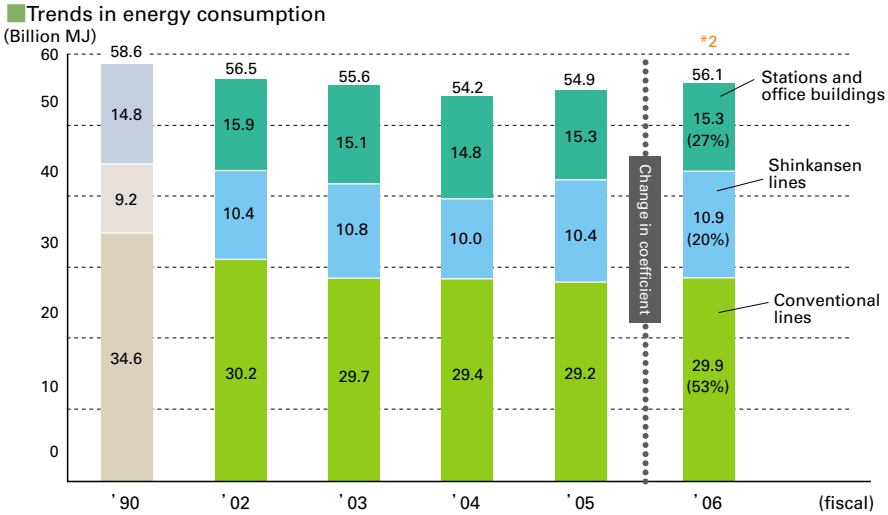
We are determined to continuously implement a wide range of CO_2 reduction measures, while putting priority on the reduction in energy for train operation, which accounts for 73% of the total energy we consume.

The amended global warming countermeasures law sets forth methods for calculating CO_2 emissions. Beginning with fiscal 2006 performance data, we used coefficients stipulated in the law to calculate total CO_2 emissions and energy consumption.

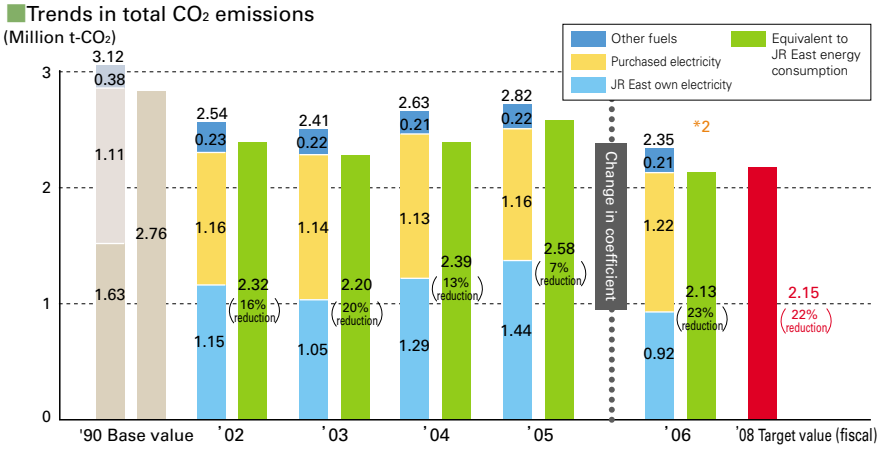
■JR East Energy flow map



■Trends in energy consumption



■Trends in total CO_2 emissions



Note: Up until fiscal 2005 the CO_2 emission coefficient and energy conversion coefficient for fuels and purchased electricity used here are taken from the "Voluntary Action Plan on the Environment" of the Japan Federation of Economic Organizations and the Federation of Electric Power Companies of Japan. Beginning with fiscal 2006, coefficients used are those stipulated in the energy saving law and the law to promote countermeasures against global warming.

***1 6.14 billion kWh**

Excluding electricity supplied to other companies, JR East consumed 5.56 billion kWh, which is equivalent to power consumed by 1.45 million ordinary homes over a period of 1 year.

***2 Change in calculation methods**

Up until fiscal 2005 CO_2 emissions from use of power and fuels and energy consumption were calculated with reference to the "Voluntary Action Plan on the Environment" by the Japan Federation of Economic Organizations. Beginning in fiscal 2006, we have adopted a new method based on the law for rationalization of energy usage and the law to promote countermeasures against global warming. Using the former coefficients, emissions for fiscal 2006 were 1.99 million t-CO_2 (a reduction of 28% compared to fiscal 1990). Also, CO_2 emissions as a specified transportation operator designated by the energy saving law (the emissions generated only by railway operation, excluding offices and hospitals) will be shown to be 2.02 million t-CO_2 in the fiscal 2006 report.

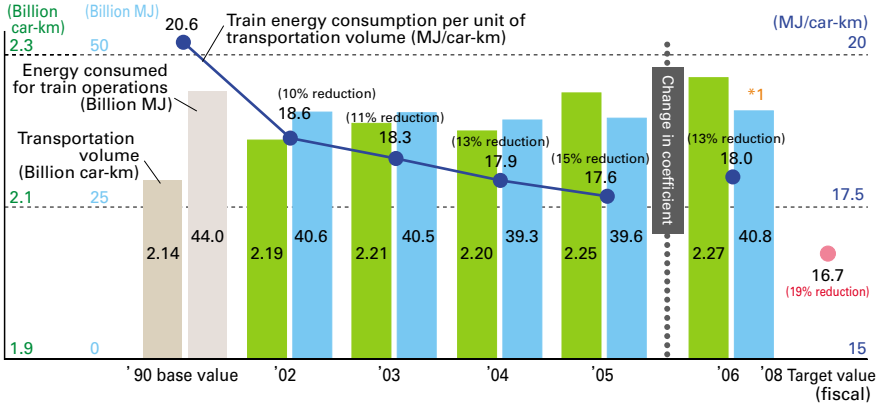
Reducing energy consumed for train operations

As of the end of fiscal 2006, JR East had 10,376 energy-efficient railcars in operation. This accounts for 83% of our railcar fleet.

We introduced more new-generation energy-efficient railcars, with features such as regenerative brakes, which can convert kinetic energy during deceleration into electric energy, and variable voltage variable frequency (VVVF) inverters, which control motors without wasting electricity.

Energy consumption per unit of transportation volume during fiscal 2006 was reduced by 13% compared with fiscal 1990. This was calculated using revised coefficients in accordance with the amended global warming countermeasures law. *1

Trends in energy consumed for train operations and train energy consumption per unit of transportation volume

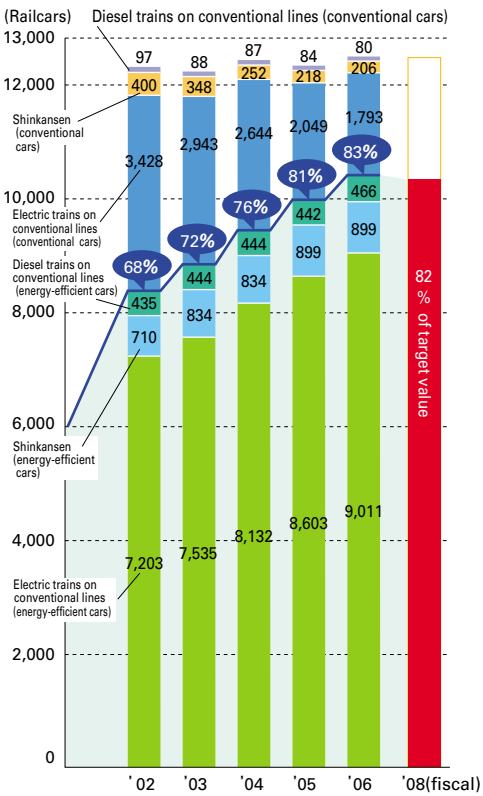


E233 series: State-of-the-art cars introduced on the Chuo Line in December 2006.

E2 series: VVVF inverter railcars used for Shinkansen "Asama" and "Hayate" trains.

E231 series: VVVF inverter cars for commuter and suburban transportation.

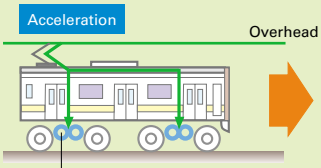
Trends in energy-efficient railcars



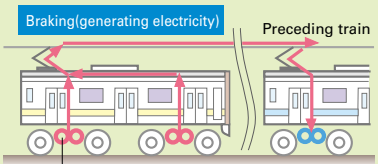
Regenerative brake mechanism

A regenerative brake generates electricity during braking

Motors of an energy-efficient railcar function as electric generators when brakes are applied, and electricity generated in this process is transmitted to the overhead wire, making more efficient use of this energy. (In case of a conventional railcar, energy generated by applying brakes is simply discharged as heat.)



Overhead wire supplies electricity to power the motors to run the train

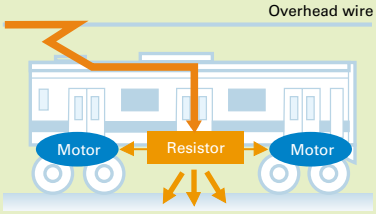


Motors function as electric generators

Motors function as generators, and electricity generated is sent to overhead wire to be used to accelerate other trains.

Mechanism of VVVF inverter control

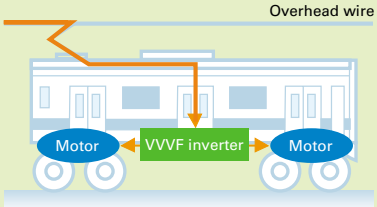
Conventional train



Wasted heat is generated

When running a train, resistors control voltage needed for motors, generating heat that is wasted.

VVVF inverter train



Efficient operation is possible

A VVVF (variable voltage/variable frequency) inverter can control electricity without wasting it, making train operation more efficient.

*1 **Change in calculation method**

Through fiscal 2005 energy consumption was calculated with reference to the Voluntary Environmental Action Program of the Japan Federation of Economic Organizations. Beginning in fiscal 2006, we have adopted a new method based on the law for rationalization of energy usage. Under the former method, energy consumption for train operation for fiscal 2006 was 39.0 billion MJ and the energy consumption per unit of transportation volume was 17.2 MJ per car-kilometer or a reduction of 17% from the level of fiscal 1990.

Reducing CO_2 emissions throughout the transportation system

Reduction of CO_2 emissions throughout the entire transportation system, taking advantage of railway superiority in environmental performance

A railway is a highly energy-efficient mode of transportation with low environmental impact, but railways alone cannot completely satisfy transportation needs of customers. JR East is working to reduce CO_2 emissions of the entire transportation system by promoting intermodal transportation *1 — combining the use of railways with use of other modes of transportation.

Also, to promote intermodal transportation, it is essential that railways improve their convenience and riding quality. We are opening new railway lines to allow passengers to go to their destinations smoothly; we are adding services that operate through on JR East and other companies; we are expanding the area in which one Suica is valid for travel on JR East and also on other lines; we are making our stations and cars barrier-free. All these efforts to create easy-to-use railways for customers can lead to reduction of CO_2.

Park-and-ride schemes

We are currently promoting park-and-ride schemes, under which we provide parking spaces in front of railway stations so that our customers can drive their cars from home to nearby stations and use our trains from there. By the end of March 2007, 124 JR East stations had prepared parking spaces for eleven thousand cars. *2.

At 10 stations between Tomobe and Iwaki on Joban Line, parking charges are free for express train customers going farther than a specified distance.

Rail and car rental

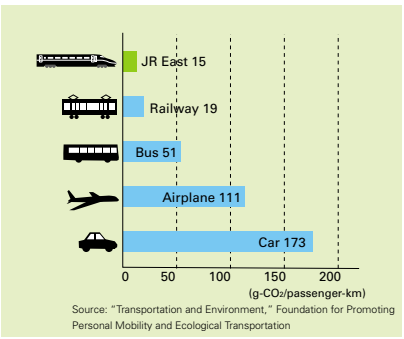
To promote travel by a combination of railways and automobiles, so that travelers can continue to their destination by car after arriving at a railway station, JR East has been offering a car rental service called "Train-ta-kun" since 1995, with discounted rental charges.

We also offer a service called "Rail & Rent-a-Car," which offers discounts on both train fares and car rental fees. Furthermore, we are facilitating intermodal transportation by introducing new classes of automobiles, such as light cars, by offering attractive rates, and by installing car navigation systems as standard equipment in rental cars.

Travel packages and railways

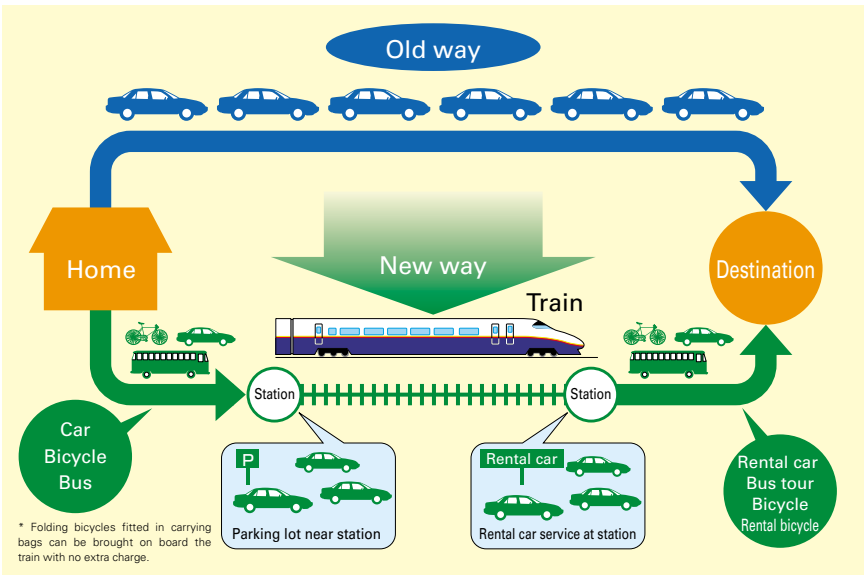
JR East is energetically promoting travel packages that use trains as a means of transportation with lower environmental impact, while capitalizing on rich natural and tourist resources in various regions. We propose a wide range of travel options that do not depend solely on automobiles. Examples include car rental plans that allow travelers to enjoy a train journey while benefiting from the mobility of rental cars, and plans for sightseeing by taxi in cooperation with local businesses.

■CO_2 emissions by mode of transportation



Source: "Transportation and Environment," Foundation for Promoting Personal Mobility and Ecological Transportation

■Intermodal transportation



* Folding bicycles fitted in carrying bags can be brought on board the train with no extra charge.

*1 **Intermodal transportation**
Intermodal transportation means transportation systems that allow a person to get from a given point to a final destination by connecting different modes of transportation.

*2 **Parking spaces for eleven thousand cars at 124 stations**
Parking spaces for eleven thousand cars at 124 stations represent the total number of parking spaces near our stations, including those owned by JR East, operated by our Group companies, and run in collaboration with local municipalities.

Reducing CO_2 emissions in supplying electricity

More efficient generation and supply of power

Electric power is indispensable for reliable train operation. At JR East we are making power generation more efficient and utilizing more renewable energy, by replacement of facilities in our own power plants, with a view to reducing CO_2 emissions.

We adjust the supply of electricity by effectively combining various sources of energy *1 — electricity generated at our thermal and hydroelectric plants and electricity purchased from outside sources—in accordance with fluctuating electricity demand. Our load dispatch command function plays a vital role in monitoring and controlling the supply of electricity in real time to make power generation more efficient.

Our own thermal and hydroelectric power generation

JR East operates a thermal power plant in Kawasaki City, Kanagawa Prefecture, with a total output of 655 thousand kW. By gradually replacing its current four generation units with more efficient combined-cycle power generation units *2, and by optimizing plant operations, we have reduced CO_2 emissions per unit of electricity generated at the plant by 38% *3 compared to fiscal 1990. Beginning with fiscal 2006 performance data, we use coefficients stipulated by the national government under the amended global warming countermeasures law. In June 2006, we replaced kerosene with natural gas as fuel for the No.3 generation unit, in our efforts to further reduce CO_2 emissions.

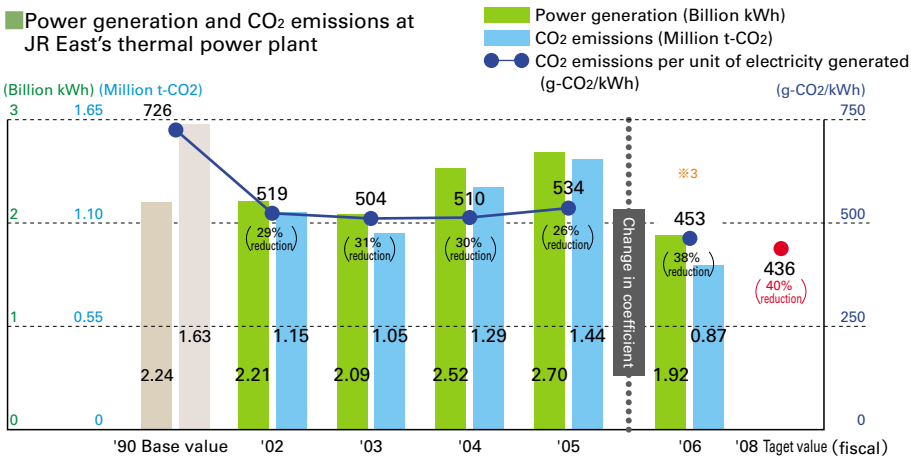
JR East has a hydroelectric plant on the Shinano River (Ojiya City/Tokamachi City, Niigata Prefecture), with a total output of 449 thousand kW. The plant generates 1.4 to 1.8 billion kWh yearly and emits no CO_2.

Fuel for the No. 3 generator at the Kawasaki thermal power plant was changed from kerosene to natural gas in June 2006.

The disaster-damaged Shinanogawa hydropower plant has been restored.

PV panels installed on the roof of the platforms at Takasaki Station.

Power generation and CO_2 emissions at JR East's thermal power plant



Utilization of renewable energy

JR East also utilizes renewable energy such as solar and wind power. Photovoltaic (PV) panels have been installed at Tokyo Station, Takasaki Station, the JR East General Education Center, and the JR East Research and Development Center. In March 2004, we doubled the number of PV panels at Takasaki Station.

Reduction of energy consumption at stations

Reduction of air conditioning energy at large stations

We are working to reduce energy consumption at stations. At large stations it is air conditioning units that consume the most energy.

At Ueno station, in conjunction with the replacement of heat exchangers (air conditioning units) that use CFCs, we analyzed our energy use, and made an optimum energy design by reviewing equipment capacity and introducing inverter controls. As a result of these efforts, we also expect to reduce energy consumption of freezers by 52%. We are making similar efforts for energy reduction at Tokyo station as well.

Reducing impact of the heat island phenomenon

Promoting greening of rooftops

As part of efforts for environmental preservation by the JR East group, which owns many station buildings and office buildings, we have been promoting green plantings on rooftops since fiscal 2004. As of May 2007 we have covered an area of about 5,500 m^2 (equivalent to about 70% of the lawn area of the National Athletic Stadium) in 12 projects. They reduce the effect of the heat-island phenomenon. The plants also absorb CO_2, and they help reduce air conditioning energy consumption in the buildings because they block some of the sun's heat.

***1 JR East's sources of electricity supply in fiscal 2006**
JR East's thermal power plant: 30%
JR East's hydroelectric plant: 26%
Purchased electricity: 44%

***2 A combined-cycle power generation unit**
A combined-cycle power generation unit is a power generation unit that combines gas turbines propelled by combustion gas with steam turbines driven by steam from the exhaust heat.

***3 Change in calculation method**
Up until fiscal 2005 CO_2 emissions were calculated with reference to the Voluntary Environmental Action Program of the Japan Federation of Economic Organizations. Beginning in fiscal 2006, we adopted a new method based on the law for promotion of countermeasures against global warming. Under the former method, CO_2 emissions per unit amount of generation are 431 g-CO_2/kWh, down 41% from the level of fiscal 1990.