

# JR East's Commitment to Preserving The Earth

Takeshi Okuno

## Introduction

The growing but unsustainable expansion of human industrial activity, coupled with mass consumption is threatening the earth with serious environmental damage. Despite the long history of railways, railway operators have little prior experience in tackling these modern issues. This article explains how the East Japan Railway Company (JR East) is responding to the crisis.

## Ecological Problems and Transportation

After intense international debate and behind-the-scenes lobbying, the UN Framework Convention on Climate Change (FCCC) held in December 1997 in Kyoto, Japan, reached a compromise accord on international targets for reducing emissions of carbon dioxide (CO<sub>2</sub>), the so-called greenhouse gas primarily responsible for global warming that could result in serious global climate change. The industrialized nations participating in the Conference are attempting to enforce various measures to meet the agreed targets.

More than 6.2 billion tonnes of CO<sub>2</sub> are emitted annually worldwide and Japan ranks fourth in emissions after the USA, Russia, and China. The transport sector including railways produces about 20% of the total and the rate is still gradually rising. As is widely known, railways are by far the most energy efficient and environment-friendly mode of transport compared to other transport modes. In Japan, they account for 29% of passenger transport, but use only about 7% of the total energy consumed by the entire transport sector, producing just 5% of the CO<sub>2</sub> emissions (Fig. 1). In other words, railways are six to nine times superior to private automobiles in terms of energy consumption and CO<sub>2</sub> emissions per passenger/

kilometer (Table 1).

The data on personal mobility and CO<sub>2</sub> emissions in industrialized nations show no great differences in national mobility despite huge differences in land area (Table 2). However, there are big differences in per-capita CO<sub>2</sub> emissions due to transportation.

The main reason explaining Japan's high mobility but low per-capita CO<sub>2</sub> emissions is its dense and well-used network of

energy-efficient railways. For example, in the Tokyo metropolitan area alone, about 37 million passengers take the train every day, accounting for about 56% of travel in the region. The number of daily passenger kilometers is equivalent to 24% of all railway journeys in the world, suggesting the unparalleled importance of railways in Japan as a means of public transport.

Figure 1 General Comparison of Transport Systems

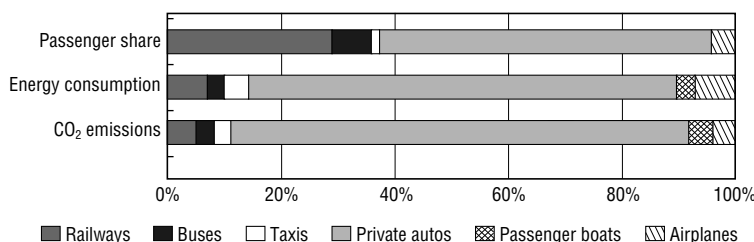


Table 1 Energy Consumption and CO<sub>2</sub> Emissions

	Railways	Buses	Airplanes	Private autos
Energy consumption <sup>1)</sup>	100	176	409	587
CO <sub>2</sub> emissions <sup>2)</sup>	100	413	643	949

Notes:  
<sup>1)</sup> Summary of Transport-Related Energy Consumption, Japanese Ministry of Transport, 1996  
<sup>2)</sup> Transportation and the Environment, Japan Institution for Transport Policy Studies

Table 2 Mobility and Transport CO<sub>2</sub> Emissions (1994)

	Japan	USA	Germany	UK	France
Mobility (km/person) <sup>1)</sup>	10,850	13,123	9,395	11,378	12,895
CO <sub>2</sub> emissions (kg/person) <sup>2)</sup>	1,947	5,900	2,251	2,408	2,336
Land area (1,000 km <sup>2</sup> )	378	9,373	357	244	547

Notes:  
<sup>1)</sup> 1996 Overseas Transportation Statistics, Japanese Ministry of Transport  
<sup>2)</sup> Taken from data of Japanese Ministry of Transport

## Serving Customers with Eco-friendly Railways

How should Japanese railway operators respond to global environmental issues? The two main responses are described below.

### Developing efficient and convenient passenger services

In concrete terms, railways should provide better services with higher efficiency and more competitive fares than other transport modes. Attention to ecological issues is much easier when passenger levels are high and the financial base is sound. In other words, user support is vital in a free, competitive market and making railway attractive to passengers will maximize efforts to protect the environment.

For railway operators, promoting railways by saying 'Take the railway because it is environment friendly.' is illogical. They

should be thinking about 'Contributing to environment preservation through development of passenger-friendly railways.' Taking such a posture and combining past efforts with the environment issue should produce a better understanding of the issues.

### Developing eco-friendly services

We must not forget that railways do consume energy and do emit some CO<sub>2</sub>, although much less than other transport modes. In other words, railways are not an exception in having adverse effects on the environment. Therefore, railways must continue to make every possible effort to curtail such effects. An important aspect is whether a management system has been established within the company to continuously implement and monitor environmental improvements.

The rest of this article describes how JR East is dealing with these issues, and specific improvement programmes.

## JR East's Devotion to Environmental Protection

After the 1992 Earth Summit in Rio de Janeiro, JR East organized a Committee on Ecology to examine the challenges of global environmental problems. Its objective was to take a positive and serious posture in harmonizing railway operations with a healthy and safe environment. To this end, the Committee established the following guidelines:

- Provide passengers and communities with pleasant services
- Develop new environmental protection technologies
- Increase awareness of environmental preservation

Since railways and the environment are so closely and extensively linked, to perform a quantitative analysis, the initial step was a thorough investigation of the environmental load caused by the railways. The results were then used to determine

**Table 3 Environmental Protection Projects & Development**

Field	Objective	Unit	'94 base level	'95 result	'96 result	Target	Major effort
Energy	Reduction of energy per unit transport consumed directly for train operation	kcal./passenger km	84	82 (2% down)	80 (5% down)	10% reduction	Use of energy-saving cars and efficient operation
	Reduction of CO <sub>2</sub> emissions per unit energy supplied by Kawasaki thermal power plant	g/kWh	598	595 (0.5% down)	593 (1% down)	10% reduction	Replacement of No. 3 generator (operation starts: End of 1998)
Pollutants	Reduction of NOx emissions from Kawasaki thermal power plant	tonne	880	848 (4% down)	848 (4% down)	40% reduction	Replacement of No. 3 generator (operation starts: End of 1998)
Ozone layer protection	Reduction of air conditioning equipment using CFCs	number	70	65 (7% down)	61 (13% down)	60% reduction	Installation of units using non-CFCs when replacing current units
Refuse	Recycling of wastes from factories and construction	%	57	40	62	70%	Suppression of non-recyclables at design stage
	Recycling of refuse discarded on trains and at stations	%	14	18	22	30%	Establishment of additional recycling centres
Resources	Using recycled paper for routine work	%	78	92	91	95%	Boosting further use of recycled paper
	Saving water consumption	6 years = 100	100	98	98	5% reduction	Installation of water saving equipment when replacing current equipment
Natural environment	Planting trees every year	sapling	—	—	—	30,000 every year	Promoting plantations along lines
Residential environment	Suppressing noise along Tohoku and Joetsu shinkansen lines	Measures have been completed by the end of 1996 to suppress noise level down to 75 dB for quasi-collective housing areas			Further extension being considered	Continuation of provision of noise suppression measures to achieve the 75-dB level	

specific targets for the required major environmental improvements. These efforts were published in March 1996.

The environmental improvement and operation targets are reviewed periodically in accordance with the operation progress. In other words, an autonomous environment-improvement action programme is formulated and updated in the so-called Plan, Do, Check, Action (PDCA) cycle. The project targets various fields and the progress is shown in Table 3.

### Environment Management System

The International Standards Organization (ISO) adopted the ISO14000 standard for the environment in September 1996 after the earlier introduction of the ISO9000 standard. So far, about 400 companies, mainly in the manufacturing sector, have obtained ISO14000 certification.

JR East is planning to further develop its current environment management system into a fully qualified system in accordance with ISO14000. This endeavour, which is presently centred around the head office, is being extended to the branch offices. Additionally, a separate environment management system is being con-

figured for stations, train yards, and other operation facilities. All-in-all, JR East aims to complete these systems so as to obtain ISO certification as soon as possible. Also, the Niitsu Rolling Stock Manufacturing Factory, one of JR East's rolling stock manufacturers, aims to achieve ISO14000 certification by late 1998. So far, no railway in the world has obtained ISO or Eco-Management & Audit Scheme (EMAS) environment standard certifications, including European operators who are considered to be advanced in environmental protection.

### Saving Energy and Reducing CO<sub>2</sub> Emissions

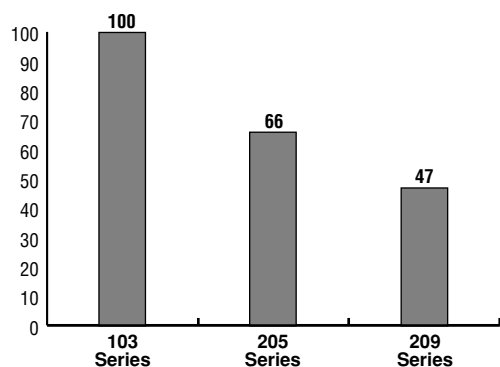
Most of the JR East CO<sub>2</sub> emissions result directly from its use of electricity. About 60% of the required total electric power is produced by JR East's three hydroelectric power stations on the River Shinano and by a thermal station in Kawasaki. To cut the CO<sub>2</sub> emissions, the generating efficiency of the thermal power station must be raised, and the energy efficiency must be improved.

In an effort to reduce the train operating power, which accounts for 80% of the total, JR East has set a 10% reduction target by 2001. In other words, the average

energy of 84 kcal. required per passenger kilometer in 1994 is to be reduced by 10%. This will be achieved by operating more energy-saving Series 209 and Series 217 electric multiple units (EMUs). The Series 209 EMU was designed around the concept of 'halved weight, cost, and service life' and uses 53% less energy than the conventional Series 103 EMU (Fig. 2). Can these energy-saving EMUs really contribute to the overall reduction of power as projected? The JR East transportation capacity has been relatively stable now that there is no need to run frequent extra trains, and total train power consumption has started falling (Fig. 3).

Furthermore, one Series 209 EMU saves as much electricity as used by 800 households—replacing all 10,000 JR East trains with the Series 209 would save the same amount of power as consumed by an entire city of 1 million households. It is often argued that environment protection measures demand big spending, but the Series 209 EMU costs just one half of the conventional cost and can easily justify its adoption. It is a good example of technology overcoming the apparent contradictions of ecology and economy. Since JR East spends about ¥50 billion annually on electric power, a 10% power reduction would save ¥5 billion.

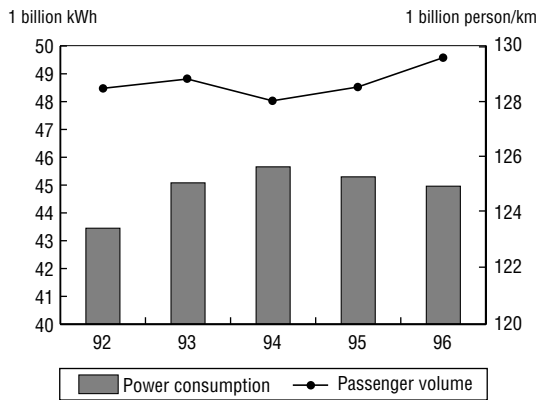
Figure 2 Comparison of EMU Energy Consumption



Energy-saving Series 209 EMU

(JR East)

**Figure 3 Trend of Railway Operating Power Consumption**



In the meantime, JR East is developing a new EMU series to succeed the Series 209. The design uses full life-cycle environmental assessment from building to disposal.

A 10% reduction in CO<sub>2</sub> emissions by 2001 from the present level of 598 g/kWh has also been set for the Kawasaki thermal power station. Two of the plant's four generators have already been replaced and another is to be replaced in March 1999.

### Planting Railway Forests

Deforestation is a rapidly growing threat to the environment; the very first snow-break forest was planted in Japan 100 years ago near Noheji Station on the Tohoku Main Line to protect train operation from blizzards. Since then, railway forests and woods have been used widely alongside tracks to protect lines from snow avalanches and falling rocks as well as to provide water reserves for steam locomotives.

JR East currently owns 4400 ha of forests with about 8 million trees along its lines, accounting for 25% of the company's

total land. To preserve these precious green belts, in 1992, the company initiated a drive to green more lines by planting 30,000 trees every year. Funds to purchase saplings are donated by tens of thousands of the people working in JR East and its affiliated companies, who also join the actual planting work voluntarily. Last year, rows of cherry trees were planted along a 1-km stretch of the Akita Shinkansen between Jindai and Sashimaki stations to commemorate the inauguration

of the new shinkansen. From last year, new employees of JR East are required to participate in the drive in an effort to raise their consciousness of the environment.

### Reducing and Recycling Refuse

The 17 million passengers using JR East each day discard about 80,000 tonnes of refuse per year, or 1% of all the refuse collected in Tokyo. In an effort to recycle as much as possible, sets of two or three refuse bins for separating refuse into recyclable and non-recyclable are being installed in stations and on trains. About 24% of refuse, including plastic PET bottles, was recycled in 1996.

An automatic can and bottle separator was installed in 1994 in the basement of Ueno Station and additional separators were installed at the Tokyo, Akita, and Nagano stations with the inauguration of the Akita and Nagano-bound shinkansen. The new Series E2 and E3 shinkansen cars have sets of three bins for separate types of refuse. Additional effort is being made to minimize refuse from items sold at stations and on board trains, and JR East aims to increase recycling to 30% by 2001.

Used train tickets amount to more than



*Young saplings planted along a 1-km stretch of the Akita Shinkansen*

(JR East)

1000 tonnes a year, and about 90% are recycled as cardboard and toilet rolls using technology to separate the iron powder and paper fibres. Waste from rolling stock works and construction and maintenance is recycled at company plants. Instead of viewing recycling as a necessary evil required by stricter regulations, this sector of the transport industry should be seen as a new business with the goal of achieving zero emissions as a model 21st-century industry. The entire JR East group is seriously studying new business opportunities in environmental fields based on its know-how and well-established network.

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### Advancing Intermodal Transportation

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Although less than 1% of Japan's total CO<sub>2</sub> emissions comes from railways, both the environmental load caused by railways as well as the entire load of the transport industry needs reducing. Using a private automobile from home to railway station and taking the train to the destination, or taking a train to a station near the destination and renting an automobile are ways to cut emissions.

As part of this idea, a free car park for 500 cars was built in 1989 at Kurikoma Kogen Station on the Tohoku Shinkansen. The number of vehicles using it has doubled since it opened. As another way to lower environmental loads, JR East is also considering combining train and car rental services.

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### Public Relations and Training

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Persuading 1000 citizens to take action over the environment is more important than persuading 10 specialists. The success of JR East's ecology activities depends on a correct perception of the issue by its 80,000 employees and their determination to act accordingly. To this end, every



Free parking for 500 cars at Kurikoma Kogen Station

(JR East)

employee is given an ecology handbook, followed up by in-house publications and training videos, etc. Along with training programmes since 1995 for new employees, from last year, ecology training programmes are being used to educate new managers.

In the public relations field, JR East informs passengers and stockholders, as well as the general public about its endeavours to protect the environment. Reports, pamphlets, and booklets are widely distributed, explaining the company's projects and accomplishments, or describing the relationships between transport and the environment.

Participation in ecologically-motivated events and publicity campaigns are all part of the effort. Enquiries from environment-oriented NGOs, administration offices, and various enterprises have been increasing recently and it would be worthwhile working with such organizations to accomplish environmental improvements.

### Future developments

The worldwide concern about the environment is an important contemporary issue for railway operators. Although railways are basically environment-friendly compared to many other industries, they lag behind in addressing the issues systematically. For example, the auto industry is desperately developing hybrid automobiles to slash fuel consumption and CO<sub>2</sub> emissions while cutting production cost.

On the other hand, there is increasing discussion of new measures, such as environment taxes and trading of emission rights. It is becoming increasingly vital for railway operators to be armed with good strategies to cope with these important issues. ■



### Takeshi Okuno

Mr Okuno joined JR East in 1988 after graduating in engineering from the University of Tokyo. He is presently a manager in the Management Administration Department of JR East Corporate Planning HQ.