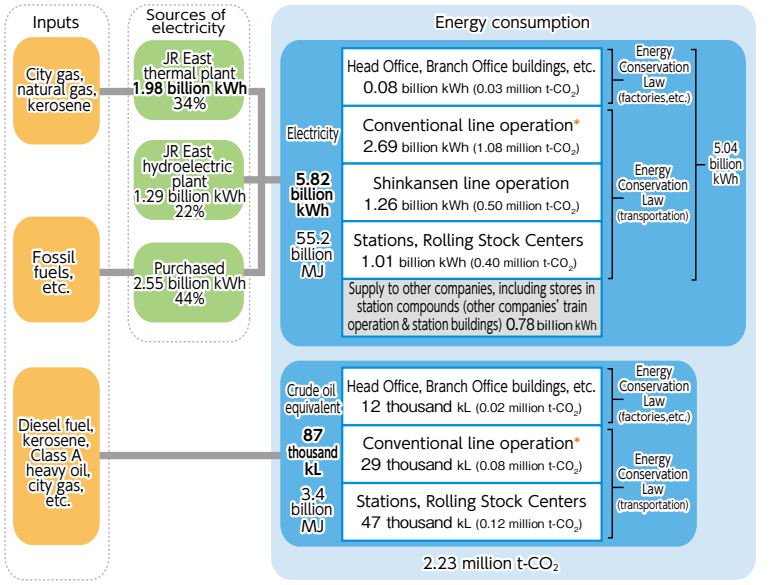
# Measures to Prevent Global Warming

## Energy conservation and $CO_2$ reduction☆

The electricity consumed by JR East for train operations as well as for lighting and air conditioning at stations and in offices is supplied by JR East's own power plants and by electric power companies.
Besides electricity, we also use diesel fuel and kerosene for diesel train operation and for air conditioning at stations and in offices. We will strive to save energy for train operation, which accounts for about 80% of our total energy consumption, and reduce $CO_2$ emissions in various ways.

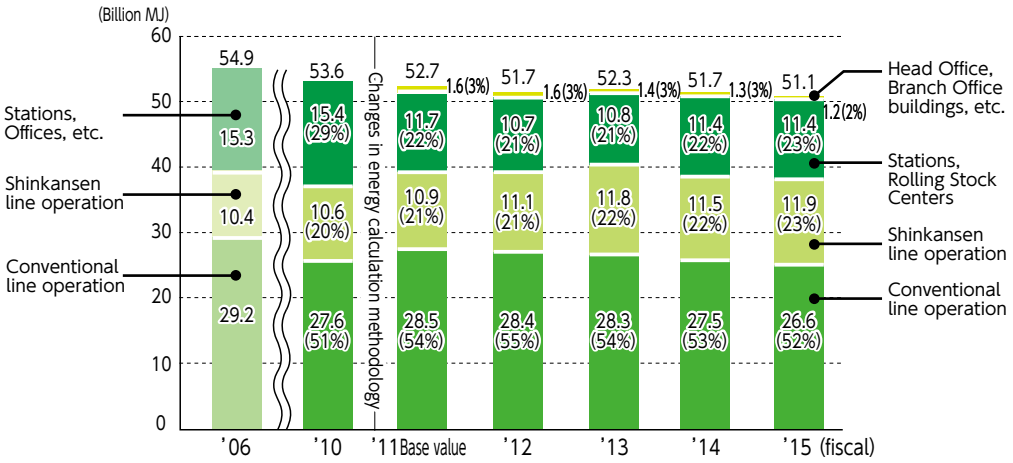
### ■ JR East Energy flow map




($CO_2$ emissions are the amount calculated with' adjusted' emission coefficients that reflect the credits purchased by electric power companies.)

* Including BRT (Bus Rapid Transit)

### ■ Composition of energy consumption by JR East




* Regarding Change in Method of Computation

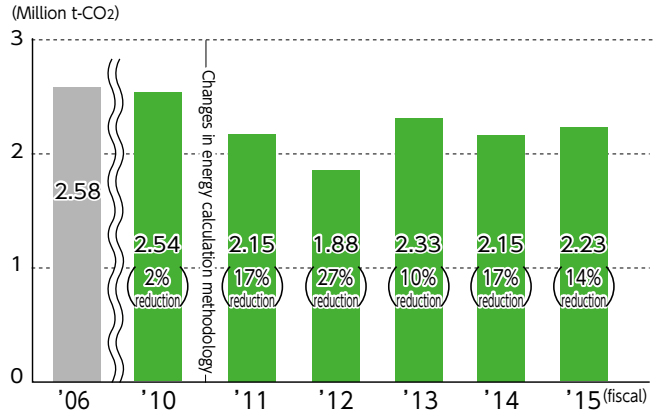
Until FY2006, computation concerning $CO_2$ emissions and energy consumption volume through the use of electricity and fuel was based on the Keidanren Voluntary Action Plan on the Environment. Beginning in FY2007, the computation method was revised based on the Energy Conservation Law and the Act on Promotion of Global Warming Countermeasures.

* The energy consumption is converted to Joules according to the Energy Conservation Law, except for the electricity generated by JR East's own hydroelectric plant, which is converted to Joules using 9.76 MJ/kWh as the conversion factor. JR East uses 0 MJ/kWh as the conversion factor for our own hydroelectric power in our report submitted to the government, as required by the Act.

## Trends in JR East's total $CO_2$ emissions☆

Our $CO_2$ emissions in the fiscal year ending March 2015 totaled 2.23 million tons, an increase of 0.08 million tons over the previous fiscal year. This is the result of an increase in the $CO_2$ emission coefficient of electric power companies despite a decrease in the $CO_2$ emission coefficient of electricity generated by JR East. As we did in last fiscal year, we are also reporting $CO_2$ emissions in Scopes 1 and 2 in accordance with the definition of the GHG Protocol.

### ■ Trends in JR East's total $CO_2$ emissions




* Total $CO_2$ emissions in FY2015, when calculated with the same calculation methodology (category and boundary) as that used until FY2010, are 2.33 million tons of $CO_2$.

*Boundary:
Energy consumption and $CO_2$ emissions have been calculated for JR East alone, in principle. Beginning with FY 2011, however, the energy consumption by and associated $CO_2$ emissions from companies to whom JR East outsources its station operations and other services are calculated as JR East's own energy consumption and $CO_2$ emissions. Meanwhile, the energy consumption by and associated $CO_2$ emissions from stores in station compounds operated by group companies are excluded from those of JR East. These changes have been made to calculate the energy consumption and $CO_2$ emissions associated with JR East's business as a whole more accurately in line with the idea of setting organizational boundaries for transportation and factories in the Energy Conservation Law. No revision was made to the past data on energy consumption and $CO_2$ emissions

*Calculation Method:
$CO_2$ emissions have been calculated based on the method specified in the Act on Promotion of Global Warming Countermeasures. However, the $CO_2$ emissions attributable to the purchased electricity are calculated, including those from the electricity used for rail transport, by using adjusted emission coefficients. The $CO_2$ emissions in the fiscal year ending March 2015 calculated by using actual emission coefficient is 2.24 million tons $CO_2$, down 0.1 million tons $CO_2$ compared to the previous fiscal year.

| Item | Scope 1 | Scope 2 |
|---|---|---|
| FY2015 Emission Volume | 1.08 million tons $CO_2$ | 1.50 million tons $CO_2$ |

Scope 1… $CO_2$ emissions directly attributable to fuel consumed in the operation of diesel railcars and the operation of JR East's thermal electric power plant.
Scope 2… $CO_2$ emissions indirectly emitted from the use of electricity purchased from electric power companies.

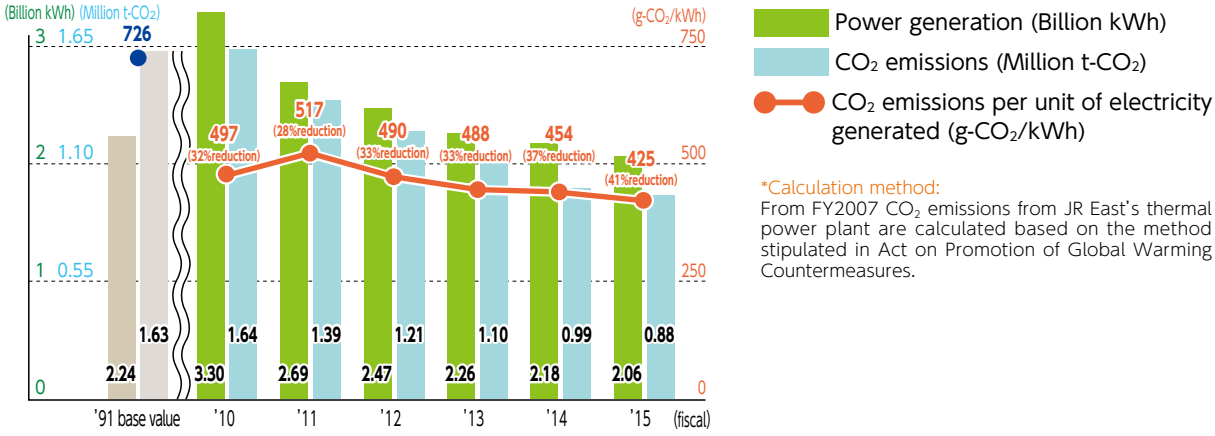
*The sum of the Scope 1 and Scope 2 emissions and the total $CO_2$ emissions do not match, since the former includes emissions associated with the production of electricity supplied to other companies.

## JR East's own thermal power plant☆

JR East operates a thermal power plant in Kawasaki City, Kanagawa Prefecture, with a total capacity of 741 MW. The plant uses combined-cycle power generation units* with improved efficiency and switched fuel from oil to natural gas when the plant was renovated to reduce $CO_2$ emissions. In addition to the start of operation of No. 4 plant in April 2014, investigation and designing for renovation of No. 1 plant are underway.

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

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




*Calculation method:
From FY2007 $CO_2$ emissions from JR East's thermal power plant are calculated based on the method stipulated in Act on Promotion of Global Warming Countermeasures.

## Reducing energy consumed for train operations☆

As of the end of FY2015, JR East had 11,696 energy-efficient railcars in operation. This accounts for 93.1% of our railcar fleet. We are putting into service 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.

E235 series:
1 trainset of state-of-the-art cars to be introduced on the Yamanote Line in fall 2015

E7 series:
The Hokuriku Shinkansen that incorporates the highest level of customer service and cutting-edge technology

E233 series:
VVVF inverter cars for commuter and suburban transportation

## Diesel-powered, electric-motor-driven hybrid railcars and the accumulator railcar train

The Kiha E200 type cars, which entered service on the Koumi Line in July 2007, are the world's first diesel-powered, electric-motor-driven hybrid railcars. Compared with the previous trains, fuel consumption rate has been reduced by about 10% and the noise level of the trains idling at stations and accelerating on departure has been lowered by 20–30 dB. Also, starting from the October to December 2010, we began operating the HB-E300 Series, a new type of resort train equipped with a hybrid system similar to the Kiha E200 type, in the Nagano, Aomori and Akita areas, and in May 2015, we began operating HB-E210 Series on the Senseki-Tohoku Connecting Line. Additionally, as a new measure toward reduction of the environmental burden in non-electric zones, we are proceeding with the development of an accumulator system, which debuted in March 2014 with the EV-E301 ACCUM railcar train, put into service on the Karasuyama Line. The introduction of the EV-E301 has enabled an elimination of emissions, as well as a reduction in $CO_2$ and noise emissions associated with diesel engines.

HB-E210 series: Diesel-powered, electric-motor-driven hybrid railcars

## Proactively adopting LED lighting for all new cars

On our conventional lines, LED lighting has been introduced on E233-series cars on the Saikyo Line (310 cars in 31 trainsets), the EV–E301-series prototype train on the Karasuyama Line (2 cars in 1 trainset), E233-series cars on the Yokohama Line (224 cars in 28 trainsets), HB–E210-series cars for the Senseki-Tohoku Connecting Line (16 cars in 8 trainsets) and the E235-series prototype for new commuter trains (11 cars in 1 trainset). E233-series cars with LED lighting are now replacing older cars on the Nambu Line, and LED lighting is also used on new E129-series cars in the Niigata area.

The first Shinkansen cars with LED lighting are the E7 series trains (192 cars in 16 trainsets). Future production of more E5 series trains will also include LED lighting.

In summary, at the end of FY 2015, over 10% of cars owned by JR East, including newly manufactured cars and renovated cars, have LED lighting. We are determined to continue making efforts for further energy saving in railway operations.

LED railcar lighting


LED lighting in use sticker

## Utilization of renewable energies

We also promote use of renewable energies, including solar and wind power. Solar panels have been installed at Tokyo Station, Takasaki Station, the General Education Center and R&D Center. In March 2004, the number of panels at Takasaki Station was doubled. Panels on the largest scale in JR East were installed at Tokyo Station in February 2011 above the platform for tracks 9 and 10, which serve Tokaido Line trains.
Following the case of Keiyo Rolling Stock Center, we began operation of a large-scale solar power generation facility between Tomobe and Uchihara on the Joban Line in February 2015. Furthermore, we are actively promoting renewable energies including solar, wind, geothermal, and biomass energies with an aim to develop northern Tohoku into a renewable energy base.
Starting full operations as the first ecoste –"eco-station" – Yotsuya Station on the JR Chuo Line began use of solar panels in March 2012. Hiraizumi Station on the JR East Tohoku Main Line began to use solar panels in June 2012, to "generate and use energy locally" and to achieve "zero emissions," i.e., no $CO_2$ emissions on fine-weather days. In September 2013, a small-sized wind power generation facility was introduced at Kaihinmakuhari Station, the third ecoste. In March and April 2015, Yumoto Station and Fukushima Station began operation as ecostes with introduction of facilities that utilize hot spring heat and earth thermal. As a result of such action, solar panels generated about 1.2 million kWh electricity using by ourselves in FY 2015.
We will continue to endeavor to introduce technology using renewable energies efficiently.

Small-sized wind power generation facility installed at Kaihinmakuhari Station

## Greening rooftops

We have been promoting the planting of greenery on JR East station and office building rooftops with the aim of reducing the heat island effect and decreasing the need for air conditioning. As of the end of March 2015, we had completed 82 greening projects (including some cases of moss planting) encompassing a combined rooftop area of 26,856$m^2$.


Rooftop greenery at the Chiba branch building

## Rooftop greening by JR Group companies

We have been promoting rooftop greening to make station buildings in the metropolitan area a place of relaxation for community residents as well as for office workers. The "Soradofarm," which is a vegetable farm rented to subscribers and built alongside the gardens, serves to create a local community, and provides education in farming and environment through people's experience in cultivating vegetables.
These are popular among many customers and have also been built in Ebisu, Ogikubo, Takasaki, Hachioji and other areas.


atre Kawasaki

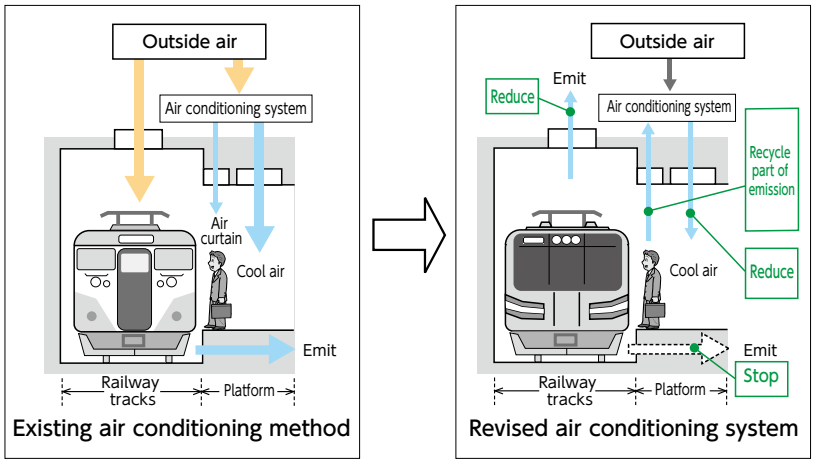

Soradofarm Ebisu

## Saving energy in office buildings

In response to revisions of laws and regulations, saving energy in office buildings has become increasingly important. We work hard on reducing energy consumption through physical measures, including the introduction of highly efficient equipment and facilities such as LED lighting, and operational measures, including temperature management of air conditioning and diligently turning off lights.

## Saving energy at stations

As we have done for office buildings, we have promoted energy conserving initiatives at stations, such as revision of air conditioning systems in line with the upgrading of facilities.
The air conditioning system for the Sobu Line underground platform at Tokyo Station had been bringing in outside air, cooling it, and then sending that cooled air up to the concourse and emitting the air to the outside. With the upgrading of the air conditioning system, we now recycle and reuse the cooled air to reduce the air conditioning load, which reduces $CO_2$ emissions by 25%.




Cool outside air to cool concourse, etc. and emit it.

Cool outside air and recycle part of the cool air to reduce the air conditioning load.

## Environmentally friendly and energy efficient office buildings

Construction was completed in FY2013 on the JR Minami Shinjuku Building, JR Kanda Manseibashi Building, and JP Tower, which are all environmentally friendly and energy efficient buildings, and construction of Shinjuku Station New Southgate Building (tentative name) is currently underway (scheduled for completion in spring 2016). The JR Kanda Manseibashi Building, JP Tower and Shinjuku Station New Southgate Building (tentative name) have acquired a class S rating, the highest rating under the CASBEE environmental labeling system, an initiative of the Ministry of Land, Infrastructure, Transport and Tourism.
Moreover, the JR Kanda Manseibashi Building earned both LEED-CS Gold and LEED-CI Gold certification, widely recognized building performance standards in the U.S., in FY 2014.
Six other buildings – Gran Tokyo South Tower, Gran Tokyo North Tower, JR Shinagawa East Building, Sapia Tower, JR Tokyu Meguro Building and Tokyo Building – earned recognition as Offices Taking Excellent Specific Global Warming Countermeasures (top-level office building or quasi top-level office building) under the Tokyo Metropolitan Ordinance on Environmental Preservation. During the first planning period under the ordinance (FY2011 to FY2015), we were able to reduce $CO_2$ in the amount largely exceeding the obligatory amount. We will use the exceeded amount of reduction for emission trading within the Group and others as stipulated in the ordinance.

JR Kanda Manseibashi Building, LEED-certified, ranked "S," in the CASBEE

GranTokyo South Tower, recognized as a top-level establishment

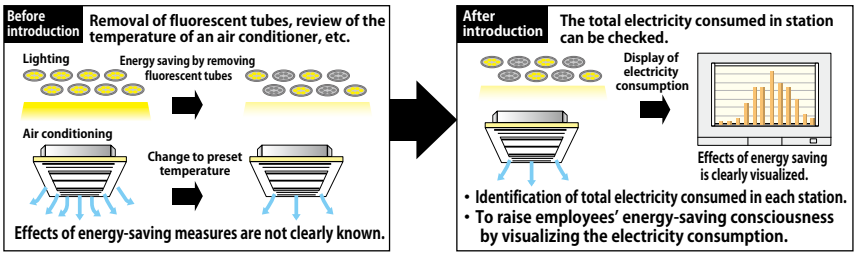
■ List of top-level establishments

| Top-level establishments | Quasi-top-level establishments |
|---|---|
| Sapia Tower (certified FY2011) | Tokyo Building (certified FY2011) |
| GranTokyo North Tower (certified FY2012) | JR Tokyu Meguro Building (certified FY2011) |
| GranTokyo South Tower (certified FY2012 as quasi-top-level establishment, upgraded FY2013) | |
| JR Shinagawa East Building (certified FY2011 as quasi-top-level establishment, upgraded FY2012) | |

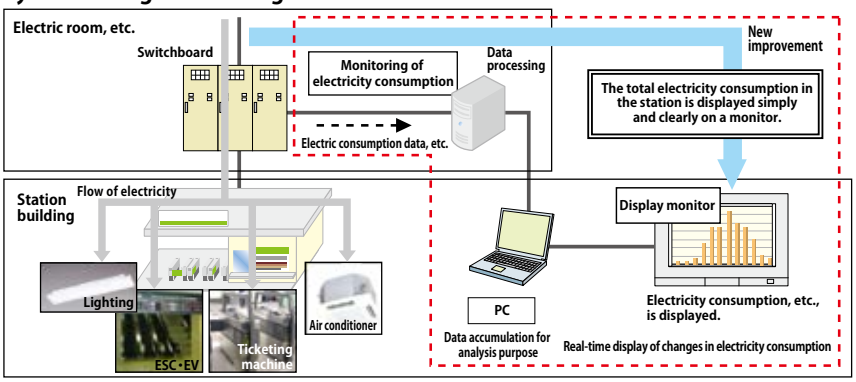
## Visualizing the power consumption in stations

JR East is introducing monitors that display the energy consumed in stations to encourage employees to be more conscious of energy saving. The visualization system measures the total electricity consumed in the station at the power-receiving location and displays it on a monitor every hour. It was introduced in about 200 stations by the end of FY2015, and is utilized for continuous energy saving initiatives.

■ Mechanism of visualization



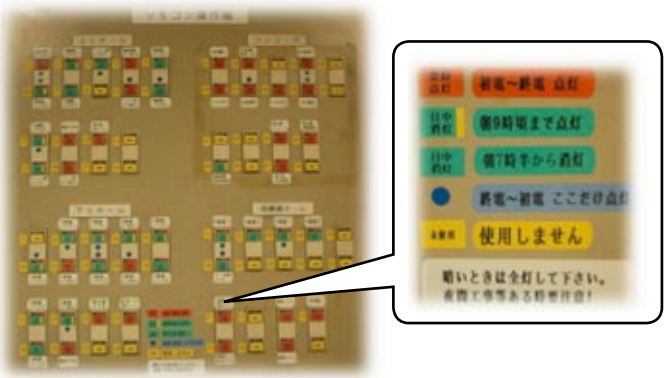

**System configuration diagram**




## Specific Examples of Energy-Saving Initiatives Based on Visualization

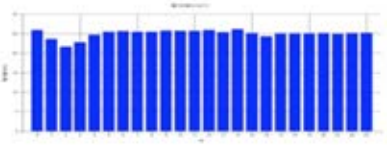
Here are some examples of station-specific initiatives based on JR East's eco-activities, My Project, and so forth that have lead to energy savings:

・Indicating switch usage times on the operating panel for platform lights that were turned on and off at different times during operating periods depending on the employee. The results of this initiative are quantitatively demonstrated through visualization.

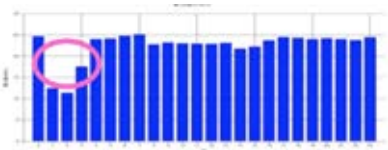



Indication on lighting switch control panel

Before improvement



After improvement



Electricity consumption amount comparison

・Indicating the contracted electricity amount on the display monitor and issuing an alert that the contracted electricity rate will increase when the consumed electricity exceeds this amount over a given period of time.

・Preventing staff from forgetting to turn lights off by using a simple timer.

・Maintaining the waiting room at an appropriate temperature through frequent temperature checks.

Going forward, JR East will continue to implement energy-saving initiatives at stations through the sharing and lateral deployment of best practices at various stations via the use of notice boards and provision of information at meetings.