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# **Our progress and achievements towards decarbonizing Japanese Railway**

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East Japan Railway Company (JR East)

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# *1. Outline of JR East*

# Outline of JR East

## Operates All Kinds of Railway Transport

High Speed  
(Shinkansen)



Metropolitan



Regional



Network: **7,513** km

No. of Passengers: **17 million** /day

No. of Trains: **13,000** /day

Annual Operating Revenue: **\$ 26.2 billion**

Net Annual Income: **\$ 1.9 billion**

No. of Employees: **73,551**



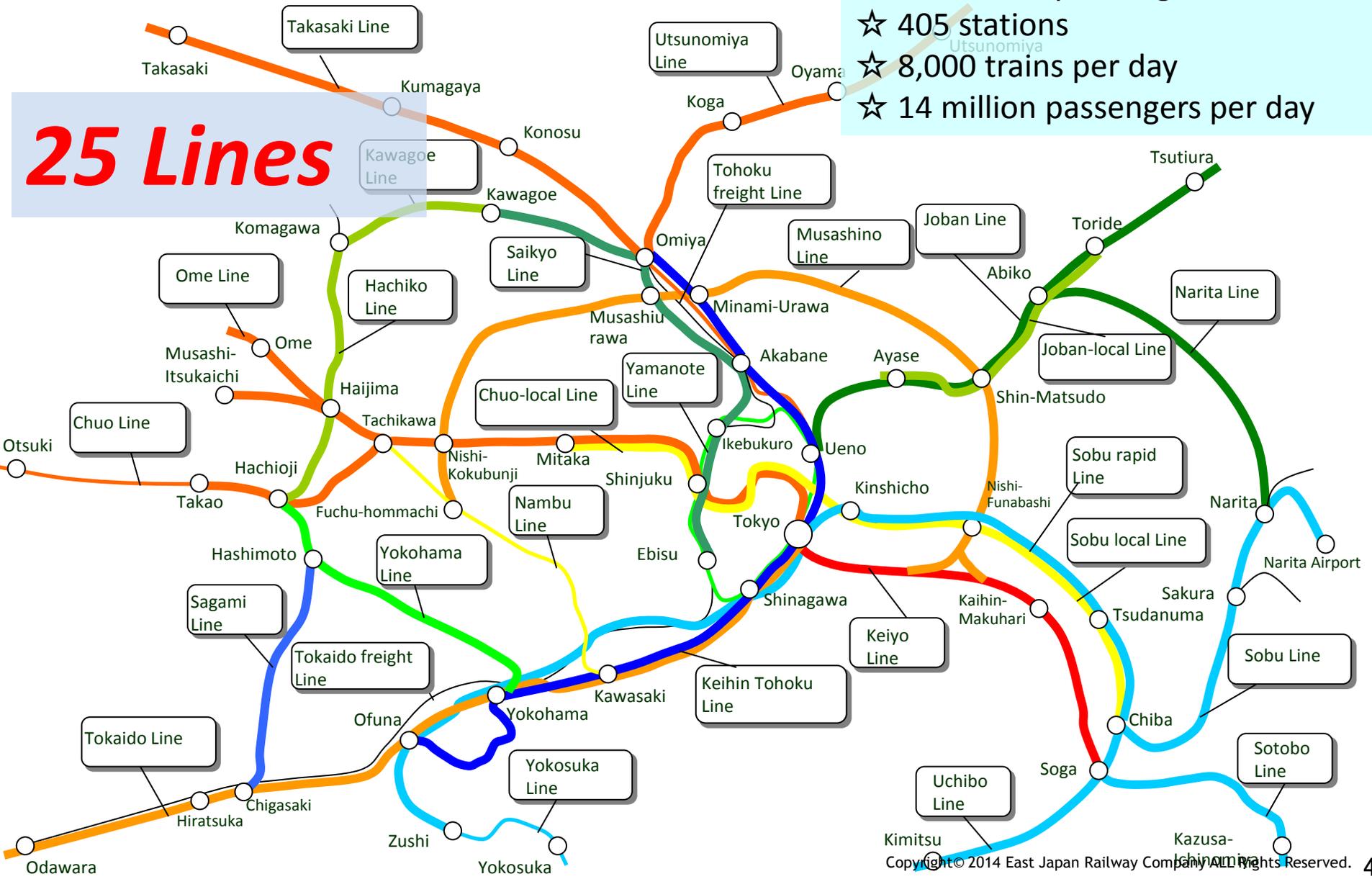
\*Numbers are as of FY ended March 31, 2014

\*Conversion into U.S. dollars at the rate of ¥103 to U.S.\$1

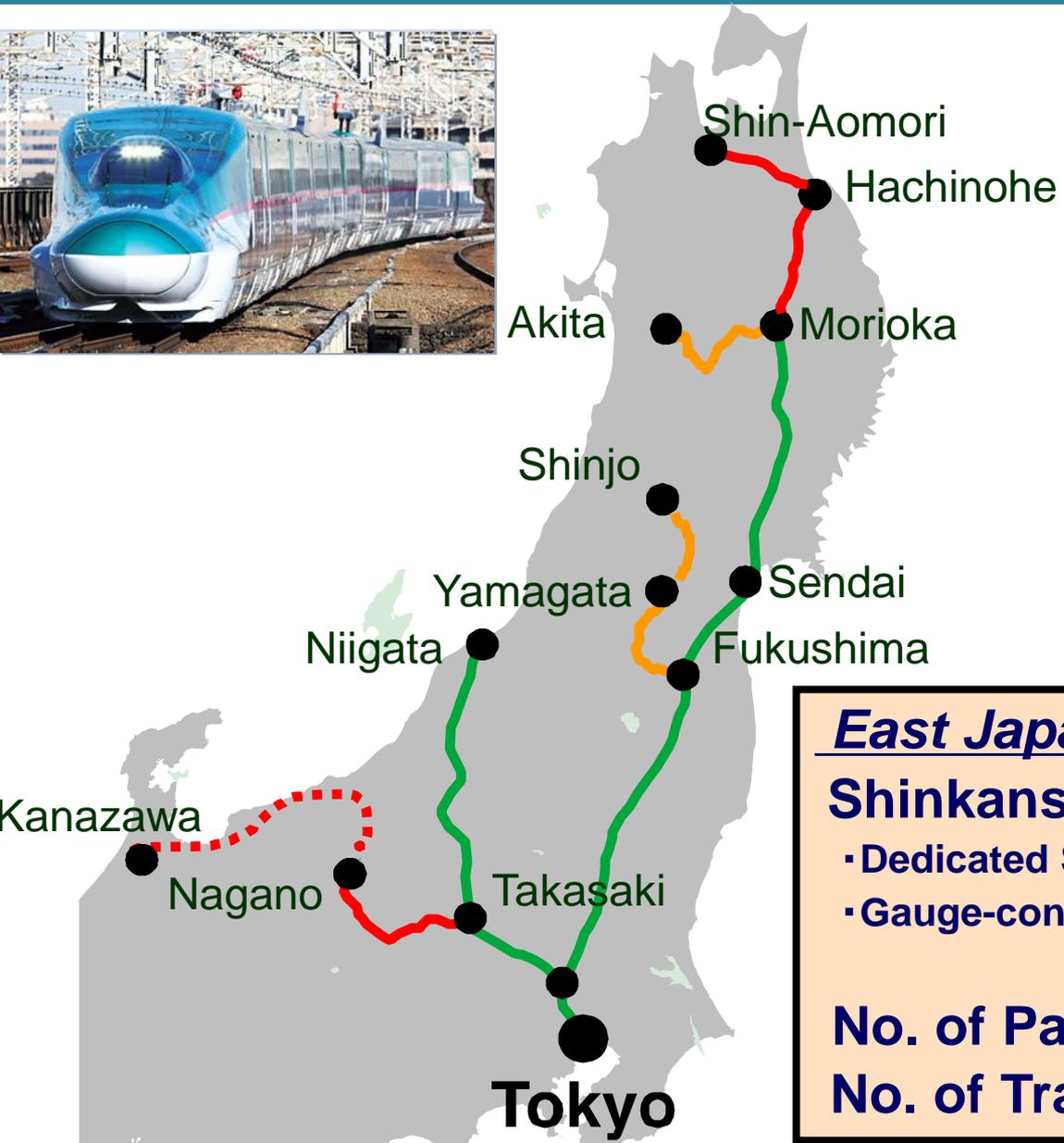
# Tokyo Metropolitan Area Network

- ☆ 1,443 km operating kilometers
- ☆ 405 stations
- ☆ 8,000 trains per day
- ☆ 14 million passengers per day

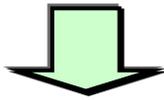
**25 Lines**



# JR EAST's Shinkansen Network



1964: Shinkansen began operation



**0 fatalities**  
for a half century

**East Japan Railway**

**Shinkansen Network: 1,411 km**

- Dedicated Shinkansen line: 1,134km
- Gauge-converted conventional lines: 277km

**No. of Passengers: 241,000 /day**

**No. of Trains: 327to 415 /day**

# Life-style business of JR East



Retail & Restaurants  
 ( "Ekinaka" )  
 2,000 stores



Office  
 24 Buildings



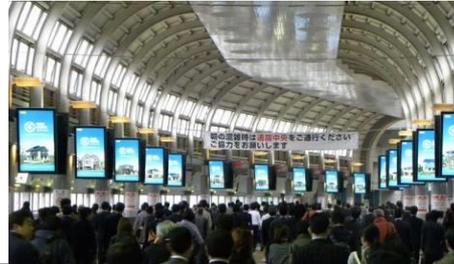
In-Station Shopping  
 Center "Ekinaka SC"  
 26 zones



Fitness Club  
 19 facilities



Shopping center  
 151 SCs



Advertising



Hotel  
 45 hotels  
 6,600 rooms



Regional  
 Revitalization  
 & More

## Maximizing the potential of railway station

## *2. Railways' Environmental Advantages*

# Energy Consumption and transportation market share

**Railways in Japan emit only 3.4%** of the total transport sector CO2 emissions, while having **a modal share of 29.0%**.

**Market Share by Passenger Transportation Mode**



**Energy Consumption by Passenger Transportation Mode**

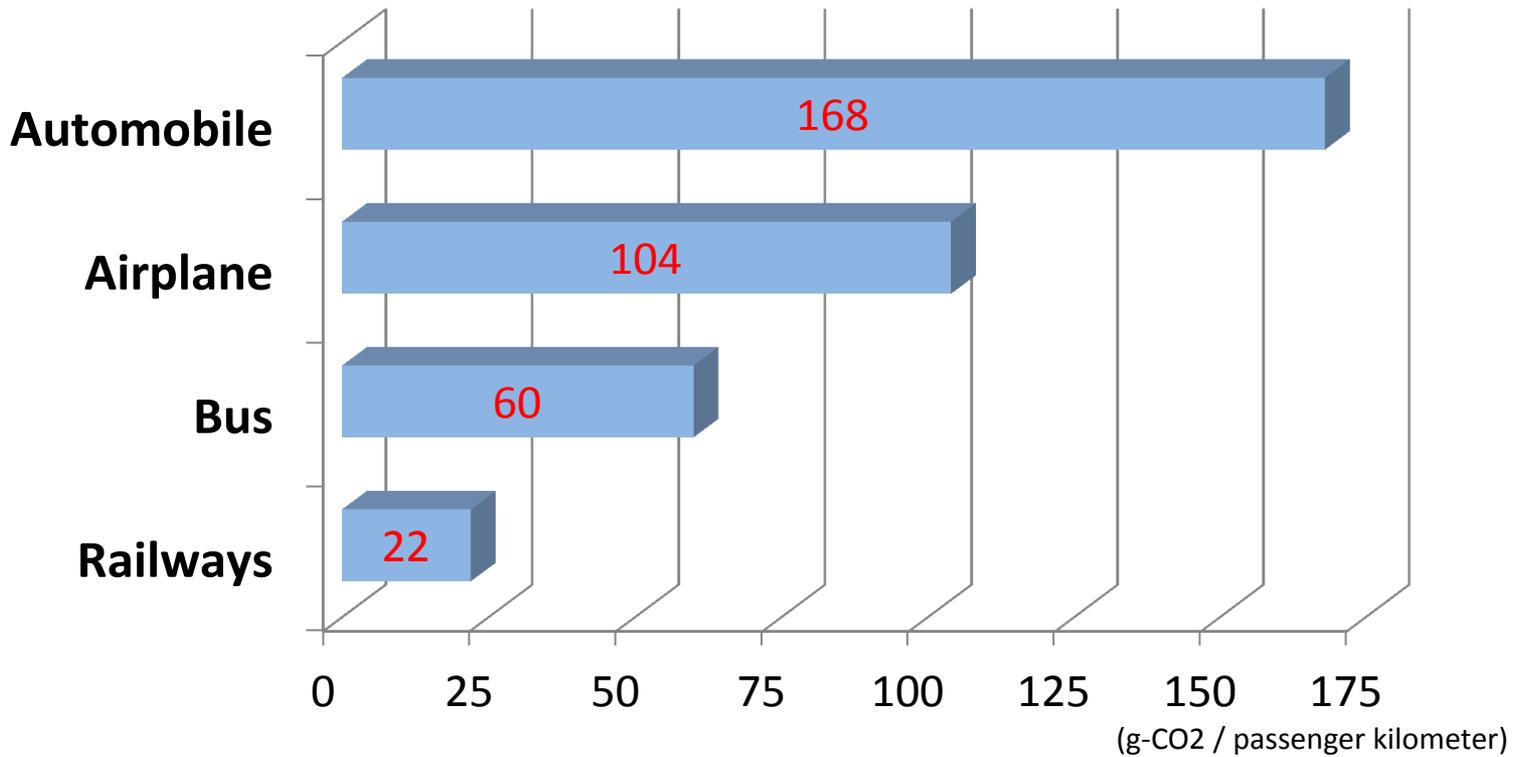


Source : Compiled based on data from The Energy Conservation Center, Japan(ECCJ)'s Handbook of Energy & Economic Statistics in Japan

# Energy Efficiency

In terms of energy efficiency per unit of transport volume, **Railways have big advantage** over cars and other forms of transport.

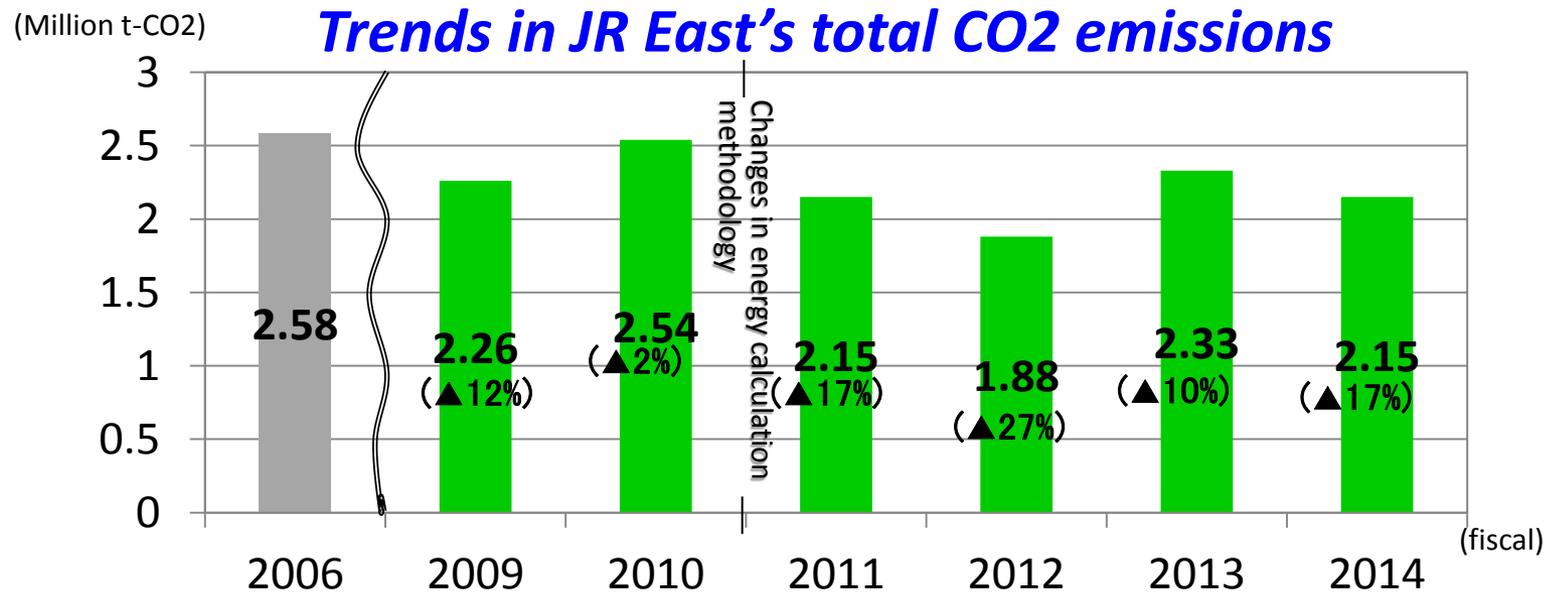
*Comparison of CO2 emissions per passenger kilometer*



Source : Ministry of Land, Infrastructure, Transport and Tourism

# Trends in JR East's total CO2 emissions

Railways can be described as an **environmentally-friendly** form of transport, with limited impact on the environment. However, JR East has a large rail network that emits 2.15 million ton of Co2 each year.



**JR East will diligently strive to balance global environmental protection with our business activities.**

# 3. Measures to reduce CO2 emissions

# Introduction of energy-efficient railcars(Conventional line)

103 Series (1963)  
Rheostatic control



Energy consumption

100

Max. speed

100km/h

205 Series (1985)  
Field added excitation control  
Regenerative brakes



66

110km/h

E231 Series (1999)  
VVVF control  
Regenerative brakes



47

120km/h

# Introduction of energy-efficient railcars (Shinkansen)

		Energy-use index	Max. speed
Series 200(1982)		100	240km/h
Series E2(1997)		69	275km/h
Series E5(2011)		67	320km/h

Max. speed:+80 km/h, energy consumption:  $\Delta$ 33% from Series 200

\* Calculated by actual measurements and simulation

# ***Ecoste (eco-station) model station***

## ***Ecoste:***

***Efforts to introduce various environment conservation technologies to stations, such as energy conservation, renewable energy etc.***

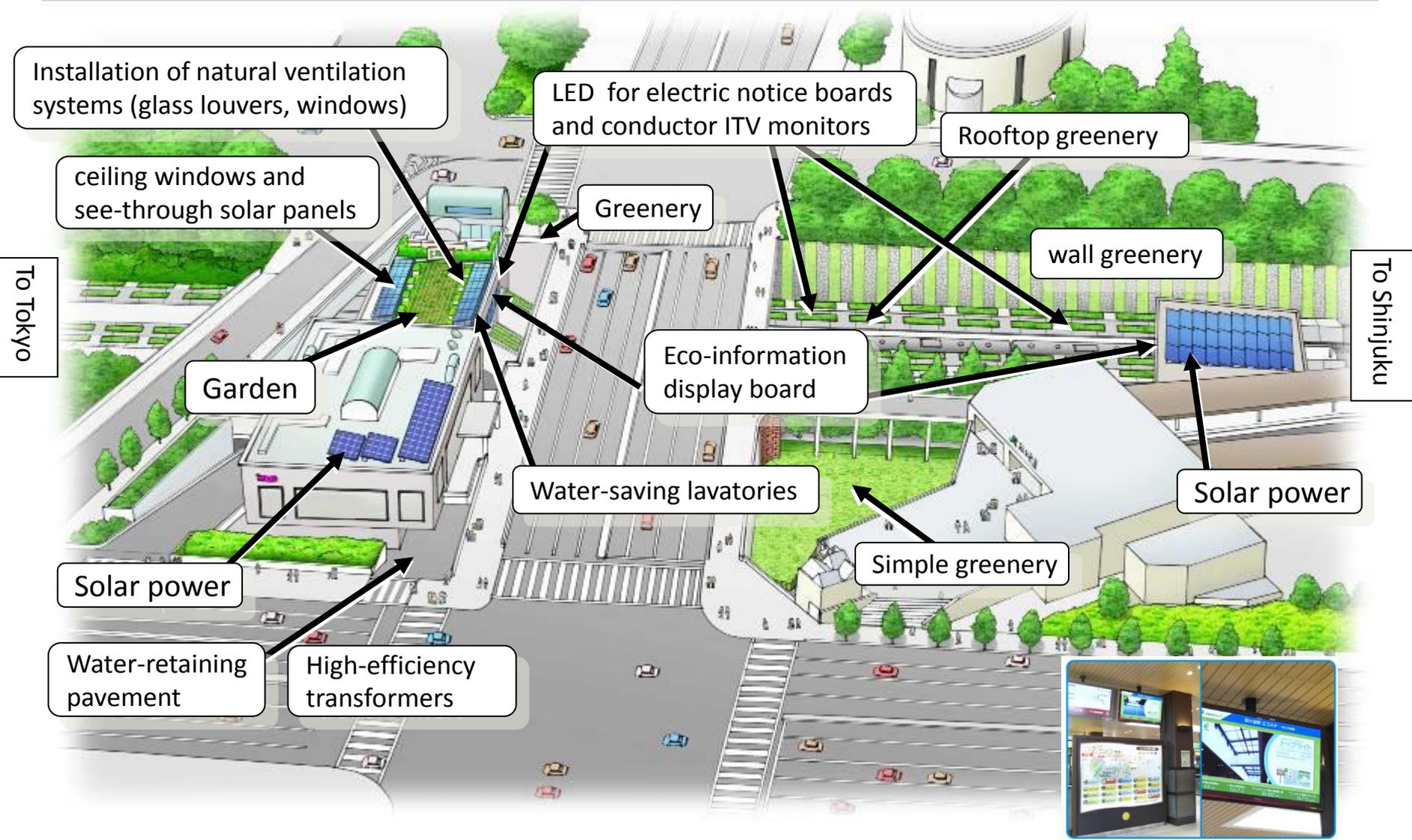


## **Ecoste: 4 pillars**

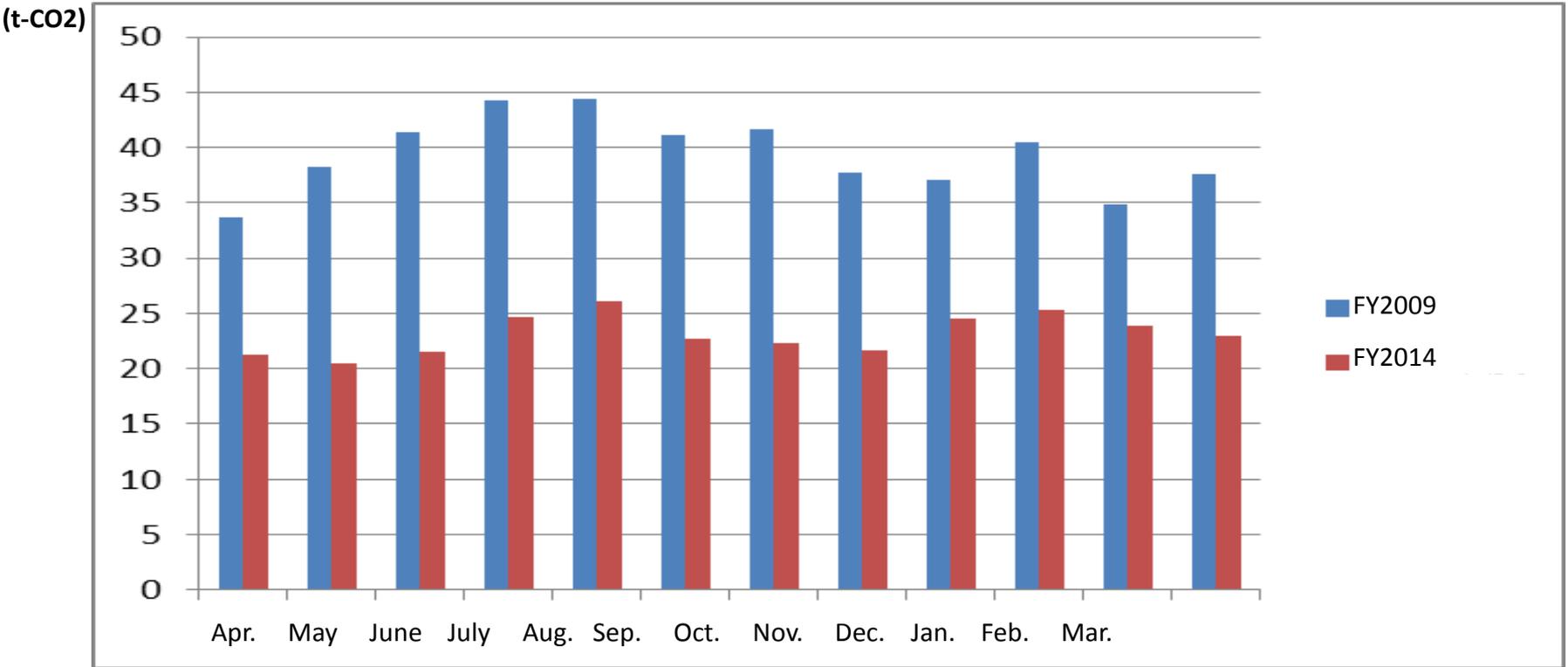
- ✓ Promoting more advanced energy conservation  
**【Energy Conservation】**
- ✓ Actively implementing renewable energy  
**【Energy Creation】**
- ✓ Preparing facilities that make users eco-aware  
**【Eco-Awareness】**
- ✓ Creating vitality by harmonizing people with their environment  
**【Environmental Harmonization】**

# Ecoste (eco-station) model station (Yotsuya)

In service since March 14, 2012



# Ecoste (eco-station) model station (Yotsuya)



**Comparison of power consumption in FY2009 and in FY2014**

Unit: t-CO2

	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
FY2009	34	38	41	44	44	41	42	38	37	41	35	38	473
FY2014	21	21	21	25	26	23	22	22	25	25	24	23	277
Reduction rate	37%	46%	48%	44%	41%	45%	46%	43%	34%	38%	32%	39%	41%

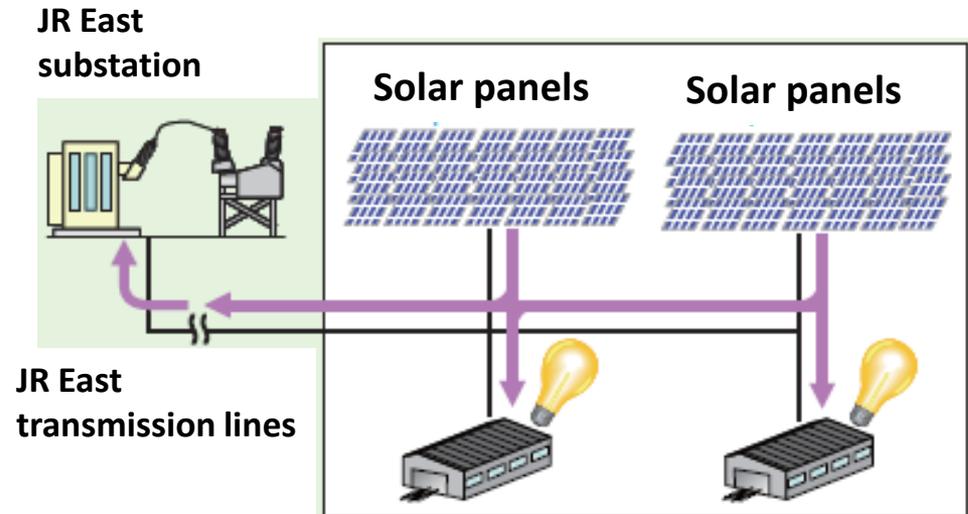
**41% reduction achieved in FY2014 (Target: 40% reduction)**

# Utilization of renewable energies

JR East promote use of renewable energies. Solar panels have been installed at stations and rolling stock depot.

## Mega-solar generation at Keiyo rolling stock depot

- Total output: 1,050kW
- Estimated output per year: 1,000MWhb
- In operation since Feb 2014

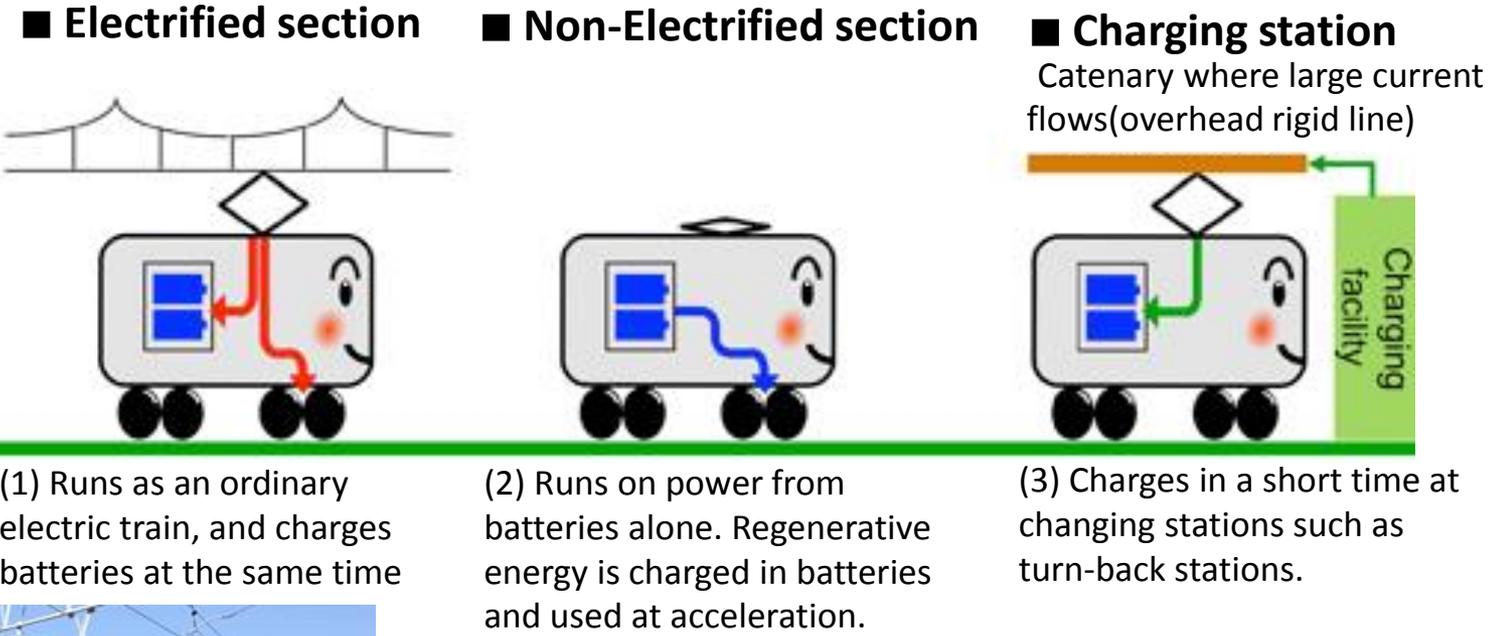


- ✓ Power generated by the solar power panels will be used in the Keiyo Rolling Stock Center office and train depot.
- ✓ Surplus electricity will be transmitted to the substation and used to operate railway services.



# Catenary and battery-powered hybrid railcar

The storage battery-driven electric train can eliminate the exhaust gases and reduce CO2 emissions.



EV-E301 (ACCUM) started operation on the Karasuyama line in March 2014.

# *4. Sustainable Railways Development*

# ***Safety and Punctuality***

- ▶ **Safety is the top priority for railways management**  
(JR East has kept it and will keep it)
- ▶ **Punctuality is the mother for everything**
  - 1) reliance by passengers and society
  - 2) competitiveness against other modes of transport
  - 3) efficient operation requiring less infrastructure and rolling stock
  - 4) reduced operation cost

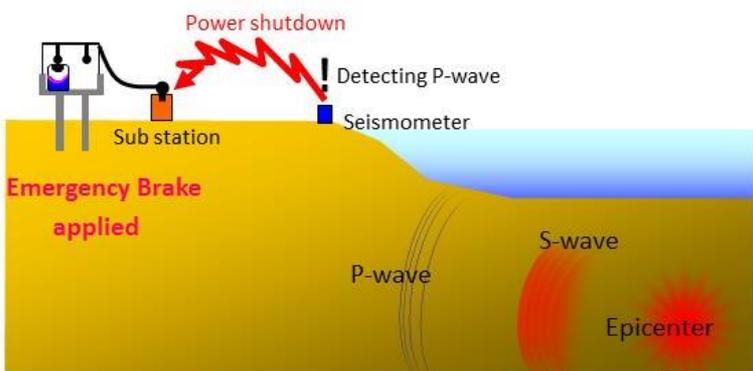
***In order to improve punctuality, an excellent operation plan, train schedule diagram, train control, maintenance, human resources, and so on are required.***

# Natural disasters countermeasures

- Pursuing “extreme safety levels”-

## Countermeasures for Large-Scale Earthquake

Approximately ¥300 billion total in seismic reinforcement countermeasures (from FY2013 to FY2017)



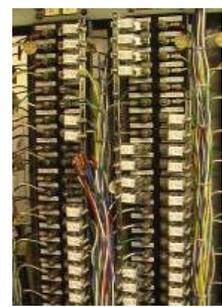
Early Earthquake Detection System

Seismic reinforcement

## Countermeasures for Heavy Rain and Thunder



slope reinforcement



Installation of surge protective device

# Better Mobility and Accessibility (3D smooth trip)

## Horizontal:

### ① Through Operations

No need to transfer  
(Continuous trip on the same seat)

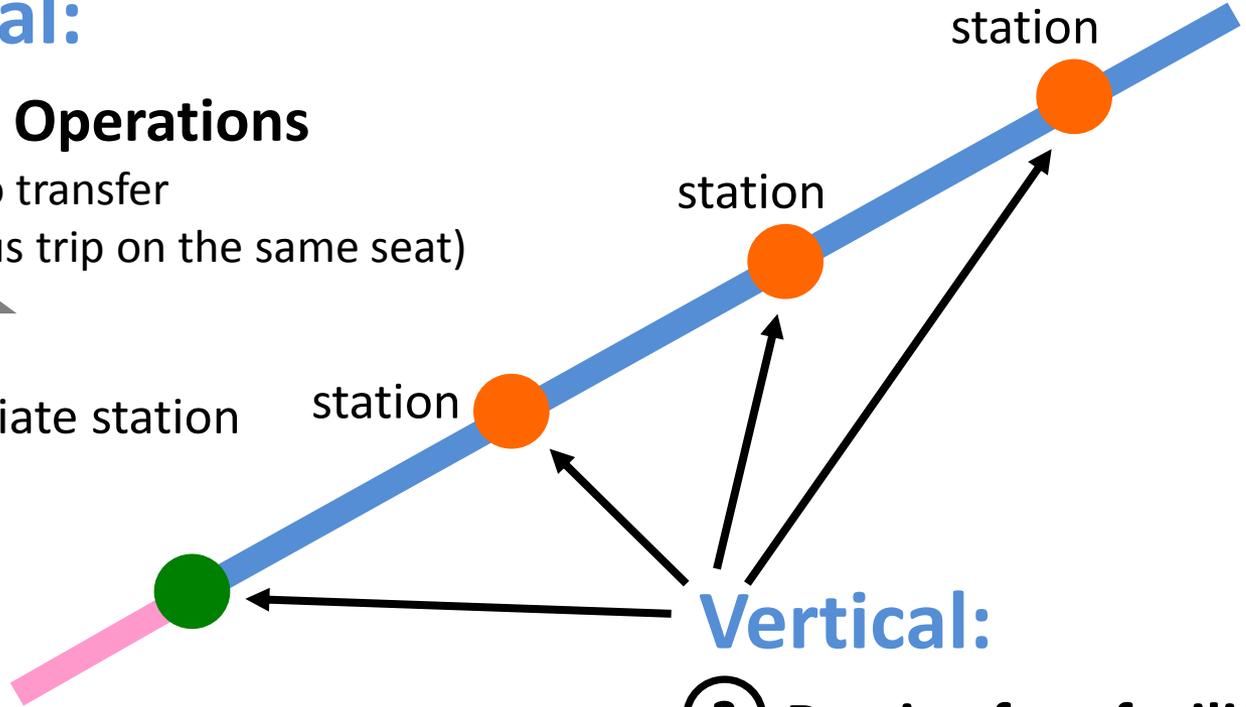


Intermediate station

station

station

station



## Vertical:

### ② Barrier-free facilities

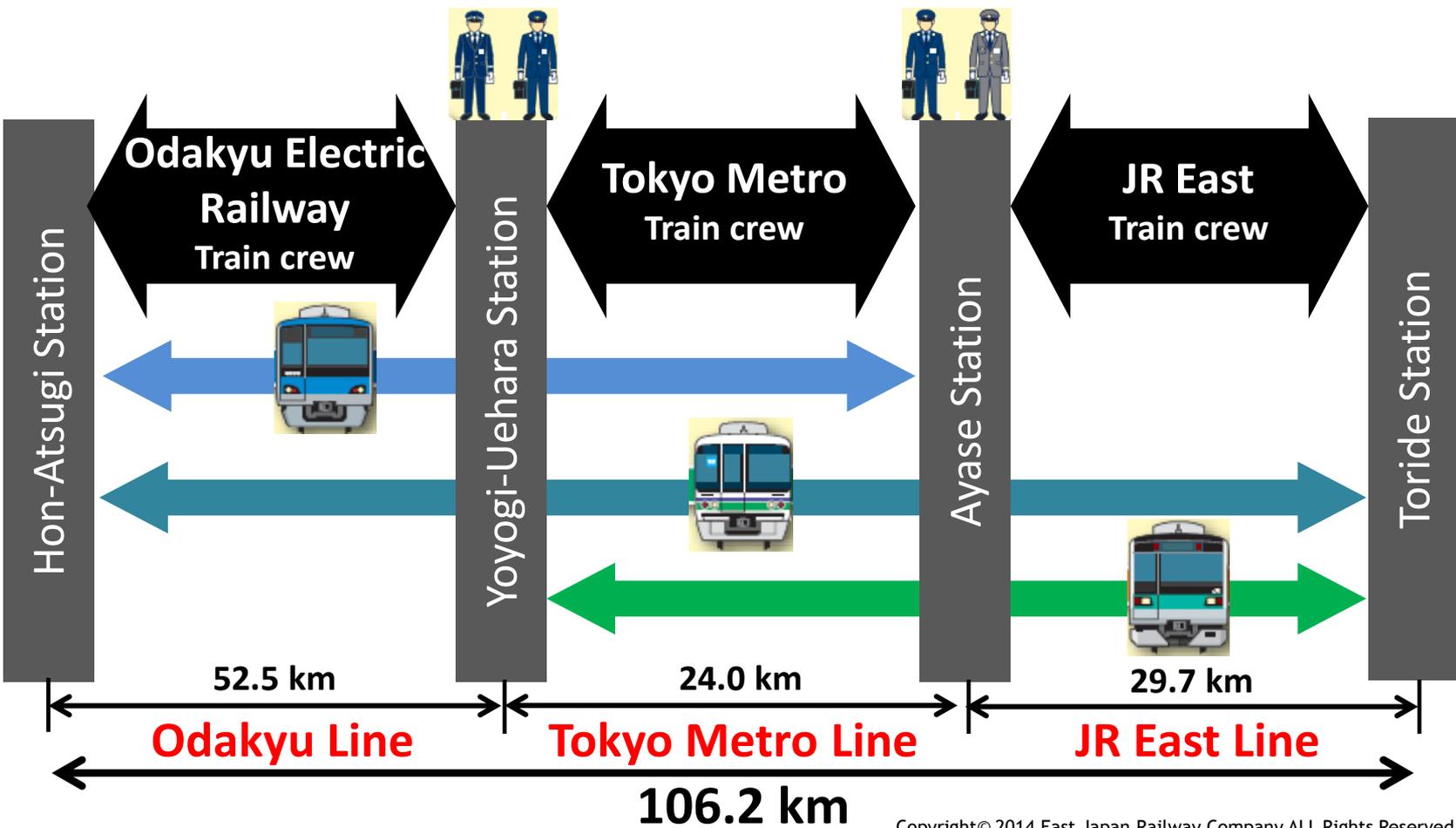
## Psychological:

### ③ IC Smartcard at the stations and on board

(tickets and micropayment by a single plastic card or an IC-chip-embedded mobile phone)

# Better Mobility and Accessibility (Through operations)

- ▶ **Result: efficient and smooth integrated mobility.**
- ▶ **Alleviating congestion at terminal stations.**
- ▶ **Eliminating inconvenience of transfer.**



# Better Mobility and Accessibility (Barrier-free facilities)

## ▶ Eliminating physical barriers.



# Better Mobility and Accessibility (IC Smartcard)

It is possible to travel on almost all trains, subways and buses all across Japan with Suica.

 **Suica** *The first Smartcard ticketing system in Japan.*

*Transaction per day*  
*approx. 80 million (stored fare and micropayment)*  
*approx. 32 million (smartcard commuter pass)*

*Total approx. **120 million***  
***0.2 sec.** to pass through automated passenger gate*



**Automated Passenger Gate**



**Micropayment**



# Low OPEX & CAPEX

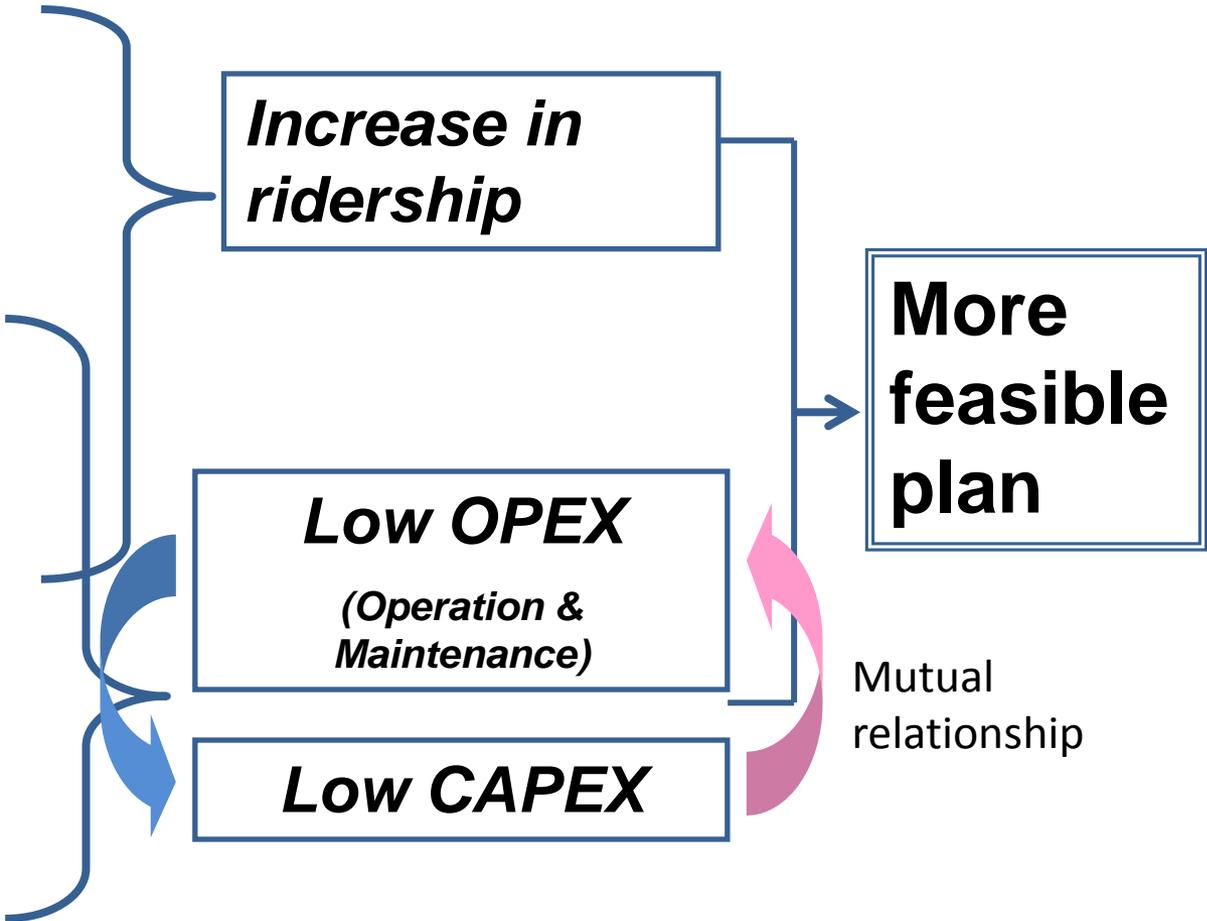
**Safety**

The top priority for Public Transport management

**Shortened total trip time**

**Punctuality**

**Cost efficiency**



## Total Life Cycle Cost efficiency

**OPEX + CAPEX = Total Life Cycle Cost**

Technology and experience of public transport can minimize the facilities, rolling stock, personnel for operation.

**OPEX:** 1) Efficient Operation

Punctuality, Train schedule, Train control, Short Turn-around at station, and so on.

2) Efficient Maintenance

Rolling stock, Track, Overhead catenary, Signalling, and so on.

*Higher efficiency*



*needs only*

**CAPEX:** 1) Minimum Infrastructure

2) Minimum Rolling Stock

*CAPEX will be saved as well!*

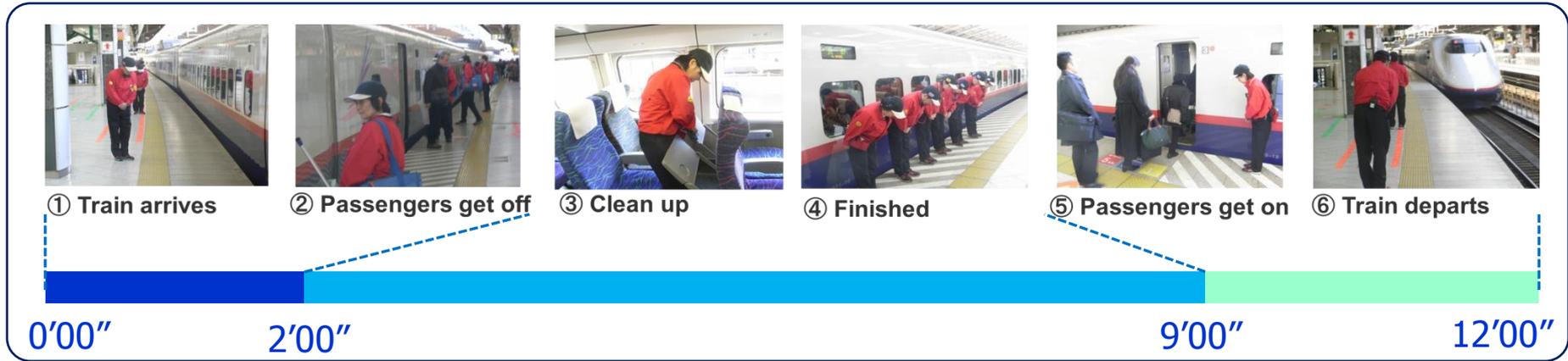
*Needs high  
efficiency of  
O&M*



# Efficient O & M

## Quick turnaround at Tokyo terminal station

With a 12-minute turnaround, we can



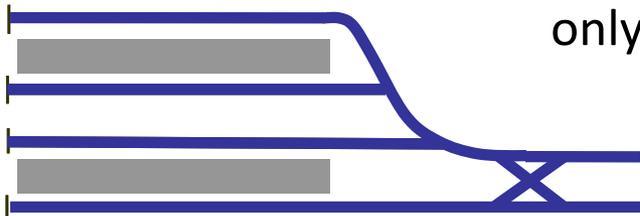
✓ provide very frequent service with minimum rolling stock

4 minute headways = high frequency  
400 trains per day

=> Minimum rolling stock (CAPEX)

✓ simplify station layout and infrastructure

only 2 platforms with 4 tracks



=> Minimum infrastructure (CAPEX)

# CONCLUSION

- ✓ Railways are **environmentally-friendly** form of transport.
- ✓ However, railway companies have to progress and achieve **further decarbonizing**.
- ✓ In addition, we must develop and operate railways **sustainably** by improving **safety, punctuality, comfort, accessibility, efficiency** and so on.

Thank you very much for your attention!