CO₂ Emissions Reduction and Energy Saving on Road Transport in Japan

1 April 2016
Environment Committee
Japan Automobile Manufacturers Association, Inc.
Agenda

• Background
• Intended Nationally Determined Contribution
• Integrated approach to CO$_2$ emissions reduction and energy saving in road transport
  – Fuel-efficient vehicles
  – Improving traffic flow
  – Eco-driving activities in Japan
  – Change in trucks use from private to business
  – Collaborative logistics
• Labeling of fuel efficiency

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
Environmental Issues Related to Motorization

- Urban air quality
- Global warming
  - CO₂ emissions reduction

Exhaust emissions reduction

Energy security and management

- Energy saving
- End-of-life vehicle recycling

Development of “eco-friendly” & clean vehicles

Noise reduction

Reduction of hazardous substances
Global warming and greenhouse gases

- Observed globally averaged combined land and ocean surface temperature anomaly 1850–2012
  - Annual average
  - Decadal average

- Atmosphere CO₂
  - CO₂ (ppm) vs. Year

- Observed change in surface temperature 1901–2012
  - Temperature anomaly relative to 1861–1880 (°C)

Source: IPPC AR5

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
**CO₂ Emission Worldwide / In ASEAN**

**Global CO₂ Emission**

- Rest of world*
- Japan
- Southeast Asia
- Middle East
- European Union
- India
- United States
- China


**ASEAN CO₂ Emission & BAU Projections**

- Indonesia
- Thailand
- Malaysia
- Philippines
- Other

*Source: Asia/World Energy Outlook 2014, Institute of Energy Economics, Japan*
Intended Nationally Determined Contribution
## GHG reduction target

<table>
<thead>
<tr>
<th>Country</th>
<th>Target</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>26% reduction from 2013</td>
<td>2030</td>
</tr>
<tr>
<td>EU</td>
<td>40% reduction from 1990</td>
<td>2030</td>
</tr>
<tr>
<td>USA</td>
<td>26-28% reduction from 2005</td>
<td>2025</td>
</tr>
<tr>
<td>Thailand</td>
<td>20% reduction from BAU&lt;br&gt;25% reduction from BAU with international support</td>
<td>2030</td>
</tr>
<tr>
<td>Indonesia</td>
<td>29% reduction from BAU</td>
<td>2030</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>8% reduction from BAU&lt;br&gt;25% reduction from BAU with international support</td>
<td>2030</td>
</tr>
<tr>
<td>Philippines</td>
<td>70% reduction from BAU with international support</td>
<td>2030</td>
</tr>
<tr>
<td>Singapore</td>
<td>36% reduction of emissions Intensity from 2005</td>
<td>2030</td>
</tr>
<tr>
<td>China</td>
<td>60-65% reduction per GDP from 2005</td>
<td>2030</td>
</tr>
<tr>
<td>India</td>
<td>33-35% reduction per GDP from 2005</td>
<td>2030</td>
</tr>
</tbody>
</table>

* BAU: Business As Usual
## Intended Nationally Determined Contribution

Total ranking of effort for GHG reduction (Challenge)

<table>
<thead>
<tr>
<th>Country</th>
<th>Rating</th>
<th>Score</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>✪✪✪✪✪</td>
<td>5.2</td>
<td>Very excellent</td>
</tr>
<tr>
<td>Japan</td>
<td>✪✪✪✪</td>
<td>4.5</td>
<td>Excellent</td>
</tr>
<tr>
<td>EU28</td>
<td>✪✪✪</td>
<td>4.1</td>
<td>Good</td>
</tr>
<tr>
<td>Australia</td>
<td>✪✪☆</td>
<td>3.9</td>
<td>Medium</td>
</tr>
<tr>
<td>New Zealand</td>
<td>✪☆☆☆</td>
<td>3.1</td>
<td>Medium</td>
</tr>
<tr>
<td>Thailand</td>
<td>☆☆☆☆</td>
<td>2.3</td>
<td>Medium</td>
</tr>
<tr>
<td>Canada</td>
<td>☆☆☆☆☆☆</td>
<td>1.9</td>
<td>Bad</td>
</tr>
<tr>
<td>Korea</td>
<td>☆☆☆☆☆☆</td>
<td>1.9</td>
<td>Bad</td>
</tr>
<tr>
<td>Norway</td>
<td>☆☆☆☆☆☆</td>
<td>1.6</td>
<td>Bad</td>
</tr>
<tr>
<td>East Europe</td>
<td>☆☆☆☆☆☆</td>
<td>0.7</td>
<td>Bad</td>
</tr>
</tbody>
</table>

This evaluation is estimated using index numbers for GHG emissions/person, GHG emissions/GDP, cost of reducing CO₂ and others.


(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
Intended Nationally Determined Contribution (Japan)

- Japan’s INDC includes an emissions reduction target of 26% below 2013 emission levels by 2030.

(In appendix to main INDC document:)

**Transport sector:** 2013: 225Mt-CO₂ ⇒ 2030: 163Mt-CO₂

- Through the wider use of next-generation vehicles ▲28%
  (HEVs, EVs, PHEVs, FCVs, Clean Diesels)
- Through the wider adoption of eco-driving
- Through improved traffic flow
- Through the more efficient use of vehicles
- Through increased vehicle fuel efficiency
Mid-term perspective of energy supply and demand

• Basic policy for setting the energy mix
  – Simultaneously achieve safety, steady supply, economic effectiveness, and environmental compatibility as basic aspects of the energy policy.
  – Introduce thorough energy saving, and renewable energy. Promote the efficiency of thermal power generation and minimize nuclear power generation. May be effective when measures are taken based on the direction of the energy basic plan.

Policy target of 3E+S

<table>
<thead>
<tr>
<th>Energy Security</th>
<th>25% or more than before the Great East Japan Earthquake (20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-sufficiency ratio</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economy</th>
<th>Reduce from the present situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity cost</td>
<td>9.7 trillion yen(2013) → 9.5 trillion yen(2030)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental Conservation</th>
<th>Set the greenhouse gas reduction target at not less than in Europe and America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse gas emission</td>
<td></td>
</tr>
</tbody>
</table>

Safety
Safety is fundamental

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
Mid term perspective of energy supply and demand

**Energy demand**

- **2013 Actual**
  - Thermal, Fuel, City gas: 361 bL (75%)
  - Electricity: 94 bL (25%)
  - Final energy consumption: 326 bL

- **2030 After energy saving measures**
  - Economic growth: 1.7% / year
  - Through energy saving: 50.3 bL (Reduction Ratio ≈ -13%)
  - Final energy consumption: 289 bL (72%)

**Primary energy supply**

- **2030**
  - Total energy demand: 489 bL
  - Oil: 146 bL (30%)
  - Coal: 122 bL (25%)
  - Natural gas: 88 bL (18%)
  - LPG: 15 bL (3%)
  - Nuclear: 50 bL (11-10%)
  - Renewables: 33 bL (13-14%)

- **Self-sufficiency ratio**
  - ≈ 24.3%
Japan’s global warming countermeasures

• Transport sector
  ➢ Broad countermeasures
  ➢ Relevant government ministries, industries, institutes, academies and consumers are involved

There are many countermeasures in Japan
Japan’s global warming countermeasures

- **Transport sector** 2013: 225Mt-CO2 ⇒ 2030: 163Mt-CO2
  - Improvement of fuel efficiency
  - Promotion of next-generation automobiles
  - Other measures in the transport sector (*traffic flow improvement*, promotion of public transport, modal shift to railways, comprehensive measures for eco-friendly ship transportation, reduction of land transportation distance by selecting nearest port, comprehensive low-carbonization at ports, *optimization of truck transport*, improvement of energy efficiency of railways, improvement of energy efficiency of aviation, accelerated promotion of energy saving ships, making vehicle transport business more eco-friendly by *eco-driving*, promotion of collective shipment, promotion of *Intelligent Transport Systems ITS* (centralized control of traffic signals), *development of traffic safety facilities* (improvement of traffic signals, greater use of LED traffic lights), *promotion of automatic driving, eco-driving* and car sharing)
  - Utilization of the special zones system for structural reform for global warming measures
  - Promotion of inter-ministry collaborative measures following the roadmap of global warming measures, etc.

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
Road Transport CO₂ Emissions-3

Trends in Japan's Transport Sector CO₂

CO₂ emissions in Japan’s transport sector have declined significantly since the early 2000s.
Present status of oil consumption in the transport sector in Japan

- GDP grew 2.5 times after the oil crisis (1973-2013)
- After 2000, oil consumption by the transport sector started to decrease

Countermeasures
- Improvement of fuel efficiency (development of technology, incentives by government)
- Traffic flow improvement (traffic signals, road improvements)
- Eco-driving (truck transport)
- Optimization of logistics
- Bio-fuel
- Continue many countermeasures

Source: METI: Comprehensive energy statistics
Factors Contributing to CO₂ Reduction in the Transport Sector

CO₂ reduction in the transport sector is mostly attributable to increased vehicle fuel efficiency and greater efficiency in truck use.

Current status

- Passenger cars
  - Improved vehicle fuel efficiency
  - Improved traffic flow (reduced congestion)

- Trucks
  - Greater efficiency in truck use

- Trucks
  - Eco-driving
  - Improved traffic flow

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
The integrated approach to CO₂ emissions reduction in road transport
To reduce road transport CO₂ emissions worldwide, we propose that the measures we are recommending here be adopted and implemented by the global road transport sector as “best practices,” based on our own (i.e., Japan’s) experience with them.

The integrated approach to road transport CO₂ reduction comprises four areas of effort/activity involving auto manufacturers, government, fuel suppliers, and vehicle users:
1. **Through increased vehicle fuel efficiency:**
   - Development and market introduction of fuel-efficient vehicles [Automakers]
   - Incentives for purchasing fuel-efficient vehicles [Gov’t]

2. **Through improved traffic flow:**
   - Electronic toll collection, Intelligent Transport Systems (ITS), Expressway network expansion [Gov’t]

3. **Through more efficient vehicle use:**
   - Eco-driving, Truck logistics: Eco-driving management systems, “Green Eco Project” [All stakeholders]

4. **Through diversified automotive fuel supply:**
   - EV power supply, Hydrogen fuel, biofuels [Gov’t and Fuel/energy suppliers]
The Integrated Approach to CO2 Reduction in Road Transport

Fuel-efficient vehicles
Japan’s automakers are developing new technologies for fuel-efficient conventional (internal combustion engine) vehicles and next-generation vehicles.

- **Fuel-efficient conventional vehicles**
- **Hybrid vehicles**
- **Electric vehicles**
- **Fuel-cell vehicles**
- **Clean diesel vehicles**
- **Plug-in hybrid vehicles**
Incentives for the Purchase of Fuel-Efficient Vehicles

- Replacement of older vehicles with new models is stimulated by tax incentives for fuel-efficient and low-emission vehicles that are designated (in Japan) by an environmental performance certification and labelling system.
- All vehicle types (including trucks and buses) are awarded incentives. All users can therefore choose a vehicle with high fuel efficiency.

**Japan’s Tax Incentives for Fuel-Efficient and Low-Emission Vehicles (partial listing)**

<table>
<thead>
<tr>
<th></th>
<th>Fuel Efficiency Criteria</th>
<th>Emissions Performance Criteria</th>
<th>Incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Next-Generation</strong></td>
<td>Electric (including fuel-cell), plug-in hybrid, clean diesel and natural gas vehicles</td>
<td>Emissions down by 75% from 2005 standards</td>
<td>Exempt</td>
</tr>
<tr>
<td><strong>Vehicles</strong></td>
<td>Compliant +20% with 2020 fuel efficiency standards</td>
<td></td>
<td>Exempt</td>
</tr>
<tr>
<td></td>
<td>Compliant +10% with 2020 fuel efficiency standards</td>
<td></td>
<td>Exempt</td>
</tr>
<tr>
<td><strong>Passenger Cars</strong></td>
<td>Compliant +10% with 2020 fuel efficiency standards</td>
<td>Emissions down by 75% reduction from 2005 standards</td>
<td>75% reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>75% reduction</td>
</tr>
<tr>
<td></td>
<td>Compliant +15% with 2015 fuel efficiency standards</td>
<td>Compliant with 2009 emission standards, with NOx and PM emissions down by 10% from those standards</td>
<td>Exempt</td>
</tr>
<tr>
<td></td>
<td>Compliant +10% with 2015 fuel efficiency standards</td>
<td></td>
<td>80% reduction</td>
</tr>
<tr>
<td><strong>Heavy-Duty</strong></td>
<td>Compliant +15% with 2015 fuel efficiency standards</td>
<td>Compliant with 2009 emission standards, with NOx and PM emissions down by 10% from those standards</td>
<td>Exempt</td>
</tr>
<tr>
<td><strong>Vehicles</strong></td>
<td>Compliant +10% with 2015 fuel efficiency standards</td>
<td></td>
<td>75% reduction</td>
</tr>
</tbody>
</table>
Sales of next-generation vehicles have grown significantly in Japan as a result of government incentives (purchasing subsidies and tax incentives). Incentives thus accelerate replacement of a country’s vehicle fleet with more fuel-efficient new vehicles.
The Integrated Approach to CO2 Reduction in Road Transport

Improving traffic flow
The upgrading of roads and road infrastructure, including expanding the use of Intelligent Transport Systems (ITS), alleviates congestion. Smoother traffic flow increases fuel economy and reduces CO$_2$ emissions.
Expand the Use of Intelligent Transport Systems

Electronic toll collection and a two-way road-vehicle communications system providing real-time road traffic information to drivers help reduce congestion.

- Vehicle sensors, infrared beacons: Approx. 34,000 sites
- ITS “spot” devices: Approx. 1,600 sites
- ETC gates: Approx. 1,000 sites

Reduce road congestion with real-time traffic information communication to drivers

Electronic Toll Collection (ETC)

Source: Ministry of Land, Infrastructure, Transport and Tourism
Expanding the Use of Intelligent Transport Systems

ITS provide route guidance and real-time road traffic information.

Optimal route guidance to drivers via in-vehicle screen displays

ITS provide advanced road-to-vehicle information on traffic signals.

Real-time information on status of signals

Real-time wide-area information on status of signals and traffic flow

Source: Ministry of Land, Infrastructure, Transport and Tourism

Source: Japan Automobile Research Institute

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
Expanding the Use of Intelligent Transport Systems

Real-time traffic flow control and information delivery

Congestion avoidance warnings:
“Maintain speed,”
“Keep distance to vehicle ahead”

(In case of congestion build-up)

Real-time traffic flow control:
Posting of speed limits, notification of lane-changing restrictions

On-screen notification to use shoulder lane

(Congestion eliminated, normal traffic flow restored)

Real-time traffic information delivery

On-road driver information

“Congestion ahead”

“Incline ahead, increase speed”

Source: NEXCO Higashinihon
The Integrated Approach to CO2 Reduction in Road Transport

Eco-driving activities in Japan
Promoting Eco-driving

On-road CO₂ emissions are estimated to decrease by about 10% with the adoption of eco-driving.

Four kinds of happiness to be derived from eco-driving

**Profitable!**
Fuel efficiency improves by about 10%!

**Safe!**
Traffic accidents are just about halved!

**Ecological!**
CO₂ reduced by about 10 million tons in Japan!

**Fantastic!**
Eco-driving increases credibility!
Promotion of Eco-driving in Japan

Eco-driving is promoted in Japan with in-vehicle systems for real-time monitoring of fuel efficiency performance and by means of dedicated awareness-raising activities.

Onboard equipment for eco-driving

Eco-driving awareness-raising event at the Tokyo Motor Show

Eco-driving promotion by Japan’s Ministry of the Environment

Eco-driving promotional campaigns conducted by local governments and organizations
Japan’s Ongoing Promotion of Eco-driving

In Japan, eco-driving has been widely adopted by truck fleet operators and drivers because it also helps reduce operational costs. The adoption of eco-driving practices by passenger car drivers is being actively promoted on an ongoing basis.

Ten Tips for Fuel-Conserving Ecodriving (as promoted in Japan)

1. Accelerate gently.
2. Maintain a steady speed and keep your distance.
3. Slow down by releasing the accelerator.
4. Make appropriate use of your air conditioner.
5. Don’t warm up or idle your engine.
6. Plan your itinerary to avoid congested routes.
7. Check your tire pressure regularly.
8. Reduce your load.
9. Respect parking rules and regulations.
10. Check the readings on your fuel efficiency-monitoring equipment.
Eco-driving Management Systems (“EMS”)

Results of EMS implementation:
Fuel consumption down by an average of 26.3% (according to MLIT survey)
- Rapid adoption of eco-driving practices by drivers
- Reduced fuel costs
- Greater safety in truck operation, reduced accident occurrence
- Reduced maintenance costs

Onboard eco-driving equipment
(Subsidized by MLIT)

Insertion of memory card

During driving

In-vehicle excessive speed warnings, commands to shut down engine (idling prevention)

Truck operation

Company HQ

Data relay

Data viewing

Evaluation of all driving behavior

Eco-driving training course

Guidance

Evaluation results-based guidance to driver by eco-driving manager
“Green Eco Project” (Tokyo Tracking Association)

Managing Better through Environmental CSR

Green Eco Project

~What we can do for our future~

Paper-and-pencil project

Achievement made in last 8 years

- Fuel efficiency progress rate: 15.6% improvement in average in 8 years
- Corresponding value in CO2: Amount of fuel reduced equivalent to about 4,480,000 cedar trees
- Amount of fuel reduction: about 24,000 kℓ
- Decreasing rate of traffic accidents: 28.2% lowered in average in 8 years

3,500 Companies are members of TTA
Started in 2006 with 25 Companies with 549 Trucks

Currently 639 companies with 18,971 trucks

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
“Green Eco Project” (Tokyo Trucking Association : TTA)

Fuel efficiency competition between members, annual award of ☆ to ☆☆☆ ratings.

Application and Evaluation

- Record the volume of fuel and distance traveled at every refueling by each truck, and submit data monthly to TTA.
- TTA evaluates ranking in each classification (weight & type of truck) every year and gives 3 ratings ☆ to ☆☆☆ for companies with good results.

Result

- They can use the rating for their business, indicating the rating on a sticker on the trucks.
The Integrated Approach to CO2 Reduction in Road Transport

Change in trucks use from private to business
Change in truck use from private to business

**Company**

Products

Private trucks

Costs
- Driver cost
- Vehicle purchase
- Maintenance, repair
- Fuel & toll road cost
- Insurance, tax
- Parking area
- Risk
- Accident

**Company**

Products

Outsourcing

Transportation Company

- Transportation fee
  Eg: 71% cost saving

**CO₂ reduction 1/7**

**Cost reduction 1/3**

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.
The Integrated Approach to CO2 Reduction in Road Transport

Collaborative logistics
Collaborative logistics

- The **logistics efficiency law** was enforced in October 2005 and revised in February 2016 to realize green logistics.

- **Advantage** for logistics companies
  - Tax reduction, integration and simplification of many applications, deregulation and financing support for medium and small companies
  - 221 collaborative logistics companies submitted applications and approved by MLIT

Source: MLIT
Eco-sticker
(Labeling of fuel efficiency)
Labeling of fuel efficiency

How is Fuel Efficiency 20.0km/L certified?

Vehicles are tested according to the FE test method set by the government, who checks the results, and certifies their FE.

For fair measurement, vehicles are placed on running equipment and are driven according to a predetermined running pattern.

FE Test
A vehicle fixed on running equipment is operated by a test driver. The rotation of the tires is conveyed to the rollers of the equipment, thus simulating on-road driving.

FE Test Cycle
The New European Driving Cycle (NEDC) is designed to measure the emission levels and fuel efficiency values of passenger cars. This test cycle has also been adopted by ASEAN countries.

You can consider certified FE roughly the same as the mileage obtained when your car is driven along a flat, straight road without turning on the air conditioner and lights.
Labeling of fuel efficiency

Is something wrong if my FE is different from the certified FE?

No, nothing’s wrong. It’s natural that your on-road FE is not the same as the certified FE.

Even vehicles of the same model give different on-road FE values, depending on how and where they are used by each driver. Certified FE is just the baseline obtained under a certain driving condition.

It is surprising that even vehicles of the same model are so widely different in their on-road FE.
Labeling of fuel efficiency

How wide is the gap between certified FE and on-road FE?

On-road FE scores lower than certified FE, depending on the vehicle operating environment, electric equipment usage, and driving habits.

*Electric equipment includes air conditioners, navigation systems, audio, lights and wipers used for purposes other than tire rotation.

FE varies according to the vehicle operation environment, the use of electric equipment, and driving practice. Certified FE value is measured by the test without the use of the vehicle’s electric equipment.

On-road FE values vary even among vehicles of the same model, and are affected by diverse factors.
Labeling of fuel efficiency

Let’s set the air conditioner to a moderate temperature!

- When the air conditioner is on, the car’s FE is down more than 10%.
- Do not excessively cool the cabin by setting the target temperature too low.

---

Manual air conditioners: Lower the fan level
Automatic air conditioners: Set the target temperature closer to the outdoor temperature (The higher the outdoor temperature, the lower the FE due to increased electricity and fuel consumption.)

Outdoor temperature: 25°C
Minimum
Fan level of air conditioner
Maximum

(C) Copyright Japan Automobile Manufacturers Association, Inc., All rights reserved.