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Economic Cooperation**

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Reducing CO2 Emissions in Road Transport Sector

Submitted by: Japan Automobile Manufacturers Association (JAMA)



**APEC Cooperative Energy Efficiency
Design for Sustainability - Energy Efficient
Urban Passenger Transportation
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Reducing CO₂ Emissions in Road Transport Sector



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**Japan Automobile Manufacturers Association, Inc.
San Francisco, September 15, 2011**

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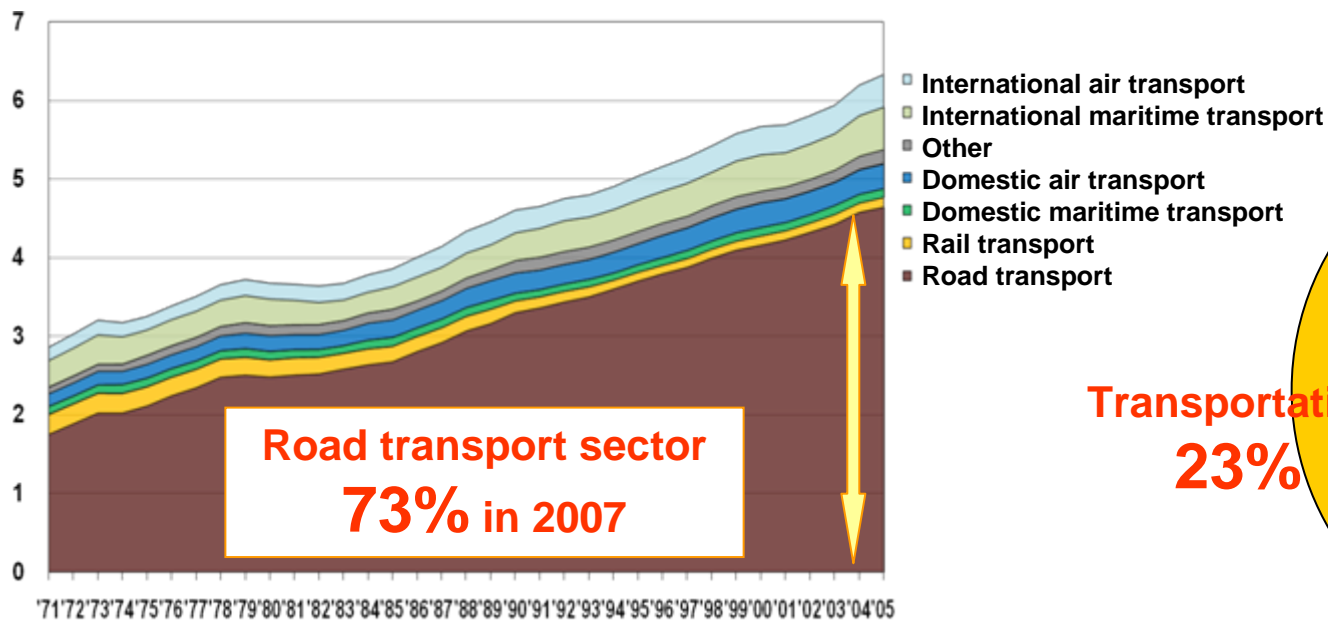
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1. Introduction

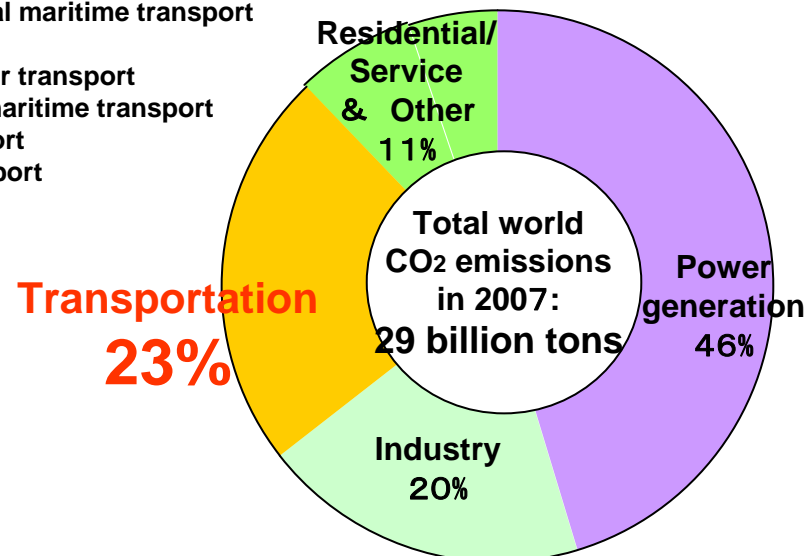
◆Transport sector

- Steady increase to **29 billion tons** in CO2 emissions
- **23%** of total worldwide CO2 emissions in 2007
- **73%** was generated by road transport.

CO2 Emissions in the Global Transport Sector



World CO2 Emissions by Sector



Source: World Energy Outlook 2009,
International Energy Agency

◆ Promoting Sustainability in the Road Transport Sector

◆ Improving Air Quality

Through a significant reduction of tailpipe-emitted pollutants

◆ Countering Global Warming

Through a significant reduction of CO2 emissions

◆ Conserving Energy

Through new energy policies for the oil-dependent transport sector
(e.g. the development and supply of alternative fuels)



The challenges for sustainable solutions in these three areas

◆ Integrated Approach Promotion

Driving Sustainability through an **Integrated Approach**

2. Cause and Countermeasure of CO₂

◆ Calculating CO₂ Emission Volumes in the Road Transport Sector

Emissions intensity : Fuel efficiency performance

Activity volume : Total distance travelled

$$\text{CO}_2 \text{ emissions} = \boxed{\text{Emissions intensity}} \times \boxed{\text{Activity volume}}$$

$$= \boxed{\text{On-road fuel efficiency}} \times \boxed{\text{CO}_2 \text{ emissions coefficient}} \times \boxed{\text{Total distance travelled}}$$

$$= \boxed{\text{Certified fuel efficiency (km/ℓ)}^{-1}} \times \boxed{\text{Travelling coefficient}} \times \boxed{\text{CO}_2 \text{ emissions coefficient (gCO}_2\text{/ℓ)}} \times \boxed{\text{Total distance travelled (v-km)}}$$

Improved by
Automotive Technologies

Improved by
**Congestion Mitigation
& Eco-Driving**

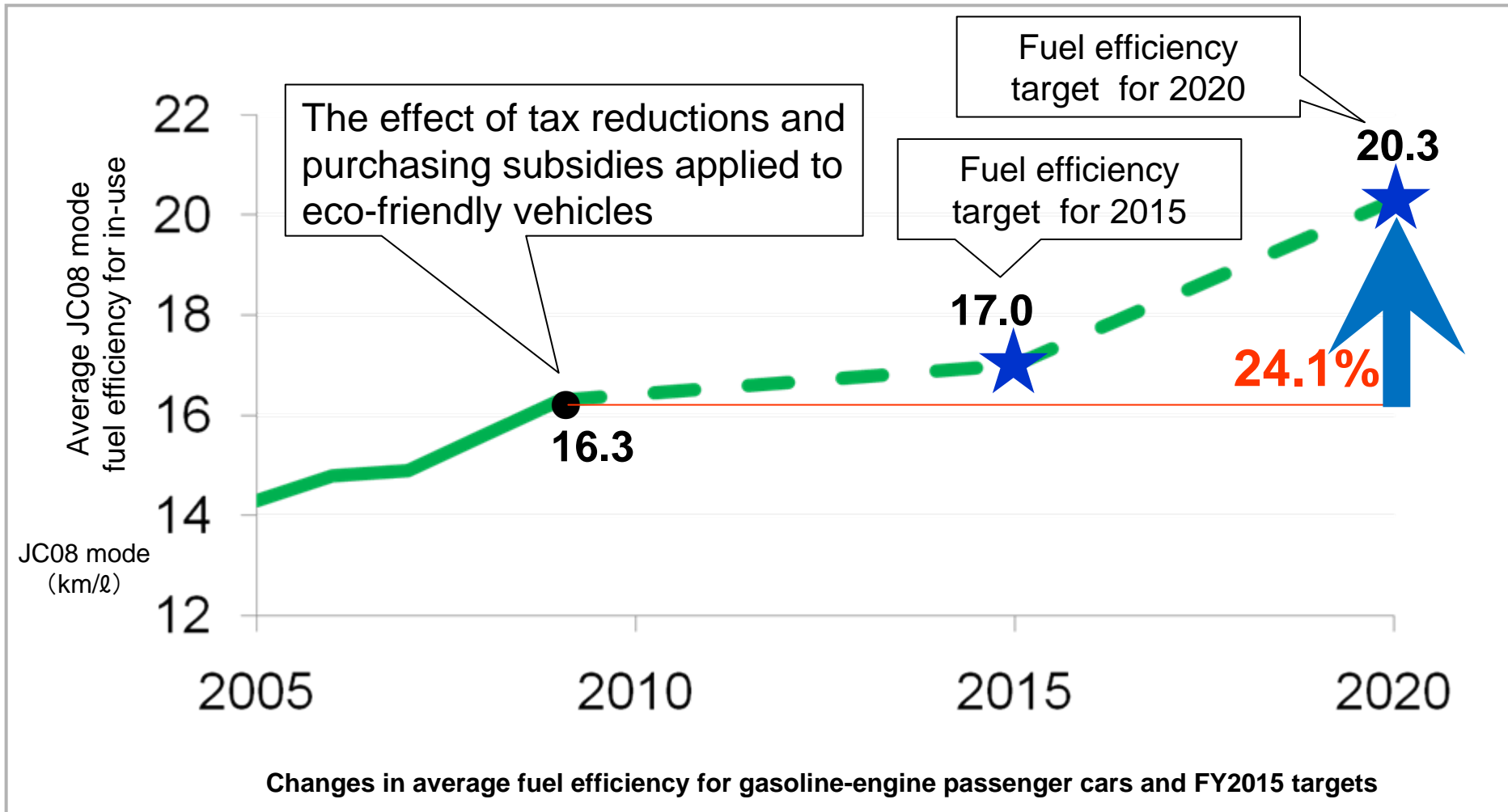
Improved by
Bio-Fuels

Improved by
Modal Shifts

- Notes:
1. km/ℓ: Kilometer/liter are the units of measurement used in Japan.
 2. "Travelling coefficient" represents the ratio of on-road fuel efficiency and certified fuel efficiency based on averages of all in-use vehicles.
 3. v-km: Vehicle-kilometers.

◆ Improving Vehicle Fuel Efficiency

- **24.1%** increased compared by 2009 in 2020 includes Next- Generation Vehicles.
- The effect of tax reductions and purchasing subsidies applied to eco-friendly vehicles.
- The actual fuel efficiency improvement achieved to **16.3km/l** in 2009 in Japan.

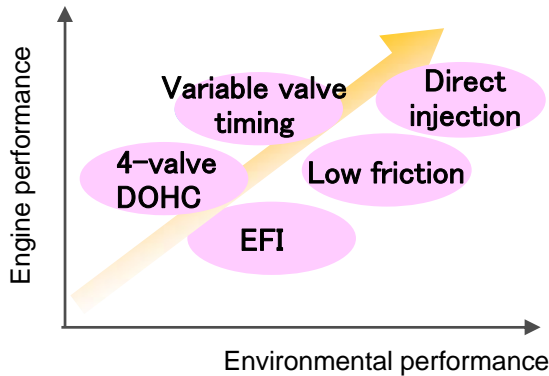


◆ Adopted Technologies

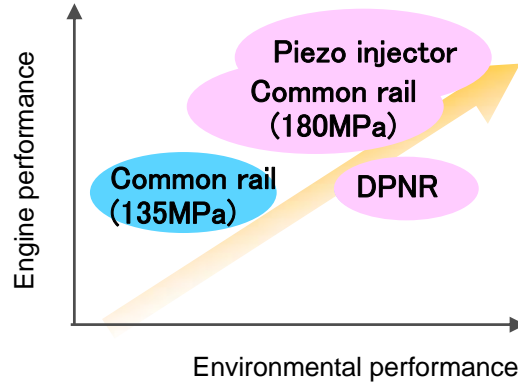
- Fuel efficiency improvement is achieved through step-by-step advances in technology.

Improved Engine Efficiency

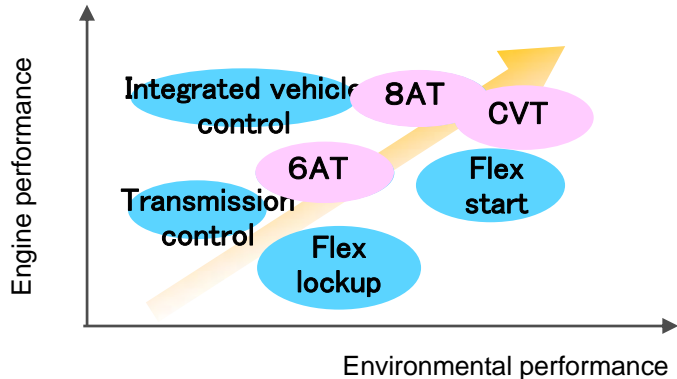
Gasoline Engine



Diesel Engine



Improved Drive System

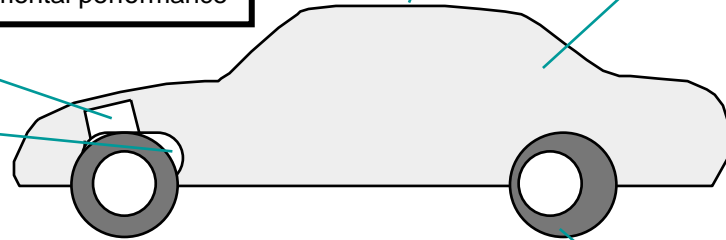


Improved Aerodynamics

Improved body configuration

Reduced Vehicle Weight

Expanded use of lightweight materials
Improved body structure



Other

Electric power steering
Idling prevention
Hybridization

Reduced Rolling Resistance

Low rolling-resistance tires

◆ Current & Next-Generation Alternative-Energy Vehicles

- Next generation vehicles are expanded to **26/571** models in 2009.



Flex-Fuel Vehicle



Electric Vehicle



Electric Vehicle



Hybrid Vehicle



Fuel Cell Vehicle



Natural Gas Vehicle



Plug-In Hybrid Vehicle



Clean-Diesel Vehicle

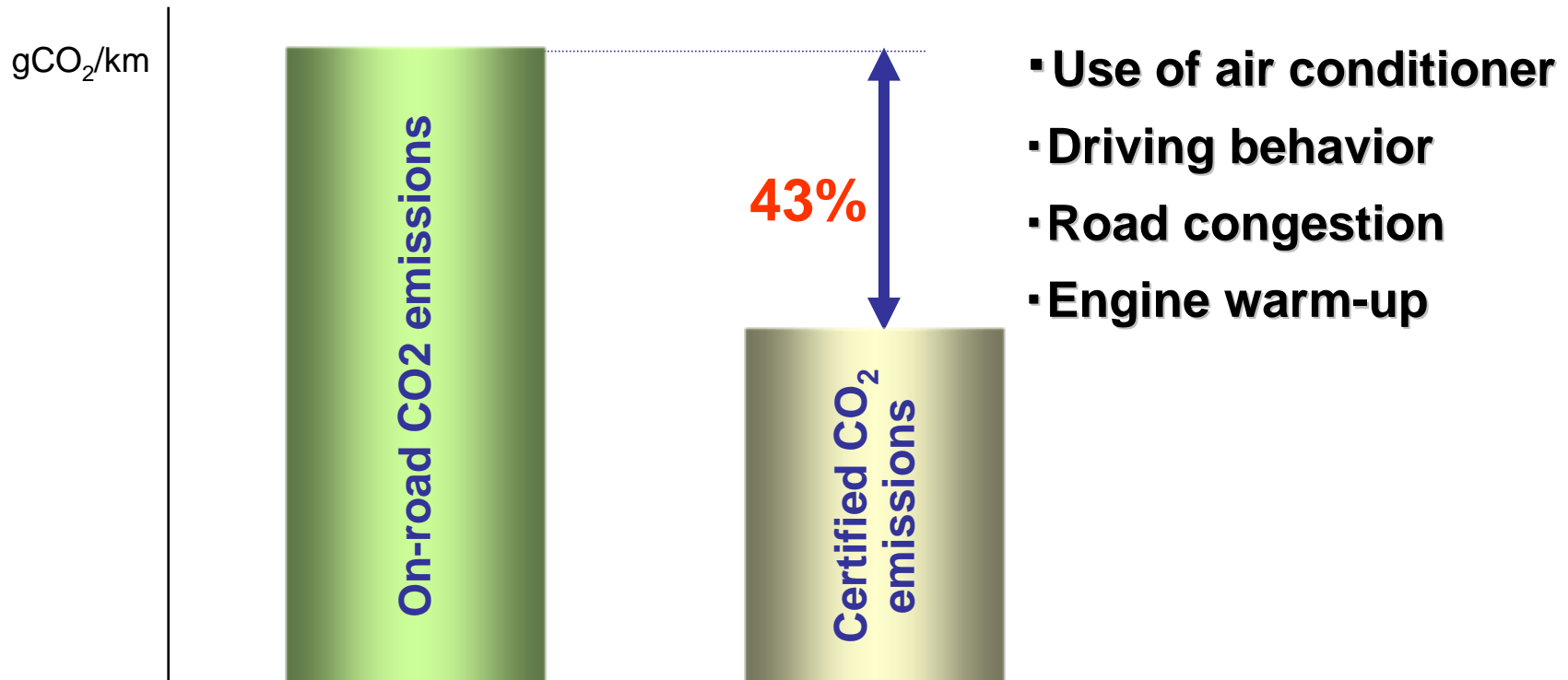


Hydrogen Vehicle

◆ The Travelling Coefficient

$\text{CO}_2 = \text{Fuel efficiency} \times \text{Travelling coefficient} \times \text{CO}_2 \text{ emissions coefficient} \times \text{Total distance travelled}$

$$\text{Travelling coefficient} = \frac{\text{On-road CO}_2 \text{ emissions}}{\text{Certified CO}_2 \text{ emissions}}$$

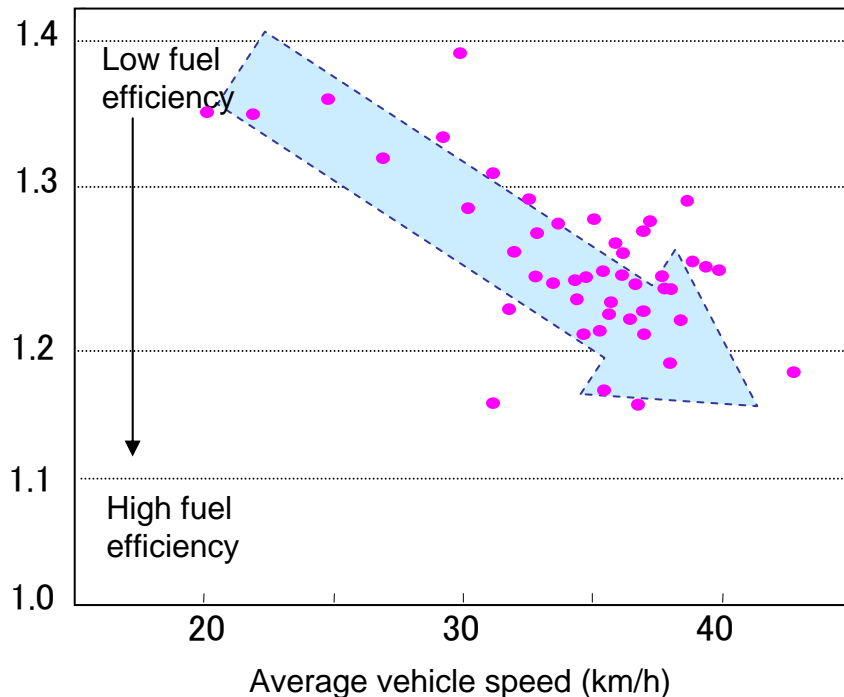


3. Success Case in reducing CO2 in Japan

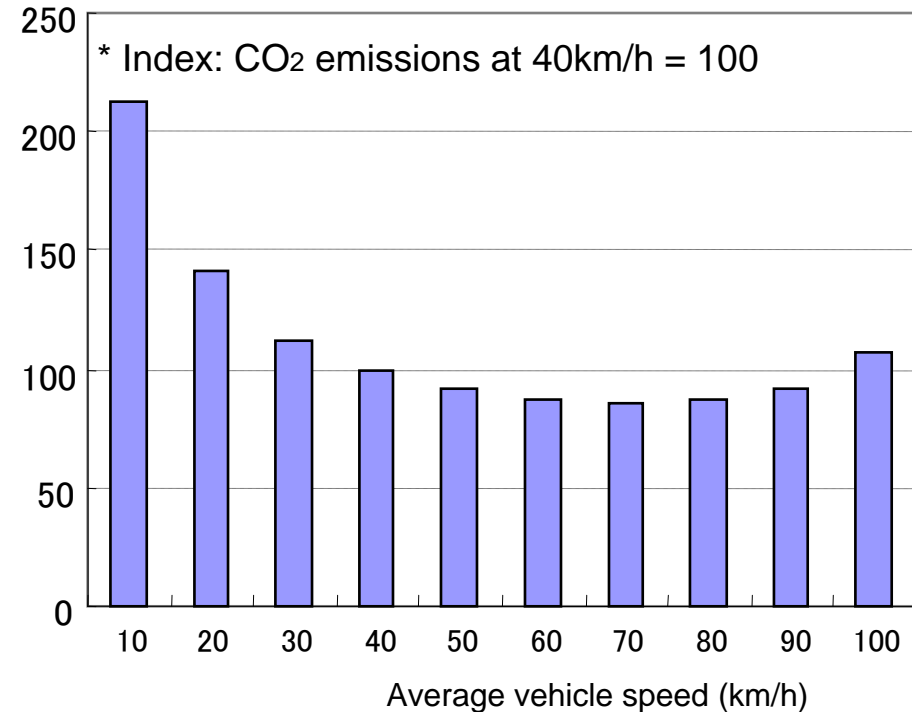
◆ Upgrading Road Infrastructure

- Improved road traffic flow increases vehicle travelling speed,
- Upgrading road networks and infrastructure to reduced road transport CO2 emissions.

Travelling Coefficient Values in Congested Traffic (Japan Case Study)



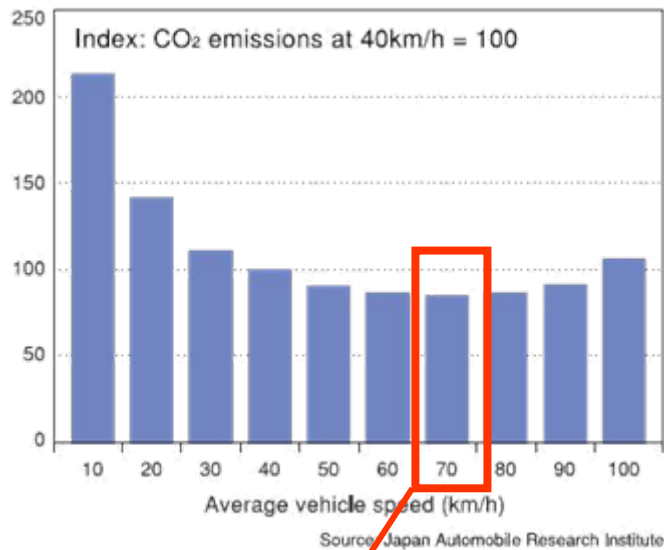
Impact of Vehicle Speed on CO2 Emissions



◆ Improved traffic flow

- JAMA calculated CO2 reduction by new bypass road as **20kt-CO2** per year with our transportation static data.

Impact of Vehicle Speed on CO₂ Emissions



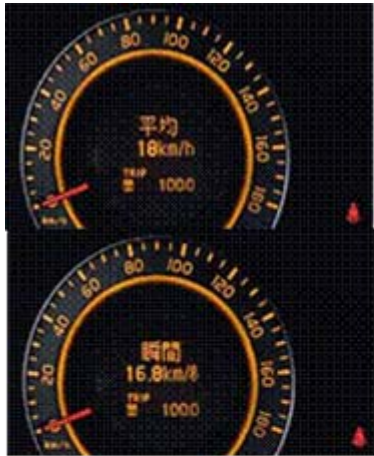
70km/h

A Tokyo Case Study



◆ Onboard Equipment for Eco-driving

- Wide variety of eco-driving support tools are being installed.



◆ Customers

- Wider use of low-carbon vehicles
- Eco-driving

Ten tips for eco-driving being promoted in Japan

1. Accelerate gently
2. Maintain a steady speed
3. Slow down by releasing the accelerator
4. Limit the use of your air conditioner
5. Don't idle your engine
6. Don't warm up your engine before starting off
7. Know your itinerary
8. Check your tire pressure regularly
9. Reduce your load
10. Respect parking regulations



◆ Benefits of Eco-driving

- On-road CO₂ emissions are estimated to decrease by roughly **10%** through the adoption of fuel-conserving eco-driving practices.

Impacts on Vehicle Fuel Efficiency of Selected International Eco-driving Program Initiatives

Country	Scope of Initiative	Impact (Short-Term)	Impact (Mid-Term)
Netherlands	National	Up 10-20%	Up 5-10%
Austria	National	Up 10-15%	Up 5-10%
Japan	-Driver training courses -Eco-driving contests	Up 12% Up 25%	
Germany	-National (new drivers) -Professional fleet drivers	Up 6-10%	Up 6-10% Up 6-8%
	-Passenger-car driver training courses	Up 10-25%	Up 10-15%
UK	Fleet operators/drivers	Up 10%	

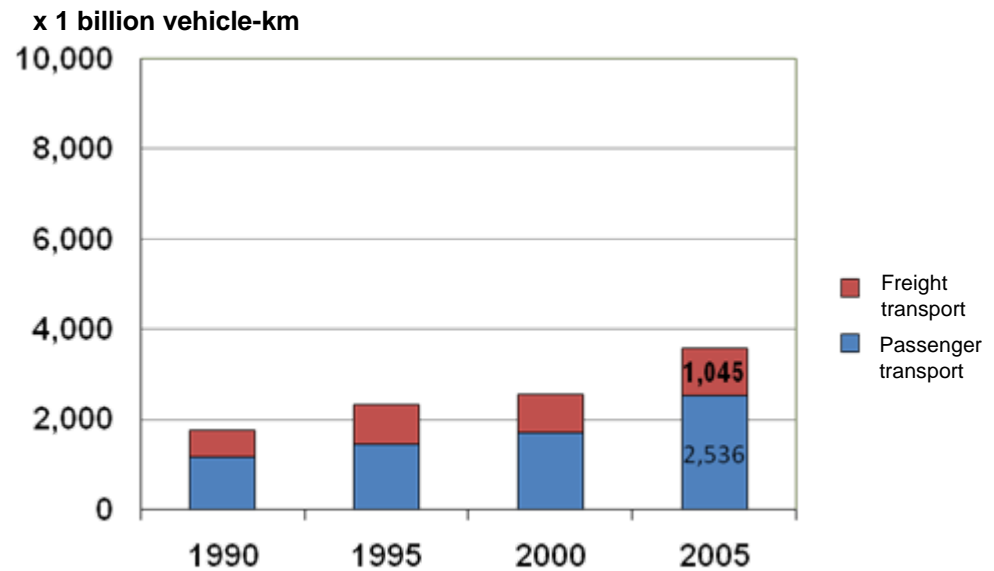
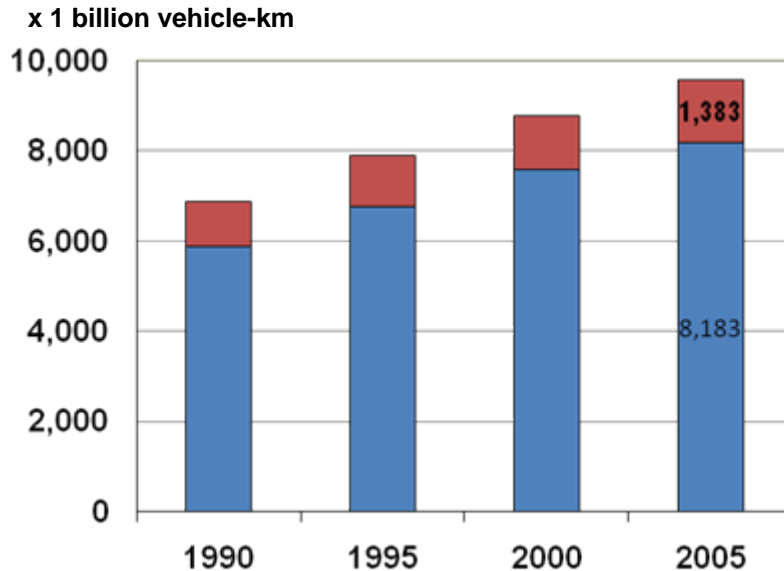
Source: Workshop on Ecodriving, *International Energy Agency (2007)*

◆ The Total Distance Travelled by Automobiles Worldwide

- Over **13 trillion vehicle-km**
- The ratio of passenger transport and freight transport was roughly 8 to 2.

OECD Member Countries, 2005
(73% of global v-km)

OECD Non-Member Countries, 2005
(27% of global v-km)

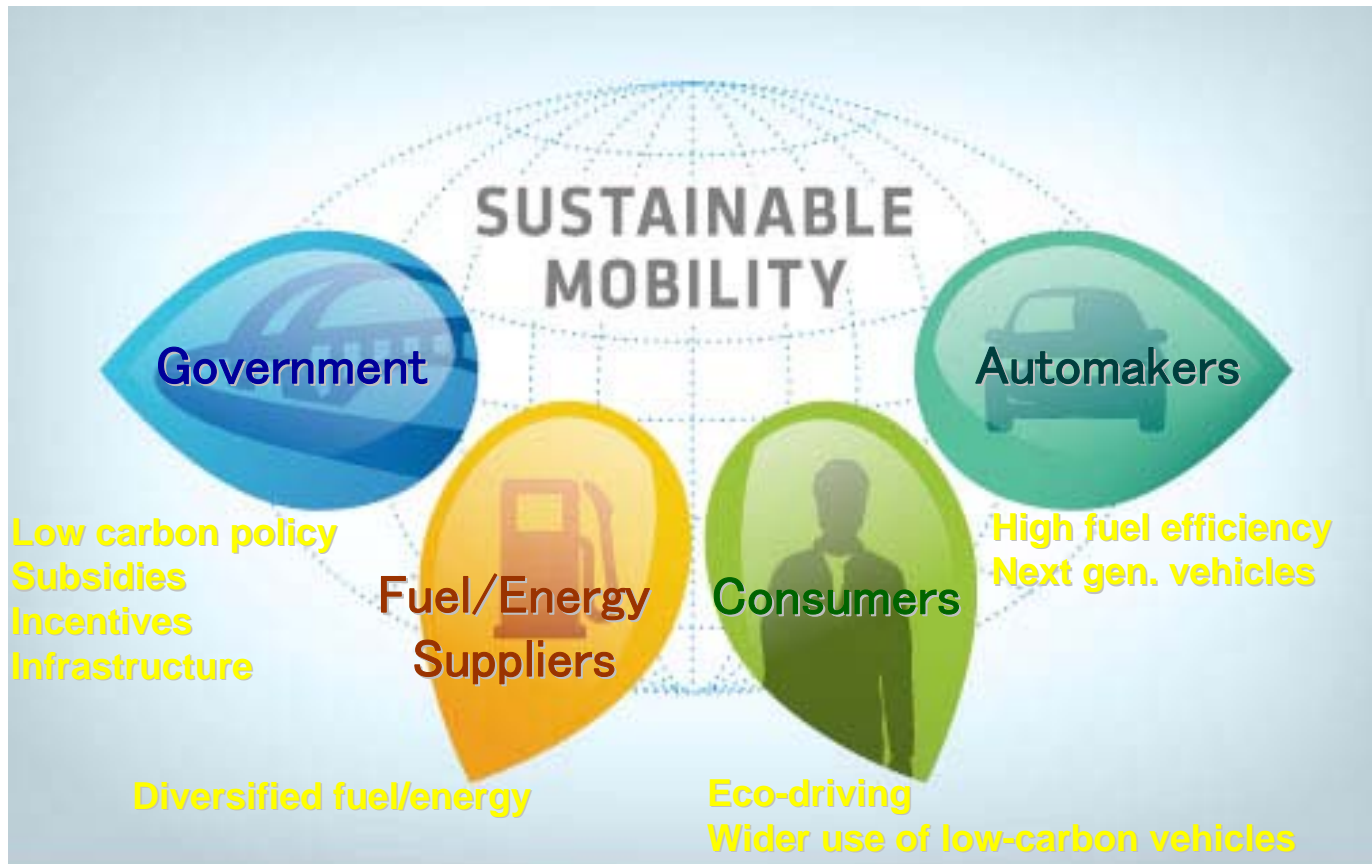


Note: Figures are JAMA estimates, based on the following sources: Environmental Data Compendium (for 2006-2007), *OECD*; Energy Balances of Non-OECD Countries (for 2004-2005), *OECD-International Energy Agency*; World Motor Vehicle Statistics (Vol. 7, 2008), *JAMA*; Yearbook of Survey on Motor Vehicle Transport (Vol. 44, No. 13, 2007), *Ministry of Land, Infrastructure and Transport (Japan)*.

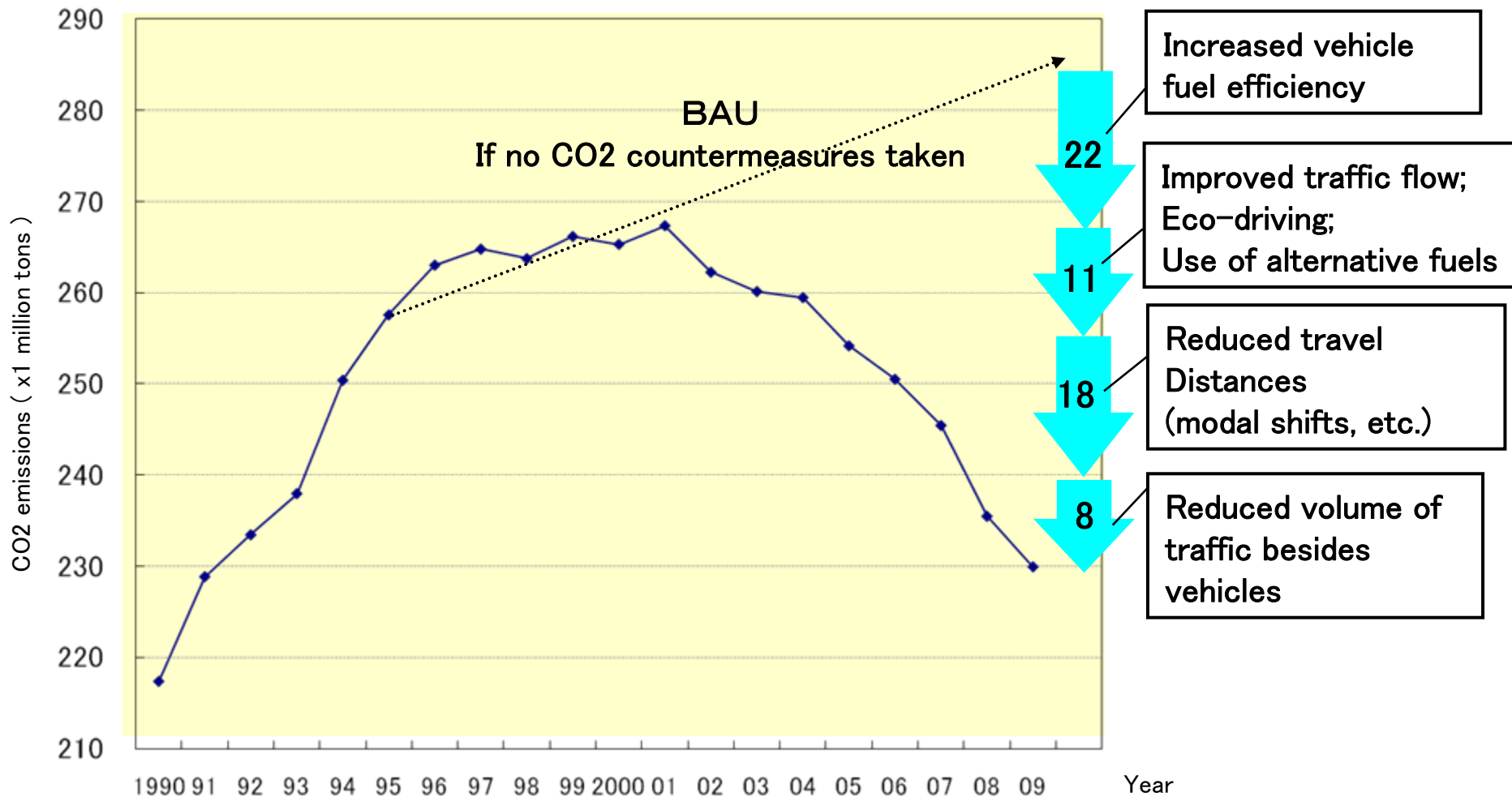
Proposal for Integrated Approach

◆ Integrated Approach Promotion

Driving Sustainability through an Integrated Approach



◆ Factors in CO2 Emission Reduction in Japan's Transport Sector



◆ Government -Policy, Subsidy, Incentives, Infrastructures

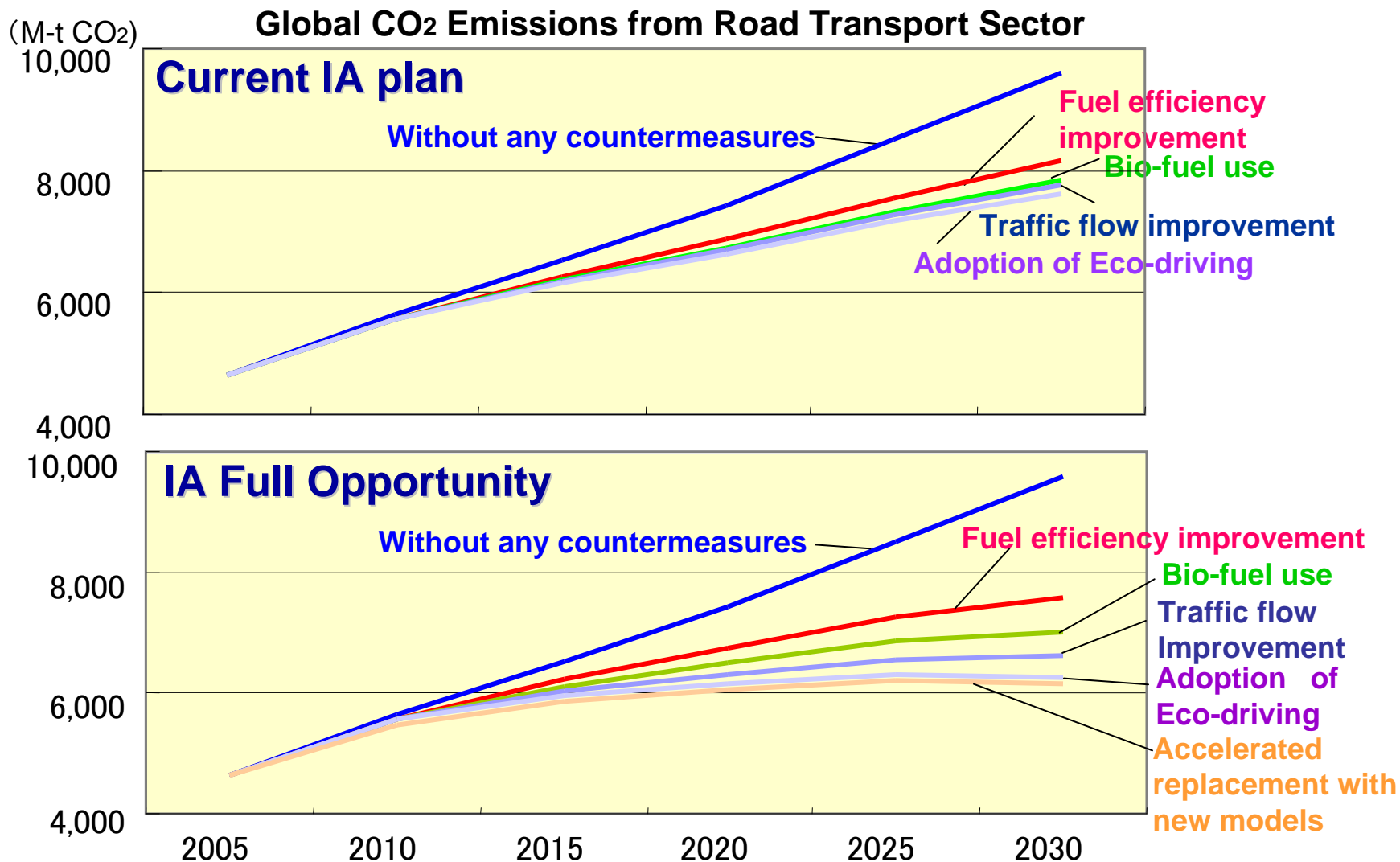
- Fuel Efficiency Standards
 - Adoption of fuel efficiency standards in all countries
- Fuel-Efficient Vehicles Promotion
 - TAX incentives
 - Purchase subsidy
- Acceleration of Replacement with New-Model Vehicles
 - Replacement incentives
- Traffic flow Improvement
 - Intelligent transportation systems (i.e. route guidance, signal control)
 - Traffic flow design initiative for new cities
- Infrastructures for next generation vehicles
 - Battery charge stations
 - Smart grid
 - Hydrogen supply stations

◆ Fuel / Energy Suppliers -Diversified fuel/energy

- High Quality of Conventional Fuels
- Low Carbon Fuels and Energies
 - Bio-fuels, Cellulosic bio-ethanol fuels and Biomass to liquid fuels
 - Electric power with renewable energy

◆ Assumption of Integrated Approach Effectiveness

- Peaked out Global CO₂ from road transportation sector with the integrated approach implementation.



Thank you

Japan Automobile Manufacturers Association, Inc.

<http://www.jama.or.jp>