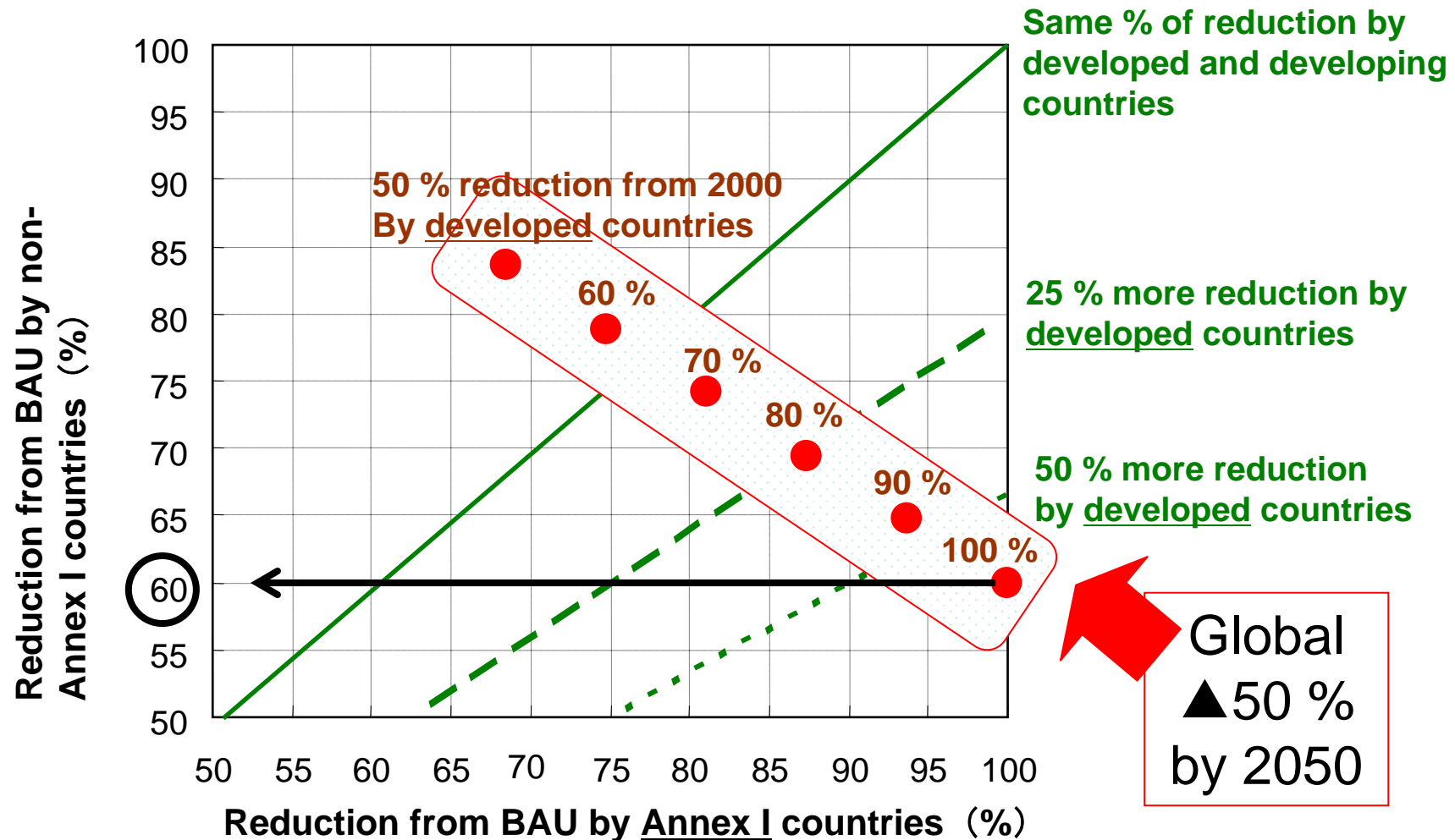


Views on Road Transport Sectoral Approach

November 17, 2008

Masayuki Sasanouchi
Toyota Motor Corporation

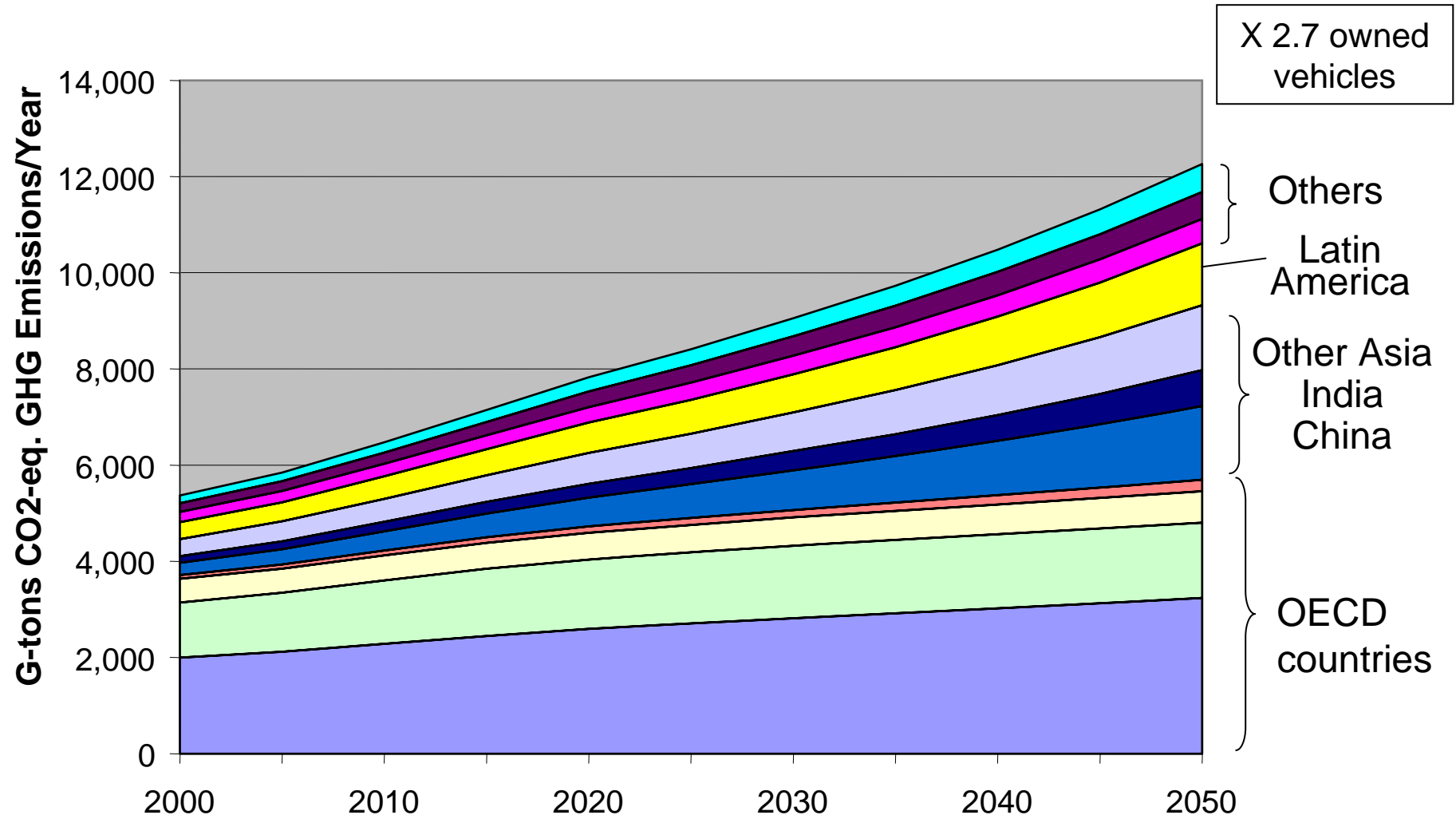
What is Differentiated Responsibilities to Achieve 50 by 50 ?



Should developed countries realize no emission, developing countries would still need to reduce 60% from BAU emission in 2050.

(Source: Akimoto, RITE, Yamaguchi, Tokyo University)

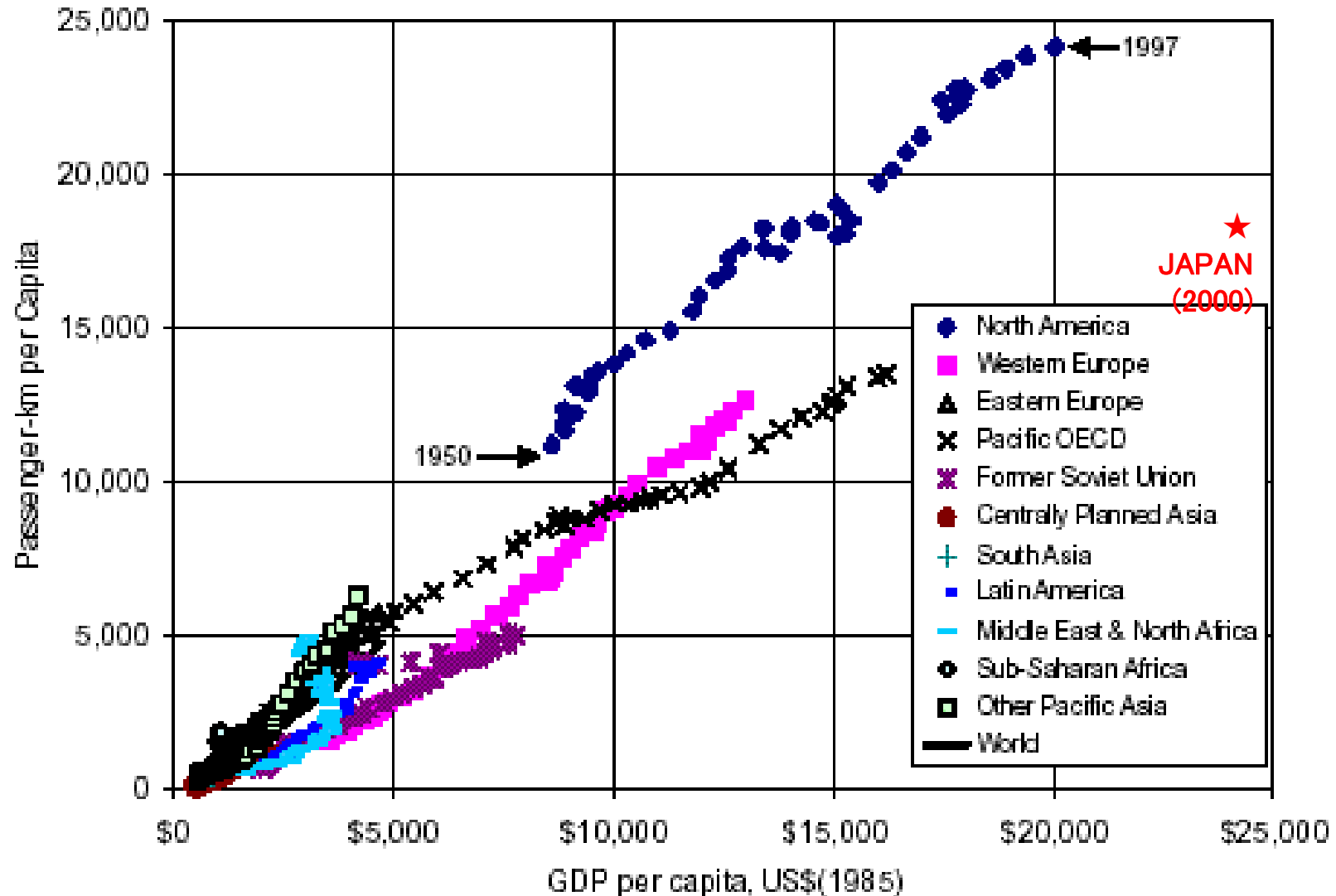
Transportation Vehicle CO₂ Emissions by Region



Source: Mobility 2030, WBCSD

Passenger Travel & GDP by Region

Passenger Travel and GDP by Region: 1950-1997¹



Source: Updated data based on Schafer (1998), Mobility 2001 WBCSD

Factoring the Total CO₂ Emission to Take Measures

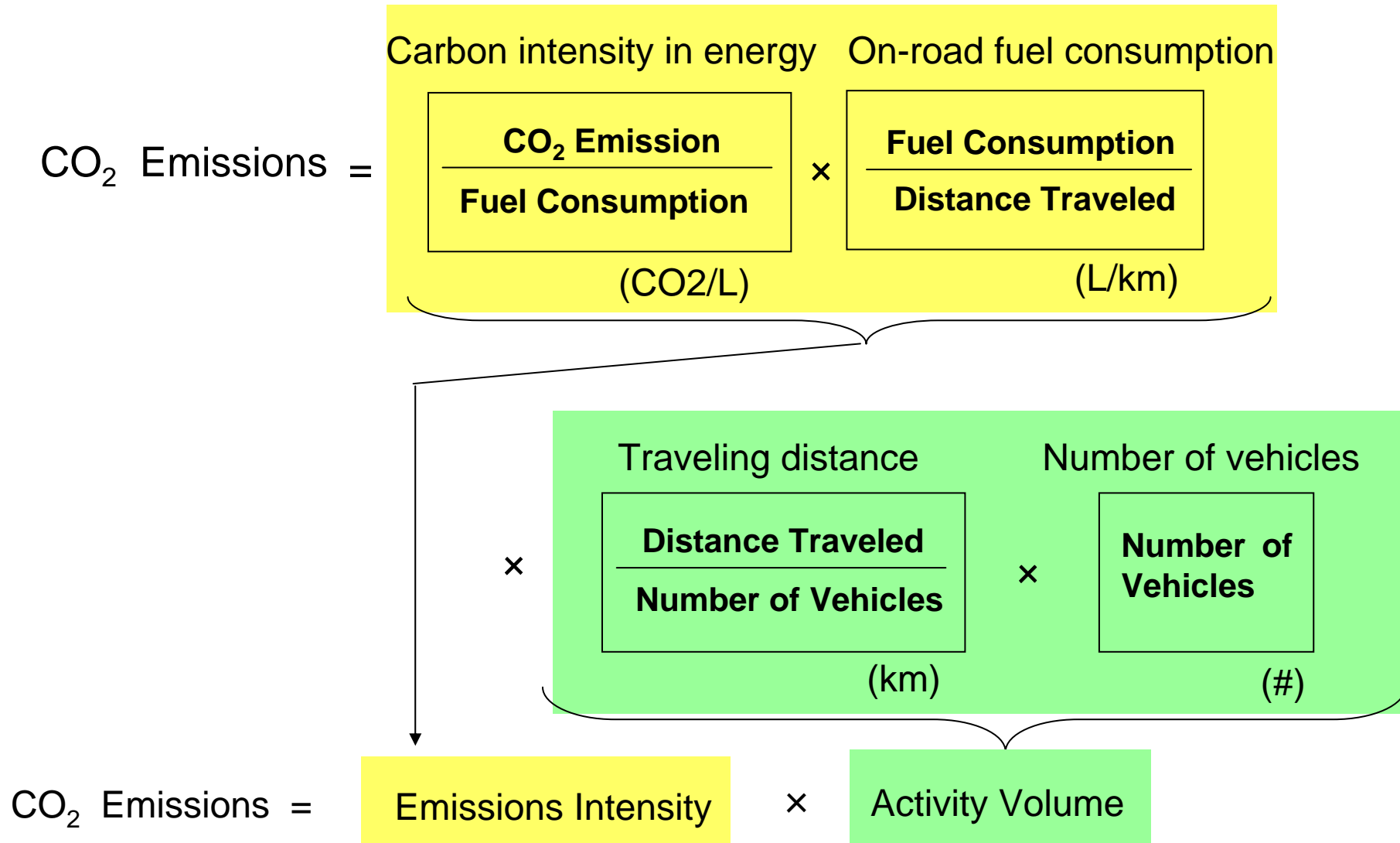
Anthropogenic CO₂ emissions can be factored into the product of emissions intensity and activity volume.

The Kaya Identity

$$\text{CO}_2 \text{ Emissions} = \frac{\text{CO}_2 \text{ Emissions}}{\text{Energy Consumption}} \times \frac{\text{Energy Consumption}}{\text{GDP}} \times \frac{\text{GDP}}{\text{Capita}} \times \text{Population}$$

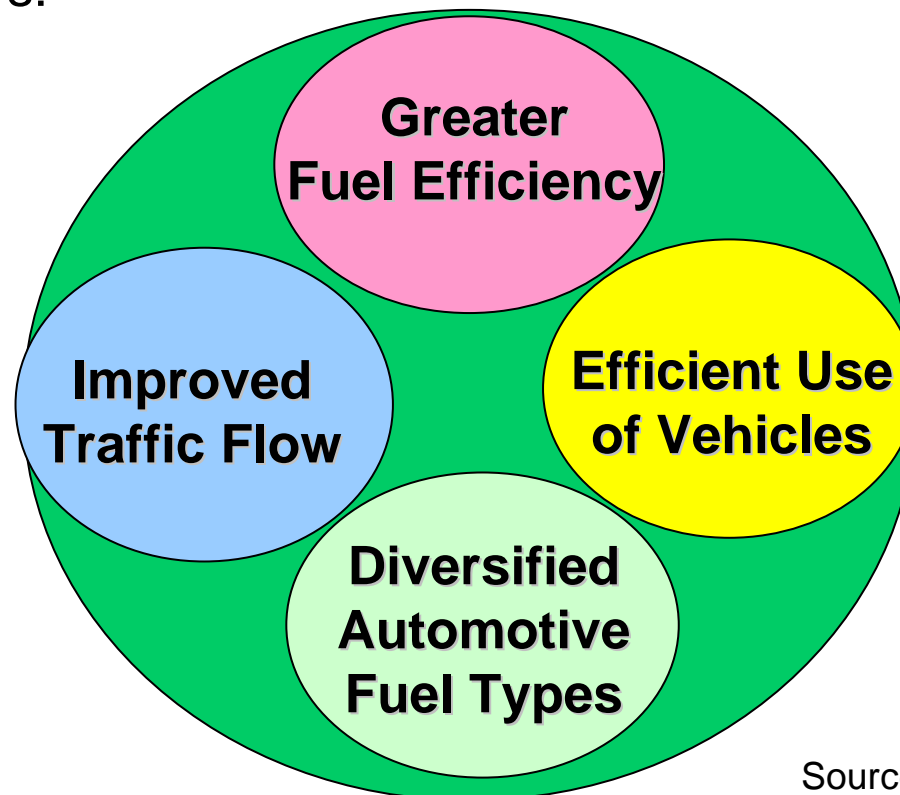
$$\text{CO}_2 \text{ Emissions} = \text{Emissions Intensity} \times \text{Activity Volume}$$

Factoring CO₂ Emission in the Road Transport Sector



Importance of Integrated Approach

JAMA (Japan Automobile Manufacturers Association) has promoted sectoral approach for reducing CO₂ emissions in the global road transportation sector. JAMA proposes that sectoral approach should comprise four areas of effort/activity involving automobile manufacturers, government, fuel suppliers and vehicle users:

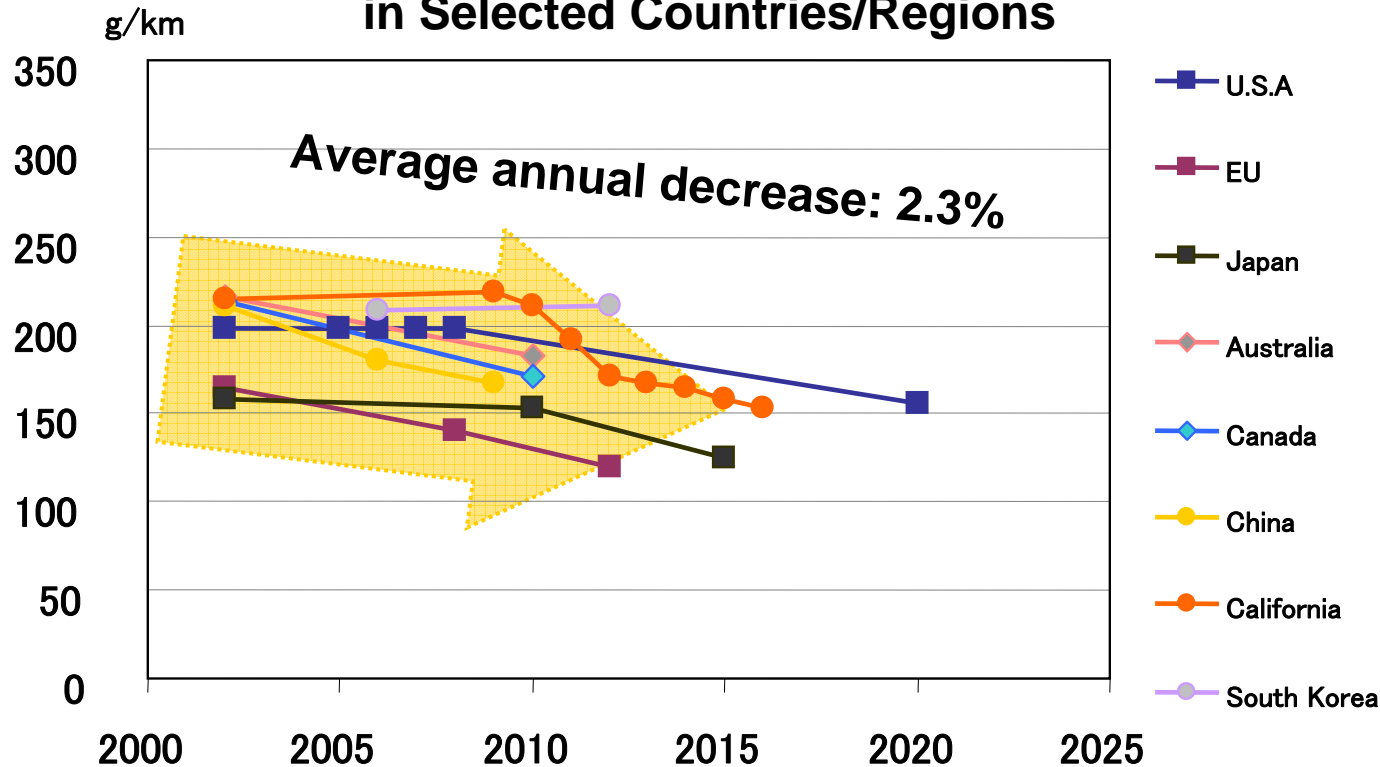


Source: JAMA

$$\text{Emissions intensity} = \frac{\text{CO}_2}{\text{Fuel}} \times \frac{\text{Fuel}}{\text{Distance}}$$

CO₂ (g/km) in Countries With Fuel Efficiency Standard

Projected CO₂ Emissions for New Passenger Cars
in Selected Countries/Regions

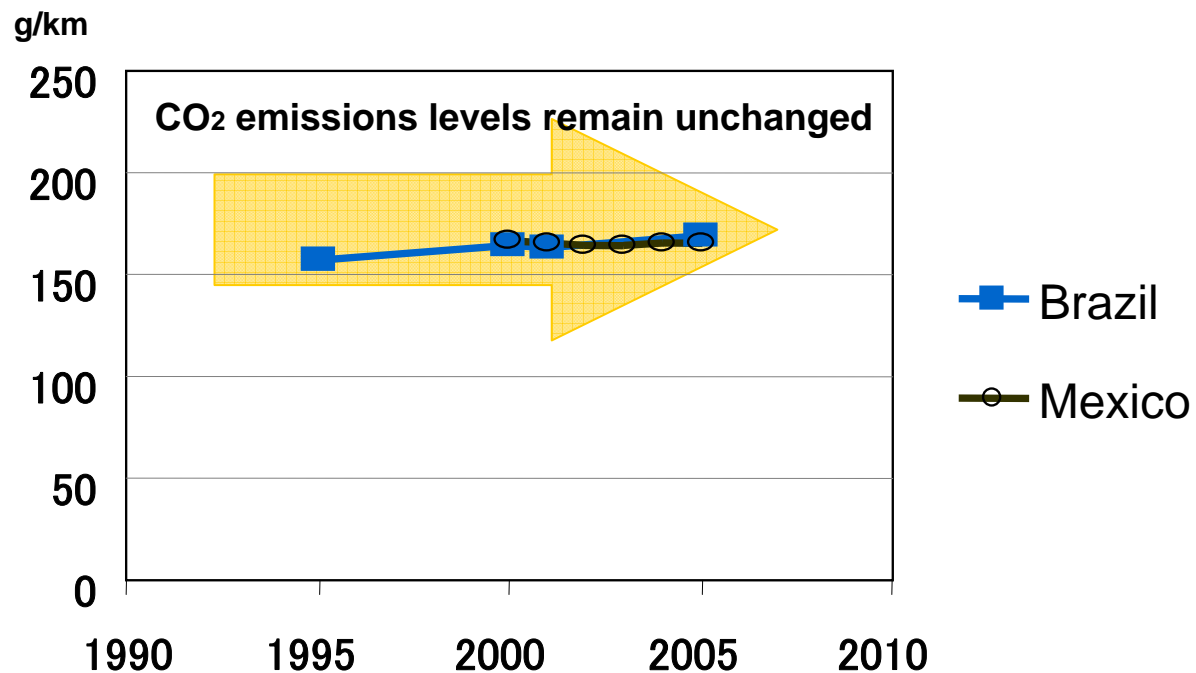


Source: Adapted from Comparison of Passenger Vehicle Fuel Economy and Greenhouse Gas Emission Standards Around the World by Feng An and A. Sauer, Pew Center on Global Climate Change (2004)

$$\text{Emissions intensity} = \frac{\text{CO}_2}{\text{Fuel}} \times \frac{\text{Fuel}}{\text{Distance}}$$

CO₂ (g/km) in Countries Without Fuel Efficiency Standard

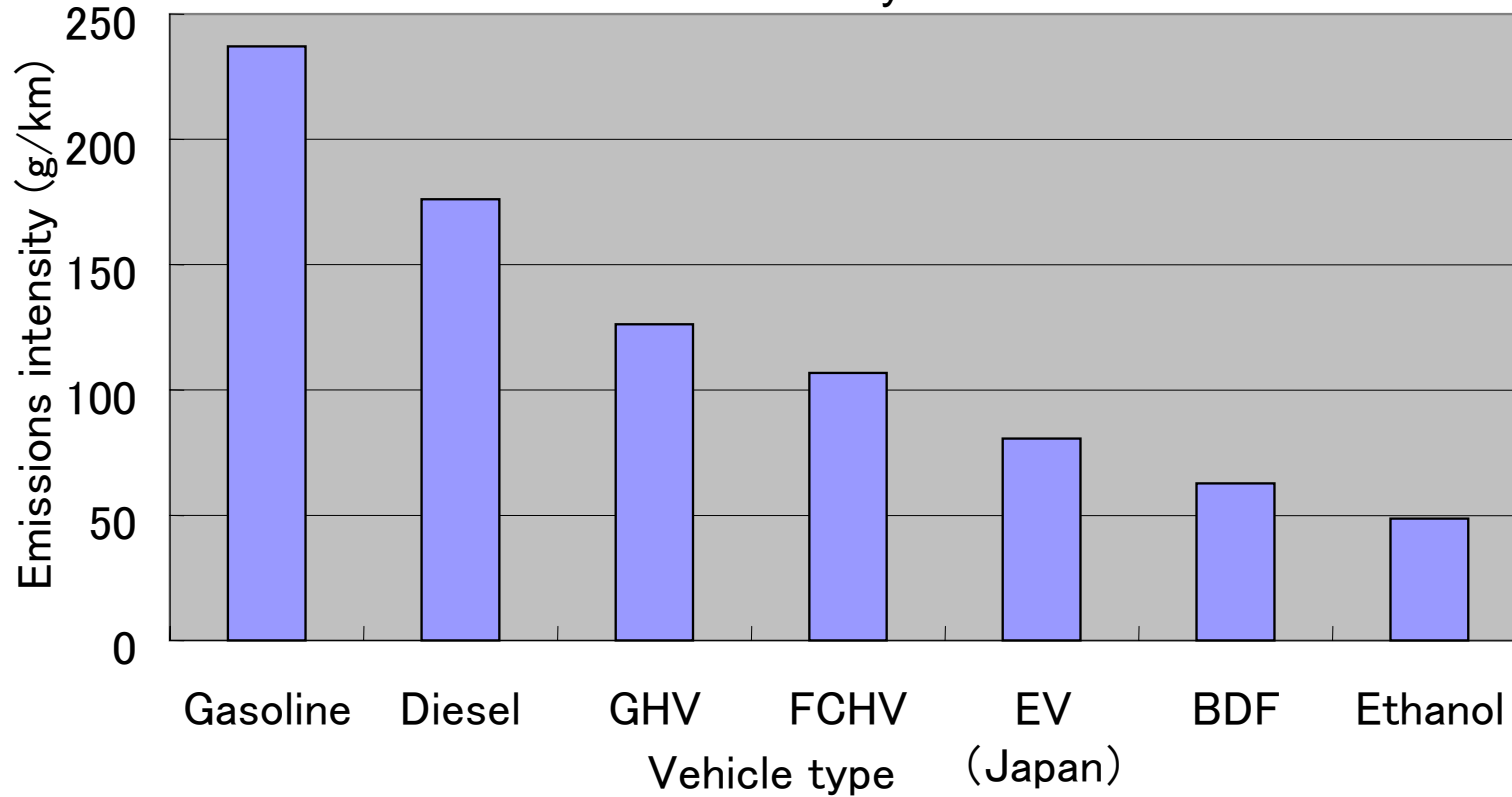
CO₂ Emissions of Gasoline Passenger Cars in Countries Without Fuel Efficiency Standards



Source: MoMo database, *International Energy Agency*

$$\text{Emissions intensity} = \frac{\text{CO}_2}{\text{Fuel}} \times \frac{\text{Fuel}}{\text{Distance}}$$

Emission intensity of the vehicle



Assumptions made for the calculation of the emission intensity

Carbon intensity	
Energy	g/L
Gasoline	2774.67
Diesel	2835.03
Hydrogen	1.3
Electricity	442.8 (g/kWh)
BDF	1141.92
E100	368.12

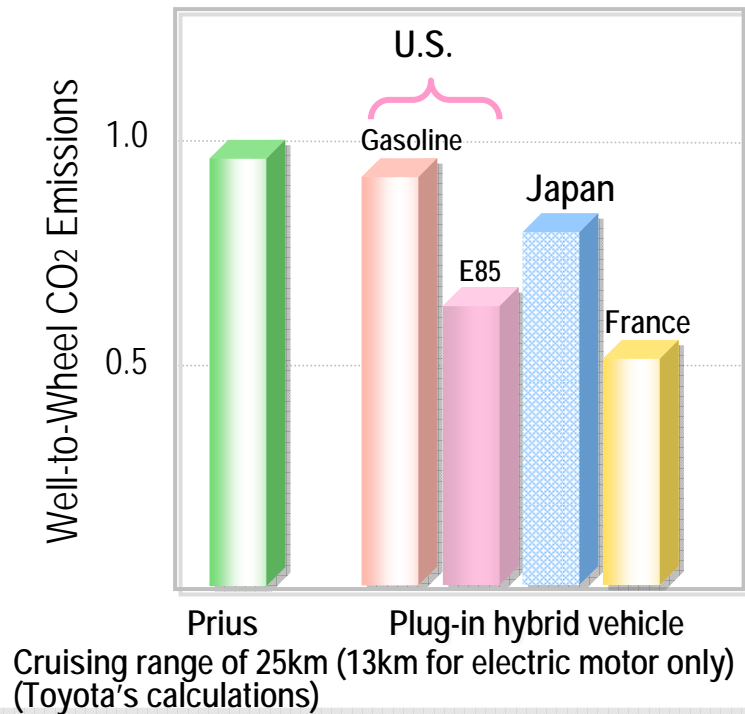
Fuel economy	
Type of vehicle	km/L
Gasoline	11.7
Diesel	16.1
HV with gasoline	22
FCHV	0.0122
EV	5.5 (km/kWh)
BDF	18.2
Ethanol	7.57

CO₂
Fuel

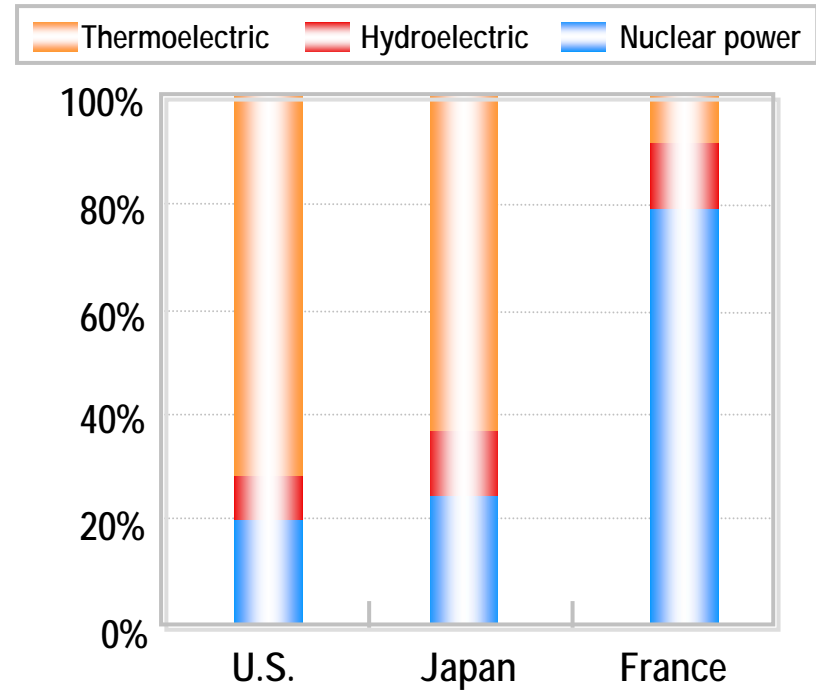
Carbon intensity in fuel

Advantages of Plug-in Hybrid Vehicles

Well-to-Wheel CO₂ Emissions



Electricity Sources by Country



PHVs make possible reductions in Well-to-Wheel CO₂ emissions.
Benefits can be expanded through combination with biofuels.

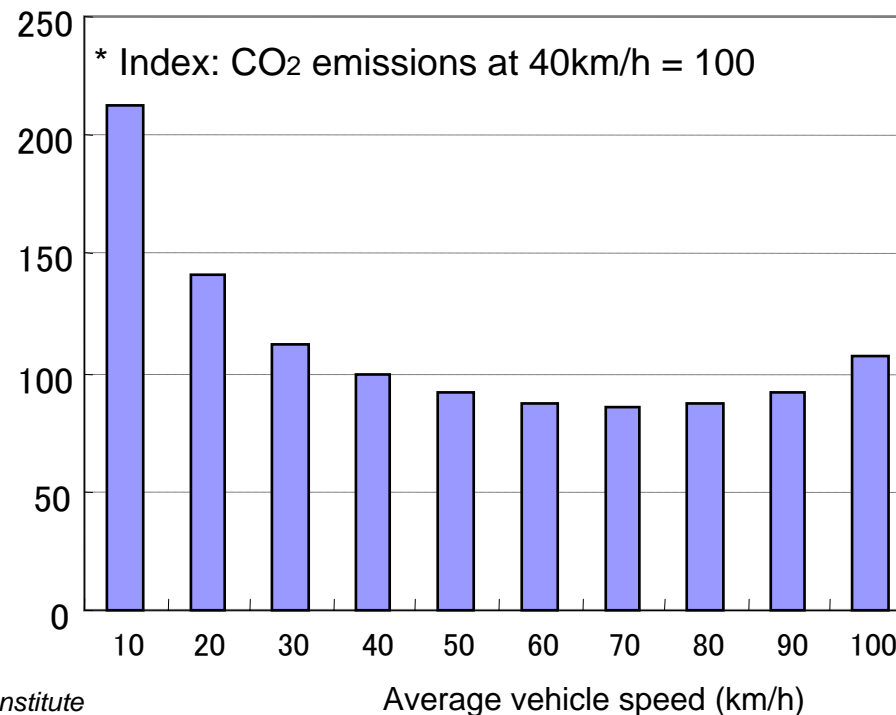
Fuel
Distance

On-road fuel consumption

Upgrading Road Infrastructure

Improved traffic flow by upgrading road infrastructure contributes CO₂ emission reduction.

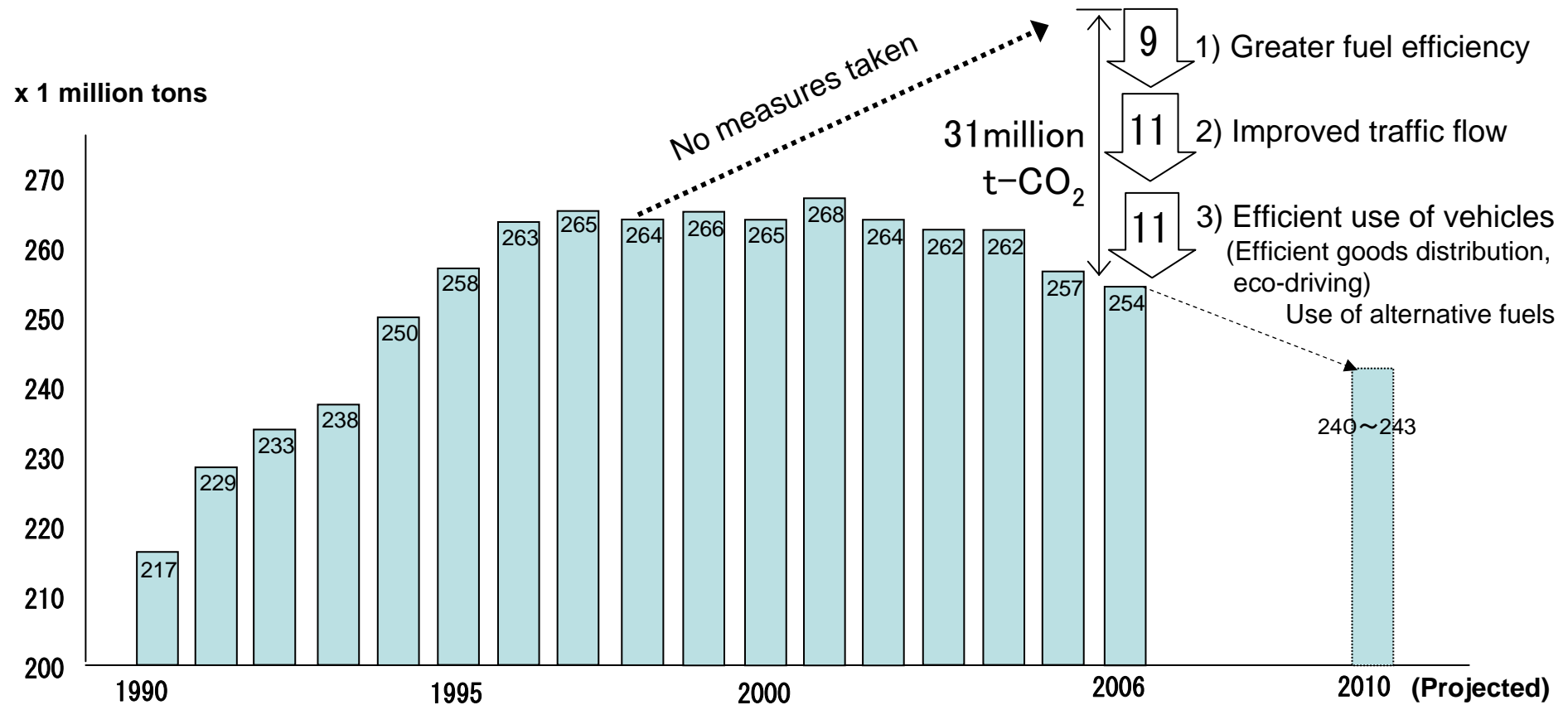
Impact of Vehicle Speed on CO₂ Emissions



Source: Japan Automobile Research Institute

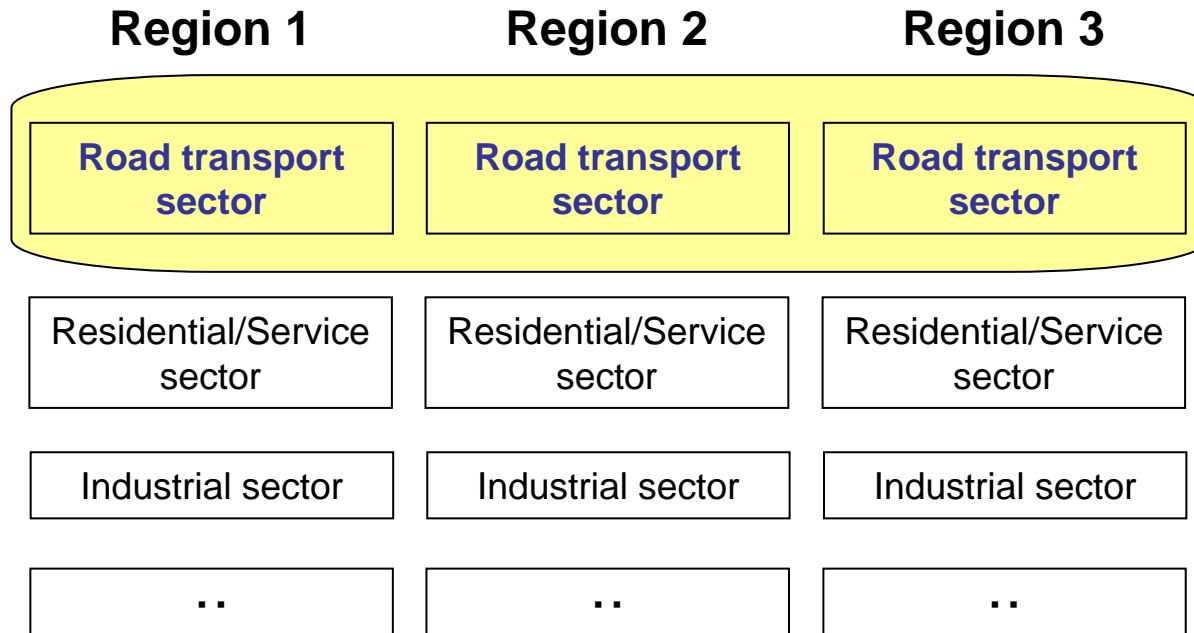
Example: Japan's experience
of reducing CO₂ emissions from transport sector

Road Transport CO₂ Emission in Japan

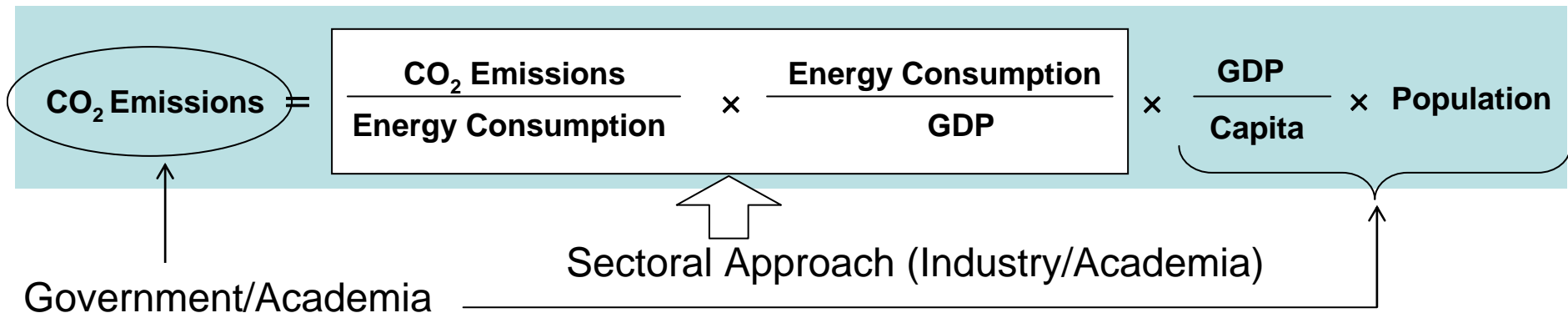


Source: Ministry of the Environment (Japan)

Importance of Sectoral Approach



Auto manufacturers, energy industry, and academia should work together for the reduction of CO₂ emissions in the global road transport sector without undermining the economic development of individual countries.



Data Compilation Statuses of Countries

				Japan	US	Europe	China	India
Fuel Economy (efficiency)	① New fleet fuel economy (efficiency)	km/L mpg gCO2/km etc.	Certified fuel economy (efficiency) (Ref. ; Definition 1)	JAMA [10-15 test mode, JC08test mode]	NHTSA [LA-4, Highway]	ACEA/JAMA [NEDC]	NDRC [NEDC]	ND (SIAM under investigation)
	② Stock fleet fuel economy (efficiency)	km/L mpg gCO2/km etc.	Certified fuel economy (efficiency) (Ref. ; Definition 2)	JAMA	Computable	Computable	ND	ND
	③ Actual (on-road) fuel economy (efficiency)	km/L mpg gCO2/km etc.	③ = ① / ②	JAMA	Computable	Computable	ND	ND
Amount of Car	④ Sales amount of new car	vehicle unit	Required for ①, ②	JAMA, JAIA, JMVA	JAMA <i>World Motor Vehicle Statistics</i>	JAMA <i>World Motor Vehicle Statistics</i>	NBSC <i>China Statistical Yearbook</i>	SIAM
	⑤ Stock amount of car	vehicle unit	Required for ②	MLIT <i>Survey on Motor Vehicle Transport</i>	JAMA <i>World Motor Vehicle Statistics</i>	JAMA <i>World Motor Vehicle Statistics</i>	NBSC <i>China Statistical Yearbook</i>	MSRTH <i>Motor Transport Statistics</i> JAMA <i>World Motor Vehicle Statistics</i>
	⑥ Scrappage (residual) rate of car	%	Required for ②	AIRIA, JAMA (estimated by JAMA for mini (K) vehicles)	ND	ND	ND	ND
Run volume	⑦ Run volume	vehicle-km	Annual value	OECD OECD Environmental Data Compendium	OECD OECD Environmental Data Compendium	OECD <i>OECD Environmental Data Compendium</i>	ND	ND
	⑧ Traffic volume	passenger-km ton-km	Annual value	MLIT <i>Survey on Motor Vehicle Transport</i>	RITA <i>National Transportation Statistics</i>	EEA <i>Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union</i>	NBSC <i>China Statistical Yearbook</i>	ND
Fuel consumption	⑨ Amount of fuel consumption	L	gasoline, diesel oil, LPG, NG, etc.	ANRE/METI <i>Energy Balance Table</i> IEA/OECD <i>Energy Statistics of OECD countries</i>	IEA/OECD <i>Energy Statistics of OECD countries</i>	IEA/OECD <i>Energy Statistics of OECD countries</i>	IEA/OECD <i>Energy Statistics of non-OECD countries</i>	IEA/OECD <i>Energy Statistics of non-OECD countries</i>
Vehicle speed	⑩ Average travel velocity of vehicles on road	km/h	by category of vehicle by category of road	MLIT <i>Road Traffic Census</i>	ND	ND	ND	ND