

Transport Future Workshop

2nd Workshop for Automobile and Energy

**Outlook for Energy and Transport
Demand in the Road Sector**

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Background

We are faced with some problems related to energy, such as high prices, resources and climate change.

Rapid motorization in developing countries will increase oil demand and CO2 emission. Therefore, analyses and discussions with regard to automobiles will become more and more important.

We developed a simulation model “IEEJ2050 Model” for world energy demand in 2050, focusing on the transport / automobile sector in order to analyze scenarios surrounding motorization.

Structure of “IEEJ2050 Model”

[Output] World Energy Demand and Energy-related CO2 Emission

[Prediction period] Between 2010 and 2050 (every 5 years)

[Geographic division] 16 countries/regions

[Model Structure]

(A) Final Energy Consumption (Industry, Residential & Commercial, and Transport sectors)

(B) Energy Conversion (Power generation, Heat supply, Hydrogen, etc.)

(C) Total Primary Energy Supply and CO2 Emission

There is also a transport sub-model for detailed analysis in the road sector.

Region	Classification in the model
North America	1) USA, 2) Canada
Latin America	3) Brazil, 4) other Latin American countries
Europe	5) European OECD countries, 6) Russia, 7) other European countries
Asia and Pacific	8) Japan, 9) China, 10) India, 11) Korea, 12) ASEAN, 13) Oceania, 14) other Asian countries
Middle East	15) Middle East
Africa	16) Africa

Structure of Transport Sub-model

[Model Structure] Passenger sector: Passenger cars, Buses, Bikes, Railways, Ships, Airlines

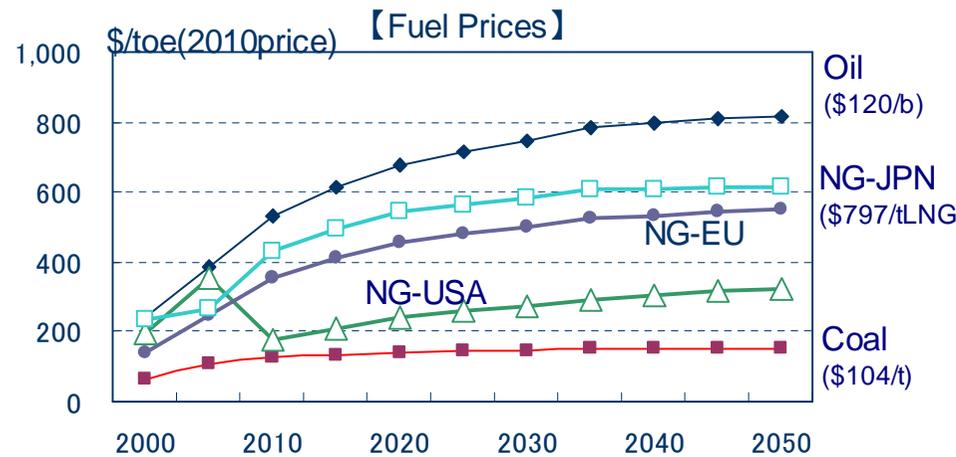
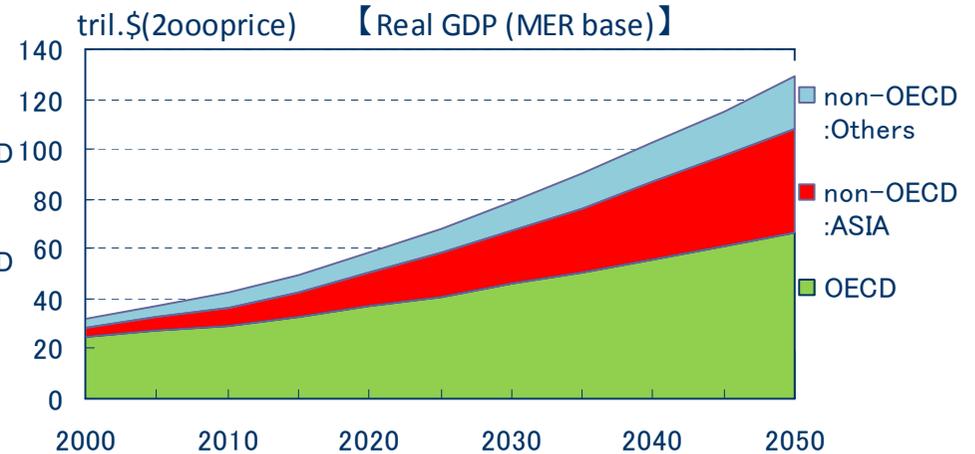
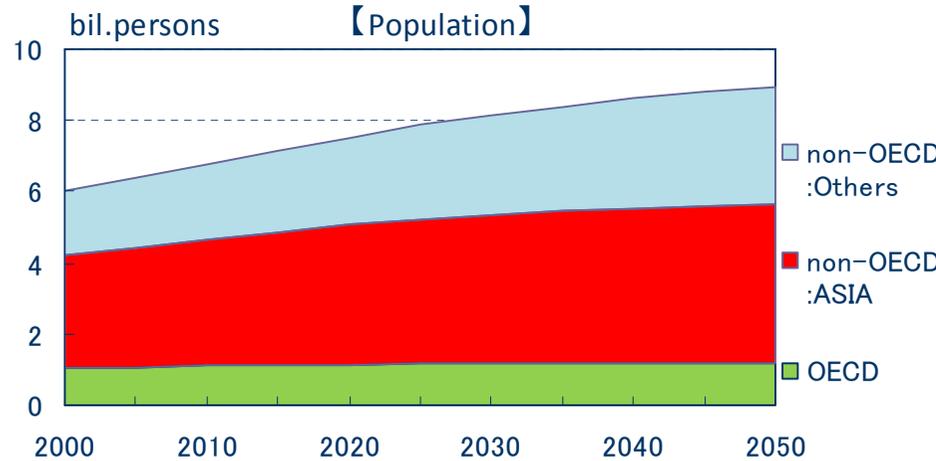
Freight sector: Trucks, Railways, Ships, Airlines

[Car and Truck] Flow-Stock replacement structure

(sales) technology share / fuel efficiency >>> (stock) technology share / fuel efficiency

Fuel type	Technology type by power source		
	Internal Combustion Engine Vehicle [ICEV]	ICE & Motor Hybrid Electric Vehicle [HEV]	Motor Zero Emission Vehicle [ZEV]
Gasoline	1) Gasoline-engine Vehicle	5) Gasoline-powered Hybrid Vehicle 6) Plug-in Gasoline-powered Hybrid Vehicle (*also using electricity)	
Diesel	2) Diesel-engine Vehicle	7) Diesel-powered Hybrid Vehicle	
LPG	3) LPG-powered Vehicle		
CNG	4) CNG-powered Vehicle		
Electricity			8) Electric Vehicle
Hydrogen			9) Fuel Cell Vehicle 10) Plug-in Fuel Cell Vehicle (*also using electricity)

Major Assumptions for 2050



- World population increase to 9 billion in 2050, or 1.4 times the 2005 level.

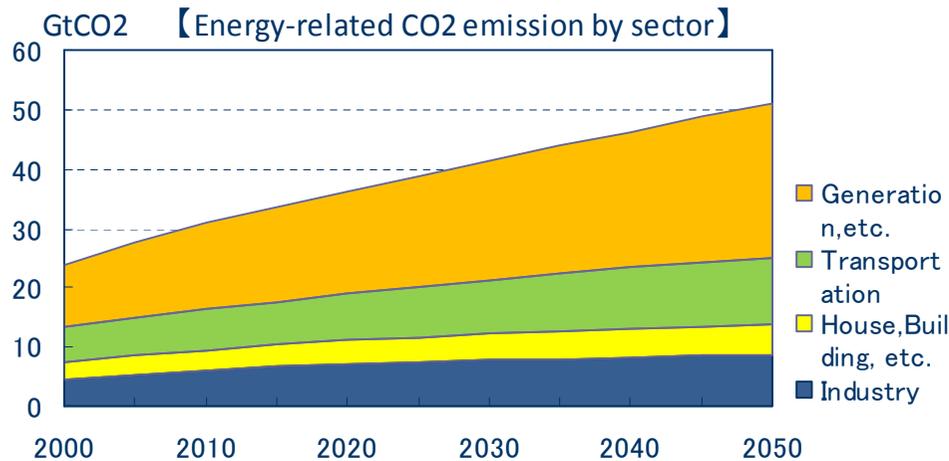
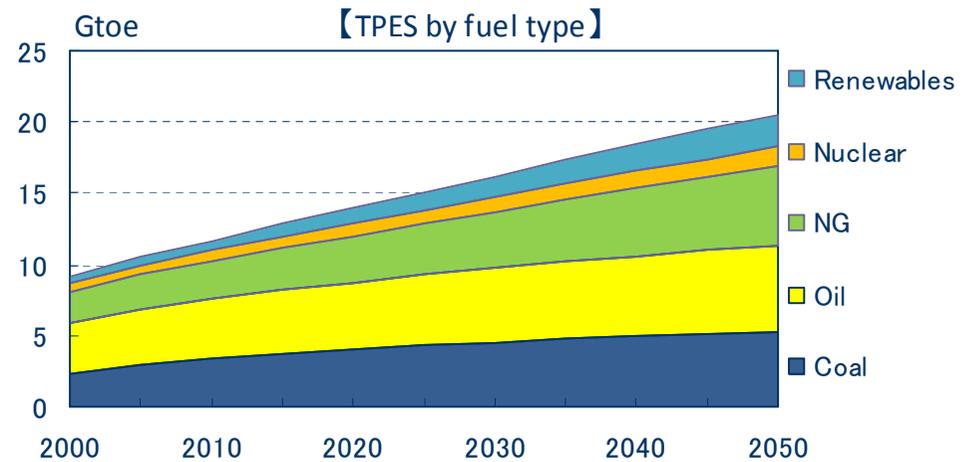
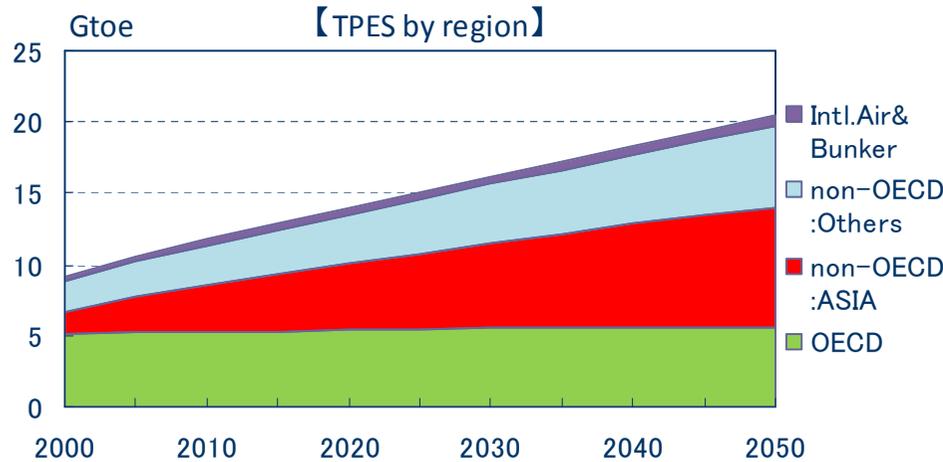
Developing countries contribute most to the increase.

- World economy is growing by 2.8%/yr.

Asia is maintaining high growth of 5.0%.

- Oil price is assumed at 120USD/barrel in 2050, while the gas price is 800USD/t-LNG.

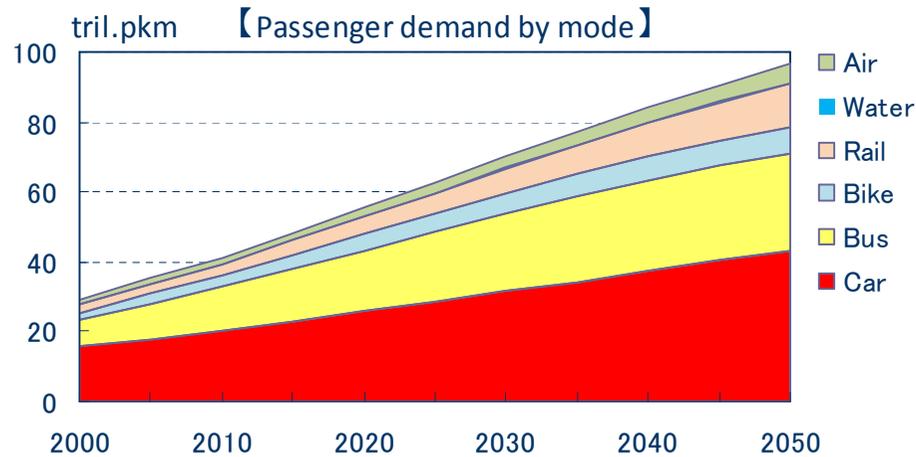
Outlook for World Energy Demand



We assume present technological systems and energy policies in “Reference Case”

- TPES increase by 1.9 times that of 2005. Industry: x1.8, Transport: x2.0, Res.& com.: x2.0
- Oil: x1.5, Coal: x1.8, Gas: x2.4
- Fossil fuel share remains high (83%).
- CO2 emission of 51 billion tons in 2050, or 1.8 times that of 2005.

Passenger/Freight Demand

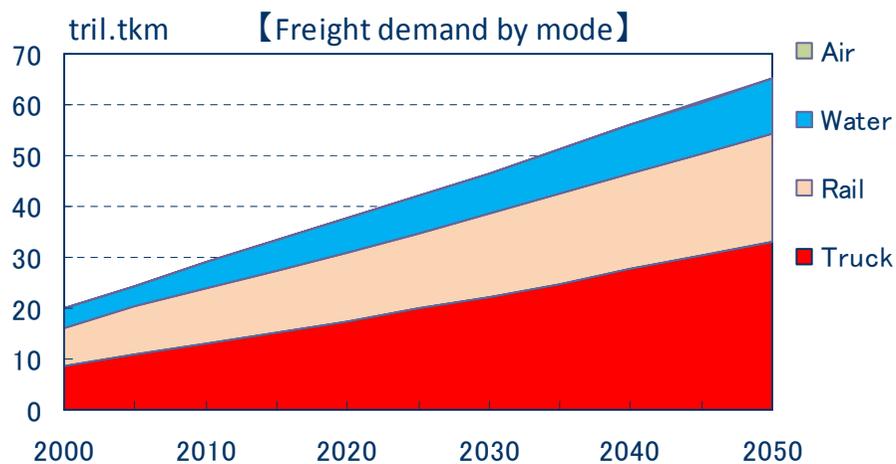


- Passenger demand increase
by 2.7 times that of 2005.

(4.4 times in Asia)

Rail: x4.4, Air: x3.4, Car: x2.4

Share of Car will be 44% in 2050.

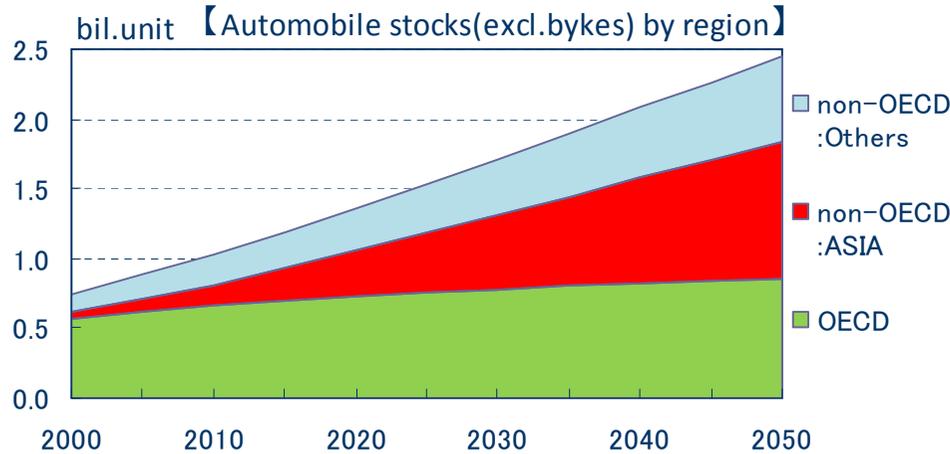


- Freight demand increase
by 2.7 times that of 2005.

(4.4 times in Asia)

Truck: x3.0, Truck share: 51%

Automobile Stocks



- Automobile stocks increase

from 0.9 bil. to 2.4 bil. units (x2.8).
 [2005] [2050]

More than 80% of the increase is contributed by developing countries.

- Cars: 0.7 bil. to 2.1 bil. (x2.8)

Bus: 10 mil. to 30 mil. (x2.2)

Truck: 0.1 bil. to 0.3 bil. (x2.4)

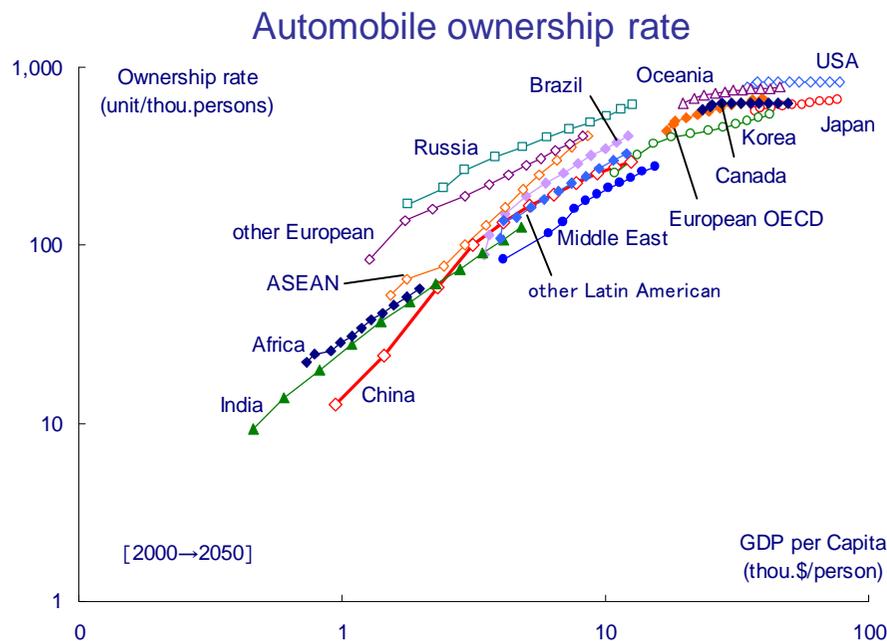
Bike: 0.3 bil. to 0.9 bil. (x3.1)

- Ownership rate in OECD:

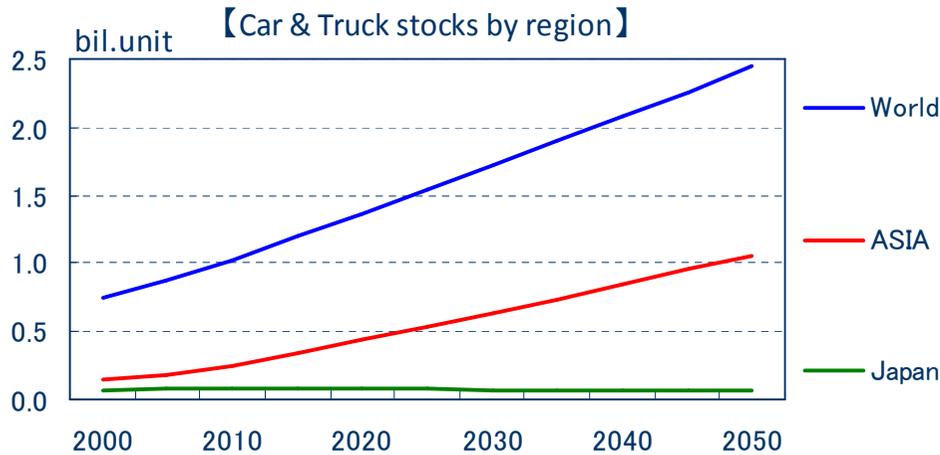
586 to 721 units / 1,000 persons

- In non-OECD: 48→204 units

This is one-fourth the OECD level,
 so there is much room for increase after 2050.

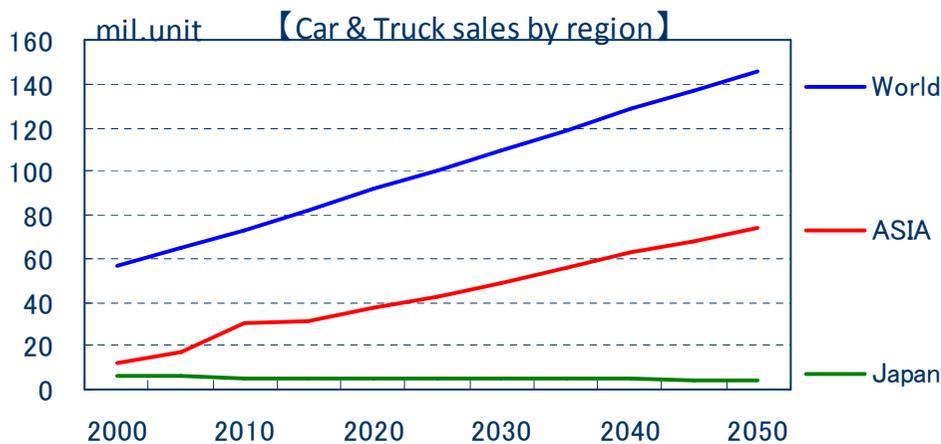


Stocks / Sales of Automobiles



- Automobile stocks in Asia increase from 0.2 bil. to 1.1 bil. units (6.0 times).
 [2005] [2050]

In Japan, automobiles decrease.
 (76 mil. to 62 mil. units)



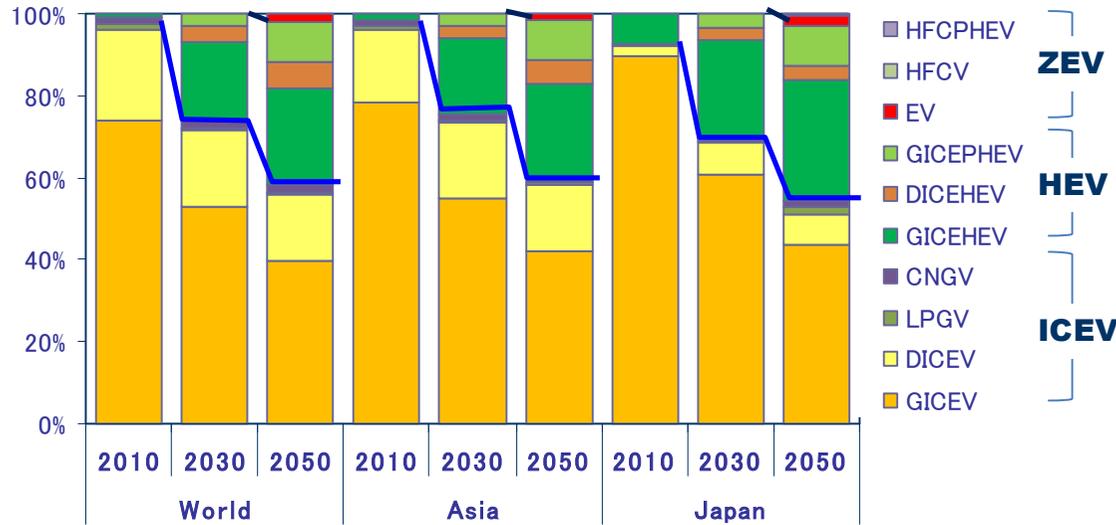
- World automobile sales increase from 64 mil. to 150 mil. Units (2.3 times).

In Asia
17 mil. to 74 mil.(4.4 times)

In Japan
 5.9 mil. to 4.3 mil (decrease)

Share of Automobiles

【Share of Car & Truck Sales by type】



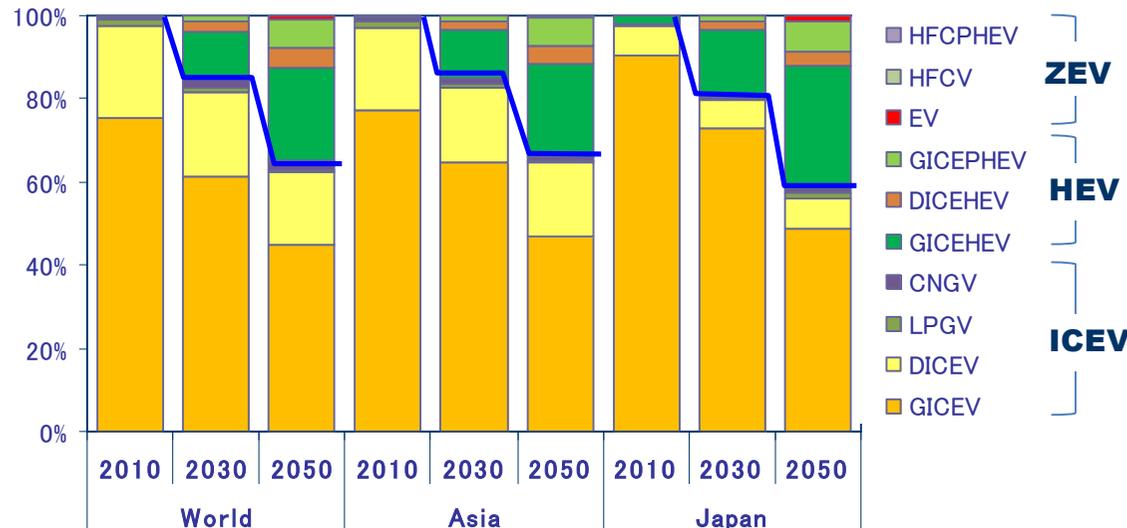
- Sales share of automobiles (2050)

World) ICEV: 59%, HEV: 39%

Asia) ICEV: 60%, HEV: 38%

Japan) ICEV: 54%, HEV: 43%

【Share of Car & Truck Stocks by type】



- Stock share of automobiles (2050)

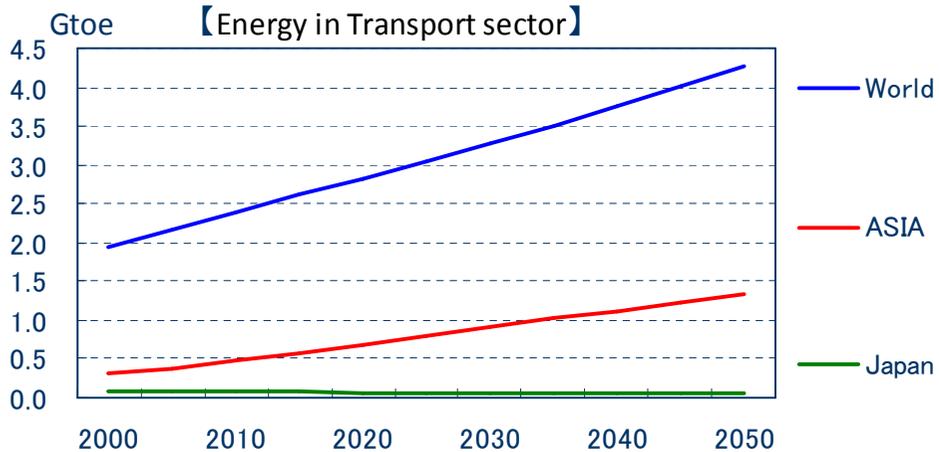
World) ICEV: 65%, HEV: 34%

Asia) ICEV: 66%, HEV: 33%

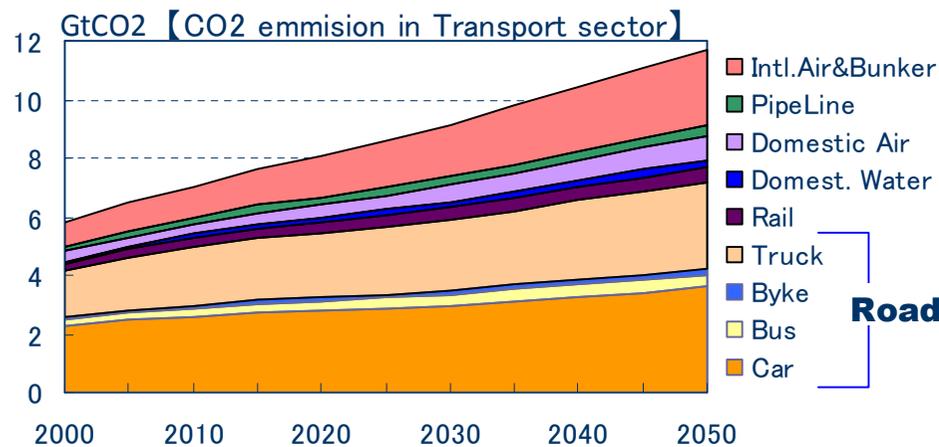
Japan) ICEV: 59%, HEV: 40%

GICEV: Gasoline-engine Vehicle, DICEV: Diesel-engine Vehicle, LPGV: LPG-powered Vehicle, CNGV: CNG-powered Vehicle
 GICEHEV: Gasoline-powered Hybrid Vehicle, DICEHEV: Diesel-powered Hybrid Vehicle, GICEPHEV: Plug-in Gasoline-powered Hybrid Vehicle
 EV: Electric Vehicle, HFCV: Fuel Cell Vehicle, HFCPHEV: Plug-in Fuel Cell Vehicle

Energy Demand in Transport Sector



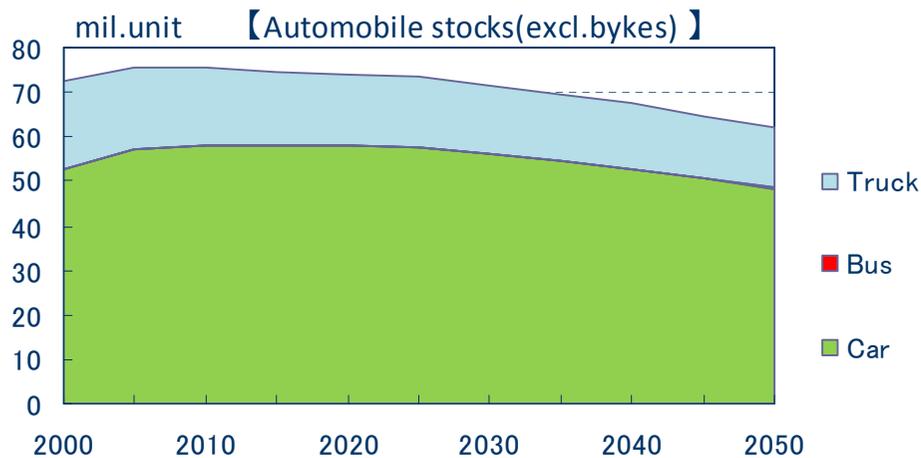
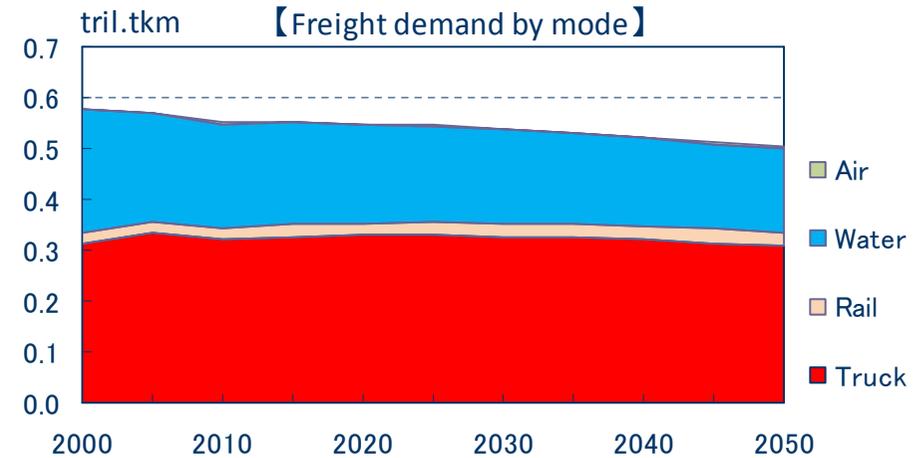
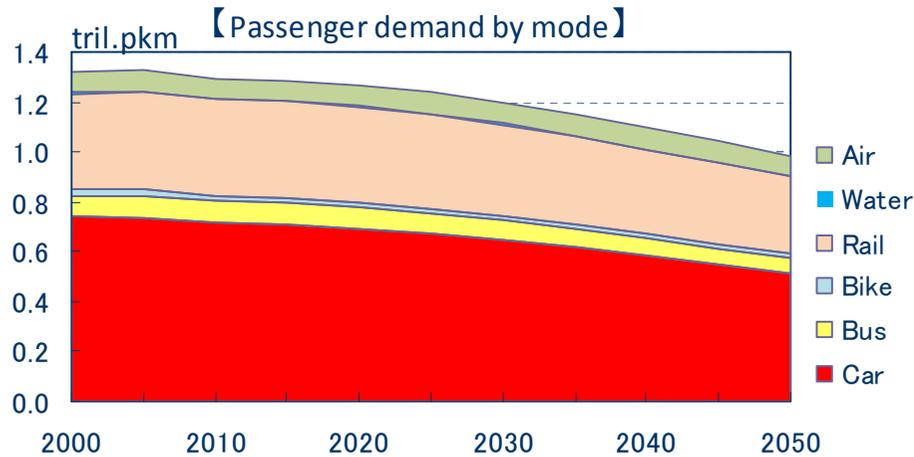
- World energy demand in the transport sector increases by 2.0 times that of 2005.
(Asia: x3.7, Japan: x0.6)



- CO2 emission in transport increases by 1.8 times that of 2005
(*including CO2 in the generation sector)

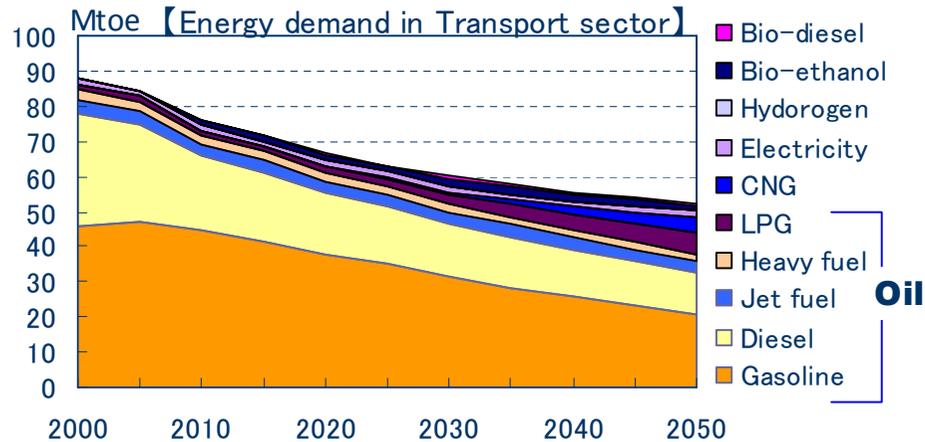
CO2 share of the road sector decreases from 71% (2005) to 61% (2050).
Share of international air & bunker increases from 15% to 22%.

Transport Demand in Japan



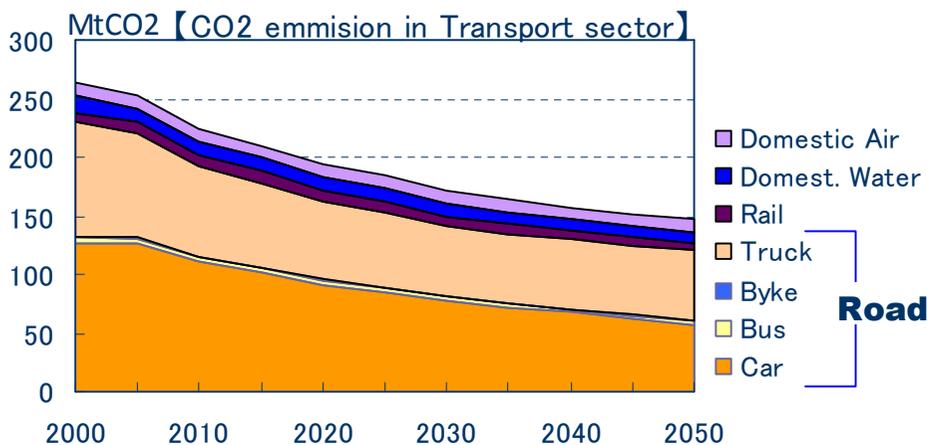
- Passenger demand decreases
by 26% from 2005.
- Freight demand decreases
by 12% from 2005.
- Automobile stocks:
Car: 57 mil. to 48 mil. units
Truck: 18 mil. to 14 mil. units

Energy Demand in Transport in Japan



- Japan's energy demand in transport (excl. international air & bunker) decreases by 38% from 2005.

Oil share in transport sector decreases from 98% to 84%, but oil remains dominant.



- CO2 emission in transport sector (excl. international air & bunker) **decreases by 41% from 2005.**
 (*including CO2 in the generation sector)

CO2 in road sector decreases by 45%

Summary

- **World transport demand (passenger/freight) will increase greatly.**
 - World transport demand increases by 3 times that of 2005. (4 times in Asia)
 - World automobile stocks increases from 0.9 bil. to 2.4 bil. units.
(0.2 bil. to 1.1bil. units in Asia)
- **Energy demand and CO2 emission in transport will also increase greatly.**
 - Energy demand and CO2 increase by 2.0 times that of 2005. (3 times in Asia)
 - CO2 in road sector increases by 1.5 times.
 - CO2 in international air & bunker increases by 2.8 times.
- **On the other hand, transport /energy demand in Japan will decrease.**
 - Transport demand: –20% from 2005, Automobile: 75mil. to 62mil. units
 - Energy and CO2 decrease by 40% from 2005, respectively.

We predict transport demand to increase rapidly in emerging countries, especially Asian countries. More detailed analyses concerning the motorization scenario in Asia are necessary.