Passenger Transportation Sector

AIM Training Workshop

Tokyo, Japan Oct 22-26, 2007

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- Trip demand (Passenger-km)
  - Passenger trip generation coefficient
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  - Average Trip distance
- Energy consumption
  - Service share (technology selection)
  - Energy efficiency

Terms and Definitions

Trip

Trip is defined as unit of “move” of person from one point to another with a certain objective. Trip changes only when the objective of the move changes. Trip is counted as one even if several modes of transportation are used for the objective.

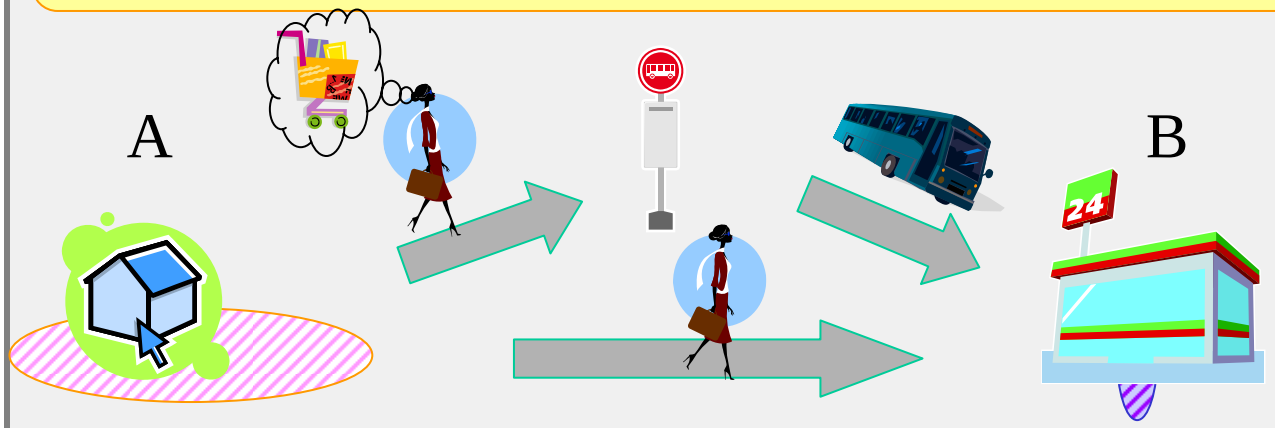
Person Trip Survey

“Personal-trip” survey is aimed to understand the whole trip generated in a day with in a region in question, and investigate when, who, and for what purpose, the trips were generated.

Terms and Definitions

Trip Generation Coefficient

Number of trips generated by a certain person per day



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Calculation flow of CO2 emissions

Personal Attribute

Service demand

- **Trip generation coeff.** — How many trips are generated every day?
  - Ex. Urban, 15-64 years old, Female, Shopping: 0.88trip/day

- **Modal Share** — Which transportation mode is selected?
  - Ex. Car? Raiway? Maritime? Aviation?

- **Average trip distance** — What is the trip distance of each mode?
  - Ex.Cars:12.4km/trip, Railways:22 km/trip

Energy Consumption

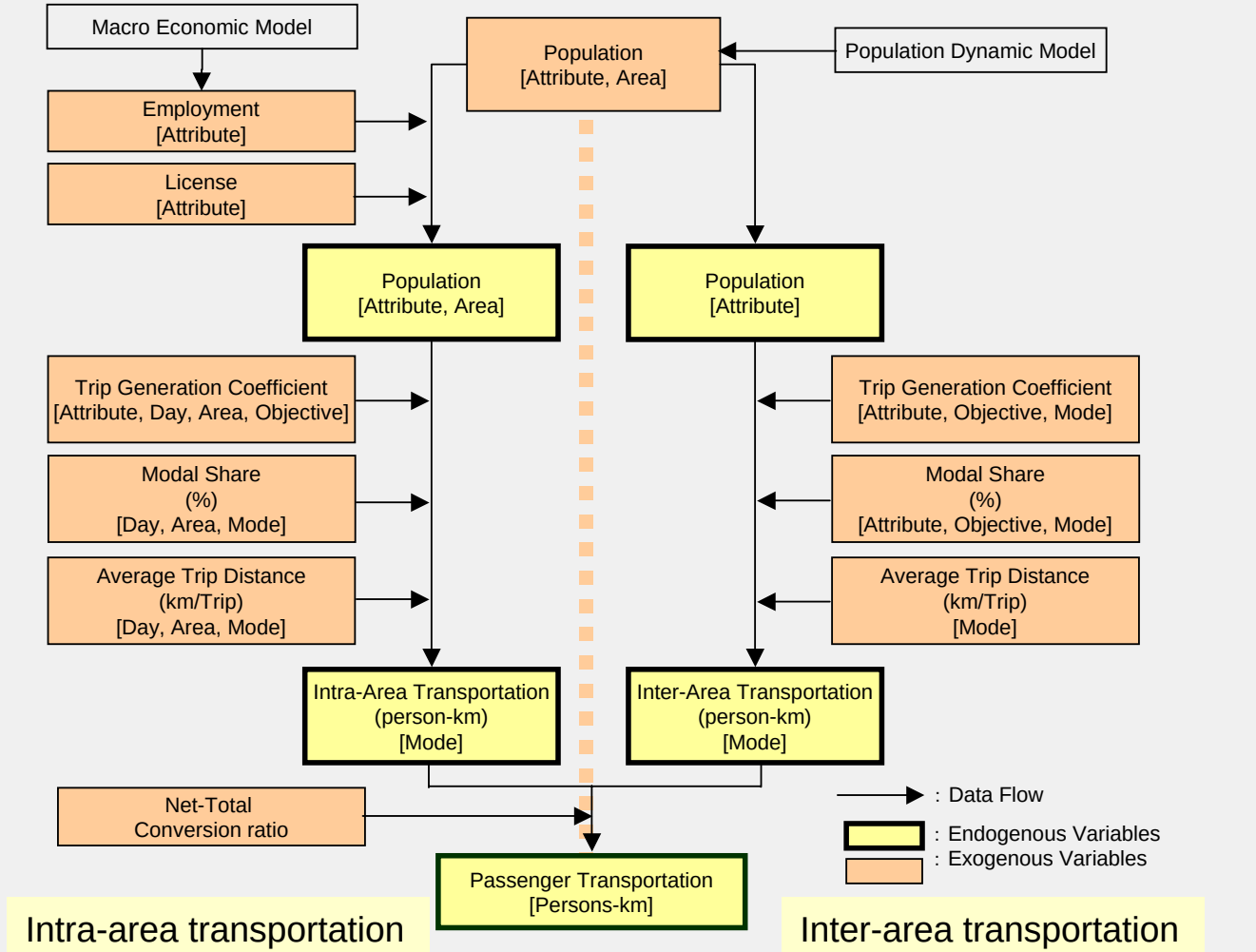
- **Technology selection** — What kind of technology (fuel) is selected?
  - Ex. Gasoline vehicle 20%, FCV60%, EV20%

- **Energy efficiency** — To what extent the energy efficiency would be improved?
  - Ex. XX% efficiency improvement from 2000

CO2 Emission

- **CO2 emission coeff.** — What is the CO2 emission coefficient of electricity/hydrogen?
  - Ex. Nuclear, Renewable, Natural gas, Oil…

Calculation Flow of Japan TDM_P



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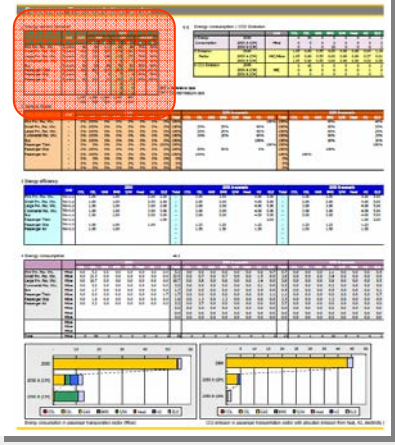
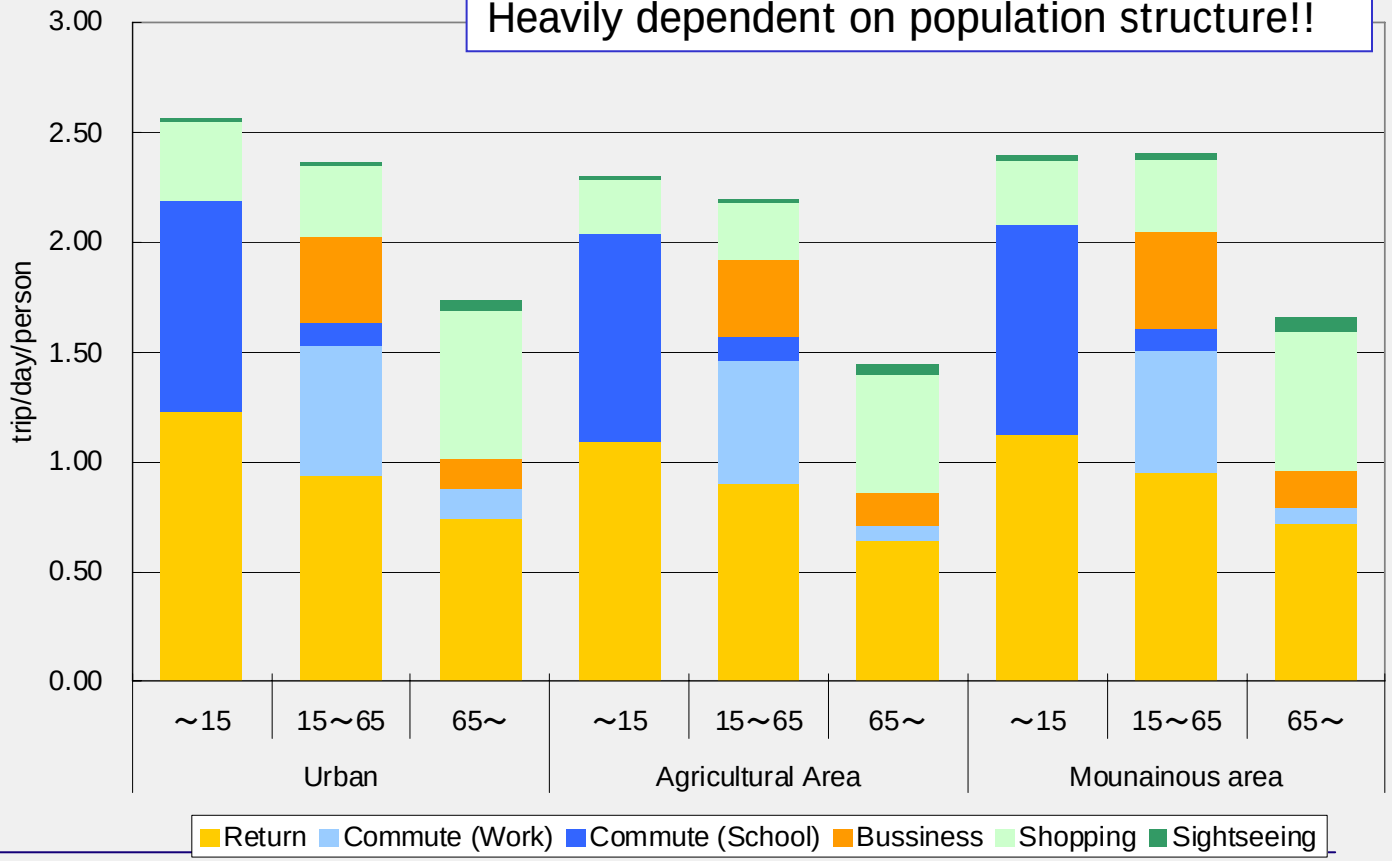


Trip Generation Coefficient

Male, Weekday

Heavily dependent on population structure!!



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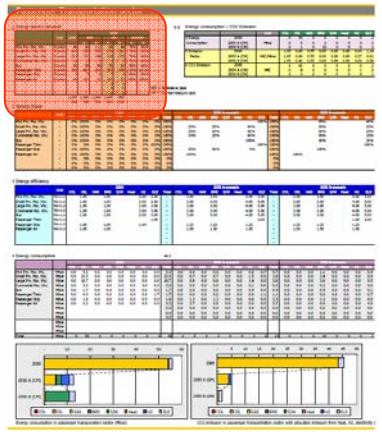
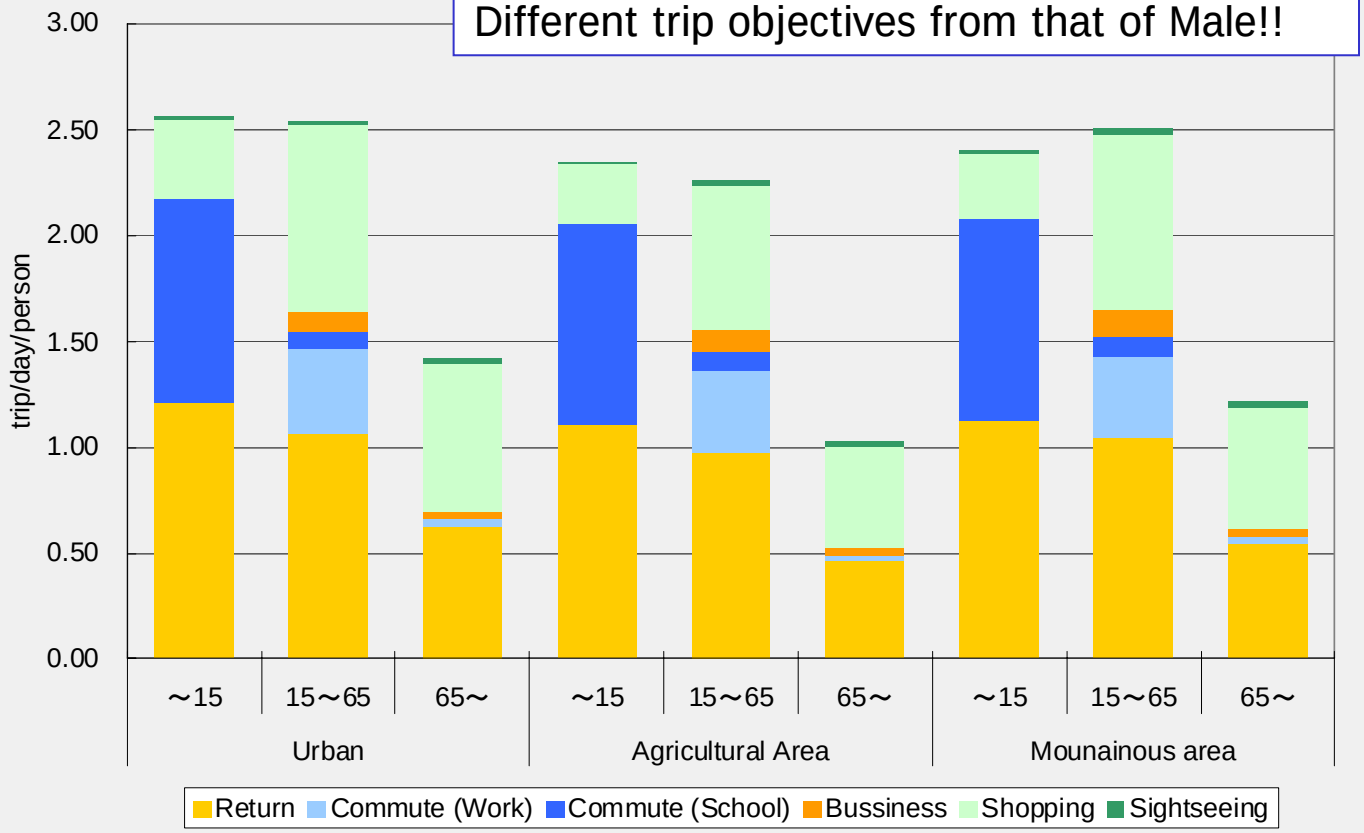


Trip Generation Coefficient

Female, Weekday

Different trip objectives from that of Male!!



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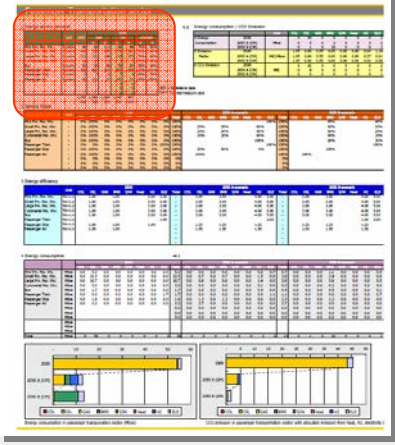
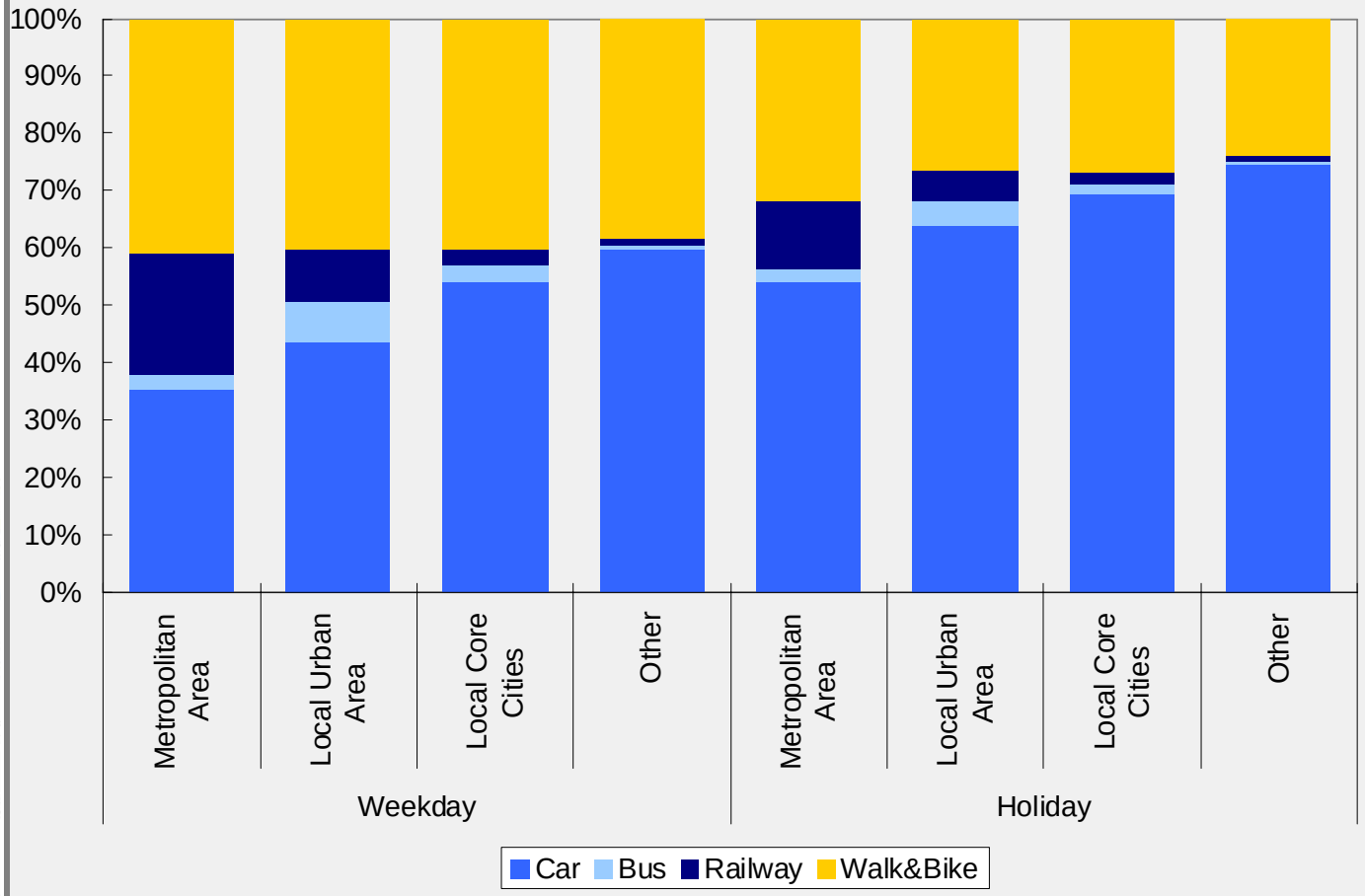


Modal Share

Heavily dependent on the areas (infrastructures)!!



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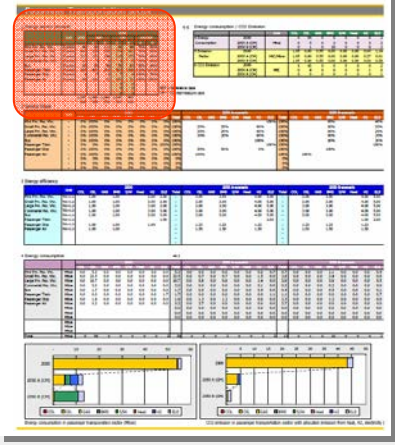
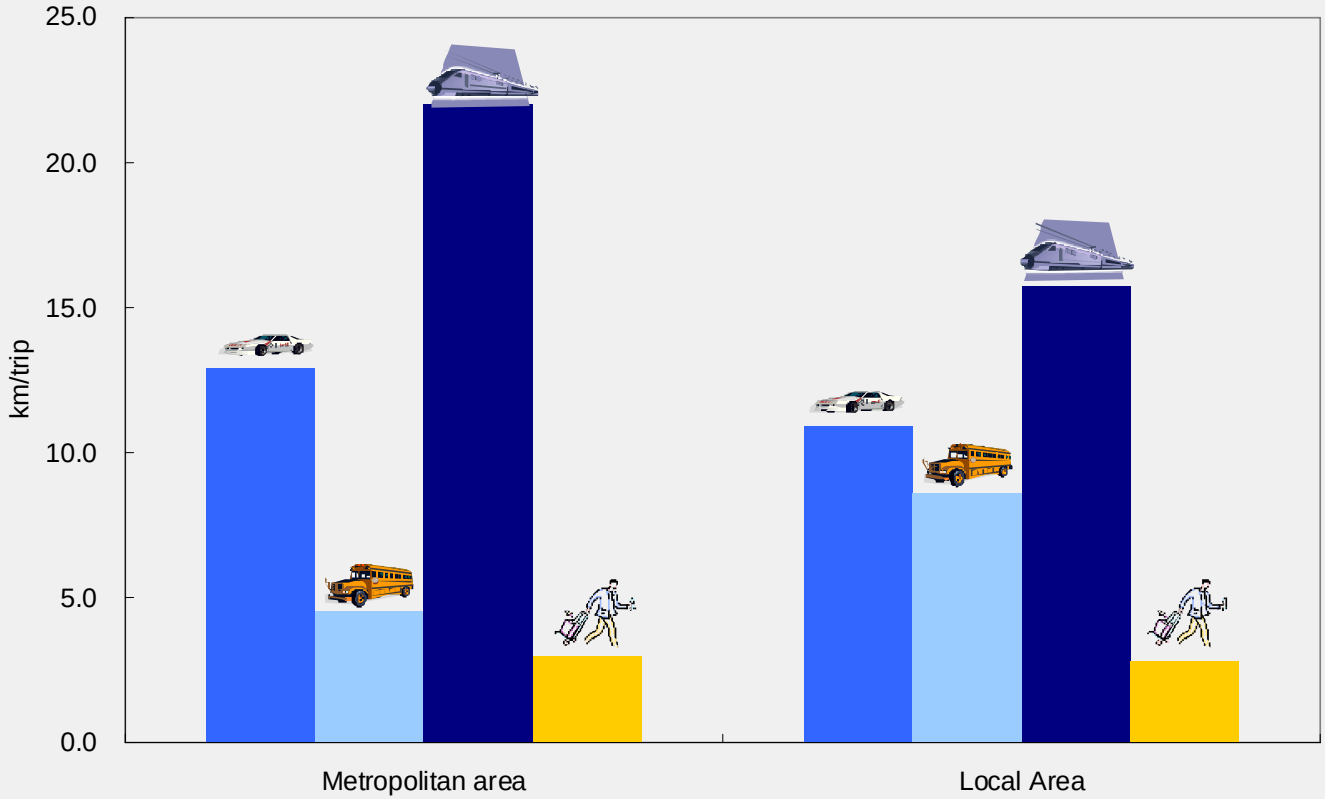


Trip Distances



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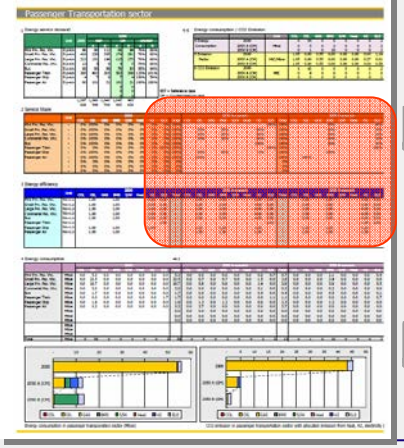
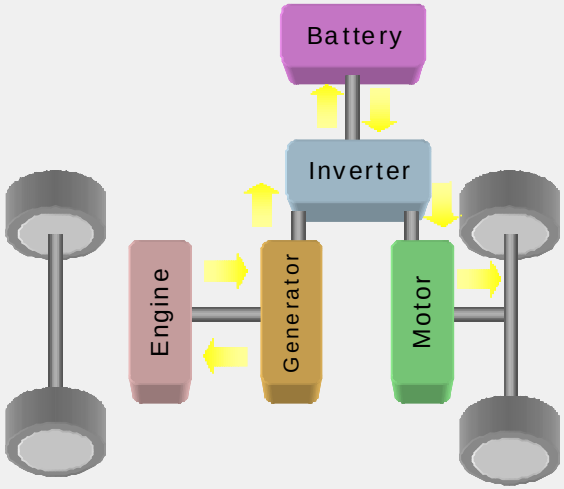
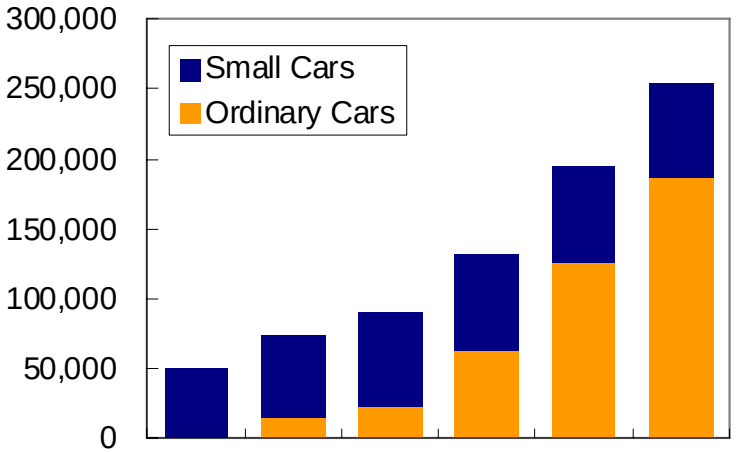
Hybrid Electric Vehicles (HEV)

Hybrid-electric vehicles (HEVs) combine the benefits of gasoline engines and electric motors and can be configured to obtain different objectives, such as improved fuel economy, increased power, or additional auxiliary power for electronic devices and power tools.

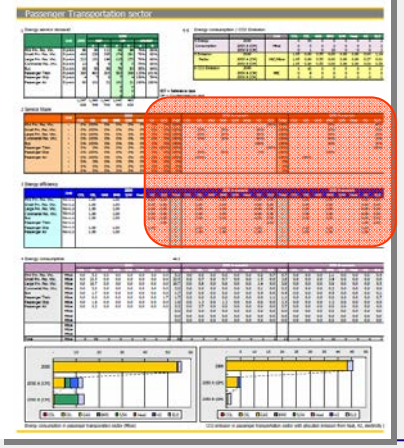
www.fueleconomy.com







No. of Hybrid Cars in Japan



Flexible fuel vehicles (FFV)

Flexible fuel vehicles (FFVs) are designed to run on gasoline or a blend of up to 100% ethanol. Except for a few engine and fuel system modifications, they are identical to gasoline-only models.FFVs have been produced since the 1980s, and dozens of models are currently available..

FFVs experience no loss in performance when operating on E85 (85% ethanol) in USA. However, since a litter of ethanol contains less energy than a litter of gasoline, FFVs typically get about 20-30% fewer miles per gallon when fueled with E85.

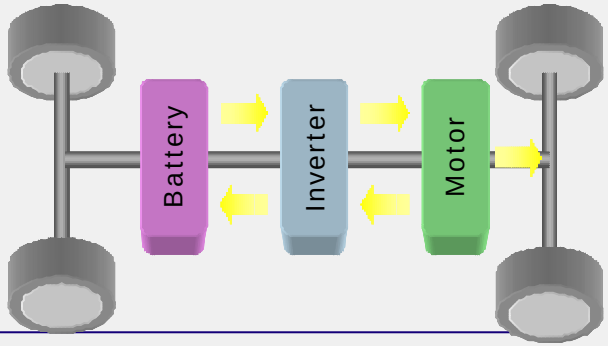
Ethanol is produced from corn and other crops and produces less greenhouse gas emissions than conventional fuels.

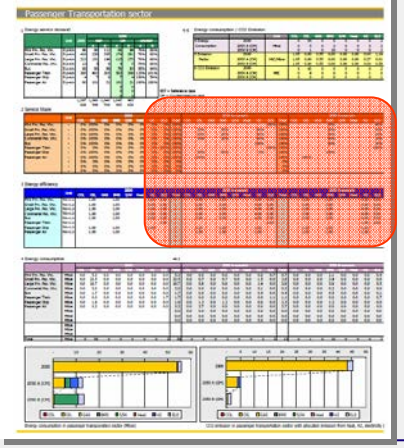
www.fueleconomy.com

Electric vehicles (EV)

In an electric vehicle (EV), a battery or other energy storage device is used to store the electricity that powers the motor. EV batteries must be replenished by plugging in the vehicle to a power source. Some electric vehicles have onboard chargers; others plug into a charger located outside the vehicle. Both types, however, use electricity that comes from the power grid. Although electricity production may contribute to air pollution, EVs are considered zero-emission vehicles because their motors produce no exhaust or emissions.

Alternative Fuel and Advanced Vehicle Center





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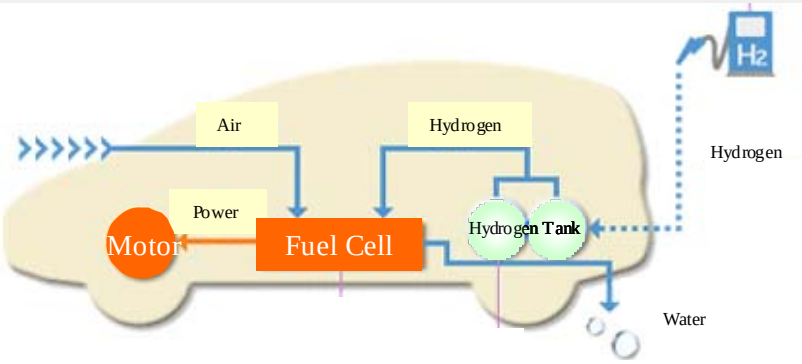
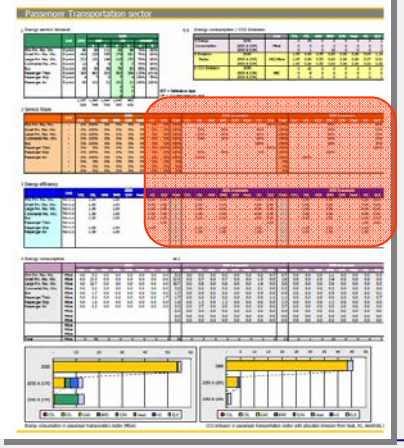
Fuel Cell Hybrid Vehicles



http://www.jhfc.jp

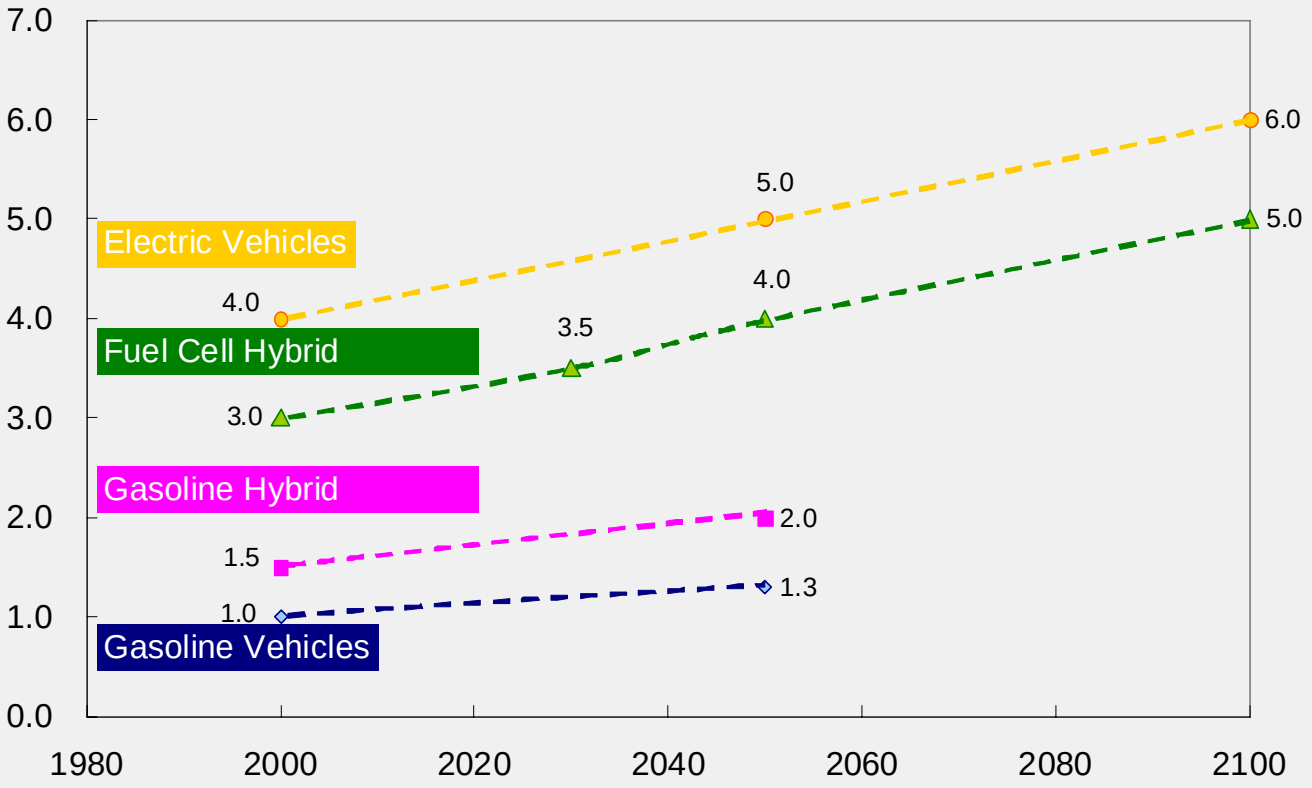


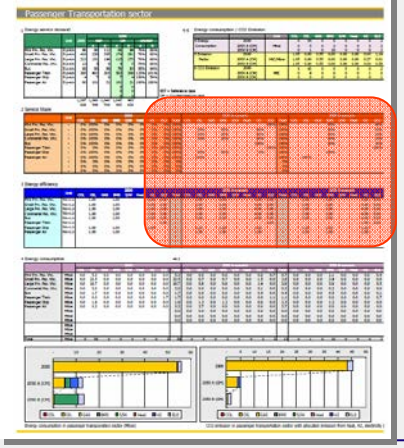
Burning fossil fuels such as gasoline or diesel adds greenhouse gases to the earth's atmosphere. Greenhouse gases trap heat and thus warm the earth because they prevent a significant proportion of infrared radiation from escaping into space. FCVs powered by pure hydrogen emit no greenhouse gases. If the hydrogen is generated by reforming fossil fuels, some greenhouse gases are released, but much less than the amount produced by conventional vehicles.

Alternative Fuel and Advanced Vehicle Center

Cars (Projection)

Efficiencies Indexes of Vehicles (Relative to current gasoline vehicles 2000=1.0)





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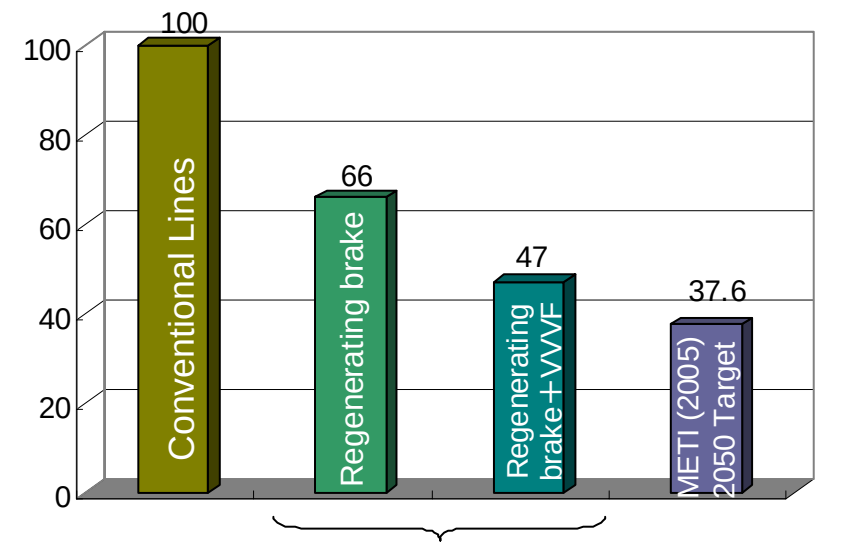
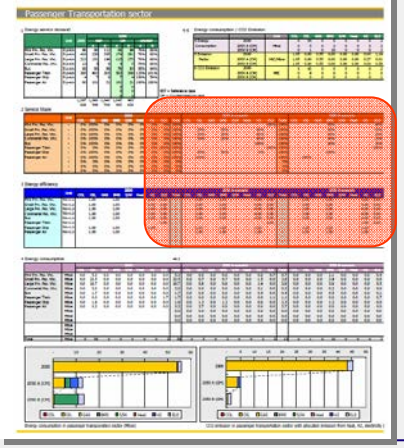
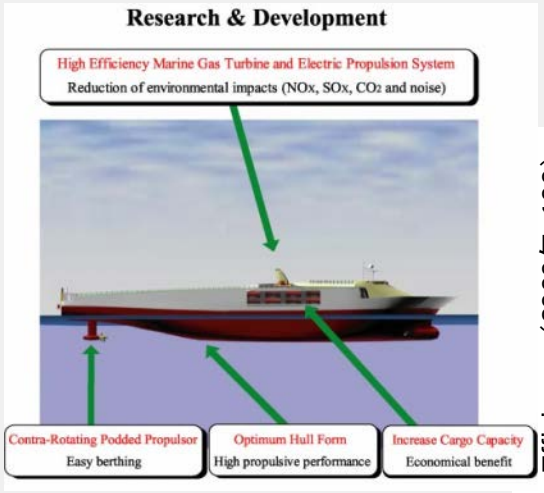
Railway

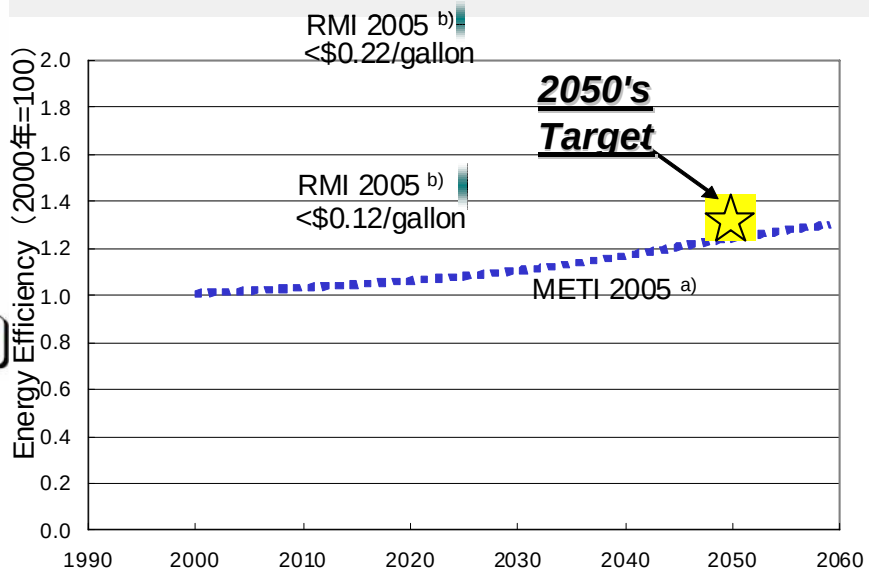


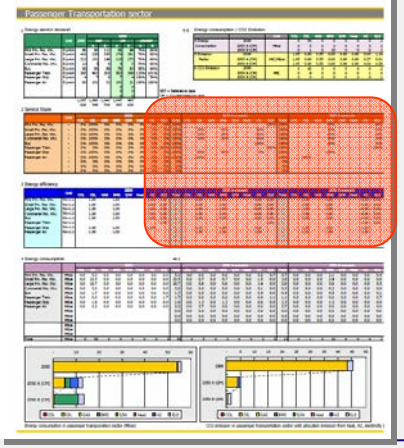
Penetration Rate in 2000
JR-East 60%
JR-West 40%



Maritime





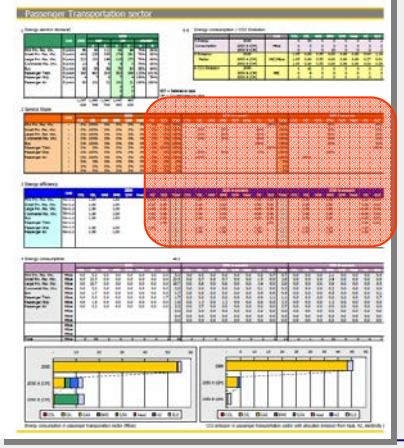


Ref : a) METI(2005) : Strategic Technology Roadmap in Energy Field -Energy Technology Vision 2100
b) Lovins(2004) : Winning the Oil Endgame

The Super-Eco ship will be equipped with highly efficient gas turbine and electric driven contra-rotating podded propulsor.

NMRI: http://www.nmri.go.jp/eco-pt/index_e.html

Aviation



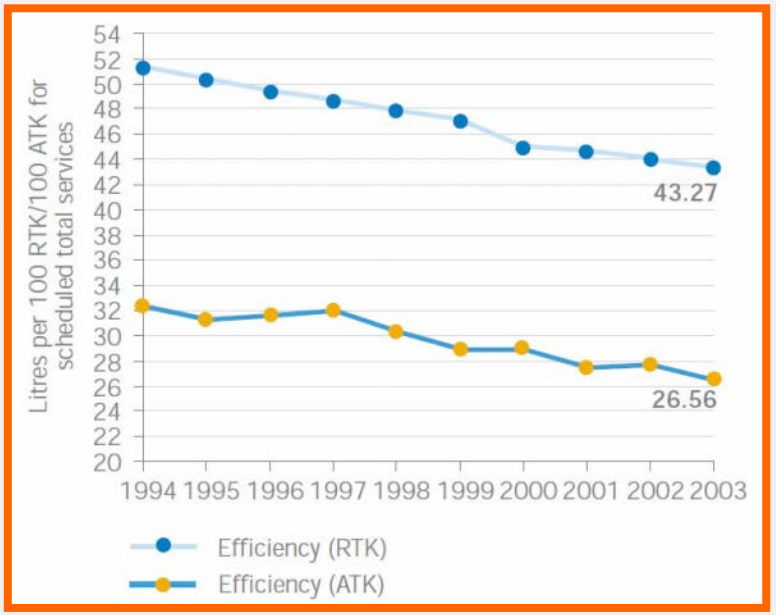
* New aircraft are 70% more fuel efficient than 40 years ago and 20% better than 10 years ago.

* Airlines are aiming for a further 25% fuel efficiency improvement by 2020.

* Modern aircraft achieve fuel efficiencies of 3.5 litres per 100 passenger km.

•The A380 and B787 are aiming for 3 litres per 100 passenger km – better than a compact car

IATA Website



RTK: Revenue tonne-km
ATK: Available tonne-kilometre
http://www.iata.org/ps/publications/9486.htm

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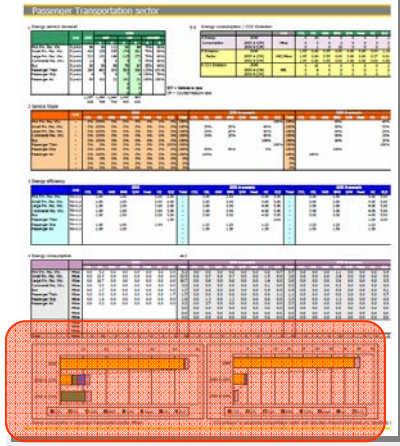
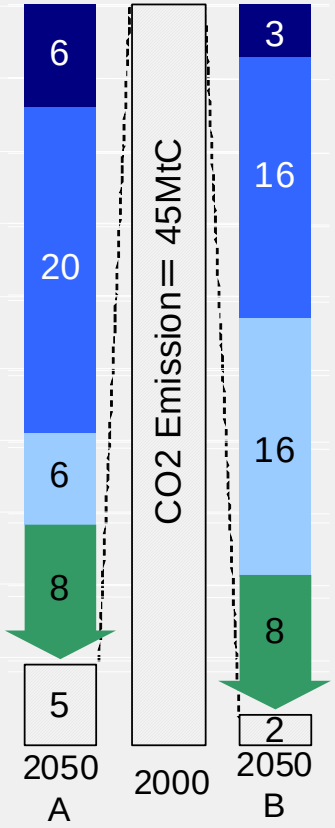


Results

Scenario A

Natural decrease in demand	・Changes in trip characteristics associated with population change ・Shorter trip distances derived from intensive land use
Energy Efficiency Improvement	・Lightening of car body ・Improvement of air resistance ・Energy efficient aviation, maritime, railways
Fuel change	・Modal shift especially in urban area ・Application of FCV/EV
Changes in CO2 intensity of secondary energy	・Electricity generation / Hydrogen production with low carbon energy resources (nuclear, fossil fuel with CCS etc)



Scenario B

Natural decrease in demand	・Changes in trip characteristics associated with population change ・Decrease in trip demand by spread of new work style (Small office, Home office etc)
Energy Efficiency Improvement	・Lightening of car body ・Improvement of air resistance ・Promotion of energy efficient aviation, maritime, railways
Fuel change	・Introduction of mass transit ・Increase in walk & bike ・Spread of biomass fuel
Changes in CO2 intensity of secondary energy	・Electricity generation / fuel production from low carbon energy resources (Biomass)

Any Questions?

Thank you for your attention!!

Exercise

Exercise

- Calculate or estimate “Trip generation coefficient”, “Modal share”, and “average trip distance from given dataset (or your national statistics)
- Assume the parameter changes in 2050 based on narrative visions and estimate passenger transportation demand (Passenger-km)
- Explain grounds for parameter settings
- Calculate energy consumption & CO2 emission using ESS tool
- If you finish the exercise above try freight transportation sector

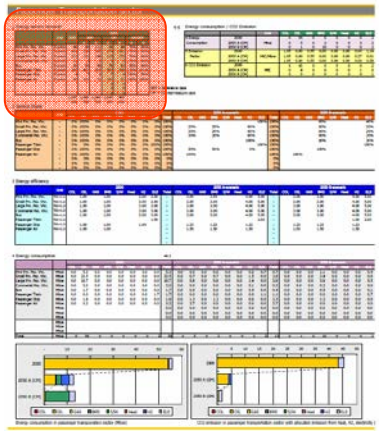
Template for parameter settings

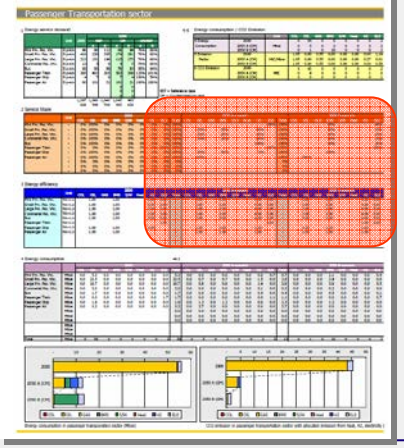
Base Year		
Population		million
Trip Generation Coefficient		trip/capita/day
Generated trip (Year)	0	million trip
Urban Population rate		

		Unit	Walk	Car	Bus	Railway
Total	Modal Share	%				
	Trip Distance	km/trip				
	Volume of transportation	mil.passenger-km	-	-	-	-
	No. of passengers	passenger/vehicle				
	Volume of transportation	Vehicle-km	-	-	-	-
Urban	Modal Share	%				
	Trip Distance	km/trip				
	Passenger trip	mil.passenger-km	-	-	-	-
	No. of passengers	passenger/vehicle				
	Volume of transportation	Vehicle-km	-	-	-	-
Rural	Modal Share	%				
	Trip	Trip				
	Trip Distance	km/trip				
	Passenger trip	mil.passenger-km	-	-	-	-
	No. of passengers	passenger/vehicle				
	Volume of transportation	Vehicle-km	-	-	-	-
Statistical Dat	mil.Passenger-km					

PT

Pass.-km





Template for parameter settings

Service share & Efficiencies (Passenger)

Category	Grounds for the parameters (Service share)	Grounds for the parameters (Efficiencies)
Motorbike		
Car		
Bus		
Railway		
Maritime		
Aviation		