CDM in Urban Railway Sector and JICA's Cooperation

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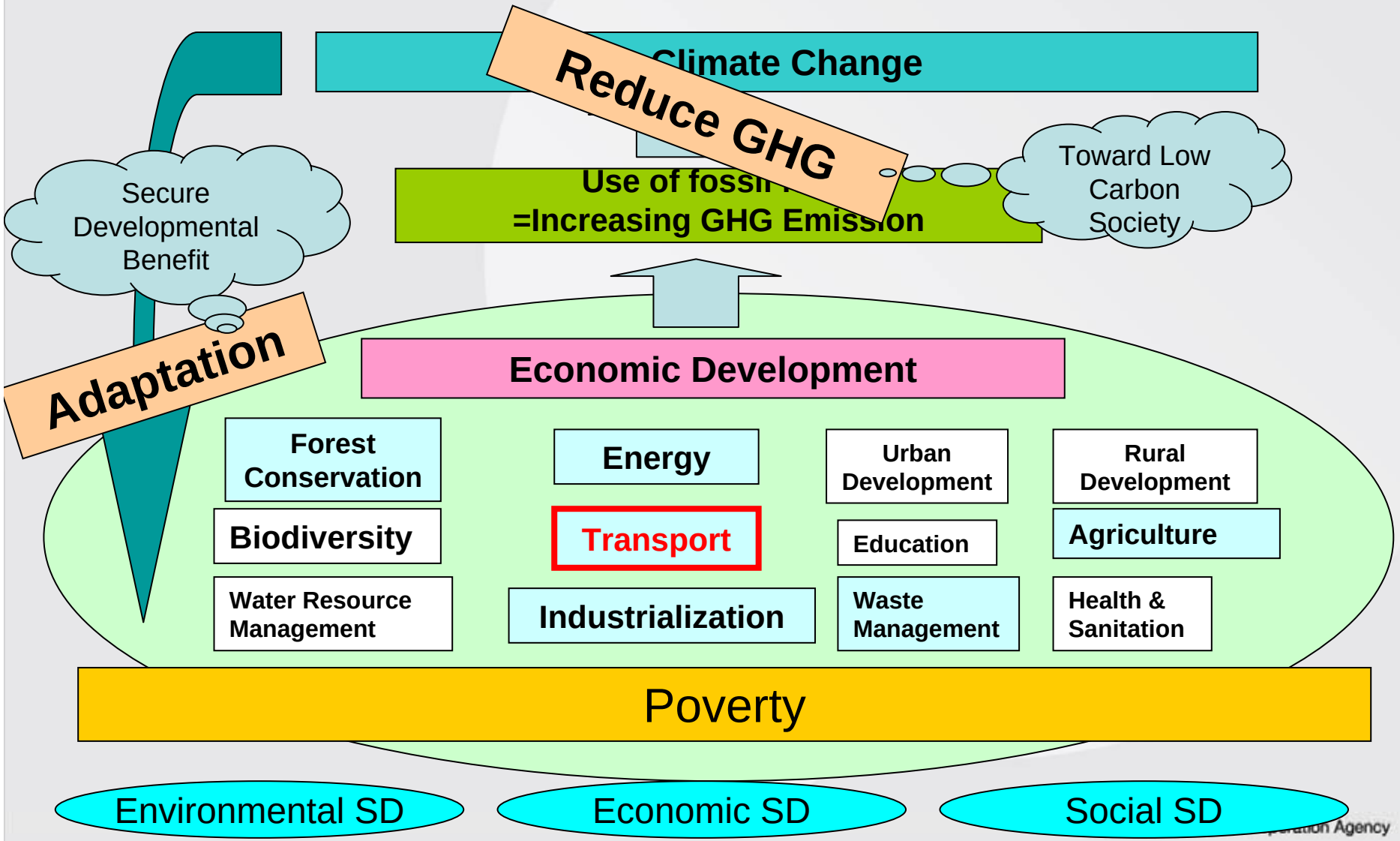
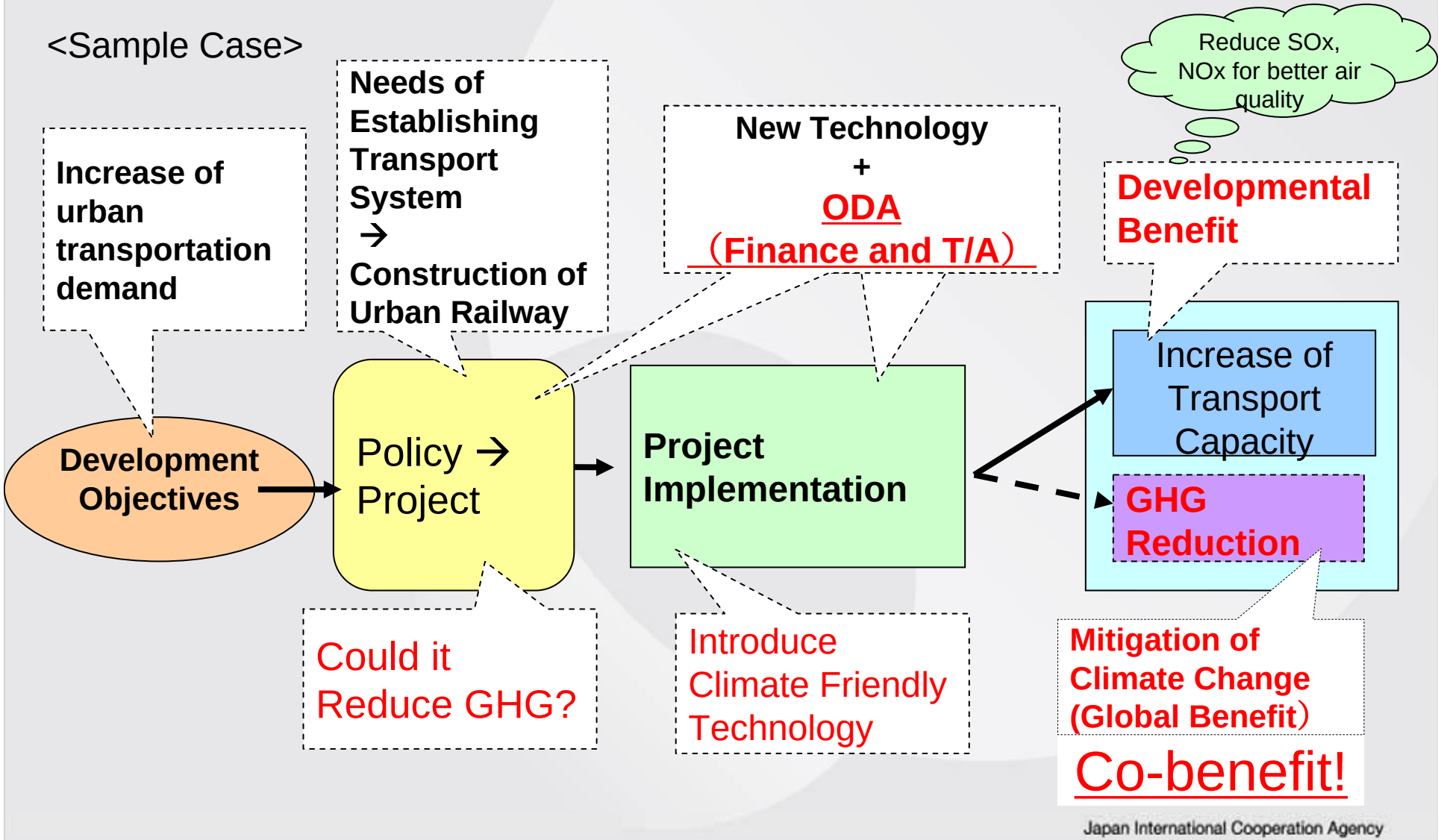
Development Agenda and Climate Change

- Toward "Low Carbon Society"



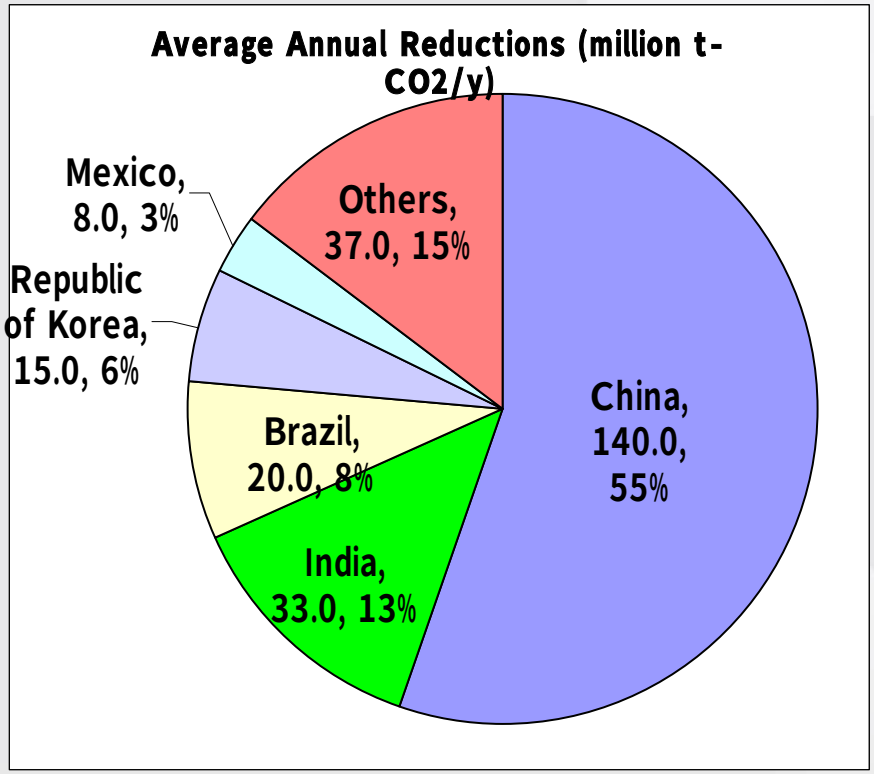
To Generate “Co-benefit”

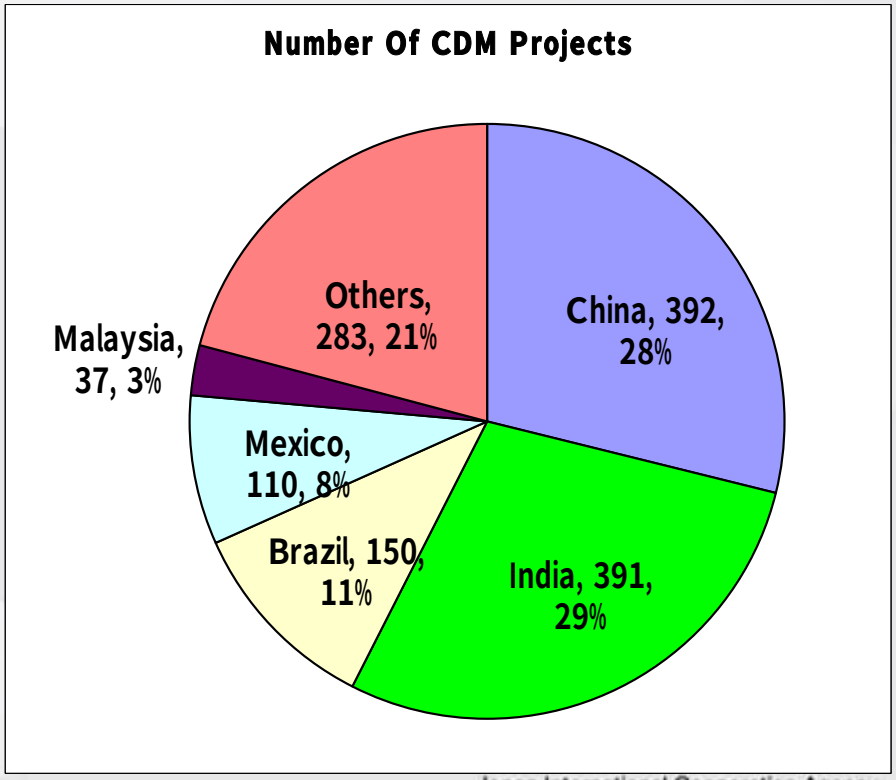


Current Situation of CDM

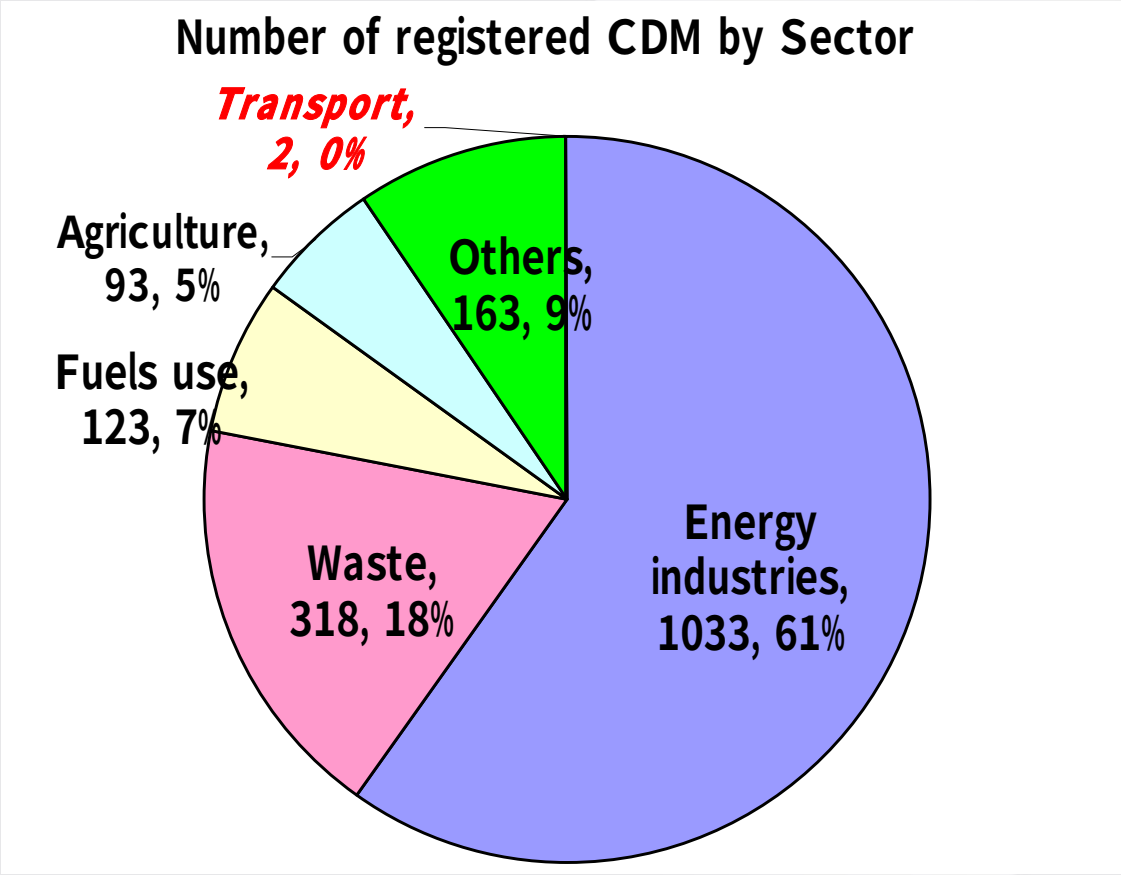
1,363CDM Projects are Registered. (as of Jan 30, 2009)

But, majority of CDM projects are shared among a few countries (India, China, Brasil, Mexico)!





Clean Development Mechanism (CDM) by sector



80% of CDM projects are Renewable energy development (most of them are biomass & biogas), and waste handling and disposal (Landfill gas)

⇒ Only 2 transport sector projects registered.

Challenges in Transport CDM

- Limited Methodologies
  - 15 methodologies were submitted,
    - Only 5 approved (1 for normal scale, 4 for small scale)
    - 2 are approval process in progress ➔ Rejected

AM0031	**Expansion of the bus system in Bogota**	**Bus Rapid Transit System for Bogotá, Colombia: TransMilenio Phase II to IV**
AMS III.C	**Emission reductions by low-greenhouse gas emitting vehicles**	**Installation of Low Green House Gases (GHG) emitting rolling stock cars in metro system**
AMS III.S	**Introduction of Low-emission vehicle to commercial vehicle fleet**	**-**
AMS III.T	**Plant oil production and use for transport application**	**-**
AMS III.U	**Cable cars for Mass Rapid Transit System**	**-**
NM0258	**Methodology for Bus Lanes**	**Metrobus Insurgentes, Mexico City**
NM0266	**Methodology for Rail Based Urban Mass Rapid Transit Systems (MRTS)**	**Mumbai Metro One, India**

Delhi Mass Rapid Transport System Project, India

Summary	Date of L/A	Project Cost		Total Length	Traffic Capacity
		Total	JICA Loan		
		Billion Yen	Billion Yen	km	Million man*km/day
Constructing a subway (11.0km), and a surface and elevated rail corridor (44.3km)	Feb 1997	278	163	65.1	5.88

– **Project objective:**

- To relieve traffic congestion and improve the urban environment through the reduction of vehicle emissions in the capital territory of Delhi by constructing the capital's first mass rapid transport system.

- The service commenced on Nov. 2006. The mass transit system is expected to carry 2.26 million passengers a day, a figure comparable to the volume of passengers carried by the subway system in Tokyo or in Osaka.

Japan International Cooperation Agency

Delhi Mass Rapid Transport System Project, India

<Project description as CDM>

Registered as CDM: Dec. 29, 2007

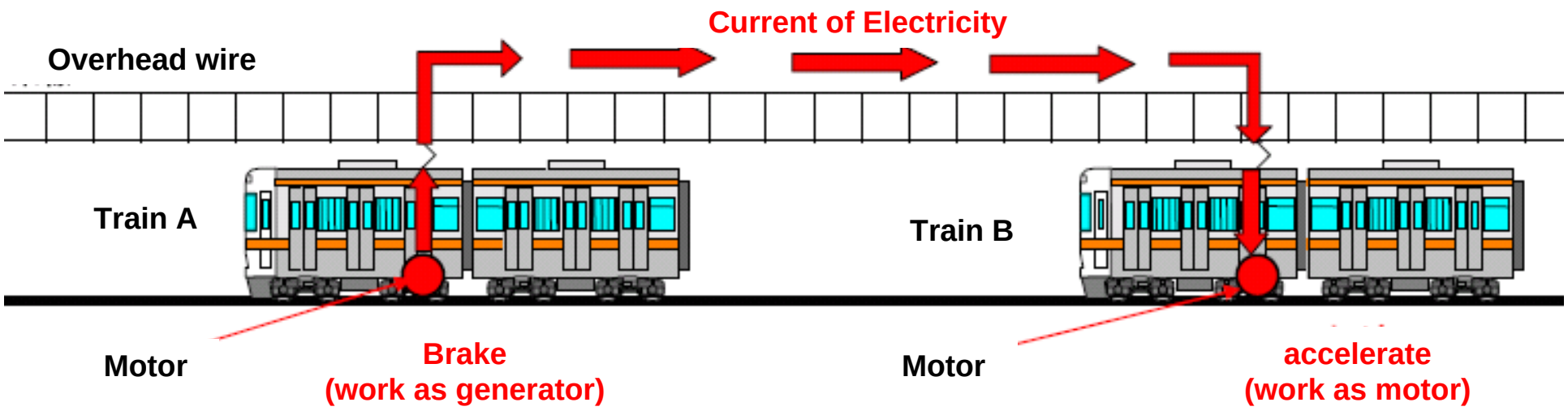
Methodology used: **AMSIII.C** (Emission reductions by low-greenhouse gas emitting vehicles)

Emission reduction: 41,160tCO2/year

- Energy saving with **regenerative brake system**

Ref: Approx 38,000 t CO2 reduction by modal shift from vehicles are estimated.

Regenerative Brake System



- The motor is an equipment that converts electricity into a mechanical motion, conversely, the motor become a generator by converting kinetic energy into electricity.
- Regenerative brake system is a system applying such characteristics of the motor and recycling electric energy within the network.
- In above picture, When train A brake is applied, the motor of train A works as a generator.
- By supplying electricity from Train A to overhead wire, the electricity generated by Train A can be used by Train B for powering.
- Thus, electricity generated by fossil fuel power plant can be saved and, in turn, GHG emission will be reduced.

Challenges in Transport CDM

- Challenges to develop Methodology for transport

(Lessons learned from rejected methodology: MN229 “Methodology for Mass Rapid Transit Project)

  - How to address “Rebound effect”?
  - How to set system boundary?
  - How to show leakage?

➔Further discussion may be necessary…

Study on the Reduction of CO_2 Emission by the Underground Rail Development in Seoul Metropolitan Area

Acknowledgement: I would like to express my sincere gratitude to Seoul City Government, SMC, SRTC, SDI, KOTI for their advices, comments and cooperation in data collection for this study.

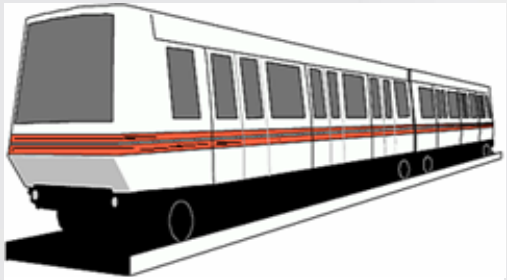
Background and Objectives of Study

Background

- Seoul Metropolitan Government has been developing the underground railway systems since early 1970's. The development of the systems is partially financed by the Japanese ODA loan.
- The urban rail development in Seoul has contributed not only to improving the traffic condition and mobility of Seoul citizens, but also to reducing the overall emission of CO2 in the transport activities in the city.

Objectives

- The objective of this joint study is to estimate CO2 emission reduction by the underground rail development in Seoul by applying the concept of Life Cycle Assessment (LCA).
- This study, however, does not examine implications to CDM methodology.



Map of Seoul Metro Network

Factors Influencing GHG Emission in MRTS Projects

(Items highlighted by yellow are considered in this study)

	Road Component	Railway Component
Infrastructure		
Construction	Alternative road construction to cover passenger flow of MRTS (methodology not established)	Construction of MRTS (including consumption of materials)
Replacement of facilities	Decrease replacement of pavement (methodology not established)	Replacement of electric facility (small)
Maintenance	Reduction of maintenance of road (methodology not established)	Maintenance of facility such as replacement of rail
Operation		
CO_2 Emission (reductions) by Operation	MRTS users not using buses, cars, taxis, and other Ease of traffic jam *(Alternative option)*	Electricity consumption by MRTS
Maintenance & Replacement of vehicles/ rolling stock	Reduced number of bus coaches for replacement	Manufacture / Replacement of rolling stocks
	Reduced number of tires for replacement	(Wheel replacement included in Maintenance)
	Reduction of maintenance materials such as motor oil (methodology not established)	Maintenance of rolling stocks

Method of calculation : Railway Component

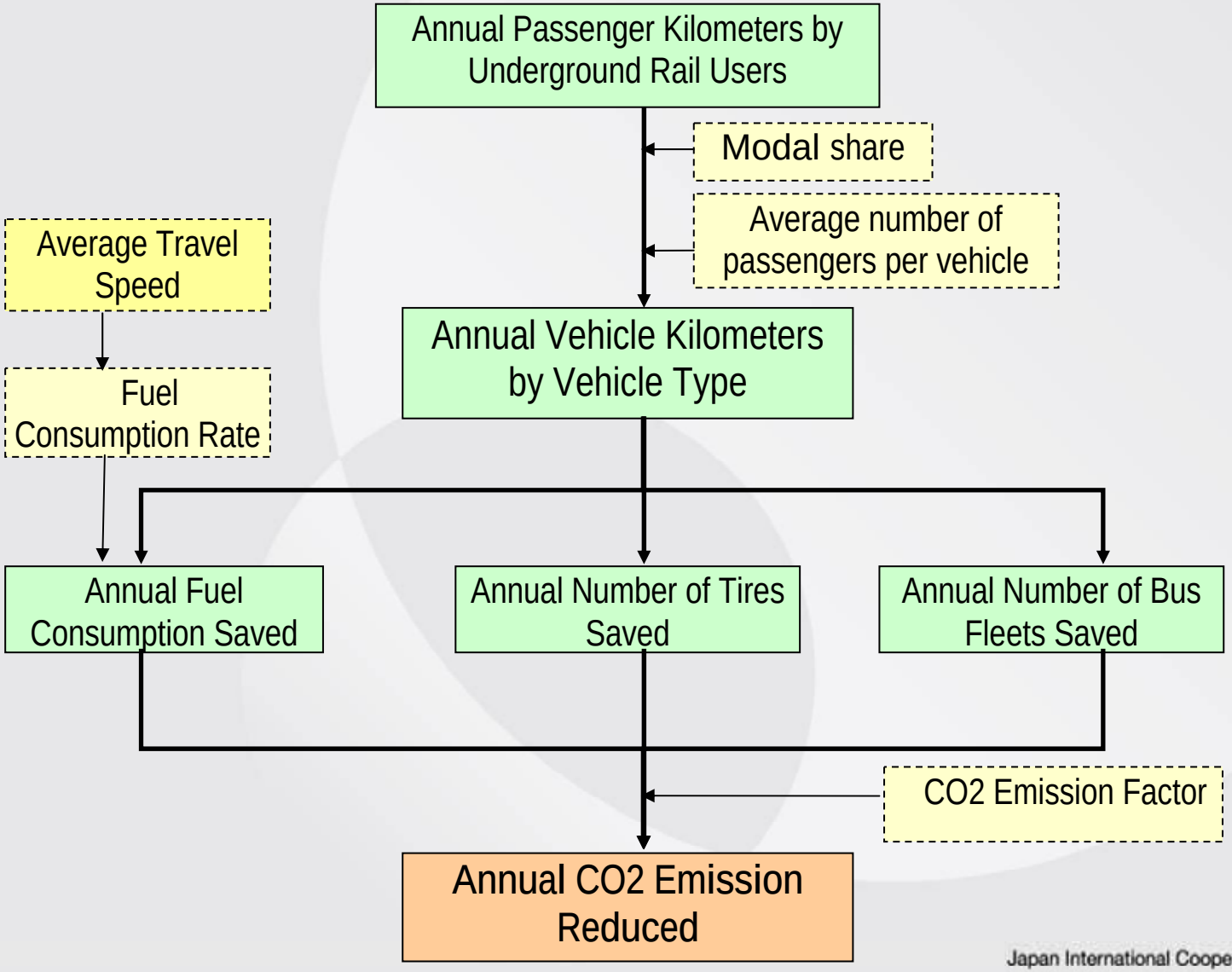
Infrastructure

- Construction of MRTS
  - Viaduct, Tunnel, Station, Depot
  - (Including production of material, fuel consumption)
- Maintenance of facility
  - Rail, OHC
  - (including production of material, fuel consumption)

Operation

- Electricity consumption by MRTS
  - Manufacture / Replacement of rolling stocks
- Rolling stock, auxiliary electricity for facilities
  - (including production of material, fuel consumption)
- Maintenance of rolling stocks
  - Pantographs, brakes, wheels
  - (including production of material, fuel consumption)

Calculation of CO2 Emission Reduction by Modal Change



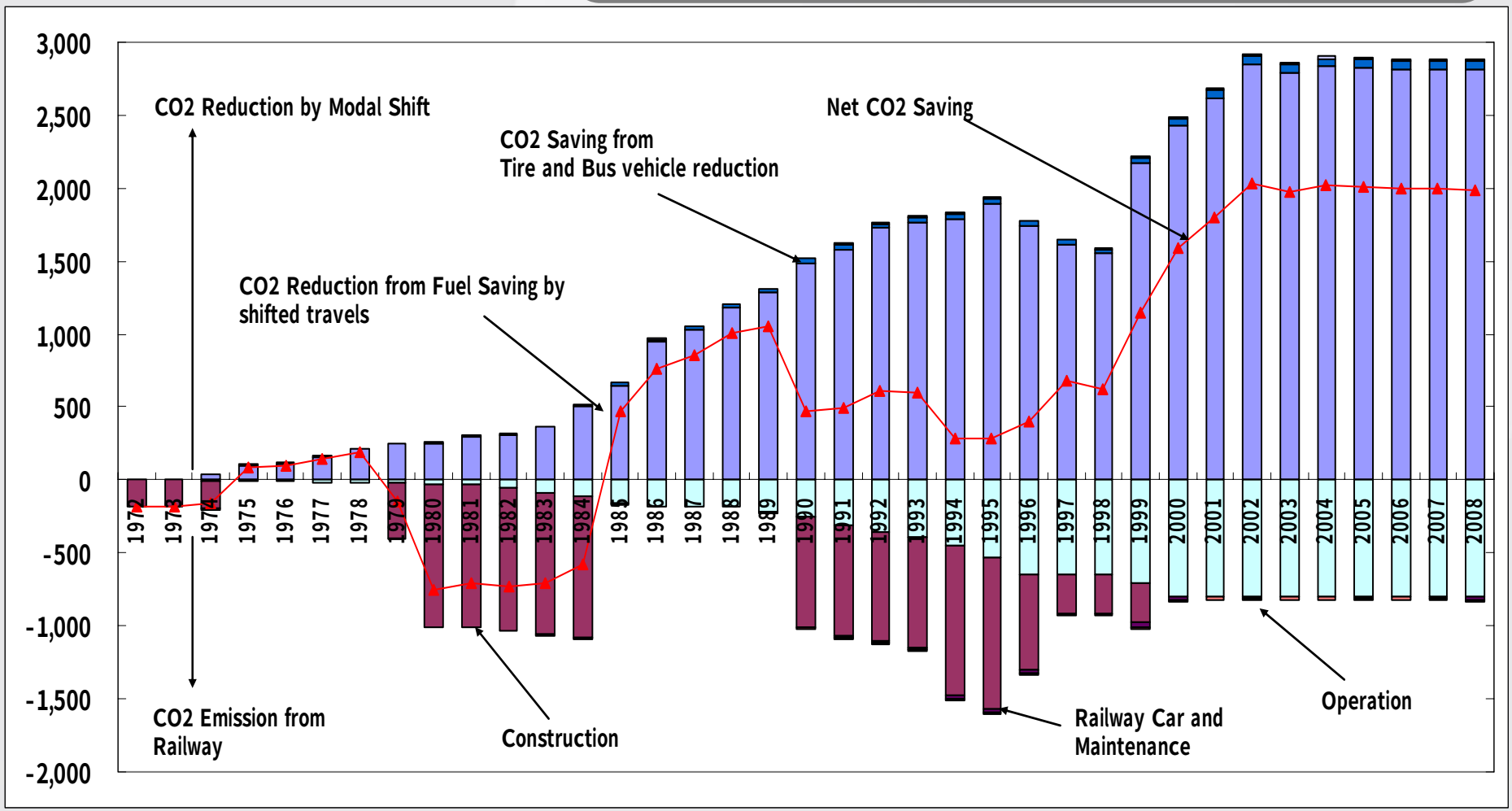
Lines Considered in the Calculation

Lines (sections) operated by Seoul Metro and Seoul Rapid Transit Corporation were included in the calculation (sections operated by other operators were not included due to availability of information)

Operating Entity	Seoul Metro				Seoul Rapid Transit Corporation			
Line Number	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8
Start of Operation	1974	1980	1985	1985	1995	1999	1996	1996
Length by type of track structure (km)								
Elevated	0.000	15.251	2.863	6.936	0.434	0.060	2.133	0.040
Underground (Open-Cut)	8.678	34.900	20.185	18.164	20.7	17.7	22.1	14.0
Underground (Shield)	0.000	8.162	13.945	7.575	33.5	18.5	23.4	5.7
Ground Level	1.213	3.837	0.720	0.694	0.221	0.472	1.300	1.170
Total	9.891	62.150	37.713	33.369	54.823	36.706	48.937	20.897
Number of Stations								
Elevated	0	13	2	5	0	0	0	0
Underground	10	37	29	21	51	38	42	17
Ground Level	0	0	0	0	0	0	0	0
Maintenance Yard								
Capacity (Rail cars)	404	460	700	400	536	256	560	108

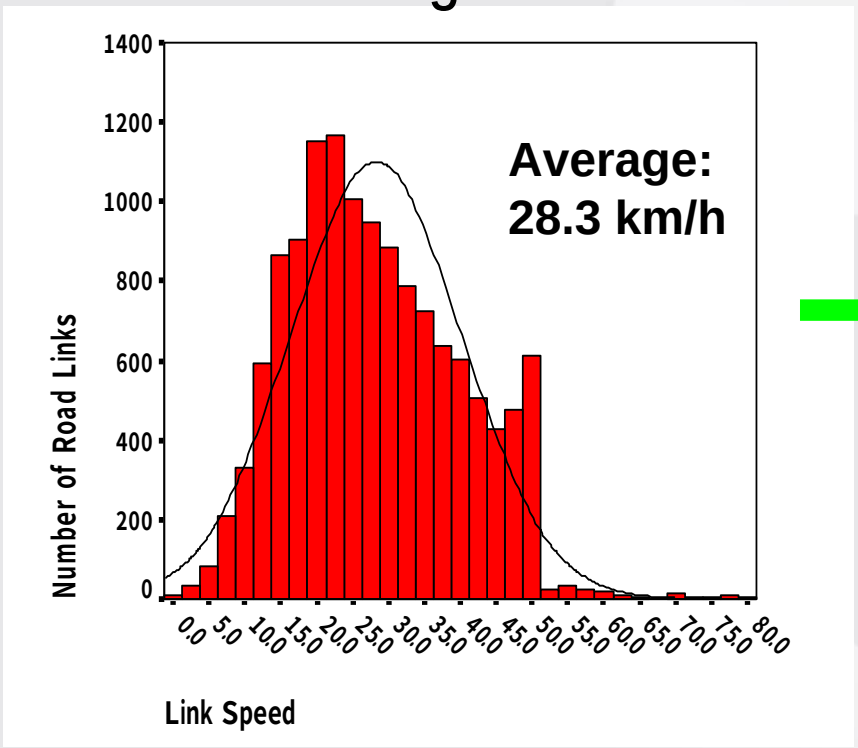
CO2 Emission reduction between 1972 and 2008

Accumulative CO2 emission reduction: 24.71mil t-CO2
(Equal to newly planted trees of 41,116 ha)
Annual CO2 emission Reduction: 2.1 mil t-CO2 (2008)

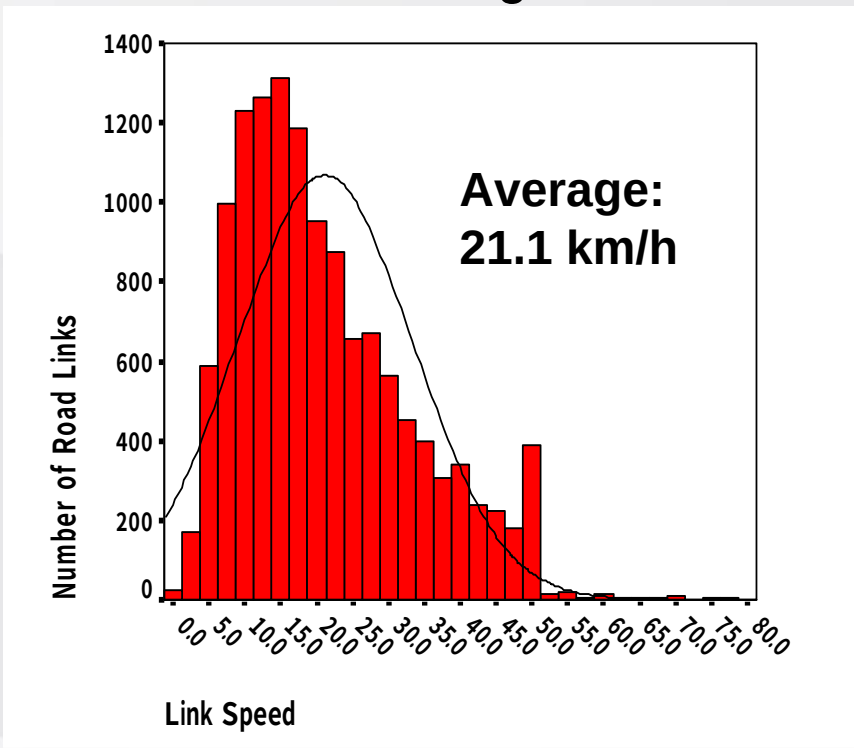


Impact of Underground Rail Systems on Speed of Road Traffic

WITH Underground Rail



WITHOUT Underground Rail



NOTE: Calculation is made by a traffic simulation model for Seoul Metropolitan Area using the 2006 data. Average speeds are not weighted by traffic volume or link length.

Conclusion

- Environmentally sustainable Transport Sector is
  - most important sector for developing countries to promote economic growth as well as to secure better air quality.
  - great potential for sector to contribute to reduce GHG emission.

  →Great potential to realize “co-benefit”

  =JICA will provide its cooperation to develop/implement co-benefit projects in developing countries.

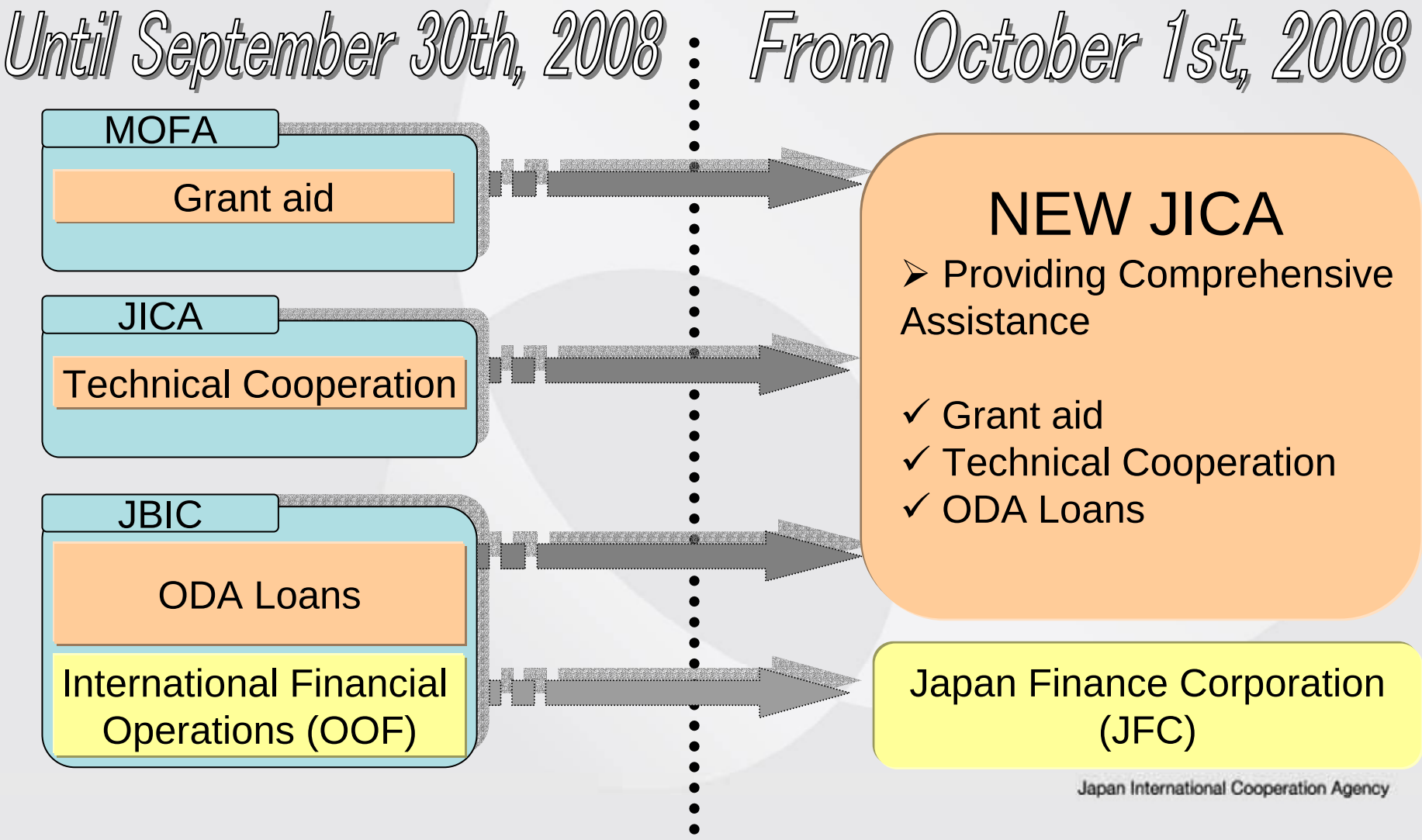
- Seoul Metro system contributes to GHG reduction as Environmentally Sustainable Transport
  - The study demonstrated that the underground rail systems in Seoul contributed to the reduction of CO2 emission in Seoul Metropolitan Area since its development.
  - Net savings on CO2 emission was achieved within several years of Metro construction.
  - Seoul Metro contributes to the reduction of traffic congestion.

The way forward

- Current CDM Methodology for transport sector is still limited, in turn, number of registered CDM in Transport Sector is also limited.
  - Further methodology development is critical.
  - Survey on actual reduction of GHG emission by existing MRTs in Asia may contribute to further discussion on CDM methodology development.
- Our calculation tool also needs to be improved further
  - CO2 emissions reduction by reduced traffic congestion can also be estimated if detailed traffic simulation models are available.
  - Unit CO2 emission rates for railway construction in Korea may have to be developed to increase the accuracy.

Reference

Japan's ODA Reform



Facts & Figures of New JICA

- **Staff:**
  - 1,664 staff. They are supplemented at any one time by thousands of Japanese experts and young and senior volunteers on both short-term and long-term contracts.

- **Operational Volume:**
  - It is the world's largest bilateral development assistance agency with a size of estimated $10.3 billion dollars.

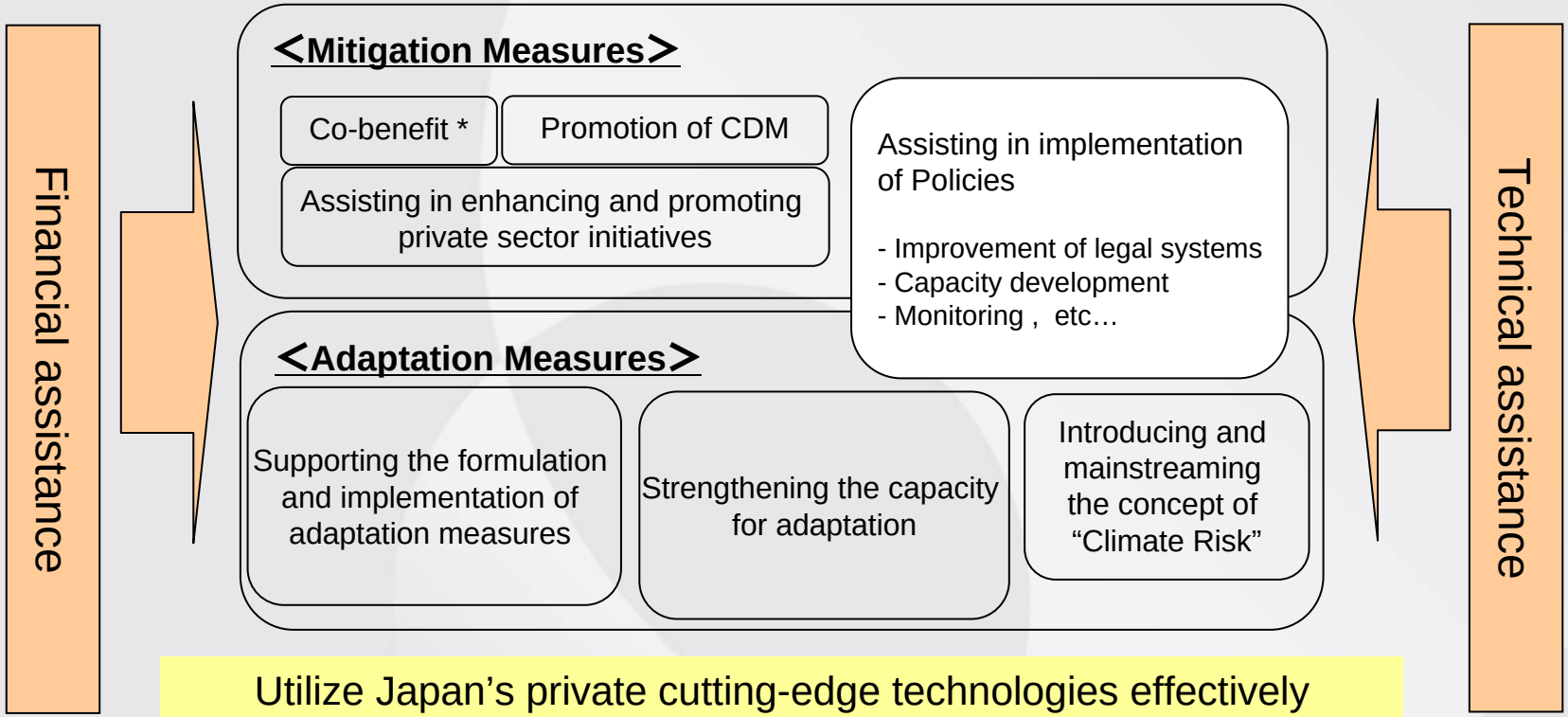
Comparison with other Major Donor Agencies

World Bank	Number of Staff	8,600
	Volume of Operation	US$19,634mil
Asian Development Bank	Number of Staff	2,443
	Volume of Operation	US$6,851mil
USAID	Number of Staff	2,227
	Volume of Operation	US$3,976mil
New JICA	**Number of Staff**	**1,664**
	Volume of Operation*	**US$10,280mil**

Exchange Rate used: JPY100.10/US$ (IFS rate for 2008 March end)
*estimated based on FY2008 budget (full year)

Direction of New JICA's Operation Addressing Climate Change

NEW-JICA's policies and concrete measures (Image)



Utilize Japan's private cutting-edge technologies effectively

Promote globally conducive research

* "Co-benefit" approach ・・・Project or program which realize both developmental benefits for developing country and GHG emission reductions.