



# JICA Initiatives / Strategy in Financing Sustainable and Low Carbon Urban Transport in Asia

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Shinya Ejima  
Office for Climate Change  
Japan International Cooperation Agency



## Urban Transport - One of the Key Sector of JICA Assistance

- Steady and strong Growth in Asia, Mass-migration into Cities
- Urban Infrastructures fall behind the Population Growth
- Massive consumption of Fossil Fuel in Transportation, Waste of Time and Energy; bad for Environment and Global Warming
- Urgent and serious demand for Mass Transit System in Asian Mega-cities → Over 20% of Financial Assistance by JICA for Urban Transport in Asia (2008, commitment base)



# JICA's Support for Urban Transport is Expanding in Asia

- Seoul (Korea) 70s - early 90s
- Beijing (China) late 80s - 90s
- Manila (The Philippines) 90s
- Bangkok (Thailand) 90s
- Chongqing (China) 2000s
- **Underway:** Jakarta (Indonesia)  
Delhi\*, Chennai, Kolkata and Bangalore (India)  
Bangkok - **Red** and **Purple** Lines (Thailand)  
Ho-Chi-Minh and Hanoi (Viet Num)

\*Phase 1 and a part of Phase 2 are in service



# Delhi Mass Rapid Transport System (Delhi Metro) Project, India

Construction of mass rapid transport system, total length of 414km, in Delhi and its suburb. Underground in urban and surface/elevated corridor in suburb.

2006 Phase 1 (65km) in service

2010 Phase 2 (128km) to be in service

2021 completion of Phase 4

- First Mass Rapid Transport system in India
- To relieve traffic congestion and improve the urban environment through the reduction of vehicles and their emissions
- Constructed and operated by **Delhi Metro Rail Corporation Limited (DMRC)**





## Finance: case of Delhi Metro Phase 2

(Million US\$)

Total Project Cost (128km)	4,318 (100%)
Capital Subscription	
From National Government	704 (16%)
From National Capital Territory	704 (16%)
Domestic (concessional) Loan*	
From National Government	113 (3%)
From National Capital Territory	113 (3%)
ODA Loans from Japan (5 loans)**	2,355 (55%)
Profit from precedent project	281 (7%)
Others	48 (0.1%)

\* 0% interest rate

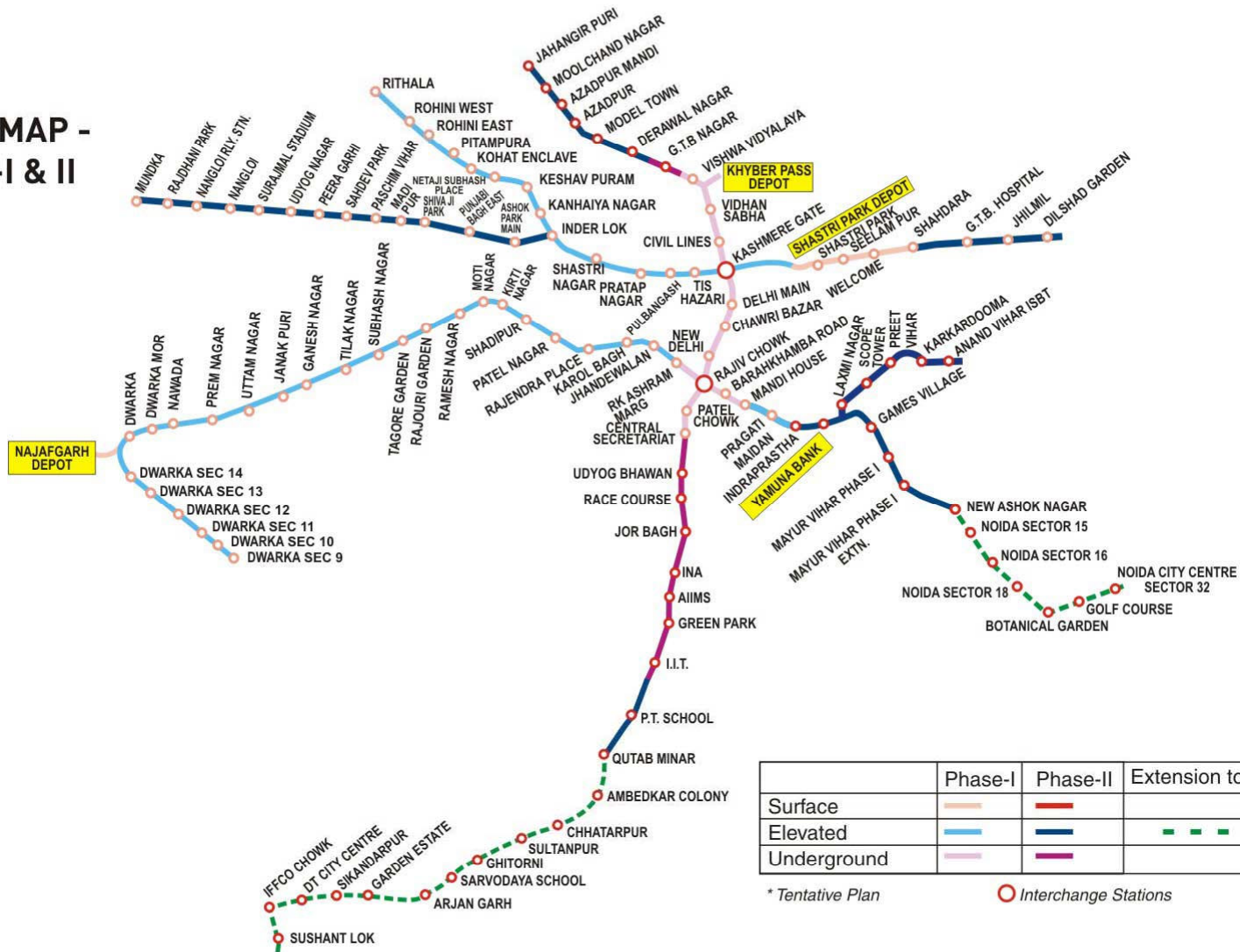
(US\$1=¥90)

\*\*1.245% interest rate (weighted average)



# Delhi Metro Rail Route Map

## ROUTE MAP - PHASE-I & II



	Phase-I	Phase-II	Extension to NCR
Surface	Orange	Blue	Green dashed
Elevated	Light blue	Dark blue	Green dashed
Underground	Pink	Magenta	

\* Tentative Plan ○ Interchange Stations



# Mass Transit System Project in Bangkok (MRT Blue Line Project), Thailand

- Construction of mass rapid transport system (first subway) in Thailand. Total Length of 20km (Blue Line)
- July 2004 in service
- To relieve traffic congestion and improve the urban environment through the reduction of vehicles and emissions
- Civil Works (tunnels, tracks, stations) by **Public Sector**: Mass Rapid Transit Authority (MRTA)
- Rolling Stocks, Communication System, and Signals as well as O&M by **Private Sector**: Bangkok Metro Public Company Limited (BMCL) – **25 Years Concessionaire** of Blue Line (to 2029)



Two-tiered System



# Finance: case of Bangkok Blue Line

## Investment by Public Sector

(Million US\$)

Total Project Cost : Civil Works only (20km, all underground)	3,777 (100%)
Domestic finance (Budget from National Government)	1,500 (40%)
ODA Loans from Japan (6 loans)*	2,277 (60%)

\*1.283% interest rate (weighted average)

(US\$1=32Baht)

### Investment by BMLC : about \$600 Million

(BMLC consolidated financial statements 2009)



## Two-tiered System

- For Public Sector
  - Significant saving of initial investment (\$600 Million) (rolling stocks, etc.)
  - Expectation of efficient operation and maintenance by private sector
  - Mitigation of uncertainty of cash flow
- For Private Investor
  - Wider preferential treatment (50% deduction of import duty, exemption from corporate income tax for 8 years, etc.)
  - Less initial investment, compared to BOT
  - Direct linkage of operational efforts and return

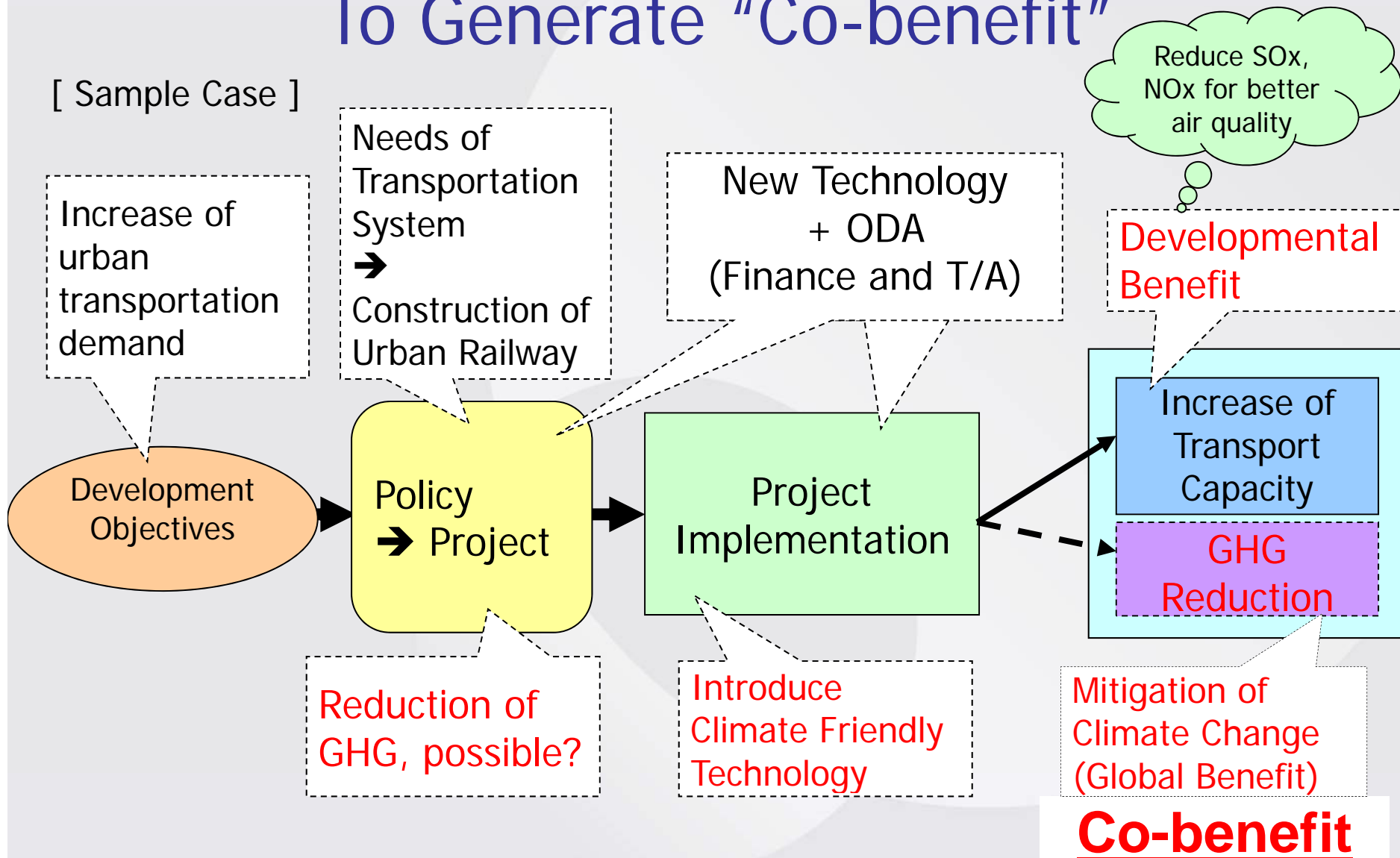


## Possible Solutions in Finance Enhancement of Sustainability

- Private Sector Investment
- Public Sector Project utilizing ODA
- PPP: Public-Private Partnership – Best Mix of Private and Public
- To capture and maximize various Business Opportunities other than Fare Box, e.g. commercial development: Shops, Ads, Real Estate, etc.
- To register the Project as **CDM**

# Development and CDM To Generate "Co-benefit"

[ Sample Case ]



**Co-benefit**



# Delhi Metro Project, India

Project description as CDM

Registered: Dec. 29, 2007

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

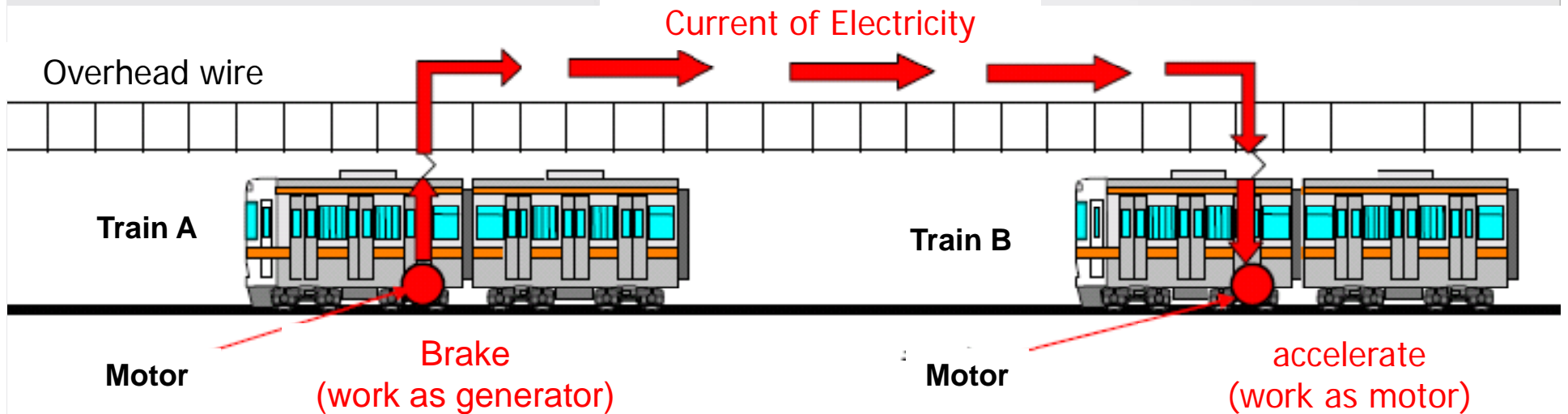
Emission reduction: 41,160 tCO<sub>2</sub>/year

Energy saving with **regenerative brake system**

Ref: Estimated reduction by **modal shift from vehicles** Approx. 38,000 tCO<sub>2</sub>.



# Regenerative Brake System



- The motor converts electricity into a mechanical motion, conversely, the motor become a generator by converting kinetic energy into electricity.
- **Regenerative brake system** applies such characteristics of the motor and recycling electric energy within the network.
- 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

- Limited Methodologies
  - Out of 180 Methodologies, Only Seven (7) approved; One (1) for Normal Scale, Six (6) for Small Scale
- Small Number of Registered Projects
  - Out of 2,318 Projects, Only Three (3) registered

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.U	Operation of Cable Cars	Replacement of Bus Services along steep slope by Cable Cars in Metro Medellin, Colombia

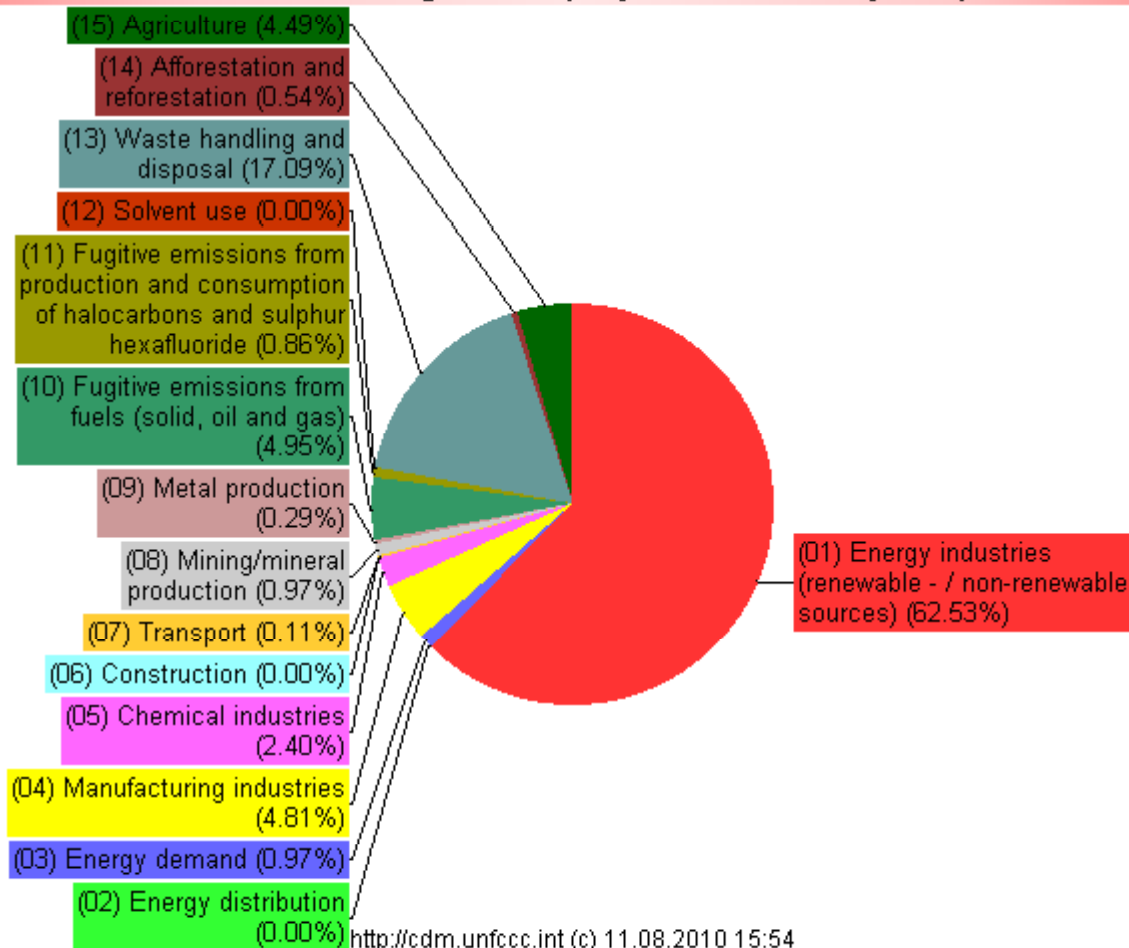
( as of August 10, 2010 )



# Clean Development Mechanism

## Unevenly distributed by sector

Distribution of registered project activities by scope



Registered: **2,317**  
Energy : 63% (1,742)  
Waste and Disposal:  
17% (476)  
Transport : **0.1%**  
Only **3** Projects

(as of Aug 10, 2010)



# Challenges in Transport CDM

## ■ Challenges to develop Methodology for transport

Lessons learned from rejected methodology:

NM229 "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...



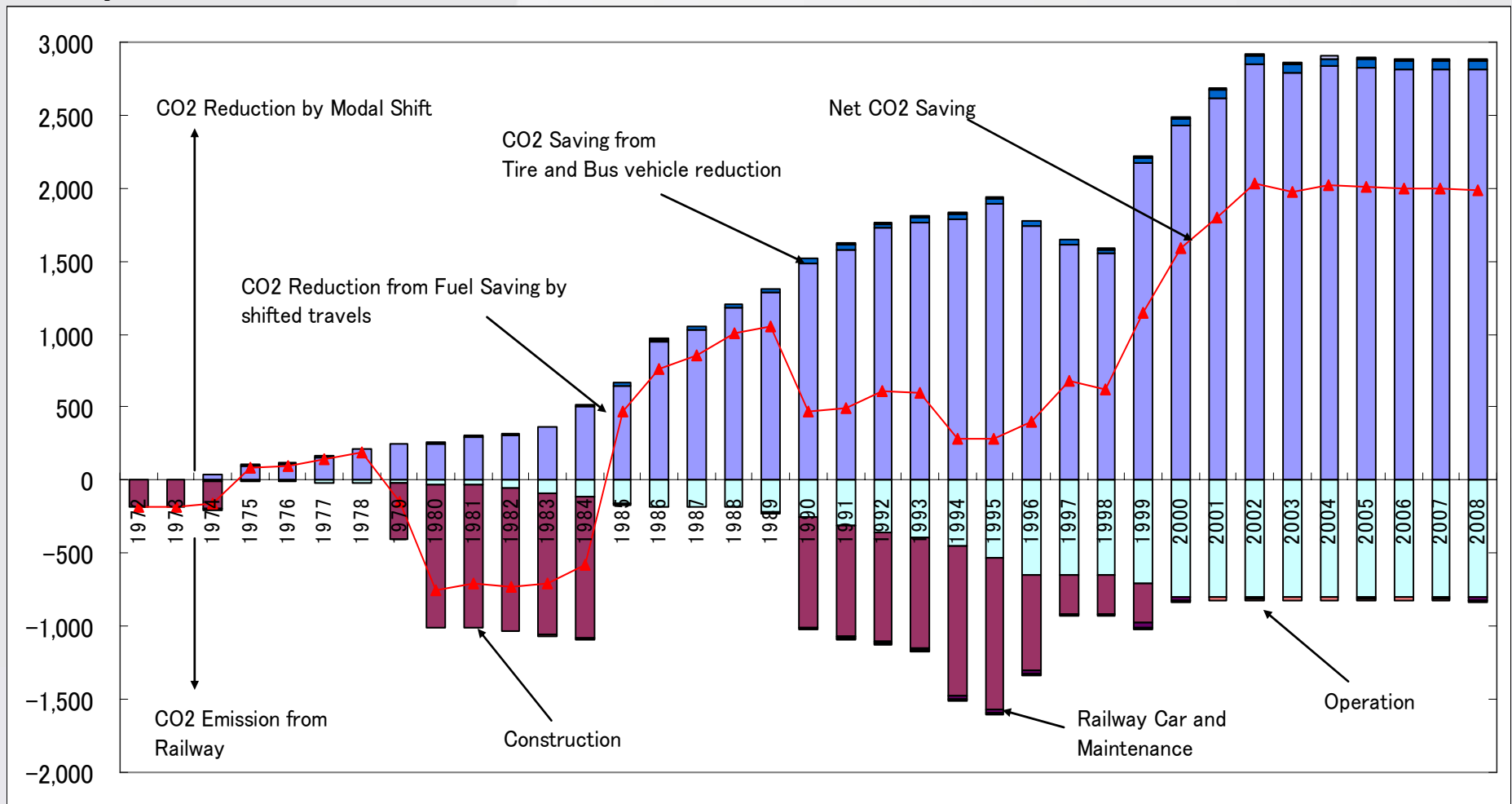


# Reference: Study on the Reduction of CO<sub>2</sub> Emission by the Underground Rail Development in Seoul Metropolitan Area

## CO<sub>2</sub> Emission reduction between 1972 and 2008

Accumulative CO<sub>2</sub> emission reduction: 24.71mil t-CO<sub>2</sub>  
Annual CO<sub>2</sub> emission Reduction: 2.1 mil t-CO<sub>2</sub> (2008)

CO<sub>2</sub> Emission Reduction  
1,000t/year





# Conclusion

- Environmentally Sustainable Transport Sector is;
  - The most important sector for developing countries for their economic growth as well as environment (better air quality).
  - Great potential to contribute to reduce GHG emission.
  - Big opportunity to realize “Co-Benefit”
- Huge Cost Requirement (Delhi Metro, Phase 2: \$38mil/km, Bangkok Metro, Blue Line: \$219mil/km), despite a Longer Payout Period.
  - Need to Mobilize various Finance and determine the best mix of Public-Private combination and/or division of labor.
  - Maximum utilization of business opportunities is expected.
  - ODA assumes the important role.
  - CDM enhances the sustainability.
  - JICA is to support Co-Benefit Projects in view of Development as well as Climate Change and Environment.



## CDM : The Way Forward

- CDM Methodologies for transport sector are 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.



Thank you for your attention.

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