Mitigation Impacts of Mass Rapid Transit System (MRT)

Issues for Discussion
based on JICA Study on Seoul Metro LCA GHG Emission and JICA Climate Finance Impact Tool (JICA Climate-FIT)
Web: http://www.jica.go.jp/english/operations/climate_change/mitigation.html

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1. Introduction:
Japan’s Role for Climate Change and Development
Japan’s Role for Climate Change and Development

◆ JICA and Japan’s ODA

- Since 1954, Japan has been providing financial and technical assistance to developing countries through ODA (Official Development Assistance). JICA (Japan International Cooperation Agency) is in charge of administering all ODA except contributions to international organizations.
- JICA, taking advantage of accumulated experiences, the results of assisting of developing countries and Japan's technology, conducts multi-benefit assistance, which contributes to sustainable developments in developing countries and simultaneously contributes to resolve various development subjects. JICA assists by mixing organically financial and technical assistance for mitigation measures, which contribute to reduce greenhouse gas (GHG) emission and for adaptation measures to the negative effects caused by climate change in various sectors.

*This excludes Grant Aid which the Ministry of Foreign Affairs will continue to directly implement for the necessity of diplomatic policy.

Japan is the Largest Climate Change Donor

Mitigation
Total: USD 17.64 billion

Adaptation
Total: USD 9.34 billion

Bilateral Support on climate change in 2010
(OECD DAC Statistics 2011)
JICA’s Approach: Low-Carbon and Climate Resilient Development Cooperation

**Direction of JICA Operation Addressing Climate Change**
JICA’s taking actions to combat climate change are based upon the following principles.

- **Comprehensive Assistance**
- **Climate Change, A Global Agenda**
- **Climate Compatible Sustainable Development**

**Strategic Mitigation Actions**
- NAMA, MRV, REDD+, etc.
- Low-carbon Technologies
  - Renewables, Energy Efficiency, etc.
- Efficient Use of Resources, etc.
  - Mass Transit, Smart-grid, etc.

- **Policy & Institutional Reform, Finance Mechanism, Human Resource Development**
- Modeling / Vulnerability Assessment
  - Climate Prediction, GIS, etc.
- Enhancing Adaptive Capacity
  - Awareness, Early Warning System, etc.
- Resilient Infrastructure
  - Irrigation, Flood Control, etc.

- **Disaster Risk Management, Water, Agriculture, Sanitation, etc.**

**Equitable Growth**
- Sustainable Development
- Human Security

**Energy, Transport, Forestry, Waste Management, etc.**

**Reduction of GHG Emission**
- Responding to Climate Change
- Enhancing Adaptive Capacity

**JICA’s Approach:**
- Low-Carbon and Climate Resilient Development Cooperation
- Policy & Institutional Reform, Finance Mechanism, Human Resource Development
- Reduction of GHG Emission
  - Responding to Climate Change
  - Enhancing Adaptive Capacity
- Sustainable Development
- Human Security
- Energy, Transport, Forestry, Waste Management, etc.

**PDCA Cycle:**
Four-step (Plan, Do, Check and Action) management cycle which continuously improves the processes

**MRV:**
Measurable, reportable and Verifiable / Approach which enables to measure, report and certificate the amount of GHG reduction due to mitigation projects

2. Case Study:
GHG Reduction in Life Cycle Assessment (Seoul Metro Subway)
Case Study:
GHG Reduction in Life Cycle Assessment
(Seoul Metro Subway)

- Conducted in Fiscal 2008

Background
Seoul Metropolitan Government has been developing the subway system since early 1970’s. The development of the system is partially financed by the Japanese ODA loan. The system has contributed not only to improving the traffic condition and mobility of Seoul citizens, but also to reducing the GHG emission from transport activities.

Objective
To estimate GHG emission reduction by subway system (Lines 1 - 8) developed in Seoul by applying the concept of Life Cycle Assessment (LCA). The study, however, does not examine implications to CDM methodology.
Factors Considered for GHG Emission Impact Analysis

(Items highlighted in yellow are considered in this study)

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Road Component</th>
<th>Subway Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Alternative road construction to cover passenger flow of subway (methodology not established)</td>
<td>Construction of subway (including consumption of materials)</td>
</tr>
<tr>
<td>Replacement of facilities</td>
<td>Decrease of replacement of pavement (methodology not established)</td>
<td>Replacement of electric facility (small)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Reduction of maintenance of road (methodology not established)</td>
<td>Maintenance of facility such as replacement of rail</td>
</tr>
</tbody>
</table>

| Operation                           |                                                                              |                                                                              |
|-------------------------------------|                                                                              |                                                                              |
| CO₂ Emission (reductions) by Operation | Subway users not using buses, cars, taxis, and other                       | Electricity consumption by subway                                              |
| 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                                                  |

Result

Total CO₂ emission reduction: 24,705,884 t

Unit: 1,000 tons of CO₂ Emission Reduction / year
JICA Climate-FIT
Simplified Methodology

Japan International Cooperation Agency (JICA)
Climate Finance Impact Tool
for Mitigation and Adaptation (Summary)

JICA Climate-FIT (Summary)
Draft Ver. 1.0

June 2011
Office for Climate Change
JICA Global Environment Department

Final Report for Study on Mainstreaming Climate Change Considerations into JICA
Operations (Summary) by NETWITIIS CO., LTD.

Baseline Emission is calculated based on the assumption that the output level (traffic volume) is equal to the with-project case.

\[ E_{Ry} = B_{Ey} - P_{Ey} \]

Covers substantial portion of the mitigation (and emission) impacts
Focuses on the impacts during the operation stage (after project completion)

Construction & maintenance emissions considered in the Seoul Study are not covered
Other factors (such as emissions for manufacturing cars, increase of other modes to reach subway stations) are not considered either
Issues for Discussion

- GHG emission/reduction in LCA
  To what extent should “GHG emission/reduction in LCA” be considered?

- Accuracy of Data to be Collected
  Desirable to MRV emission reduction of “the whole network” rather than “individual projects (i.e. subway lines),” but difficult to obtain --

  --- “line-by-line” data when network is complicated
  --- several decades of data (network is built over a long time)
  --- modal shift rate - hard to monitor and changes over time
  --- realistic assumption of technology improvement for baseline case
  --- increase of use of other modes to get to MRT stations
  --- avoiding road traffic jam (but may end up increasing volume), etc.

3. Lessons Learnt from Policy and Project Support on Transport Sector

(Based on the side event “East Asia Low Carbon Growth Partnership Dialogue” in “East Asia Knowledge Platform for Low Carbon Growth”, April 2012)  
Sustainable Low-carbon Development in the Transport Sector

<table>
<thead>
<tr>
<th>Country</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>Urban Master Plan, MRT (technical assistance, concessional loan)</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Introduction of Energy Efficient Public Bus (Vientiane Capital, grant aid)</td>
</tr>
<tr>
<td>Thailand</td>
<td>Urban MRT (Delhi, Chennai, Calcutta, Bangalore / concessional loan, CDM)</td>
</tr>
<tr>
<td>Laos</td>
<td>Introduction of Energy Efficient Public Bus (Vientiane Capital, grant aid)</td>
</tr>
<tr>
<td>UNCRD/JICA</td>
<td>Environmentally sustainable transportation training (participants from 19 countries)</td>
</tr>
<tr>
<td>JICA</td>
<td>Global urban transport database on person-trip (household interview) survey in (15 cities)</td>
</tr>
</tbody>
</table>

Building Urban Mass Transit System in Fast-Growing Vietnam

~Japanese expert is scheduled to assist operation of urban railway constructed using Japan’s ODA loan~

- Utilizing knowhow and technologies of Japanese railway system
  - Osaka Municipal Transportation Bureau is scheduled to assist operation of urban railway in Ho Chi Minh City (Business Partner City (BPC) of Osaka City)
- *STEP is an ODA loan scheme for which Japanese technologies and equipment are substantially utilized. Currently, procedures for bidding by Japanese firms are under way for Line 1 in Ho Chi Minh City.
Designing Sustainable Metropolis
Low-carbon Urban Planning and Mass Rapid Transit in Bangkok, Thailand

### Mass Rapid Transit Network (Physical Infrastructure)
- Bangkok faces serious traffic congestion and air pollution.
- JICA is supporting Bangkok to ease traffic congestion and cut greenhouse gas emissions by shifting traffic from road to public mass rapid transit.

### Low-carbon Urban Planning (Blueprint for Green City)
- Bangkok announced ambitious GHG emission reduction targets.
- Bangkok officials are formulating a low-carbon policy using JICA's cooperation framework (includes mass transit, renewable and efficient energy, waste, expanding park areas).

Cooperation from Yokohama, Japan
- Launched "Yokohama Smart City Project" to design and build "Next Generation Energy Infrastructure and Social System" to maximize GHG emission reduction.

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**India: Delhi Mass Rapid Transport System Project**

This is an example of a Mass Rapid Transport System in India and the first railway project registered as CDM in the world.

**Brief Overview**

<table>
<thead>
<tr>
<th>Loan Agreement</th>
<th>Signed in Feb 1997 (162,751 mil. Yen - Phase I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementing Agency</td>
<td>Delhi Metro Rail Corporation (DMRC)</td>
</tr>
<tr>
<td>Project Description</td>
<td>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 (55.3km).</td>
</tr>
<tr>
<td>Effect of the Project</td>
<td>Registered as CDM in Dec 2007</td>
</tr>
<tr>
<td></td>
<td>Approx 39,500tCO₂/year will be reduced by installation of a regenerative brake system. -&gt; target for CDM project</td>
</tr>
<tr>
<td></td>
<td>Approx 46,200tCO₂/year will be reduced by modal shift from vehicles. -&gt; only an estimation by JICA</td>
</tr>
</tbody>
</table>

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17 18
Findings, Evaluation and Lessons Learnt (1)

<table>
<thead>
<tr>
<th>Outcome (expected or achieved)</th>
<th>Moving goods and people smoothly is indispensable for socio-economic development of any nation.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In developing countries, however, expansion of freight and transportation infrastructure is slow, which impedes economic growth.</td>
</tr>
<tr>
<td></td>
<td>Designing and promoting sustainable freight and transportation infrastructure network can lead to low carbon development through more efficient logistics, cleaner technologies and less traffic congestion, which also contributes to less air pollution and healthier livelihood.</td>
</tr>
</tbody>
</table>

1. Transition towards Sustainable Low-carbon Development

| Good mix of policy packages (1) reduction of travel demand, 2) shift to carbon efficient modes, 3) technological improvement) is needed. |
| Policy packages should be accompanied by price and regulatory signals to promote modal shifts and avoid traffic congestion. |

Findings, Evaluation and Lessons Learnt (2)

2. Capacity Development

| Sharing lessons learnt to meet growing demands are crucial for utilizing evolving state-of-the-art technologies and best practices. |
| Engaging the public to educate the needs of carbon efficient choice of transportation is just as important as training experts. |

3. Bottlenecks of Current Framework

| Progress of infrastructure development cannot cope with rapid motorization |
| Lack of feasible business models to expand private investment to develop transportation infrastructure (such as BOT) |

Other Key Issues

| Appropriate use of market mechanism (existing CDM and new approaches) to give right incentives for low carbon investment |