CLEAN DEVELOPMENT MECHANISM
AND
DELHI METRO RAIL CORPORATION

- S A VERMA
DY. CHIEF ENGINEER

WORK SHOP ON CDM- “SUBSIDY TO FOSSILS OR LEAPFROG TO TECHNOLOGY”
CENTRE FOR SCIENCE AND ENVIRONMENT
NEW DELHI

NOVEMBER 17, 2011

http://www.delhimetrorail.com
CDM in Numbers

- CDM Projects in pipeline: 5600
- Registered Projects: 3571
  Annual Average CERs: 536,796,574

- Requesting Registration: 69
  Annual Average CERs: 6747,942
Registered Projects-3571

- China (46.21%)
- India (20.72%)
- Brazil (5.52%)
- Mexico (3.75%)
- Malaysia (2.86%)
- Viet Nam (2.21%)
- Indonesia (2.02%)
- Republic of Korea (1.79%)
- Others (14.93%)

http://cdm.unfccc.int (c) 14.11.2011 14:55
Major Players-CERs

CERs issued by host party. Total 774,737,324

- China (58.26%)
- India (15.77%)
- Republic of Korea (9.99%)
- Brazil (7.53%)
- Others (6.83%)
- Mexico (1.62%)
Two projects registered with UNFCCC so far:

(i) Project Code-1351: “Emission Reduction by Low GHG emitting vehicles” (also called regenerative braking project) registered on 29.12.2007
(ii) Project Code - 4463: “Metro Delhi, India” (also called Modal Shift project) registered on 30.06.2011
GHG and Transportation

- Transportation sector is responsible for nearly 24% of CO₂ emissions
- Fastest growing source of GHG Emissions
- Contributes equally to polln, congestion, accidents, adverse health etc.
CDM and Transportation

- Of 3571 projects registered, very few in transportation sector – just 10

- Only few projects involving Public Transport
## Registered CDM Projects - Transportation

<table>
<thead>
<tr>
<th>Registered Date</th>
<th>Project Title</th>
<th>Host Parties</th>
<th>Other Parties</th>
<th>Methodology</th>
<th>Reductions</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 Dec 06</td>
<td>BRT Bogotá, Colombia: TransMilenio Phase II to IV</td>
<td>Colombia, Switzerland</td>
<td>Netherlands</td>
<td>AM0031</td>
<td>246563</td>
<td>0672</td>
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<td>29 Dec 07</td>
<td>Installation of Low Green House Gases (CHG) emitting rolling stock cars in metro system</td>
<td>India, Japan</td>
<td></td>
<td>AMS-III.C. ver. 10</td>
<td>41160</td>
<td>1351</td>
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<td>26 Apr 10</td>
<td>Cable Cars Metro Medellin, Colombia</td>
<td>Colombia, Switzerland</td>
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<td>AMS-III.U.</td>
<td>17290</td>
<td>3224</td>
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<tr>
<td>19 Oct 10</td>
<td>BRT Chongqing Lines 1-4, China</td>
<td>China, Switzerland, Germany</td>
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<td>AM0031 ver. 3</td>
<td>218067</td>
<td>3760</td>
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<td>17 Dec 10</td>
<td>Plant-Oil Production for Usage in Vehicles, Paraguay</td>
<td>Paraguay, Switzerland</td>
<td></td>
<td>AMS-III.T.</td>
<td>17188</td>
<td>3291</td>
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<tr>
<td>04 Feb 11</td>
<td>Modal Shift from Road to Train for transportation of cars</td>
<td>India</td>
<td></td>
<td>AMS-III.C. ver. 11</td>
<td>23001</td>
<td>4066</td>
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<td>30 May 11</td>
<td>BRT Lines 1-5 EDOMEX, Mexico</td>
<td>Mexico, Switzerland</td>
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<td>ACM0016</td>
<td>145883</td>
<td>3869</td>
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<tr>
<td>07 Jun 11</td>
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<td>China, Switzerland, Portugal</td>
<td></td>
<td>AM0031 ver. 3</td>
<td>204715</td>
<td>4744</td>
</tr>
<tr>
<td>30 Jun 11</td>
<td>Metro Delhi, India</td>
<td>India, Switzerland</td>
<td></td>
<td>ACM0016</td>
<td>529043</td>
<td>4463</td>
</tr>
<tr>
<td>10 Aug 11</td>
<td>BRT Metrobus Insurgentes, Mexico</td>
<td>Mexico, Spain</td>
<td></td>
<td>ACM0016 ver. 2</td>
<td>46544</td>
<td>4945</td>
</tr>
</tbody>
</table>

*AM - Large scale, ACM - Consolidated Methodologies, AMS - Small scale

**Estimated emission reductions in metric tonnes of CO2 equivalent per annum (as stated by the project participants)
CDM and Transportation

- BRT : 5
- Cable Car : 1
- Metro/Railway : 2
- Fuel Switch : 1
- Commercial Transport : 1
WHY ???
Hurdles / Difficulties

- Methodologies in transport are complex
- Monitoring in transport can be costly and difficult
- Establishing baseline is costly as additional studies are required
- Additionality
- Foolproof documentary evidence of GHG reduction
- Little familiarity / acceptance of CDM as a concept
Transportation Sector
DMRC Projects

✓ No previous Methodology available for modal shift
✓ Two methodologies proposed earlier were rejected
✓ Survey subjectivity, huge sample size
✓ Only a few Consultants available
DMRC CDM Projects

Two in number.

Should be viewed against the above challenges.

(i) “Installation of low GHG emitting rolling stock in metro system”

(ii) “Metro Delhi, India”
DMRC’s First CDM Project

“INSTALLATION OF LOW GHG EMITTING ROLLING STOCK IN METRO SYSTEM”
Methodology Applicable

Title: “Emission Reduction by Low GHG emitting vehicles”.

UNFCCC Reference: AMS IIIC

Project No.: 1351

Registration: 29.12.2007
Salient Feature

• The Regenerative Braking Technology employed in DMRC is different from the prevalent system adopted by the other metro system in the country which uses conventional electro-dynamic Rheostatic Braking system.

• The project activity replaces conventional electro-dynamic rheostatic braking technology in other metros with regenerative braking technology fitted Rolling Stock.
Basic Principle

• In conventional system, braking converts the kinetic energy of decelerating Rolling Stock into the thermal energy which is dissipated as heat.

• In Regenerative technology the kinetic energy while braking is converted to electrical energy by the same traction motor which acts as a generator while braking.
• The regenerative electrical energy is used by other Rolling Stocks in the line operating in power mode.

• This reduces consumption of net grid electrical energy required by the powering trains thereby conserving electrical energy and GHG emission reduction.
## Emission Reduction

<table>
<thead>
<tr>
<th>Years</th>
<th>Emission reduction (tCO$_{2e}$)</th>
</tr>
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<tbody>
<tr>
<td>2007-2008</td>
<td>41,160</td>
</tr>
<tr>
<td>2008-2009</td>
<td>41,160</td>
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<tr>
<td>2009-2010</td>
<td>41,160</td>
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<td>2010-2011</td>
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<td>41,160</td>
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<td>2014-2015</td>
<td>41,160</td>
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<tr>
<td>2015-2016</td>
<td>41,160</td>
</tr>
<tr>
<td>2016-2017</td>
<td>41,160</td>
</tr>
<tr>
<td><strong>Total estimated</strong></td>
<td><strong>411,600</strong></td>
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</tbody>
</table>

Reductions (tonnes of CO$_{2e}$)
VER Certificate

CERTIFICATION REPORT

DELHI METRO RAIL CORPORATION (DMRC)

INSTALLATION OF LOW GREEN HOUSE GASES (GHG) EMITTING ROLLING STOCK CARS IN METRO SYSTEM

90,004 TON CO₂e

CERTIFICATION PERIOD 2004-01-31 – 2007-12-28

Report No: 63228507-08/113-C01.1

Date: 2009-February-16

TÜV NORD DEUT GmbH
JCMO Certification Program
Langemarckstrasse 20
45128 Essen, Germany
Fax +49-201-40-21-20
www.tuv-nord.com

CERTIFICATION STATEMENT

Project Title: Installation of Low Green House Gases (GHG) Emitting Rolling Stock Cars in Metro System

Project Participants: Delhi Metro Rail Corporation

Applicable Standard: Sponge Carbon Standard (version 1)

Type of Verification: GB

Monitoring Period: 2004-01-31 to 2007-12-28


Verifiable document: Report dated 2008-04-21

Verification Opinon: TÜV NORD GC: Low carbon reduction to low greenhouse gas emitting vehicles, Version 3.3

TÜV NORD GC: Low carbon reduction to low greenhouse gas emitting vehicles, Version 3.3

The purpose of the verification is the determination of greenhouse gas (GHG) emissions for the project. The verification is based on the project documentation and the reporting form. The verification process includes the review of the project documentation and the reporting form. The verification process includes the review of the project documentation and the reporting form.

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DMRC’s Second CDM Project

Modal Shift Project:

Metro being efficient, faster, safer and more reliable means of transport, people shift from other more polluting motorised modes to the less polluting metro.
Title: “Metro Delhi, India”.

UNFCCC Reference: ACM 016

Project No.: 4463

Registration: 30.06.2011
The baseline situation is a continuation of traditional modes of transport including buses, taxis, private cars, rickshaws, motorcycles and bikes.

Baseline emissions include the emissions that would have happened due to the transportation of the passengers who use the project activity, had the project activity not been implemented.
Project Scenario

- The metro complements other modes of transport and replaces partially, trips made by conventional or traditional means of transit by metro.

- Emission reductions are achieved through reducing GHG emissions per passenger-kilometre, comparing conventional modes of transport with metro.
The resource efficiency of transporting passengers by the Metro is improved i.e. emissions per passenger kilometer are reduced compared to the situation without project.

Similarly project scenario for other Metro Projects, for whom it is now made possible to earn carbon revenue.
Emission Reduction

This is realized through following changes:

- **Improved efficiency:** metro has lower GHG emissions per passenger-kilometre compared to other modes of transport used in absence of the project.

- **Mode switching:** The MRTS is more attractive to clients due to reduced transport times, increased safety and reliability. It can thus attract private car, taxi or motorized rickshaw users with higher emission rates to switch to public transport.
## Emission Reduction

<table>
<thead>
<tr>
<th>Year</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>305,077</td>
</tr>
<tr>
<td>2012</td>
<td>477,389</td>
</tr>
<tr>
<td>2013</td>
<td>497,989</td>
</tr>
<tr>
<td>2014</td>
<td>519,448</td>
</tr>
<tr>
<td>2015</td>
<td>541,799</td>
</tr>
<tr>
<td>2016</td>
<td>565,077</td>
</tr>
<tr>
<td>2017</td>
<td>591,082</td>
</tr>
<tr>
<td>2018</td>
<td>205,443</td>
</tr>
</tbody>
</table>

Total estimated reductions 1st crediting period (tCO$_{2eq}$)  3,703,304

Annual average over the crediting period of estimated reductions (tCO$_{2eq}$)  5,29,043
Next Steps

- CDM: Modal Shift Phase- III
- Gold Standard VERs
THANK YOU