



**Monitoring report form for CDM project activity**  
**(Version 06.0)**

*Complete this form in accordance with the instructions attached at the end of this form.*

**MONITORING REPORT**

<b>Title of the project activity</b>	Installation of Low Green House Gases (GHG) emitting rolling stock cars in metro system	
<b>UNFCCC reference number of the project activity</b>	UNFCCC reference number 1351	
<b>Version number of the PDD applicable to this monitoring report</b>	05	
<b>Version number of this monitoring report</b>	01	
<b>Completion date of this monitoring report</b>	30/01/2019	
<b>Monitoring period number</b>	7 <sup>th</sup> Monitoring Report	
<b>Duration of this monitoring period</b>	01/01/2013 to 28/12/2017 (Both days included)	
<b>Monitoring report number for this monitoring report</b>	1	
<b>Project participants</b>	The project participant is Delhi Metro Rail Corporation	
<b>Host Party</b>	India	
<b>Sectoral scopes</b>	7	
<b>Applied methodologies and standardized baselines</b>	AMS III.C. "Emission reduction by low greenhouse gas emitting vehicles" Version: 10	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period</b>	<b>Amount achieved before 1 January 2013</b>	<b>Amount achieved from 1 January 2013</b>
	-	226,717 tCO <sub>2</sub>
<b>Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD</b>	243,137 tCO <sub>2</sub>	

## **SECTION A. Description of project activity**

### **A.1. General description of project activity**

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**Purpose of the project activity and the measures taken to reduce greenhouse gas emissions.**

The project activity operates low GHG emitting rolling stocks having regenerative braking system in Delhi Metro Rail Corporation (DMRC). The project activity replaces the conventional electro-dynamic rheostatic braking technology, with regenerative braking technology fitted rolling stocks. The regenerated electrical energy reduces the consumption of equivalent grid electrical energy required by the powering trains, thereby conserving electrical energy and subsequently leading to GHG emission reduction.

### **Brief description of the installed technology and equipments.**

Delhi Metro Rail Corporation (DMRC) has electrical driven Mass Rapid Transport System, which uses 4 car rolling stocks on different service lines. A typical rolling stock used by DMRC consists of two units, each comprising of two cars, a Driving Trailer car (DT) and a Motor Car (M). The Delhi Metro System is designed for rolling stock where coaches are equipped with 3 phase AC traction motors with regenerative braking system. The regenerative braking technology employed in DMRC is different from the prevalent system adopted by metro system in the country, which uses conventional electro-dynamic rheostatic braking system. The electro-dynamic rheostatic braking system converts the kinetic energy of decelerating Rolling stock into the thermal energy of rheostats, which is dissipated as heat without regenerating electrical energy while decelerating. Hence, the choice made by DMRC for using regenerative braking technology displays the environmental consciousness of the management.

The technology for regenerative braking system in the rolling stock is provided by Mitsubishi Electric Corporation, Japan without any technology transfer. The regenerative braking system works on the principle of converting kinetic energy of the rolling stock while decelerating, into electrical energy using 3 phase Induction motor and Variable Voltage Variable Frequency Control (VVVF) Technology. In the regenerative mode, the traction motors work as generators and the Converter- Inverter (CI) converts the electrical energy regenerated to Direct Current (DC). The DC is subsequently converted to single-phase line frequency AC voltage, which is stepped up by transformer to the level of 25 kV. The single phase line frequency AC voltage is then fed back to the Over Head Equipment (OHE). The regenerated electrical energy supplied back to the OHE is used by other accelerating Rolling stock in the same service line. The regenerated electrical energy reduces the consumption of equivalent amount of grid electrical energy which would otherwise have been consumed by the accelerating trains, thereby conserving electrical energy and reducing GHG emissions.

All the 70 Rolling Stocks were under operation during the monitoring period i.e. 01/01/2013 to 28/12/2017. No special event took place during the monitoring period i.e.01/01/2013 to 28/12/2017. Further no equipment related to project activities has been exchanged.

No events or situations took place during current monitoring period which would have impacted the applicability of the methodology used in the project activity.

### **Total emission reductions achieved in this monitoring period.**

Emission reductions during monitoring period are as follows:

For the Monitoring Period from 01/01/2013 to 31/12/2013: 444,74

For the Monitoring Period from 01/01/2014 to 31/12/2014: 428,75

For the Monitoring Period from 01/01/2015 to 31/12/2015: 440,31

For the Monitoring Period from 01/01/2016 to 31/12/2016: 483,54

For the Monitoring Period from 01/01/2017 to 28/12/2017: 469,83

Total Emission Reduction: 226,717 tCO<sub>2</sub>

## A.2. Location of project activity

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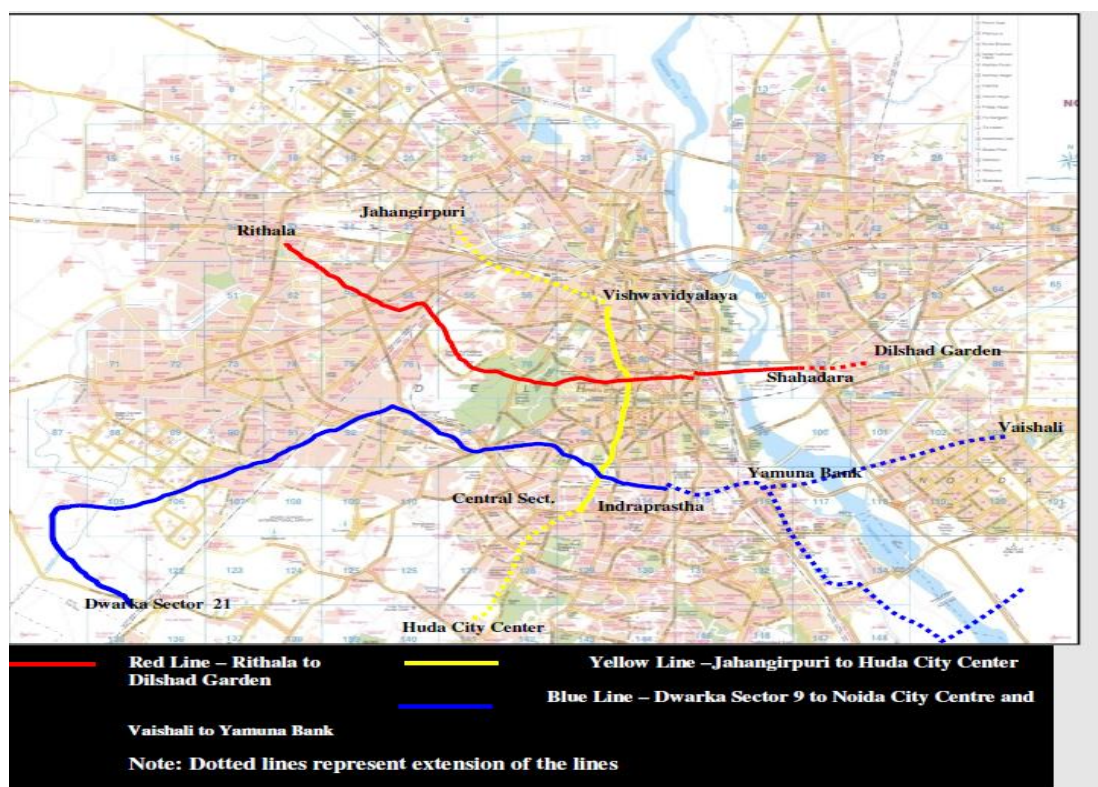
The project activity has been implemented in Delhi, India. The geographical details of the project site are given below:

Longitude	77.23°E
Latitude	28.61°N

The project activity has been implemented in Delhi on the following metro corridors

- Dilshad Garden- Rithala
- Samaypur Badli - Huda City Center
- Noida City Centre- Dwarka Sector 21
- Vaishali-Yamuna Bank

The map of these metro corridors is as follows:



## A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host Party)	Delhi Metro Rail Corporation	No

**A.4. Reference to applied methodologies and standardized baselines**

&gt;&gt;

Title: AMS III.C. "Emission reduction by low greenhouse gas emitting vehicles"

Version: 10

The methodology is available at following link:

<https://cdm.unfccc.int/methodologies/DB/AWVYMI7E3FP9BDRQ646203OVPKFPQB>**A.5. Crediting period type and duration**

&gt;&gt;

Fixed; 10 years starting from 29/12/2007

**SECTION B. Implementation of project activity****B.1. Description of implemented project activity**

&gt;&gt;

The introduction of low GHG emitting rolling stocks having regenerative braking system in Delhi Metro Rail Corporation (DMRC) has been commissioned in the three corridors (four service lines).

There are five different depots on these operational lines. The depots on various service lines are as follows:

Service Line	Corridor	Operational depots
1	Dilshad Garden- Rithala	Shastri Park Depot (SPD)
2	Jahangirpuri - Huda City Center	Khyber Pass Depot (KPD) and Sultanpur Depot (SLPD)
3 & 4	Noida City Centre - Dwarka Sec 21, Vaishali – Yamuna Bank	Yamuna Bank Depot (YBD) and Najafgarh Depot (NJFD)
70		

The distributions of Rolling stock on different lines at the start of crediting period are as follows:

S.No	Service Line (Corridor Details)	Number of Rolling Stock
1.	1 (Dilshad Garden to Rithala)	29
2.	2 (Samaypur Badli to Huda City Centre)	10
3.	3 & 4 (Noida City Centre - Dwarka Sec 21) & (Vaishali – Yamuna Bank)	31

The Rolling Stock No. MC 01 was shifted from Service Line - 2 to Service Line - 1 in the month of November 2017 and another Rolling stock No. MC 03 was shifted from Service Line - 2 to Service Line - 1 in the month of December 2017. The revised Number of Rolling stocks are as follows:

S.No	Service Line (Corridor Details)	Number of Rolling Stock
1.	1 (Dilshad garden to Rithala)	31
2.	2 (Samaypur Badli to Huda City Centre)	8
3.	3 & 4 (Noida City Centre - Dwarka Sec 21)	31

	& (Vaishali – Yamuna Bank)	
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All the 70 Rolling Stocks were under operation during the monitoring period i.e. 01/01/2013 to 28/12/2017.

No special event took place during the monitoring period i.e. 01/01/2013 to 28/12/2017. Further no equipment related to project activities has been exchanged.

No events or situations took place during current monitoring period which would have impacted the applicability of the methodology used in the project activity.

## **B.2. Post-registration changes**

### **B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines**

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NA

### **B.2.2. Corrections**

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NA

### **B.2.3. Changes to the start date of the crediting period**

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NA

### **B.2.4. Inclusion of monitoring plan**

>> NA

### **B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

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NA

### **B.2.6. Changes to project design**

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NA

## **SECTION C. Description of monitoring system**

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As per Type III C, monitoring shall track the number of low emission vehicles Operated under the small-scale CDM project activity and the annual units of service for a sample of the vehicles. Emissions from electricity shall be taken into account for electric vehicles.

As per the provisions of paragraph 14 of Draft simplified modalities and procedures for small scale CDM project activities (FCCC/CP/2002/7/Add3, English, page 21) the “Project participants may use the simplified baseline and monitoring methodologies specified in appendix B for their project category” if they meet the applicability criteria of small scale CDM project activity. Since the project activity is a small-scale CDM project of Type III.C category, the monitoring methodology and plan has been developed in line with the guidance provided in paragraph 8 under Type III.C of Appendix B.

The project activity is to install low GHG emitting rolling stock having regenerative braking technology instead of conventional electro-dynamic rheostatic braking system. The emission reduction quantity depends on the number of rolling stock and annual units of service provided by

rolling stock units in all the four service lines of DMRC project activity. The monitoring of the all electrical energy data required for estimation of baseline and project emissions for the project activity is through state of the art electronic like Train Integration Management System (TIMS). This is an electronic device very high accuracy of measurement and recording.

The projects activity represent all the rolling stock trains of all the service lines for which electrical energy data is monitored through TIMS during the project activity. The emission reductions from the project activity are estimated by monitoring following parameters annually:

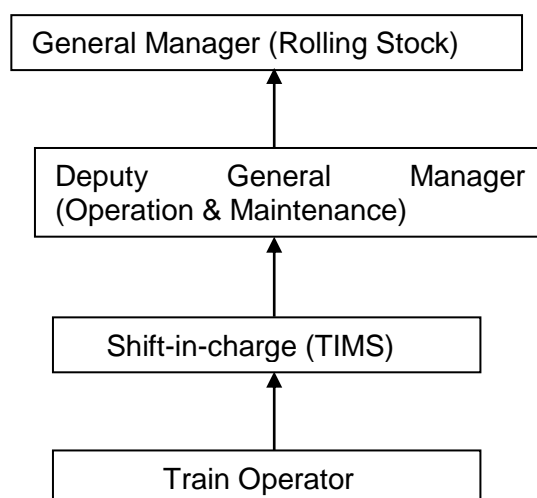
- a) Number of rolling stock in a line
- b) Electrical energy consumed by each rolling stock in a line
- c) Electrical energy regenerated by each rolling stock in a line.

The operation and maintenance staff downloads the TIMS recorded data from the rolling stock on a regular basis and stores this data on a Computer for further records. The parameters are well documented and numbered. The documented parameters are duly signed by respective Rolling Stock Depot in-charges and forwarded to CDM co-coordinator on a monthly basis. The parameters are documented according to the standard procedures quite similar to the ISO requirements. The report received from O&M department is compiled and maintained by CDM coordinator. The report would be retained till 2 years after the end of crediting period or the last issuance of CERs for the project activity whichever occurs later.

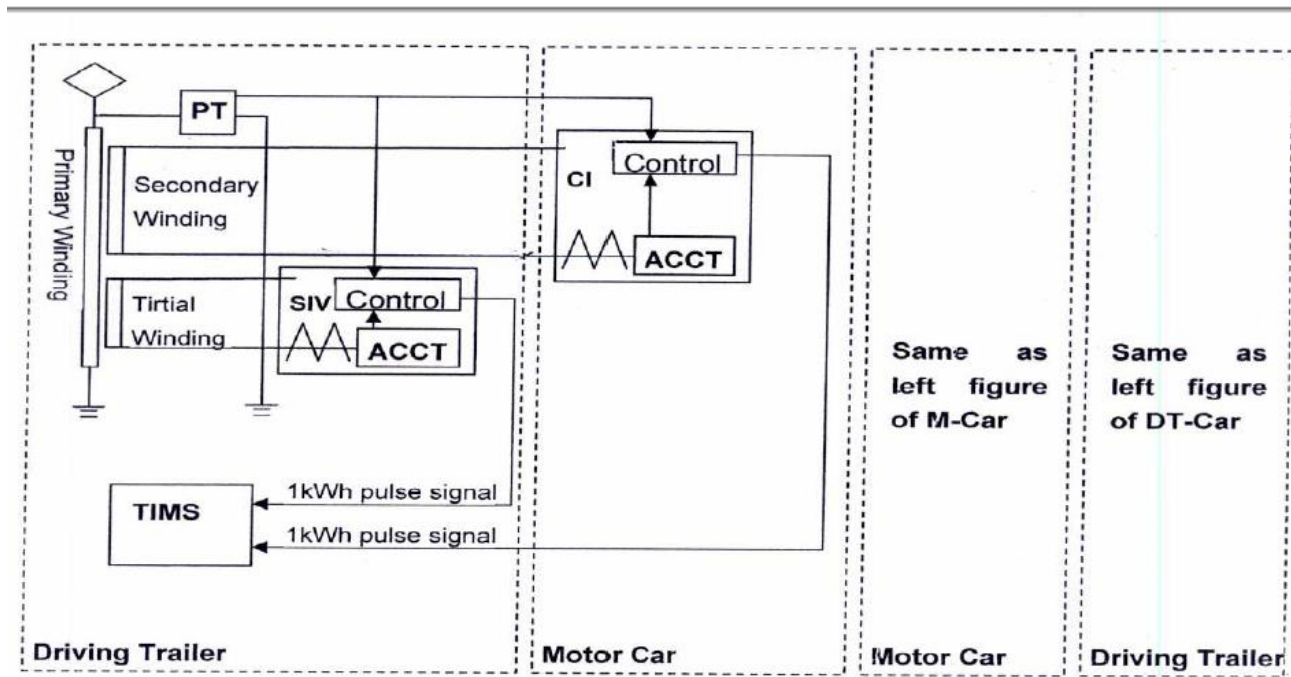
To ascertain the Quality Control and Quality Assurance of the monitored parameters, following procedure is adopted:

- The monitored data is reviewed by conducting an inter-department review meeting once in six months. The Coordinator CDM will discuss the data (received from O&M department) with CDM Team member of concerned department. Once the data is compiled and checked, it will be handed over to Verifier (DMRC official) for verification. After data verification, Auditor (DMRC official) will be invited to carry out the audit for concerned data.
- TIMS is an electronic device which monitors performance of variation subassemblies of the train through a sophisticated software. Hence, no calibration is required on this item.

A comprehensive CDM manual is prepared to illustrate the roles and responsibility of each and every person involved in project activity. The CDM manual also consist of procedure for monitoring of various associated parameters, frequency of monitoring, procedure for data storage and protection procedure for review meetings and procedure for non-conformance of data etc. CDM manual also comprises specimen copy of data formats of technical department.



## Metering Diagram



### Basic components

- Potential transformer (PT)
- Main transformer
- Current transformer (CT)
- SIV
- CI
- TIMS

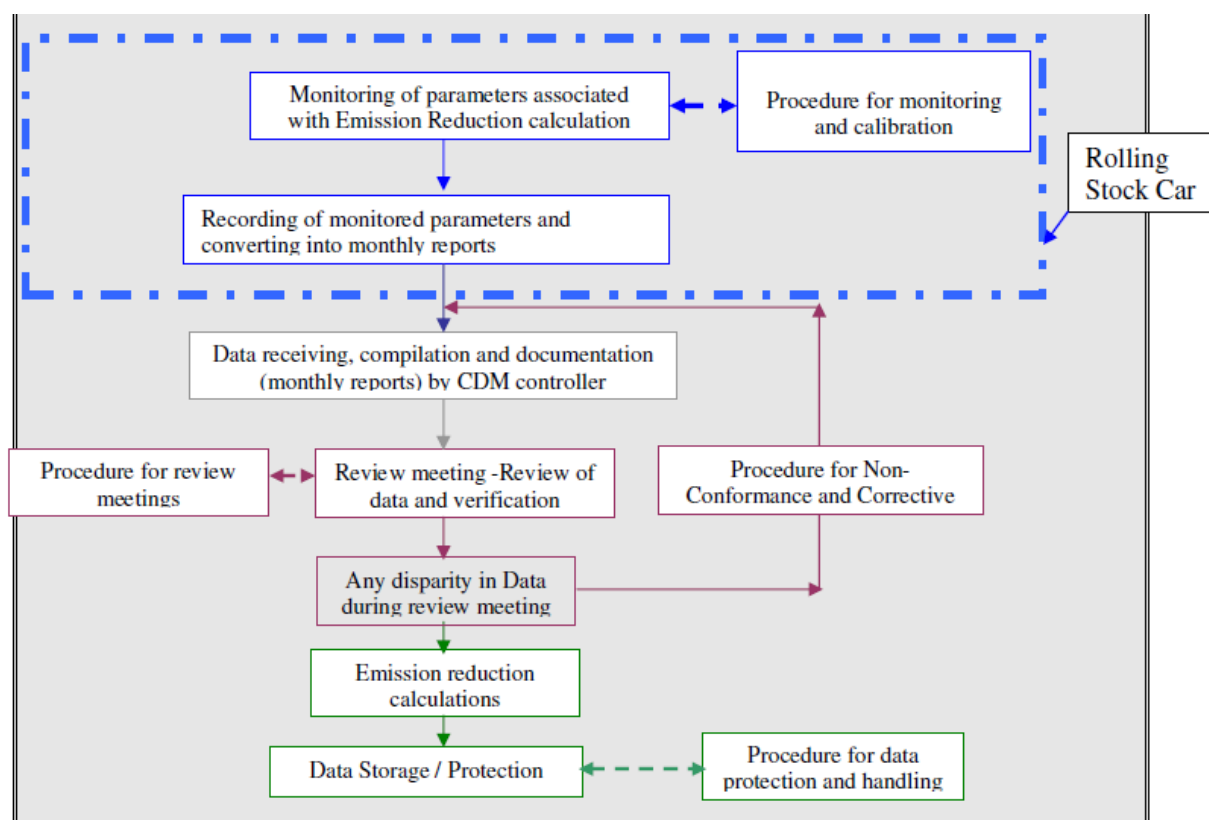
Voltage from pantograph is supplied to both CI and SIV (Main function of CI is to convert AC power to 1900V DC. This 1900V DC is converted into 3 phase AC variable voltage variable frequency by the inverter and supplied to Traction Motors. On the other hand SIV change the input AC power (AC25kV) to 3 phase AC power (AC415V) and supplies the stable 3 phase AC power). Main transformer consists of one primary, two secondary and one tertiary winding. Secondary winding of main transformer is connected to CI, whereas tertiary winding is connected to SIV. Two measuring instrument one CT (Current Transformer) & another one PT (Potential Transformer) is also placed in the line. PT is placed in parallel of the circuit to measure the voltage where as CT is placed in series for current measurement. Pulse signal of 1kWh each from CI and SIV control panel is supplied to TIMS for indication & monitoring. On TIMS cumulative readings of CI & SIV are recorded.

During failure of main monitoring system, it will not possible to capture the data manually, hence DMRC has decided not to claim CERs for that duration.

The procedure for data monitoring, storage and recording is as per the flow chart mentioned below:



## Flow Chart for CDM Data Monitoring, Recording and Storage



The operation and maintenance (O&M) staff downloads the TIMS recorded data from the rolling stock on a regular basis and stores this data on a Computer for further records. The parameters concerned are well documented and numbered. The documented parameters are duly signed by respective Rolling Stock Depot in-charges and forwarded to CDM co-coordinator on a monthly basis. The parameters are documented according to the standard procedures. The report received from O&M department is compiled and maintained by CDM coordinator.

### Calibration Procedure:

As per registered PDD of the proposed project, the energy data (EGi, Wr) is measured with TIMS which is software based electronic equipment with high degree of accuracy and it does not require calibration from time to time. However, PP does the calibration of CT/PT from accredited lab, with a frequency of once in a three year. Calibration details can be found in section D.2.

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	EFy
Unit	tCO <sub>2</sub> /GWh
Description	Emission Factor for northern grid
Source of data	CO <sub>2</sub> Emission Factor database, version 2.0 as given by Central Electricity Authority a statutory body under Ministry of Power, Government of India.
Value(s) applied	800
Choice of data or measurement methods and procedures	<a href="http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver2.pdf">http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver2.pdf</a>



Purpose of data/parameter	Baseline
Additional comments	Emission Factor from Carbon Emission Database Latest Version 2.0 of Central Electricity Authority, Ministry of Power, Government of India.

## D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

<b>Data/Parameter</b>	<b>EG<sub>i, wr</sub></b>
Unit	GWh/year
Description	Electrical energy consumed by the operational rolling stock 'i'
Measured/calculated/default	Measured /Calculated /Default: Measured & Calculated
Source of data	Train Integration and Management System (TIMS) reading
Value(s) of monitored parameter	143.629991 (2013) 140.975990 (2014) 144.344633 (2015) 158.082764 (2016) 154.981214 (2017) (for further details refer Annex 1 of this Monitoring Report)
Monitoring equipment	<p>Electrical energy consumed by each rolling stock is the sum of the electrical energy consumed by the rolling stock 'i' for motoring (M) and the Auxiliary electricity consumption (SIV), both of which are monitored by TIMS. The energy data for monitoring is downloaded from TIMS of Rolling Stock using a maintenance terminal. Since TIMS is software based electronic equipment it has a high degree of accuracy (+0.01%) and as per manufacturer specifications requires no calibration from time to time.</p> <p>Calibration details of CT/PT are mentioned below:</p> <p>CT Sr. No. CT002844, CT 125493, CT 062839 , CT 080065 Date of Calibration: 26/07/2016</p> <p>PT Sr. No: DMRC/PT-01 , DMRC/PT-02 Date of calibration: 26/07/2016</p>
Measuring/reading/recording frequency	The readings are cumulative. These readings are noted on monthly basis and downloaded using a maintenance terminal.
Calculation method (if applicable)	The cumulative readings are downloaded from TIMS. Then monthly energy consumption is calculated in Excel sheet and then summed up for the year.
QA/QC procedures	The TIMS data is recorded by CDM team member (From each service line depot) of the Rolling Stock Department and is forwarded to the CDM Coordinator of the project. A data review meeting is conducted once in 6 months which is chaired by CDM Chairman. In this meeting, data compiled by CDM coordinator is cross checked with service line data of all the rolling stock. Subsequently to check further the data authenticity and accuracy, data is verified, audited and signed by senior officials from DMRC.
Purpose of data/parameter	The data is used for Baseline emission calculation.
Additional comments	Nil.

<b>Data/Parameter</b>	<b>EG<sub>i, R</sub></b>
Unit	GWh/year
Description	Electrical energy regenerated by the operational rolling stock 'i'
Measured/calculated/default	Electrical energy regenerated by each rolling stock is monitored by TIMS. The energy data for monitoring is downloaded from TIMS of Rolling Stock using a maintenance terminal.
Source of data	TIMS reading

Value(s) of monitored parameter	55.592828 (2013) 53.593409 (2014) 55.039083 (2015) 60.442255 (2016) 58.729042 (2017) (for further details refer Annex 1 of this Monitoring Report)
Monitoring equipment	Electrical energy regenerated by each rolling stock is monitored by TIMS. The energy data for monitoring is downloaded from TIMS of Rolling Stock using a maintenance terminal. Since TIMS is a software based electronic equipment it has a high degree of accuracy ( $\pm 0.01\%$ ) and as per manufacture specifications requires no calibration from time to time.
Measuring/reading/recording frequency	The readings are cumulative. These readings are noted on monthly basis and downloaded using a maintenance terminal.
Calculation method (if applicable)	The monthly readings are calculated in Excel Sheet, which are then calculated for a year.
QA/QC procedures	The TIMS data is recorded by CDM team member (From each service line depot) of the Rolling Stock Department and is forwarded to the CDM Coordinator of the project. A data review meeting is conducted once in 6 months which is chaired by CDM Chairman. In this meeting, data compiled by CDM coordinator is cross checked with service line data of all the rolling stock. Subsequently to check further the data authenticity and accuracy, data is verified, audited and signed by senior officials from DMRC.
Purpose of data/parameter	The data are used for Baseline emission calculation.
Additional comments	Nil.

Data/Parameter	S <sub>i</sub>
Unit	km
Description	Total distance covered by the rolling stock 'i'
Measured/calculated/default	The distance travelled by each rolling stock is monitored by TIMS. The distance data of the total distance covered by the rolling stock for monitoring is downloaded from TIMS of Rolling Stock using a maintenance terminal.
Source of data	Train Integration and Management System (TIMS) reading
Value(s) of monitored parameter	943,427,2 (2013) 928,338,8 (2014) 945,607,0 (2015) 101,677,48 (2016) 988,688,1 (2017) (for further details refer Annex 1 of this Monitoring Report)
Monitoring equipment	Since TIMS is software based electronic equipment it has a high degree of accuracy (+ 0.01%). Since TIMS is an electronic device operated through software it requires no calibration from time to time.
Measuring/reading/recording frequency	The readings are cumulative. These readings are noted daily and downloaded monthly using a maintenance terminal.
Calculation method (if applicable)	The monthly readings are calculated in Excel Sheet and then calculated for Year.
QA/QC procedures	The data is monitored by the operation and maintenance department of DMRC
Purpose of data/parameter	The data are used for Baseline emission calculation.
Additional comments	Nil.

Data/Parameter	N
Unit	Nos.
Description	Total number of operational Rolling stocks in the three service lines

Measured/calculated/default	Unique Identification number of each Rolling stock is identified and verified at the regular monitoring interval
Source of data	Rolling Stock Department Log Book
Value(s) of monitored parameter	70
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Not applicable
Calculation method (if applicable)	Not applicable
QA/QC procedures	The data is monitored by the operation and maintenance department of DMRC.
Purpose of data/parameter	The data are used for Baseline emission calculation
Additional comments	Nil

### D.3. Implementation of sampling plan

>>  
N/A

## SECTION E. Calculation of emission reductions or net anthropogenic removals

### E.1. Calculation of baseline emissions or baseline net removals

>>  
 $BE = EG_{Wr} * EF$

Where:

$$EG_{Wr} = \left[ \sum_{i=1}^N (EG_{i,Wr}/S_i) * S_i \right]$$

EF      CO<sub>2</sub> emission factor of the northern grid (t CO<sub>2</sub>e / GWh)  
 $EG_{Wr}$       total electrical energy consumed by rolling stocks without regenerative braking (GWh)  
 $S_i$       total distance covered by the rolling stock 'i' (km)  
 N      total number of operational rolling stocks

### E.2. Calculation of project emissions or actual net removals

>> For the Monitoring Period 2013

$$PE = \left[ \left\{ \sum_{i=1}^N \left\{ (EG_{i,Wr} / S_i) - (EG_{i,R} / S_i) \right\} * S_i \right\} \right] * EF$$

Where,

$$EG_R = \left[ \sum_{i=1}^N (EG_{i,R} / S_i) * S_i \right]$$

EF      CO<sub>2</sub> emission factor of the northern grid (t CO<sub>2</sub>e / GWh)  
 $EG_R$       total electrical energy regenerated with regenerative braking (GWh)  
 $EG_{i,R}$       total energy regenerated by the rolling stock 'i' with regenerative braking (GWh)

Calculation:-

$$EG_{i,Wr} = 143,629,991 \text{ kWh}$$

$$EG_{i,R} = 555,928,28 \text{ kWh}$$

$$EF = 800 \text{ tCO}_2/\text{kWh}$$

$$PE = (EG_{i,Wr} - EG_{i,R}) * EF$$

$$PE = (143,629,991 - 555,928,28) * 800 / 1000000$$

$$PE = 704,30 \text{ tCO}_2$$

**>> For the Monitoring Period 2014**

$$PE = \left[ \left\{ \sum_{i=1}^N \{ (EG_{i,wr} / Si) - (EG_{i,R} / Si) \} * Si \right\} \right] * EF$$

Where,

$$EG_R = \left[ \sum_{i=1}^N (EG_{i,R} / Si) * Si \right]$$

EF CO<sub>2</sub> emission factor of the northern grid (t CO<sub>2</sub>e / GWh)

EG<sub>R</sub> total electrical energy regenerated with regenerative braking (GWh)

EG<sub>i,R</sub> total energy regenerated by the rolling stock 'i' with regenerative braking (GWh)

Calculation:-

$$EG_{i,wr} = 140,975,990 \text{ kWh}$$

$$EG_{i,R} = 535,934,09 \text{ kWh}$$

$$EF = 800 \text{ tCO}_2/\text{kWh}$$

$$PE = (EG_{i,wr} - EG_{i,R}) * EF$$

$$PE = (140,975,990 - 535,934,09) * 800 / 1000000$$

$$PE = 699,06 \text{ tCO}_2$$

**>> For the Monitoring Period 2015**

$$PE = \left[ \left\{ \sum_{i=1}^N \{ (EG_{i,wr} / Si) - (EG_{i,R} / Si) \} * Si \right\} \right] * EF$$

Where,

$$EG_R = \left[ \sum_{i=1}^N (EG_{i,R} / Si) * Si \right]$$

EF CO<sub>2</sub> emission factor of the northern grid (t CO<sub>2</sub>e / GWh)

EG<sub>R</sub> total electrical energy regenerated with regenerative braking (GWh)

EG<sub>i,R</sub> total energy regenerated by the rolling stock 'i' with regenerative braking (GWh)

Calculation:-

$$EG_{i,wr} = 144,344,633 \text{ kWh}$$

$$EG_{i,R} = 550,390,83 \text{ kWh}$$

$$EF = 800 \text{ tCO}_2/\text{kWh}$$

$$PE = (EG_{i,wr} - EG_{i,R}) * EF$$

$$PE = (144,344,633 - 550,390,83) * 800 / 1000000$$

$$PE = 714,44 \text{ tCO}_2$$

**>> For the Monitoring Period 2016**

$$PE = \left[ \left\{ \sum_{i=1}^N \{ (EG_{i,wr} / Si) - (EG_{i,R} / Si) \} * Si \right\} \right] * EF$$

Where,

$$EG_R = \left[ \sum_{i=1}^N (EG_{i,R} / Si) * Si \right]$$

EF CO<sub>2</sub> emission factor of the northern grid (t CO<sub>2</sub>e / GWh)

EG<sub>R</sub> total electrical energy regenerated with regenerative braking (GWh)

EG<sub>i,R</sub> total energy regenerated by the rolling stock 'i' with regenerative braking (GWh)

Calculation:-

$$EG_{i,wr} = 158,082,764 \text{ kWh}$$

$$EG_{i,R} = 604,422,55 \text{ kWh}$$

EF = 800 tCO<sub>2</sub>/kWh

$PE = (EG_{i,wr} - EG_{i,R}) * EF$

$PE = (158,082,764 - 604,422,55) * 800 / 1000000$

**PE = 781,12 tCO<sub>2</sub>**

**>> For the Monitoring Period 2017**

$PE = \left[ \left\{ \sum_{i=1}^N \left\{ (EG_{i,Wr} / Si) - (EG_{i,R} / Si) \right\} * Si \right\} \right] * EF$

Where,

$EG_R = \left[ \sum_{i=1}^N (EG_{i,R} / Si) * Si \right]$

EF CO<sub>2</sub> emission factor of the northern grid (t CO<sub>2</sub>e / GWh)

EG<sub>R</sub> total electrical energy regenerated with regenerative braking (GWh)

EG<sub>i,R</sub> total energy regenerated by the rolling stock 'i' with regenerative braking (GWh)

Calculation:-

EG<sub>i,wr</sub> = 154,981,214 kWh

EG<sub>i,R</sub> = 587,290,42 kWh

EF = 800 tCO<sub>2</sub>/kWh

$PE = (EG_{i,wr} - EG_{i,R}) * EF$

$PE = (154,981,214 - 587,290,42) * 800 / 1000000$

**PE = 770,02 tCO<sub>2</sub>**

### E.3. Calculation of leakage emissions

>>

No leakage calculation is required as per the paragraph 7 of the applied methodology i.e. AMS III.C Ver. 10 and registered PDD.

### E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
<b>2013</b>	114,904	704,30	0	-	444,74	444,74
<b>2014</b>	112,781	699,06	0	-	428,75	428,75
<b>2015</b>	115,475	714,44	0	-	440,31	440,31
<b>2016</b>	126,466	781,12	0	-	483,54	483,54
<b>2017</b>	123,985	770,02	0	-	469,83	469,83
<b>Total</b>	<b>593,611</b>	<b>366,894</b>	<b>0</b>	-	<b>226,717</b>	<b>226,717</b>

**For Year 2013:**

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated (kWh)	Total Distance covered (km)
Line-1	576,964,79	226,927,10	398,197,6
Line-2	203,909,70	685,016,6	124,397,5
Line-3	655,425,42	260,499,52	420,832,1
<b>Total</b>	<b>143,629,991</b>	<b>555,928,28</b>	<b>943,427,2</b>

**Emission factor of****northern regional grid** 800 tCO<sub>2</sub>/GWh (ex-ante value of registered PDD)**Baseline emissions (2013)** 114,904 tCO<sub>2</sub>**Project emissions (2013)** 704,30 tCO<sub>2</sub>**Leakage emissions** 0 tCO<sub>2</sub>

$$ER = BE - (PE + LE)$$

Calculation:-

$$ER = 114,904 - (704,30 + 0)$$

$$\text{Emission Reduction (2013)} = 444,74 \text{ t CO}_2$$

**For Year 2014:**

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	583,874,43	223,835,03	392,894,9
Line-2	187,792,09	604,691,3	113,862,2
Line-3	638,093,38	251,629,93	421,581,7
<b>Total</b>	<b>140,975,990</b>	<b>535,934,09</b>	<b>928,338,8</b>

**Emission factor of****northern regional grid** 800 tCO<sub>2</sub>/GWh (ex-ante value of registered PDD)**Baseline emissions (2014)** 112,781 tCO<sub>2</sub>**Project emissions (2014)** 699,06 tCO<sub>2</sub>**Leakage emissions** 0 tCO<sub>2</sub>

$$ER = BE - (PE + LE)$$

Calculation:-

$$ER = 112,781 - (699,06 + 0)$$

$$\text{Emission Reduction (2014)} = 428,75 \text{ t CO}_2$$

**For Year 2015:**

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	606,312,66	235,187,12	403,976,8
Line-2	191,044,77	599,005,3	115,546,2
Line-3	646,088,90	255,303,18	426,084,0
<b>Total</b>	<b>144,344,633</b>	<b>550,390,83</b>	<b>945,607,0</b>

**Emission factor of****Northern regional grid** 800 tCO<sub>2</sub>/GWh (ex-ante value of registered PDD)**Baseline emissions (2015)** 115,475 tCO<sub>2</sub>**Project emissions (2015)** 714,44 tCO<sub>2</sub>**Leakage emissions** 0 tCO<sub>2</sub>

$$ER = BE - (PE + LE)$$

Calculation:-

$$ER = 115,475 - (714,44 + 0)$$

$$\text{Emission Reduction (2015)} = 440,31 \text{ t CO}_2$$

For Year 2016:

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	656,831,34	255,001,48	433,646,4
Line-2	198,714,12	614,710,3	113,366,5
Line-3	725,282,18	287,950,04	469,761,9
<b>Total</b>	<b>158,082,764</b>	<b>604,422,55</b>	<b>101,677,48</b>

**Emission factor of****northern regional grid** 800 tCO<sub>2</sub>/GWh (ex-ante value of registered PDD)**Baseline emissions (2016)** 126,466 tCO<sub>2</sub>**Project emissions (2016)** 781,12 tCO<sub>2</sub>**Leakage emission** 0 tCO<sub>2</sub>

ER = BE – (PE+LE)

Calculation:-

ER= 126,466 – (78,112 + 0)

ER= 483,54 t CO<sub>2</sub>**Emission reduction (2016) = 483,54 tCO<sub>2</sub>**

For Year 2017:

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	642,479,44	246,300,68	410,736,7
Line-2	209,823,02	646,489,4	122,206,6
Line-3	697,509,69	276,340,80	455,744,8
<b>Total</b>	<b>154,981,214</b>	<b>587,290,42</b>	<b>988,688,1</b>

**Emission factor of****northern regional grid** 800 tCO<sub>2</sub>/GWh (ex-ante value of registered PDD)**Baseline emissions (2017)** 123,985 tCO<sub>2</sub>**Project emissions (2017)** 770,02 tCO<sub>2</sub>**Leakage emissions** 0 tCO<sub>2</sub>

ER = BE – (PE+LE)

Calculation:-

ER= 123,985 – (770,02 + 0)

**Emission Reduction (2017) = 469,83 t CO<sub>2</sub>**

Further details on each rolling stock in the respective service lines (1, 2 and 3&4) are detailed in following Annexure 1.

#### E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

	Amount achieved during this monitoring period (tCO <sub>2</sub> e)	Amount estimated ex ante (tCO <sub>2</sub> e)
2013	444,74	478,90
2014	428,75	478,90
2015	440,31	478,90
2016	483,54	478,90
2017	469,83	515,77



	Amount achieved during this monitoring period (tCO <sub>2</sub> e)	Amount estimated ex ante (tCO <sub>2</sub> e)
2013	444,74	478,90
2014	428,75	478,90
2015	440,31	478,90
<b>Total</b>	<b>226,717</b>	<b>243,137</b>

**E.6. Remarks on increase in achieved emission reductions**

&gt;&gt; NA

**Annexure I: Data****Service Line 1:**

Service line 1	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013
TS01	1023689	1056939	412408	418371	71073	72113
TS02	1048172	1052725	421928	421428	70669	72253
TS03	1064891	1006195	410980	387740	70618	68059
TS04	1035091	1005385	413358	398054	71266	67996
TS05	964846	1023066	385830	408383	65204	70722
TS06	1061086	1034121	400062	386169	72815	71260
TS07	1032721	988750	410631	383826	74776	69464
TS08	989360	993261	396084	400823	64781	66925
TS09	1021821	1026284	408763	403504	68624	69749
TS10	1074428	1023075	417317	395298	73263	70612
TS11	862855	1015132	334615	403647	57322	70059
TS12	953661	957930	359412	357418	64725	65699
TS13	937170	1062853	357298	398835	64636	71906
TS14	929294	1091011	373604	437954	62962	75056
TS15	908159	1047866	344980	386149	63103	71724
TS16	873685	1064113	359580	423140	64526	73107
TS17	907507	980322	370077	394025	63670	67516
TS18	958913	1013246	377399	396802	71220	74454
TS19	1011242	992139	410685	401605	75779	66032
TS20	1070159	1002628	431614	395614	74425	70310
TS21	1004339	1017986	395032	403255	71346	71182
TS22	1022785	1099707	387122	401155	72254	72397
TS23	970665	876561	371104	342958	66194	59843
TS24	996826	920783	401650	367500	69942	65036
TS25	987968	923337	409690	375575	67939	63120
TS26	979483	890303	396174	357515	67940	61424
TS27	1021189	881476	402169	340808	68738	60132
TS28	1013884	923604	402917	360168	70348	61928
TS29	981751	1018041	381137	401371	71148	70592
<b>Sub Total</b>	<b>28707640</b>	<b>28988839</b>	<b>11343620</b>	<b>11349090</b>	<b>1991306</b>	<b>1990670</b>

Service line 1	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014
TS01	864860	1002381	341075	378725	59216	62878
TS02	914083	984452	368610	388749	63877	66891
TS03	921803	983514	357978	379034	63770	67164
TS04	932290	942170	375074	361781	65094	63175
TS05	880786	977445	347077	377699	61085	66764
TS06	807684	1019353	309766	384546	56380	68487
TS07	943899	1033379	381360	401103	67155	70436
TS08	789453	974648	311949	380388	53755	65380
TS09	1025577	1113976	400327	416144	69229	71932
TS10	1015736	1114974	386392	407249	69696	73257
TS11	985296	1083567	382922	404391	65791	71236
TS12	945052	1024801	355733	372673	67742	71129
TS13	1053970	1066855	397591	385289	71283	68961
TS14	1050550	1059529	412001	394990	71030	68133
TS15	1026784	1084953	378913	383844	69676	71007
TS16	1037375	1094777	407781	412689	70133	70596
TS17	999147	1070191	397475	412901	68171	70971
TS18	963838	993529	371088	366819	67171	65922
TS19	992875	1114333	391121	422857	64081	72013
TS20	992202	1027365	374262	371654	67492	66656
TS21	981777	1060760	384879	393859	67689	70171
TS22	989485	1101638	384350	422690	65932	72453
TS23	1000471	1076340	380447	393890	67180	69380
TS24	1018096	1053266	402713	396269	70968	70663
TS25	1039522	1014364	419147	393681	71757	67169
TS26	952811	964599	406839	391450	69613	67399
TS27	978899	1022412	381328	380252	66789	66822
TS28	1055046	1105835	397543	408836	70988	72056
TS29	1012440	1050230	394846	398464	68396	68709
<b>Sub Total</b>	<b>28171807</b>	<b>30215636</b>	<b>11000587</b>	<b>11382916</b>	<b>1931139</b>	<b>1997810</b>

Service Line 1	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015
TS01	884480	1062607	347824	410983	59558	70817
TS02	957291	947794	405201	386633	66811	65026
TS03	869591	1042283	352281	418500	59979	71378

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TS04	848982	1007637	347328	410070	58140	69117
TS05	962783	986145	388981	393748	65472	67175
TS06	949430	1030855	371920	397521	65856	71311
TS07	912325	1070411	374583	425849	63238	73125
TS08	901732	1001370	372277	406015	61587	68362
TS09	1067599	1041579	419393	391615	70621	62219
TS10	1062595	1087263	402746	399650	71155	72026
TS11	1091371	1188367	418763	439899	70397	69907
TS12	957395	980178	363208	362281	66388	67390
TS13	1065604	1081311	399548	387258	69905	69311
TS14	1022927	1121691	403340	426447	67254	72115
TS15	1040211	1149361	375456	400132	67927	74181
TS16	1052126	1172197	414283	442473	69301	74904
TS17	1045547	1144808	417365	441432	70147	75624
TS18	1062900	1125191	411665	415712	72499	73199
TS19	1043475	1139700	410007	434529	68455	73534
TS20	1049153	1049366	414158	409211	70436	70283
TS21	1081194	1124472	422718	423744	75152	77311
TS22	1060436	1144431	418082	432154	70485	73451
TS23	1086905	1170466	415270	428158	71115	74764
TS24	1062292	1126095	410246	432396	72052	75443
TS25	1048527	1088735	428464	432232	71538	72926
TS26	955477	925521	403636	385248	68725	65623
TS27	1093649	1112611	419058	413335	72280	72298
TS28	1017401	1085663	394885	405069	67615	70204
TS29	1065978	1103782	420639	423093	70849	71807
<b>Sub Total</b>	<b>29319376</b>	<b>31311890</b>	<b>11543325</b>	<b>11975387</b>	<b>1974937</b>	<b>2064831</b>

Service Line-1	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016
TS01	1057668	1108118	416063	438584	71060	74621
TS02	1076194	1063304	431803	422751	72262	71446
TS03	1064621	1156903	425949	463673	71901	77827
TS04	1108922	1104182	450853	447788	75450	75138
TS05	1104629	1082449	442296	432917	74401	72787
TS06	1079249	1066546	413683	410617	73859	72626
TS07	1103637	1079820	444887	436311	74853	73127
TS08	1030521	1080206	424347	438285	69784	71945

TS09	1193914	1226009	461188	475488	76432	78814
TS10	1137820	1166739	432653	439831	75616	77578
TS11	1181161	1102887	443757	415446	74864	69802
TS12	1082910	1079730	408547	409181	74122	73996
TS13	1114277	1208382	410335	445385	71829	77951
TS14	1143364	1180821	444104	459547	73862	76547
TS15	1148879	1222171	410806	438440	74513	78650
TS16	1117524	1241631	428456	481334	71188	79693
TS17	1060443	1168215	417910	461523	69963	76965
TS18	1153954	1124198	438790	422915	76500	73486
TS19	1106224	1138005	434001	431338	72834	74249
TS20	1156785	1192456	456668	471520	75575	77924
TS21	1192742	1202974	460813	465700	77238	77103
TS22	1161200	1216442	445467	462717	74823	78358
TS23	1126271	1260535	418361	475394	71811	80785
TS24	1156553	1208227	452673	453021	77934	80474
TS25	1086391	1083203	435977	432971	72256	71971
TS26	1020996	1024544	433578	432201	72188	71864
TS27	1147312	1111131	434408	418061	75226	73035
TS28	1195991	1127632	460339	426713	78613	73156
TS29	1180015	1165507	459140	452644	77390	76199
<b>Sub Total</b>	<b>32490167</b>	<b>33192967</b>	<b>12637852</b>	<b>12862296</b>	<b>2148347</b>	<b>2188117</b>

Service Line - 1	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2017 to 30/06/2017	01/07/2017 to 28/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 28/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 28/12/2017
TS01	1034391	1083166	415210	429179	70578	66841
TS02	1079458	1030641	428440	395952	73297	66696
TS03	1080960	1003360	430950	383824	72614	65100
TS04	1093499	1065792	440942	409000	74044	66173
TS05	1070519	1110256	433481	435341	72378	68529
TS06	1030420	1102902	388708	410299	68996	65208
TS07	1123603	1068360	450623	411188	75911	66153
TS08	1092692	1128263	455842	453611	74140	68581
TS09	1207453	1207156	469040	457662	77266	72253
TS10	1145864	1137609	431599	418826	76147	69924
TS11	1209537	1088223	470383	405521	77751	65393
TS12	1031612	1078715	390028	391823	70210	65891
TS13	1144465	1092603	421587	391799	73585	66102
TS14	1154786	1186982	448881	445540	74699	70306
TS15	1149182	1111496	413613	380641	74271	66318
TS16	1165055	1044283	451234	399211	74764	68715
TS17	1163995	1054970	461933	402996	76134	68541
TS18	1119580	1122032	425563	406490	73911	67237
TS19	1163873	1045045	453343	400984	76410	66019
TS20	1206942	1017159	479586	378266	79412	65576
TS21	1140967	1151654	437987	426599	73188	68005

TS22	1181065	1202526	448582	438584	76210	70977
TS23	1185656	1095389	449000	400081	76597	70519
TS24	1087614	1146286	418180	435402	71965	69770
TS25	1178691	1021700	471890	403862	78125	66868
TS26	1036122	1016099	430546	405101	72524	66084
TS27	1110644	1049311	414086	392995	72673	63287
TS28	1199993	1065220	460333	403267	78693	64798
TS29	1129049	971680	433008	371398	73181	59756
TS30	-	31079	-	19856	-	2064
TS32	-	304	-	171	-	8
<b>Sub Total</b>	<b>32717687</b>	<b>31530257</b>	<b>12724598</b>	<b>11905470</b>	<b>2159674</b>	<b>1947693</b>

**Service Line 2:**

Service Line-2	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013
MC # 01	1021553	1004504	355299	341885	64683	61644
MC # 02	1009616	1041023	336001	337336	62543	61121
MC # 03	1206934	877716	420543	299221	75339	53007
MC # 04	1074620	983849	365257	332160	68060	59018
MC # 05	1151209	988797	405416	333143	71535	59353
MC # 06	1147419	942411	392895	302587	72616	56410
MC # 07	1051378	927221	363681	307787	64533	54186
MC # 08	1039835	914586	349810	296642	64846	54488
MC # 09	1053094	954328	360206	306581	65612	56512
MC # 10	1121532	879345	364285	279431	67546	50923
<b>TOTAL</b>	<b>10877190</b>	<b>9513780</b>	<b>3713393</b>	<b>3136773</b>	<b>677313</b>	<b>566662</b>

Service Line-2	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014
MC # 01	879603	1018156	293247	335665	55767	63054
MC # 02	927973	873632	309498	261670	58380	52037
MC # 03	903794	1061464	295869	342013	54811	64084
MC # 04	957191	982216	321677	305166	58793	57886
MC # 05	973757	891735	330111	279963	60699	52156
MC # 06	966677	983720	349936	306972	61745	59958
MC # 07	859628	1048774	317877	328773	52565	62407

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MC # 08	839750	924345	276217	259959	52937	50911
MC # 09	841134	998897	267385	292884	51980	58618
MC # 10	876337	970426	280099	291932	53285	56549
<b>TOTAL</b>	<b>9025844</b>	<b>9753365</b>	<b>3041916</b>	<b>3004997</b>	<b>560962</b>	<b>577660</b>

Service Line-2	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015
MC # 01	844324	924334	274350	281251	53044	55213
MC # 02	905588	977900	280167	298643	55869	58874
MC # 03	993513	1106897	330808	357516	62283	66483
MC # 04	845281	1010405	262837	310757	50444	57746
MC # 05	926163	996057	303843	304874	57465	58030
MC # 06	975741	1028545	316429	319790	61501	61987
MC # 07	892201	1034502	289710	323794	54430	61419
MC # 08	816254	743382	259873	224491	50916	43463
MC # 09	1027801	1017393	318771	300772	63797	59502
MC # 10	982534	1055662	309705	321672	59885	63111
<b>TOTAL</b>	<b>9209400</b>	<b>9895077</b>	<b>2946493</b>	<b>3043560</b>	<b>569634</b>	<b>585828</b>

Service Line-2	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016
MC # 01	902204	940127	303189	289160	53141	53651
MC # 02	888226	993850	242857	287478	51109	55698
MC # 03	963735	1044239	317394	331716	56202	58521
MC # 04	1027196	1055102	329879	334797	58825	59020
MC # 05	965031	1049877	312541	331672	56400	59530
MC # 06	1001766	1033840	313139	309348	58981	57791
MC # 07	1022887	1016248	329814	303316	59174	56363
MC # 08	852737	1061154	268326	333654	48364	59569
MC # 09	966851	1043302	294815	288734	55989	58556
MC # 10	985760	1057280	302281	322993	57466	59315
<b>TOTAL</b>	<b>9576393</b>	<b>10295019</b>	<b>3014235</b>	<b>3132868</b>	<b>555651</b>	<b>578014</b>
Service Line - 2	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2017 to 30/06/2017	01/07/2017 to 28/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to	01/01/2017 to	01/07/2017 to 28/12/2017

				28/12/2017	30/06/2017	
MC # 01	1022935	814139	329232	242888	60729	46549
MC # 02	2043205	1577980	652446	475801	119815	91133
MC # 03	944637	939153	307278	288630	54960	54507
MC # 04	983978	978986	317127	305743	56191	56273
MC # 05	1002940	1020775	325651	282087	59361	58483
MC # 06	1011448	1004615	322111	304848	58955	58653
MC # 07	964081	897255	298966	265750	56026	53720
MC # 08	1067291	879897	344842	271717	62618	51686
MC # 09	966318	881325	259685	258510	56072	51234
MC # 10	1063901	917443	334996	276586	61820	53281
<b>TOTAL</b>	<b>11070734</b>	<b>9911568</b>	<b>3492334</b>	<b>2972560</b>	<b>646547</b>	<b>575519</b>

**Service Line 3 & 4:**

Service Line-3 &4	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013	01/01/2013 to 30/06/2013	01/07/2013 to 31/12/2013
TS# 301	1033518	1114652	424641	445486	68013	71456
TS#302	876716	1158603	344351	436082	57165	73557
TS# 303	1032042	1216628	386134	460764	66254	76942
TS# 304	1131048	1178135	453503	463676	73669	75906
TS# 305	954483	1146253	358135	431929	61677	73793
TS# 306	1096061	1069735	423136	422262	69842	68480
TS# 307	1119584	1060116	440238	430542	72358	69139
TS# 308	1156620	1160401	474658	473603	76017	74934
TS# 309	1049345	1075770	401435	410898	67664	68591
TS# 310	1050415	1224408	402224	469994	66900	77151
TS# 311	1048337	1208672	395840	460495	66803	77856
TS# 312	1129928	1198683	443298	469477	72635	76471
TS# 313	1072360	1210892	439148	501316	69002	78386
TS# 314	1043423	1200654	407716	476268	67534	77009
TS# 315	1122019	1161831	463823	486836	72855	75623
TS# 316	1065110	1113877	439784	470065	68222	72148
TS# 317	1073725	1154317	415882	451531	70264	74857
TS# 318	1031419	1145631	422060	468402	65945	74881
TS# 319	1043924	1101073	425433	438875	66808	69658
TS# 320	1012192	1068668	410104	426836	64341	66844
TS# 321	947530	964593	380980	379587	60617	61238
TS# 322	975870	907353	384939	356781	62169	58801
TS# 323	1031702	942901	428143	388703	66251	60727
TS# 324	1048454	958234	435448	381056	67896	61161
TS# 325	1001822	655266	414420	265625	64365	42301
TS# 326	1090529	793395	414299	314327	69198	50079
TS# 327	1180354	780017	472444	310804	75317	49802



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TS# 328	1149221	754251	444894	327747	72481	50513
TS# 329	1202009	840353	482738	346315	76961	54168
TS# 330	1191438	919771	470144	362947	77076	56185
TS# 331	1062562	1033649	411573	409158	68285	65080
<b>Sub-total</b>	<b>33023760</b>	<b>32518782</b>	<b>13111565</b>	<b>12938387</b>	<b>2124584</b>	<b>2083737</b>

Service Line-3 &4	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014	01/01/2014 to 30/06/2014	01/07/2014 to 31/12/2014
TS# 301	1002402	1155666	401395	447014	66341	73540
TS#302	1097595	1166194	413155	421529	71834	73015
TS# 303	1159043	1130504	435733	407033	75341	69766
TS# 304	1018518	1203808	397124	454868	67022	77248
TS# 305	1137026	1190768	439779	442449	75038	75130
TS# 306	1122659	1133772	444343	430496	73884	72031
TS# 307	1109032	1206922	448737	478553	74853	79435
TS# 308	1114062	982302	451604	383346	73483	62640
TS# 309	1065707	1017415	411980	382143	70781	65686
TS# 310	1121387	1028793	435761	377478	73890	64475
TS# 311	878691	1114490	344472	431140	58770	73785
TS# 312	841859	1128843	337599	445515	56620	75280
TS# 313	1045551	976887	428870	393108	70682	65438
TS# 314	905407	1124064	344137	419068	59869	74642
TS# 315	939293	1073204	394446	438853	67395	72236
TS# 316	974738	1122160	414528	475889	65452	74871
TS# 317	938584	1002270	372969	397906	63775	67858
TS# 318	931548	1029164	370238	408611	63689	68703
TS# 319	1023597	1082314	416766	428196	69004	72297
TS# 320	1093162	1102413	440276	433901	73379	73487
TS# 321	1074571	1049870	418793	401322	72210	69286
TS# 322	704701	730174	284541	281818	48652	48615
TS# 323	1092034	1117815	458061	452013	74123	74457
TS# 324	1090371	1084512	441039	427845	73951	72604
TS# 325	1058522	1047360	439772	426257	71669	70360
TS# 326	1068129	1036146	434776	405309	71494	66972
TS# 327	1087941	999702	444166	397761	73921	64831
TS# 328	991501	1007439	413607	402880	65125	64676
TS# 329	886448	965481	365764	380916	59549	62383
TS# 330	793497	872050	300158	331983	51238	56459
TS# 331	725915	833345	281941	331263	46362	54215
<b>Sub-total</b>	<b>31093491</b>	<b>32715847</b>	<b>12426530</b>	<b>12736463</b>	<b>2079396</b>	<b>2136421</b>

Service Line-3 &4	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015	01/01/2015 to 30/06/2015	01/07/2015 to 31/12/2015
TS# 301	1044083	1091497	423892	432452	69345	69835
TS#302	950664	1196208	355762	437706	61616	75045
TS# 303	1065986	1183415	406602	441210	69848	74797
TS# 304	1042430	1158884	413493	458193	69971	75949
TS# 305	1000090	1186843	391757	450508	66373	75699
TS# 306	1040807	1226256	414132	475818	68944	78699
TS# 307	982457	1139925	401071	445989	66270	74348
TS# 308	1075979	1138696	426400	446524	71038	73549
TS# 309	1079650	1152796	412342	427008	71307	73628
TS# 310	1113721	1199011	419882	440113	72034	75091
TS# 311	1090686	1184802	435053	462676	73165	76948
TS# 312	1040649	1089806	425113	429017	71196	72459
TS# 313	1109448	1132942	465853	462090	76629	76216
TS# 314	1112437	1122885	430544	424516	75480	73590
TS# 315	1063802	1107509	448209	454232	73269	73960
TS# 316	965015	1149083	413869	483077	65237	75191
TS# 317	1067933	1070497	425840	419461	73272	71491
TS# 318	1067743	1124429	440118	451449	73119	74443
TS# 319	952496	1163735	373949	450772	64026	76028
TS# 320	993210	1105827	410511	445282	68211	74422
TS# 321	1113942	1030786	389555	398567	70184	68311
TS# 322	1032517	1039318	410671	403874	69543	68391
TS# 323	949650	1105266	392578	461065	63996	73956
TS# 324	1077648	1068092	438568	414688	73394	70794
TS# 325	976108	952859	407764	390839	66552	63718
TS# 326	891210	849934	352388	331268	58732	54331
TS# 327	835292	718013	332495	277836	54307	45811
TS# 328	883295	933273	362661	378944	57172	59793
TS# 329	880907	824030	355506	317922	58745	51890
TS# 330	908378	1000861	349633	387023	60198	64903
TS# 331	854957	898222	343392	360596	56325	58056
<b>Sub-total</b>	<b>31263190</b>	<b>33345700</b>	<b>12469603</b>	<b>13060715</b>	<b>2089498</b>	<b>2171342</b>

Service Line- 3 & 4	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016	01/01/2016 to 30/06/2016	01/07/2016 to 31/12/2016
TS# 301	1176335	1290385	466987	509707	75096	80387
TS#302	1209878	1307563	453188	491645	76479	80964

TS# 303	1245489	1324154	473359	506901	79777	82947
TS# 304	1201777	1238724	466252	477504	77375	78877
TS# 305	1198275	1311721	462146	505650	77633	82851
TS# 306	1262626	1279966	495615	502916	80706	79934
TS# 307	1237240	1326335	493883	526139	81729	85985
TS# 308	1250328	1311651	498693	527410	80823	83164
TS# 309	1228325	1268468	466562	476154	79519	79339
TS# 310	1291875	1342166	472730	513314	81621	83270
TS# 311	1156566	1155449	460300	454483	76565	74691
TS# 312	1163232	1201417	467584	475658	77797	77830
TS# 313	1159275	1208440	467007	480731	77255	78507
TS# 314	1128755	1261362	431186	483565	75368	80699
TS# 315	1122281	1166591	465480	480188	75262	75825
TS# 316	1158087	1220468	488410	517653	75819	78953
TS# 317	1107575	1195726	439324	466183	74096	78220
TS# 318	1162529	1195354	471576	487869	76676	78092
TS# 319	1162256	1230547	463370	496992	76794	80505
TS# 320	1130724	1241944	463640	513278	75615	81909
TS# 321	1150002	1211894	447072	474106	76203	78535
TS# 322	1152763	1248907	454321	504213	75878	80114
TS# 323	1158935	1216948	488231	511505	78097	80416
TS# 324	1177281	1242148	456199	487245	77455	80709
TS# 325	1092123	1217199	448512	509676	72049	80416
TS# 326	986410	987021	397862	406950	64151	63387
TS# 327	979478	942681	394559	377163	65558	61712
TS# 328	932280	1014611	377987	409279	59907	64985
TS# 329	984862	1067029	390733	423797	63252	67551
TS# 330	824306	1051132	307201	419160	52188	67768
TS# 331	1038921	1019428	423726	424275	67062	65272
<b>Sub-total</b>	<b>35230789</b>	<b>37297429</b>	<b>13953695</b>	<b>14841309</b>	<b>2303805</b>	<b>2393814</b>
Service Line - 3 & 4	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2017 to 30/06/2017	01/07/2017 to 28/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 28/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 28/12/2017
TS# 301	557971	1203514	202389	470870	33024	78274
TS# 302	1072142	1216562	409290	482006	67792	80548
TS# 303	1128423	1238917	414658	481898	72048	82191
TS# 304	1206981	980400	473266	384550	78377	64655
TS# 305	1133426	1250100	438449	489802	71701	82488
TS# 306	1102308	1217404	430835	479245	69702	80515

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TS# 307	1114218	1150542	439591	450446	72370	78498
TS# 308	1161550	1109785	470973	455087	75038	74692
TS# 309	1216458	1092907	457113	434764	77152	71718
TS# 310	1178809	1311666	474996	525211	74135	82655
TS# 311	1179554	1133090	461088	449134	77454	75709
TS# 312	1195401	1098838	478699	437825	78186	72803
TS# 313	1173619	1093289	463347	419936	76908	71983
TS# 314	1228111	1085492	464321	412469	79605	71410
TS# 315	1148349	1053979	473724	430957	75881	70348
TS# 316	1122558	1092665	474966	458343	73621	71899
TS# 317	1153006	1041349	445163	406908	75536	70056
TS# 318	1187367	1131515	481149	446397	78073	74655
TS# 319	1154338	1079609	465462	424607	75441	70347
TS# 320	1185949	1065635	489526	426448	78789	70326
TS# 321	1154889	1149216	455062	432376	76487	74762
TS# 322	1206679	1119044	498809	426540	79250	73023
TS# 323	1177493	1105639	481062	429767	77037	72022
TS# 324	1174492	1104496	460937	417483	77157	72409
TS# 325	1171473	1126318	489771	458324	77524	74621
TS# 326	1128058	947768	468378	379577	73477	63098
TS# 327	1067332	956481	434791	367591	70723	62783
TS# 328	1114694	1080317	450590	422712	71939	69112
TS# 329	1098292	1109686	434621	439659	70505	71081
TS# 330	1111467	1167133	441777	458710	72144	75230
TS# 331	1081419	1150785	460449	449186	71488	74974
<b>Sub-total</b>	<b>35086826</b>	<b>34664143</b>	<b>13985252</b>	<b>13648828</b>	<b>2278564</b>	<b>2278884</b>

Summary sheet for three lines:

Service Lines	Total Energy Consumed (kWh)	Total Energy Regenerated (kWh)	Total Distance covered (km)
<b>01/01/2013 to 31/12/2013</b>			
Line 1	576,964,79	226,927,10	398,197,6
Line 2	203,909,70	685,016,6	124,397,5
Line 3&4	655,425,42	260,499,52	420,832,1
<b>Total</b>	<b>143,629,991</b>	<b>555,928,28</b>	<b>943,427,2</b>
<b>01/01/2014 to 31/12/2014</b>			
Line 1	583,874,43	223,835,03	392,894,9
Line 2	187,792,09	604,691,3	113,862,2
Line 3&4	638,093,38	251,629,93	421,581,7
<b>Total</b>	<b>140,975,990</b>	<b>535,934,09</b>	<b>928,338,8</b>
<b>01/01/2015 to 31/12/2015</b>			
Line 1	606,312,66	235,187,12	403,976,8
Line 2	191,044,77	599,005,3	115,546,2
Line 3&4	646,088,90	255,303,18	426,084,0
<b>Total</b>	<b>144,344,633</b>	<b>550,390,83</b>	<b>945,607,0</b>
<b>01/01/2016 to 31/12/2016</b>			
Line 1	656,831,34	255,001,48	433,646,4
Line 2	198,714,12	614,710,3	113,366,5
Line 3&4	725,282,18	287,950,04	469,761,9
<b>Total</b>	<b>158,082,764</b>	<b>604,422,55</b>	<b>101,677,48</b>
<b>01/01/2017 to 28/12/2017</b>			
Line 1	642,479,44	246,300,68	410,736,7
Line 2	209,823,02	646,489,4	122,206,6
Line 3&4	697,509,69	276,340,80	455,744,8
<b>Total</b>	<b>154,981,214</b>	<b>587,290,42</b>	<b>988,688,1</b>

**APPENDIX-A**

AC-	Alternating Current
Aircon-	Air conditioner
C/I-	Converter/Inverter
CT-	Current Transformer
DC-	Direct Current
DT Car-	Driver trailer Car
M-Car-	Motoring Car
NABL	National Accreditation Board For Testing and Calibration Laboratories
OHE-	Over Head Equipment
PT-	Potential Transformer
SIV-	Static Inverter
TIMS-	Train Integrated Management System
VVVF-	Variable Voltage Variable Frequency

## Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory		
Document Type: Form		
Business Function: Registration		
Keywords: monitoring report, performance monitoring		