



**Monitoring report form for CDM project activity
(Version 07.0)**

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

MONITORING REPORT

Title of the project activity	Installation of Low Green House Gases (GHG) emitting rolling stock cars in metro system	
UNFCCC reference number of the project activity	UNFCCC reference number 1351 GS reference number 4597	
Version number of the PDD applicable to this monitoring report	05	
Version number of this monitoring report	05	
Completion date of this monitoring report	29/07/2019	
Monitoring period number	8 th Monitoring Report	
Duration of this monitoring period	19/01/2016 to 28/12/2017 (Both days included)	
Monitoring report number for this monitoring period	1	
Project participants	The project participant is Delhi Metro Rail Corporation	
Host Party	India	
Applied methodologies and standardized baselines	AMS III.C. "Emission reduction by low greenhouse gas emitting vehicles" Version: 10	
Sectoral scopes	7	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	-	92,805 tCO ₂
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	96,681 ¹ tCO ₂	

¹Ex-ante for the year 2016 (01/01/2016 to 31/12/2016) as per PDD is 47,890 tCO₂, however the registration of project on Gold Standard registry is from 19/01/2016 onward. Therefore, based on apportionment, the ex-ante value is 45,528 tCO₂ (47890*347/365).

Ex-ante for the year 2017 (01/01/2017 to 31/12/2017) as per PDD is 51,577 tCO₂, however we are considering period from 01/01/2017 to 28/12/2017, as the crediting period of the project is till 28/12/2017, therefore, ex-ante value is 51,153 tCO₂ (51,577*362/365).

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 4/6/8 car rolling stocks on different service lines.

The project was registered for 280 cars employed on 70 rolling stock with 4 car configuration. A typical four car rolling stock used by DMRC consists of two units. Each unit in the rolling stock comprise 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.

During the monitoring period, similar units were added to existing four car configuration and thus making them six/eight car configuration rolling stock. Since, the additional units are not part of registered PDD, hence these have not been considered in the monitoring period of 2016-2017.

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. 19/01/2016 to 28/12/2017. No special event took place during the monitoring period i.e. 19/01/2016 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 19/01/2016 to 31/12/2016: 45,967 tCO₂

For the Monitoring Period from 01/01/2017 to 28/12/2017 : 46,838 tCO₂

Total Emission Reduction: 92,805 tCO₂

A.2. Location of project activity

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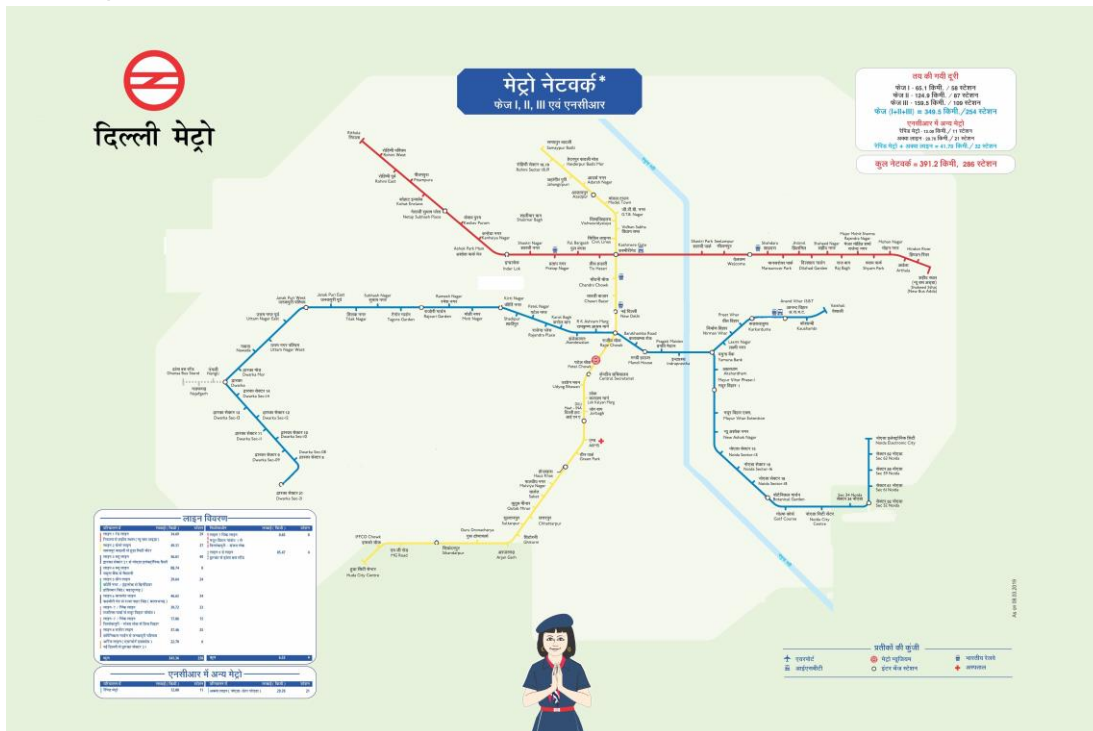
The project activity has been implemented in Delhi, India. The geographical details of the project site are given below:

Longitude	77.23° E
Latitude	28.61° N

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

- Dilshad Garden- Rithala
- Jahangirpuri -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. References to applied methodologies and standardized baselines

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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>

Date: 23/12/2006

Reference: "Appendix B- Indicative Simplified Baseline and monitoring Methodologies for Selected Small Scale CDM Project Activities"

Type III – Other project activities

A.5. Crediting period type and duration

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Fixed: 2 years starting from 19/01/2016

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

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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 (NFD)

The distributions of Rolling stock on different lines at the end of year 2016 are as follows:

S. No.	Service Line	Operational Depot	Number of Rolling Stock
1.	1	Shastri Park Depot (SPD)	29
2.	2	Khyber Pass Depot (KPD)	8
		Sultanpur Depot (SLPD)	2
3.	3 & 4	Najafgarh Depot (NFD)	25

		Yamuna Bank Depot (YBD)	6
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The Rolling Stock No. MC#1 (TS# 30) was shifted from SLPD (Service Line – 2) to SPD (Service Line – 1) in the month of November 2017 and another Rolling stock No. MC#3 (TS# 32) was shifted from KPD (Service Line – 2) to SPD (Service Line – 1) in the month of December 2017. The revised Number of Rolling stocks at the end of year 2017 are as follows:

S. No.	Service Line	Operational Depot	Number of Rolling Stock
1.	1	Shastri Park Depot (SPD)	31
2.	2	Khyber Pass Depot (KPD)	7
		Sultanpur Depot (SLPD)	1
3.	3 & 4	Najafgarh Depot (NFD)	25
		Yamuna Bank Depot (YBD)	6

All the 70 Rolling Stocks were under operation during the monitoring period i.e. 19/01/2016 to 28/12/2017.

No special event took place during the monitoring period i.e. 19/01/2016 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, standardized baselines or other methodological regulatory documents

>> NA

B.2.2. Corrections

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Post Registration Changes (PRC) reference no. is PRC-1351-002 and it has been approved by UNFCCC on 21/12/2013.

The PDD version number changed. The average CERs also got changed to 47,053 tCO₂. These changes are due to changes in design, which does not affect the Applicability, Additionality and scale of project activity. The CERs changed due to the extensions of Corridor length of service line 1, line 2 and line 3, the respective extensions of all the three lines commissioning documents has been checked as well as verified during the site visit also mentioning of actual values already accepted by UNFCCC in the earlier verifications.

The project is realized in three Phases, Phase I, Phase II and Phase III. Phase II & Phase III are added in section B.3 of the PDD to include all project phases of the three service lines (Red, Yellow & Blue Lines) explicitly in the project boundary.

Phase III considers an extension of the metro system by 9.989 km. Accordingly, the ex-ante emission reductions have been estimated and the value has changed from 47,890 tCO₂ to 51,577 tCO₂.

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

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The start date for this crediting period is taken from 19/01/2016 instead to previous monitoring report, where the start date of crediting Period is 01/01/2016.

This project has also been registered at Gold Standard registry on 19/01/2018 to claim GS CERs from this project. Hence, In order to synchronise the duration of Monitoring, the start date of this crediting Period is taken as 19/01/2016 instead of 01/01/2016.

B.2.4. Inclusion of monitoring plan

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B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

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Post Registration Changes (PRC) reference no. is PRC-1351-002 and it has been approved by UNFCCC on 21/12/2013.

The monitoring plan has been updated with respect to emergency procedure for monitoring of data in case the data monitoring system fails. This is in compliance with the monitoring methodology.

B.2.6. Changes to project design

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Post Registration Changes (PRC) reference no. is PRC-1351-002 and it has been approved by UNFCCC on 21/12/2013.

The PDD has been updated now in line with the actual situation. The PDD provides now the details of the three phase implementation, the actual status, the already conducted extension in relation to registered PDD and planned future extension, along with specific details of the extension for each line in each project phase. The changes to the registered PDD are only applicable to the three service lines, Red Line (as 1), Yellow (as Line 2) and Line Blue (as 3 & 4) of the Delhi Metro Railway System. The PDD has been updated and clearly states that only these lines are to be considered under this project activity. Related section on project boundary has been updated as well. The rolling stock numbers will remain 70 but might be interchanged from one line to another. Now the revised PDD mentions the extensions and planned extensions.

Due to the extension of the corridors, the potential emission reduction increases. Accordingly, the revised PDD section mentions that the CERs will increase as the corridor length increased but will be less than 60,000 tCO₂/year which is the threshold limit for small scale project criteria.

B.2.7. Changes specific to afforestation or reforestation project activity

>> 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:

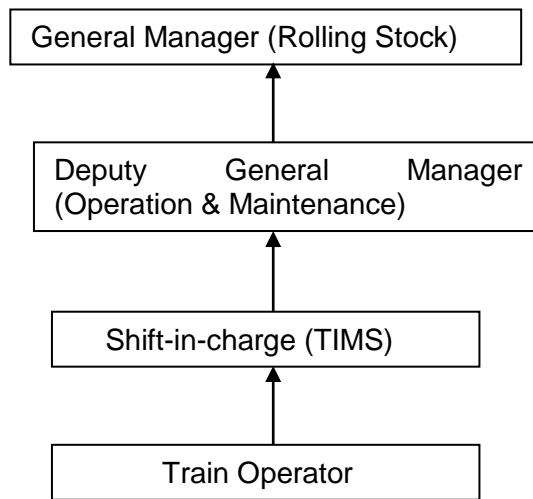
- a) Number of rolling stock in a line
- b) Electrical energy consumed by each rolling stock in a line
- c) Electrical energy regenerated by each rolling stock in a line.

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.

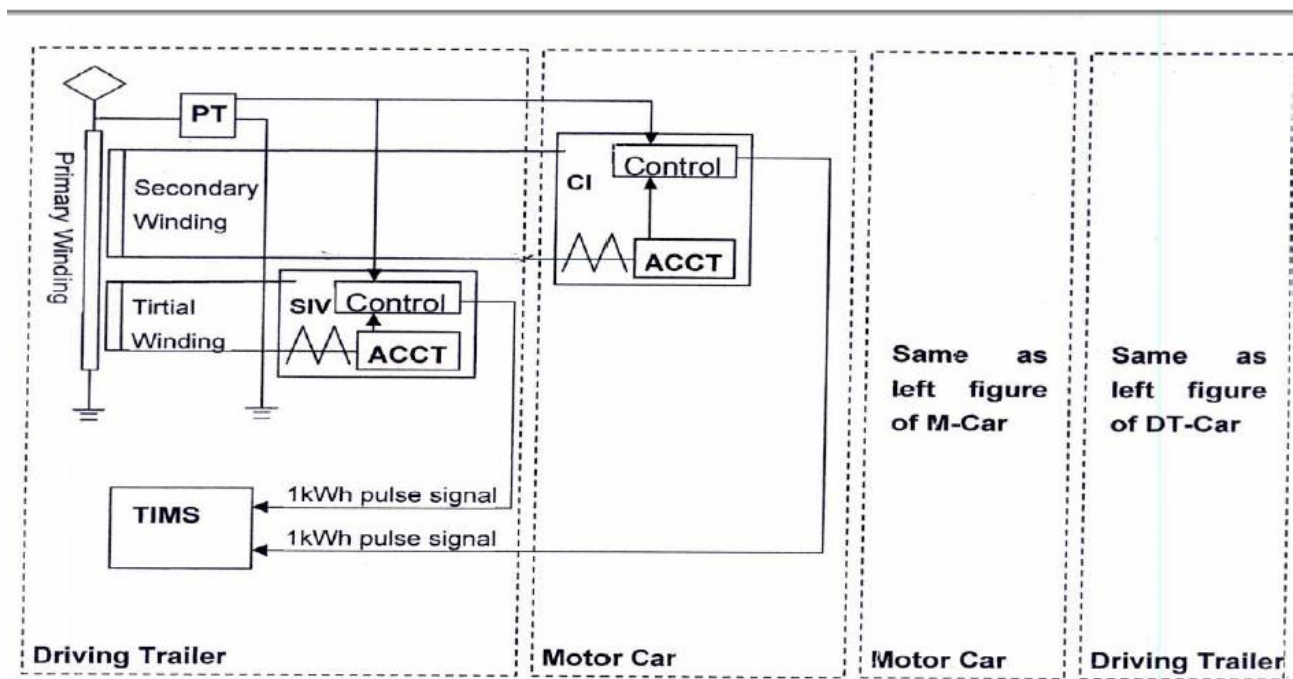
To ascertain the Quality Control and Quality Assurance of the monitored parameters, following procedure is adopted:

- 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 in 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

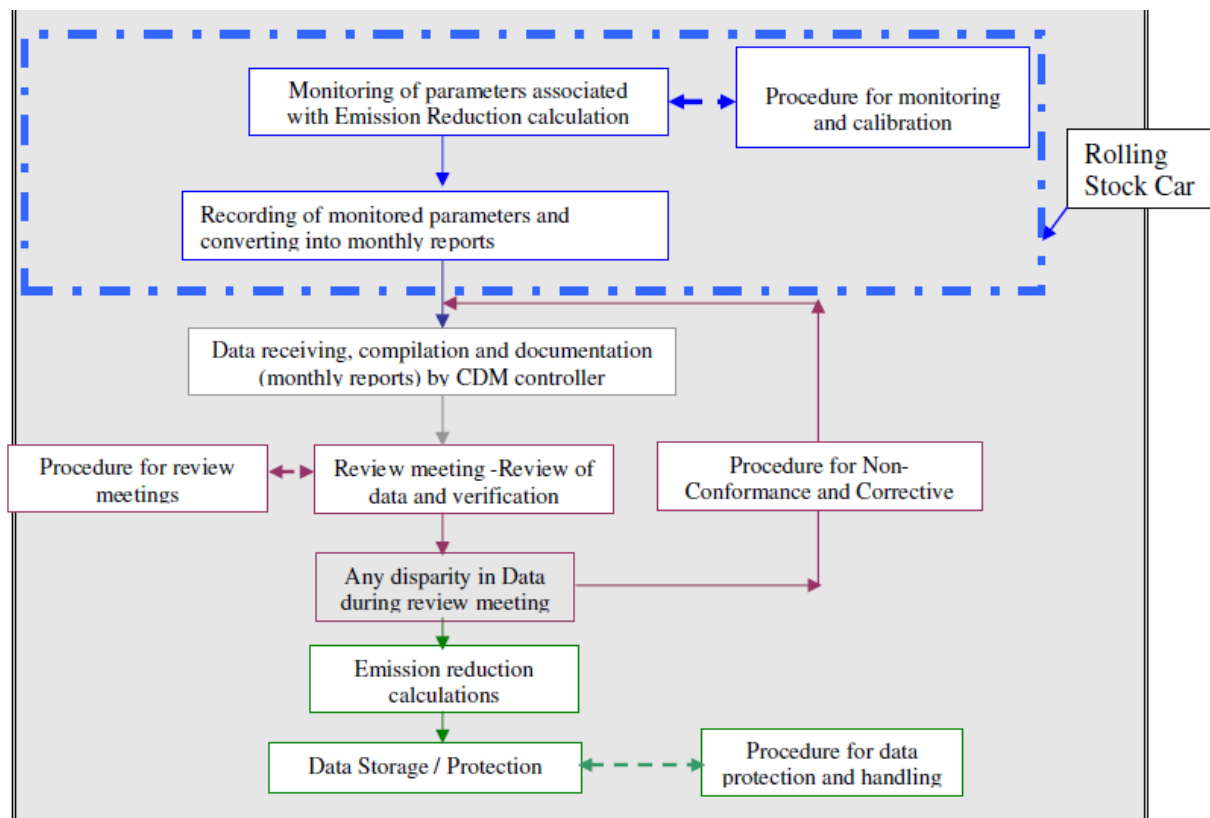
Voltage from pantograph is supplied to both CI and SIV (Main function of CI is to convert AC power to 1900V DC. This 1900V DC is converted into 3 phase AC variable voltage variable frequency by the inverter and supplied to Traction Motors. On the other hand SIV change the input AC power (AC25kV) to 3 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 on sampling basis and the details of the same can be found in section D2 of this document.

SECTION D. Data and parameters**D.1. Data and parameters fixed ex ante***(Copy this table for each data or parameter.)*

Data/Parameter	EF_y
Unit	tCO ₂ /GWh
Description	Emission Factor for northern grid
Source of data	CO ₂ 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	http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver2.pdf
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.)*

Data/Parameter	EG_{i, wr}
Unit	GWh/year
Description	Electrical energy consumed by the operational rolling stock 'i'
Measured/calculated/default	Measured & Calculated
Source of data	Train Integration and Management System (TIMS) reading
Value(s) of monitored parameter	150.286997 (2016) 154.137179 (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 which are done on sampling basis 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 daily and downloaded monthly 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

Data/Parameter	EG_{i, R}
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	57.458687 (2016) 58.547761 (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 daily and downloaded monthly 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_i
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	9,666,348 (2016) 10,015,194 (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 in each year y
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

GS Monitoring Indicators

No.	S18	
Indicator	Access to affordable and clean energy services	
Mitigation measure	Access to affordable and clean energy services refer to changes compared to the baseline in: <ul style="list-style-type: none"> Stakeholders have access to better transportation services at affordable price. Reduction in units of energy consumed will contribute towards the improvement in the power scenario of Delhi i.e. the region where GS project is implemented. Reducing dependency of fuel/ energy imports that may lead to more sustainable and affordable energy services in a country. 	
Chosen parameter	Energy Consumption for all the Rolling Stock included in project activity	
Current situation of parameter	In absence of project activity (installation of regenerative braking), equivalent amount of electricity would have been consumed by rolling stocks, from the grid. Thus, project activity displaces equivalent amount of electricity that would have been generated in the fossil fuel based power plant connected to the regional grid. The current situation shows lesser energy consumption due to retrofit of regenerative braking.	
Estimation of baseline situation of parameter	The baseline scenario for the project activity is rolling stocks without regenerative braking system, the total electricity consumption of which would have been met from northern regional grid.	
Future target for parameter	100 % monitoring of the data will be done. Data shall be archived for 2 years following the end of the crediting period	
Way of monitoring	How	The data will be measured through Train Integration and Management System (TIMS) reading. The readings are cumulative. These readings are noted daily and downloaded monthly using a maintenance terminal.
	When	Monthly
	By who	Project proponent

No.	SI6	
Indicator	Quality of employment	
Mitigation measure	The project activity ensures good quality of employment by training the staff, providing medical benefits and insurance. National norms for jobs will be maintained.	
Chosen parameter	Training of Staff, medical benefits and insurance.	
Current situation of parameter	<p>The staff recruited undergoes a training where they are informed about the working and site requirements. Refresher training is provided as in when required</p> <p>In the monitoring period 2016 and 2017, a total number of 153 executives have been imparted training at the training institute of DMRC. In addition, 274 and 489 non executive staff of electrical wing had been trained during the year 2016 and 2017 respectively</p> <p>Medical benefit and insurance are provided to DMRC employees. DMRC has laid down a master circular on medical attendance rules through which it provide medical benefits to all its employees and the same has been followed in the year 2016 and 2017. The medical benefits provided to the Operation & Maintenance employees of DMRC during FY 2016-17 were Rs 1,943 Lakhs. Further, DMRC has provided an insurance amount of Rs 40 Lakh during FY 2016-17</p>	
Estimation of baseline situation of parameter	In absence of project activity, the staff would not have been trained on regenerative braking and skills would not have been enhanced.	
Future target for parameter	Continue to provide quality employment in all operation and maintenance activity for the project by imparting training and refresher training.	
Way of monitoring	How	Number of staff trained / training records, medical and insurance benefits provided to DMRC employees.
	When	Annual
	By who	Project proponent

No.	SI7	
Indicator	Livelihood of the poor	
Mitigation measure	The project activity will have impact on the improving the livelihood. The mitigation measures involve providing homes, schools for homeless and poor, etc.	
Chosen parameter	CSR activities of DMRC related to enhancing livelihood of the poor	
Current situation of Parameter	<p>DMRC works proactively towards enhancing livelihood of the poor and needy in Delhi NCR. DMRC has been carrying out various CSR activities focused on enhancing livelihood of poor like supporting Help age India, salam balak trust (NGO working with poor senior citizens, homeless orphans and street children).</p> <p>During the year 2017, DMRC under the name of "DMRC Children home", has been carrying out various activities and events focusing on education, health and overall well-being of 136 orphan and street children.</p> <p>DMRC under their CSR programme has been sponsoring the Winter Shelter for elderly persons under the name of "Help Age India" wherein DMRC bears the expenditure of these people. During the monitoring period, 40 person were provided dinner and breakfast services from 01st November 2016 to 31st March 2017. Further, 35 person were provided dinner and breakfast services from 1st November 2017 to 31st March 2018.</p> <p>Delhi Metro Rail Corporation (DMRC) Museum at Patel Chowk engages very closely with the children and organizes a number of programmes and events for them. The main objective of the museum is knowledge sharing coordinated visits, workshops, competitions, storytelling sessions etc.</p>	

		Students from following school have visited the Museum at Patel Chowk: a. Natkhat Bachpan School b. Rukmini Devi Public school c. Masonic Public school d. The green school, e. Merry International Public school, etc. A total of 2,730 and 2,311 childrens have visited Metro Museum in year 2016 and 2017 respectively.
Estimation of baseline situation of parameter		Start date of project activity is 2001. Activities towards enhancing livelihood of poor started in 2009. Hence under baseline scenario, such activities are not undertaken.
Future target for parameter		Shelter for helpless, poor street children equipped with all necessary facilities for their overall growth. Children dormitory, classroom and playground for homeless children Old age home for helpless, homeless elders
Way of monitoring	How	Progress Report
	When	Annual
	By who	Project proponent

No.	SI9	
Indicator	Human and institutional capacity	
Mitigation measure	DMRC will develop human and institutional capacity of users / workers / etc. The mitigation measures includes workshop / ICT material to enhance awareness on environment, safety, health and other social issue.	
Chosen parameter	Training and development of human and institutional capacity through CSR activities.	
Current situation of Parameter	The revenue obtained from the project activity is being utilized for enhancing human and institutional capacity in dealing with sustainability issues. The following programs will be taken up: <ul style="list-style-type: none"> Organizing a series of nukkad natak at 12 and 10 construction sites during the safety week of 2016 and 2017 respectively to spread awareness about the safety among the workers and officials In addition, newsletters were also issued on monthly basis during the year 2016 and 2017 which focuses on various aspects such as safety, vigilance, environment, social initiatives, etc. 	
Estimation of baseline situation of parameter	Such initiatives have been initiated since 2012 ¹ hence under baseline situation i.e. prior to 2001 such initiatives were not taken.	
Future target for parameter	Continued development of human and institutional capacity by awareness programmes.	
Way of monitoring	How	Annual reports, Newsletters of DMRC
	When	Annual
	By who	Project proponent

No.	SI10	
Indicator	Quantitative employment and income generation	
Mitigation measure	Ensures employment generation during the operation and maintenance of the project activity	
Chosen parameter	Employment generation each year.	
Current situation of parameter	Employment was generated during the installations. Moreover, operation and maintenance also leads to further employment generation.	

¹http://delhimetrorail.com/press_reldetails.aspx?id=BzM0uJW3rr8Ild

Estimation of baseline situation of parameter		Number of employees in DMRC is growing pursuant to baseline situation. Number of employees with DMRC has grown from 8,629 employees in 2016 to 12,056 by March 2018 ² . Thus there is a growth of Quantitative employment and income generation. At the end of 31 st March, 2016, the number of employees were 8,629 and the same has increased to 9,864 employees at the end of 31 st March, 2017 and the same has further increased to 12,056 at the end of 31 st March 2018. The value clearly indicates that the number of staff has increased in the monitoring period 2016 and 2017.
Future target for parameter		Continue generation of employment.
Way of monitoring	How	All the employees of DMRC are governed by minimum wage rate as per govt. of India regulation. Payscale of each type of employee has been defined in the recruitment notice of DMRC and the HR Department of DMRC is in custodian of the same.
	When	Annual
	By who	Project proponent

No.	SI12	
Indicator	Technology transfer and technological self-reliance	
Mitigation measure	The successful implementation of the project activity has resulted in the use of similar technologies in upcoming metros in India.	
Chosen parameter	Similar technology (regenerative braking) being used in other metros in India planned after this project activity.	
Current situation of parameter	<p>The energy efficient technologies of the project activity have been utilized for the first time by DMRC. The project activity demonstrates the viability of the regenerative braking technology and will help in technology transfer to future phases of DMRC as well as other MRTS in India. There is no experience of such projects in the state as the technological advancements are first of its kind. Hence it is an intra-country technology transfer.</p> <p>Delhi Metro Rail Corporation has provided consultancy services to Mumbai Metro, Hyderabad Metro, Uttarakhand Metro, etc. during the year 2016 and 2017 The Detailed Project Report (DPR) prepared by Delhi Metro has mentioned about the regenerative braking system and its advantages in the Rolling Stock system.</p>	
Estimation of baseline situation of parameter	Being first of it's kind in India baseline situation is installation of Rheostatic Braking system without technology transfer similar to Kolkata metro.	
Future target for parameter	The success of the project would lead to implementation of similar technology in upcoming metro systems as well.	
Way of monitoring	How	Similar technologies being used in upcoming metros. (Refer to the DPR of Hyderabad Metro).
	When	As and when new metros are planned and DPR is available.
	By who	Project proponent

D.3. Implementation of sampling plan

>> NA

² DMRC Annual Report FY2017-18, Page Number 13. <http://www.delhimetrorail.com/OtherDocuments/DMRC-English-AR-Year-2017-18.pdf>

SECTION E. Calculation of emission reductions or net anthropogenic removals**E.1. Calculation of baseline emissions or baseline net removals**

>>

For the Monitoring Period 2016 (19/01/2016 to 31/12/2016)

$$BE = EG_{wr} * EF$$

Where:

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

- EF CO₂ emission factor of the northern grid (t CO₂ e / GWh)
 EG_{wr} total electrical energy consumed by rolling stocks without regenerative braking (GWh)
 EG_{i,wr} total energy consumed by the rolling stock 'i' without regenerative braking (GWh)
 S_i total distance covered by the rolling stock 'i' (km)
 N total number of operational rolling stocks

Calculation:-

$$\begin{aligned} EG_{wr} &= 150,286,997 \text{ kWh} \\ EF &= 800 \text{ tCO}_2/\text{kWh} \\ BE &= 150,286,997 * 800/1000000 \\ \mathbf{BE} &= \mathbf{120,230 \text{ tCO}_2} \end{aligned}$$

>> **For the Monitoring Period 2017 (01/01/2017 to 28/12/2017)**

$$BE = EG_{wr} * EF$$

Where:

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

- EF CO₂ emission factor of the northern grid (t CO₂ e / GWh)
 EG_{wr} total electrical energy consumed by rolling stocks without regenerative braking (GWh)
 EG_{i,wr} total energy consumed by the rolling stock 'i' without regenerative braking (GWh)
 S_i total distance covered by the rolling stock 'i' (km)
 N total number of operational rolling stocks

Calculation:-

$$\begin{aligned} EG_{wr} &= 154,137,179 \text{ kWh} \\ EF &= 800 \text{ tCO}_2/\text{kWh} \\ BE &= 154,137,179 * 800/1000000 \\ \mathbf{BE} &= \mathbf{123,310 \text{ tCO}_2} \end{aligned}$$

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

>>

For the Monitoring Period 2016 (19/01/2016 to 31/12/2016)

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

Where,

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

- EF CO₂ emission factor of the northern grid (t CO₂e / 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:-

$$EG_{i,wr} = 150,286,997 \text{ kWh}$$

$$EG_{i,R} = 57,458,687 \text{ kWh}$$

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

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

$$PE = (150,286,997 - 57,458,687) * 800 / 1000000$$

$$PE = 74,263 \text{ tCO}_2$$

>> For the Monitoring Period 2017 (01/01/2017 to 28/12/2017)

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

Where,

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

EF CO₂ emission factor of the northern grid (t CO₂e / 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:-

$$EG_{i,wr} = 154,137,179 \text{ kWh}$$

$$EG_{i,R} = 58,547,761 \text{ kWh}$$

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

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

$$PE = (154,137,179 - 58,547,761) * 800 / 1000000$$

$$PE = 76,472 \text{ tCO}_2$$

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 ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
2013	-	-	-	-	-	-
2016	120,230	74,263	0	-	45,967	45,967
2017	123,310	76,472	0	-	46,838	46,838
Total	243,540	150,735	0	-	92,805	92,805

For the Monitoring Period 2016 (19/01/2016 to 31/12/2016):

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated (kWh)	Total Distance covered (km)
Line-1	62,443,966	24,242,606	4,122,634
Line-2	18,891,547	5,824,944	1,077,758
Line-3	68,951,484	27,391,136	4,465,956
Total	150,286,997	57,458,687	9,666,348

Emission factor of northern regional grid 800 tCO₂/GWh (ex-ante value of registered PDD)
Baseline emissions (2016) 120,230 tCO₂
Project emissions (2016) 74,263 tCO₂
Leakage emission 0 tCO₂

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

Calculation:-

$$ER = 120,230 - (74,263 - 0)$$

$$ER = 45,967 \text{ t CO}_2$$

Emission reduction (2016) = 45,967 tCO₂

For the Monitoring Period 2017 (01/01/2017 to 28/12/2017):

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	64,166,520	24,619,124	4,267,058
Line-2	20,249,421	6,269,386	1,190,678
Line-3	69,721,238	27,659,251	4,557,459
Total	154,137,179	58,547,761	10,015,194

Emission factor of northern regional grid 800 tCO₂/GWh (ex-ante value of registered PDD)
Baseline emissions (2017) 123,310 tCO₂
Project emissions (2017) 76,472 tCO₂
Leakage emissions 0 tCO₂

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

Calculation:-

$$ER = 123,310 - 0 - (76,472 - 0)$$

$$ER = 46,838 \text{ t CO}_2$$

Emission Reduction (2017) = 46,838 tCO₂

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 (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
2016	45,967	45,528
2017	46,838	51,153
Total for two years	92,805	96,681

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

>>

As per the PDD, the ex-ante value for the year 2016 i.e. from 01/01/2016 to 31/12/2016 is 47,890 tCO₂/year and for the year 2017 i.e. 01/01/2017 to 31/12/2017 is 51,577 tCO₂. Since, the crediting period in GS was started from 19/01/2016 and is till 28/12/2017, therefore, for the year 2016, the

period is taken as 19/01/2016 to 31/12/2016 and the ex-ante value is taken as 45,528 tCO₂ (47,890*347/365) and for the year 2017, the period is taken as 01/01/2017 to 28/12/2017 and the ex-ante value is taken as 51,153 tCO₂ (51,577*362/365).

So, the ex-ante value for the monitoring period viz. 19/01/2016 to 28/12/2017 is considered as 96,681 tCO₂ (45,528 + 51,153).

E.6. Remarks on increase in achieved emission reductions

>>

Ex-ante value of Emission reduction as mentioned in the PDD has been considered based on Emission reduction achieved in the crediting period of 2012. During the crediting period of 01/01/2012 to 31/12/2012, the ER were 47,890 tCO₂ and total distance travelled by Rolling stock were 10,089,625 km.

The GS crediting period for the project is 19/01/2016 to 28/12/2017. For the year of 2016, the crediting days are 347 days instead of 365 days. Hence, for this crediting duration, the ex ante value of distance travelled by rolling stock would be 9,592,054 km (10,089,625*347/365) and the corresponding emission reduction would be 45,528 tCO_{2e} (47,890*347/365).

Whereas, the actual distance travelled in the crediting period viz. 19/01/2016 to 31/12/2016 is 9,666,348 km and actual emission reduction achieved is 45,967 tCO_{2e}.

The reason for increase in distance travelled and emission reduction can be attributed to the fact that a section of Phase-III viz. Jahangirpuri - Badli stretch, which is a part of project boundary, was opened on 10/11/2015 and hence it has been considered in the crediting period.

On comparison, it is observed that the rolling stock has travelled more KM than as compare to ex ante KM and consequently emission reductions also increased as mentioned above.

E.7. Remarks on scale of small-scale project activity

>>

CERs generated in each year from this project activity are less than 60,000 tCO₂/year, which is the threshold limit for small scale project criteria, therefore, it is a small scale project activity.

Apportionment of Emission Reduction for Monitoring Period of 2016 (19/01/2016 to 31/12/2016)

As per the monitoring methodology, the parameters as defined in Section D.2 (Data and Parameters monitored) were monitored on monthly basis.

The project is registered from 19/01/2016, whereas the monitored values were available for 01/01/2016. Hence, the value of Emission Reduction for period of 18 days of January 2016 was to be apportioned and deducted from Emission Reduction for 2016. To carry out apportionment, following two methods are considered:

- A. To evaluate average emission reduction per day based on yearly basis (Jan to Dec 2016).
- B. To evaluate average emission reduction per day on monthly basis (for January 2016 only).

The detailed calculation for both is as follows:

- A. To evaluate Emission Reduction for 18 days in January 2016, the average emission reduction on yearly basis was calculated. Based on data and parameters monitored

Monitored values for Year 2016 (01/01/2016 to 31/12/2016):

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	65,683,134	25,500,148	4,336,488
Line-2	19,871,512	6,127,103	1,133,665
Line-3	72,528,218	28,812,002	4,697,619
Total	158,082,864	60,439,253	10,167,772

Emission factor of

Northern regional grid 800 tCO₂/GWh (ex-ante value of registered PDD)

Baseline emissions (2016) 126,466.2 tCO₂

Project emissions (2016) 78,114.8 tCO₂

Leakage emissions: 0 tCO₂

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

Calculation:-

$$ER = 126,466.2 - (78,114.8 + 0)$$

$$\text{Emission Reduction (2016)} = 48,351.4 \text{ tCO}_2$$

$$\text{Emission Reduction per day: } 132.469 \text{ tCO}_2$$

$$\begin{aligned} \text{Emission Reduction for 2016 (19/01/2016 to 31/12/2016)} &= 48,351.4 - (18 \times 132.469) \\ &= \mathbf{45,967 \text{ tCO}_2} \end{aligned}$$

B. As another alternative, to evaluate Emission Reduction for 18 days in January 2016, the average emission reduction for January 2016 was calculated.

Monitored values for the month of January 2016 (01/01/2016 to 31/01/2016):

Lines	Total Energy consumed (kwh)	Total Energy regenerated (kwh)	Total Distance Travelled (km)
Line - 1	4,909,035	2,143,690	361,649
Line - 2	1,397,590	466,341	88,303
Line - 3	5,160,225	2,283,941	377,801
Total	11,466,850	4,893,972	827,753

Emission factor of

Northern regional grid 800 tCO₂/GWh (ex-ante value of registered PDD)

Baseline emissions (2016): 9,173.4 tCO₂

Project emissions (2016): 5,258.3 tCO₂

Leakage emissions: 0 tCO₂

ER = BE – (PE+LE)

Calculation:-

ER= 9,173.4 – (5,258.3+ 0)

Emission Reduction (2016) = 3,915.09 tCO₂

Emission Reduction per day: 126.29 tCO₂

Emission Reduction for 2016 (19/01/2016 to 31/12/2016) = 48,351.4 – (18 x 126.29)
= **46,078 tCO₂**

On comparison of two values, it was observed that considering the average on annual basis will yield more conservative values of Emission Reduction for 2016.

Hence, the Emission Reduction for year 2016 is 45,967 tCO₂.

Apportionment of Emission Reduction for Monitoring Period of 2017 (01/01/2017 to 28/12/2017)

Parameters monitored) were monitored on monthly basis.

The project is registered till 28/12/2017, whereas the monitored values were available for 31/12/2017. Hence, the value of Emission Reduction for period of 3 days of December 2017 was to be apportioned and deducted from Emission Reduction for 2017. To carry out apportionment, following two methods are considered:

- A. To evaluate average emission reduction per day based on yearly basis (Jan to Dec 2017)
- B. To evaluate average emission reduction per day on monthly basis (for December 2017 only).

The detailed calculation for both is as follows:

- A. To evaluate Emission Reduction for 3 days in December 2017, the average emission reduction on yearly basis was calculated. Based on data and parameters monitored

Monitored values for Year 2017 (01/01/2017 to 31/12/2017):

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	64,698,287	24,823,150	4,302,420
Line-2	20,417,234	6,321,342	1,200,545
Line-3	70,299,038	27,888,471	4,595,228
Total	155,414,559	59,032,963	10,098,193

Emission factor of

Northern regional grid 800 tCO₂/GWh (ex-ante value of registered PDD)

Baseline emissions (2017) 124,331.64 tCO₂

Project emissions (2017) 77,105.27 tCO₂

Leakage emissions: 0 tCO₂

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

Calculation:-

$$ER = 124,331.64 - (77,105.27 + 0)$$

$$\text{Emission Reduction (2017)} = 47,226.37 \text{ tCO}_2$$

Emission Reduction per day: 129.387 tCO₂

$$\begin{aligned} \text{Emission Reduction for 2017 (01/01/2017 to 28/12/2017)} &= 47,226.37 - (3 \times 129.387) \\ &= \mathbf{46,838.209 \text{ tCO}_2} \end{aligned}$$

- B. As another alternative, to evaluate Emission Reduction for 3 days in December 2017, the average emission reduction for December 2017 was calculated.

Monitored values for month of December 2017 (01/01/2017 to 31/12/2017):

Service Lines	Total Electrical Energy Consumed (kWh)	Total Energy Regenerated(kWh)	Total Distance covered (km)
Line-1	4,653,547	1,995,075	355,412
Line-2	1,066,317	354,626	70,997
Line-3	5,218,244	2,341,454	389,360
Total	10,938,108	4,691,155	815,769

Emission factor of
 northern regional grid 800 tCO₂/GWh (ex-ante value of registered PDD)
 Baseline emissions (2017) 8,750.48 tCO₂
 Project emissions (2017) 4,997.55 tCO₂
 Leakage emissions: 0 tCO₂

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

Calculation:-

$$ER = 8,750.48 - (4,997.55 + 0)$$

$$\text{Emission Reduction (2017)} = 3,752.93 \text{ tCO}_2$$

Emission Reduction per day: 121.066 tCO₂/day

For apportionment,

Therefore, Emission Reduction for year 2017 (01/01/2017 to 28/12/2017) = 47,226.37- (3 x 121.066)
 = 46,863 tCO₂

On comparison of two values, it was observed that considering the average on annual basis will yield more conservative values of Emission Reduction for 2017.

Hence, the Emission Reduction for year 2017 is 46,838 tCO₂.

Annexure I: Data

Service Line 1:

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 31/12/16	01/01/16 to 30/06,/2016	01/07/2016 to 31/12/2016
TS01	1,057,668	1,108,118	416,063	438,584	71,060	74,621
TS02	1,076,194	1,063,304	431,803	422,751	72,262	71,446
TS03	1,064,621	1,156,903	425,949	463,673	71,901	77,827
TS04	1,108,922	1,104,182	450,853	447,788	75,450	75,138
TS05	1,104,629	1,082,449	442,296	432,917	74,401	72,787
TS06	1,079,249	1,066,546	413,683	410,617	73,859	72,626
TS07	1,103,637	1,079,820	444,887	436,311	74,853	73,127
TS08	1,030,521	1,080,206	424,347	438,285	69,784	71,945
TS09	1,193,914	1,226,009	461,188	475,488	76,432	78,814
TS10	1,137,820	1,166,739	432,653	439,831	75,616	77,578
TS11	1,181,161	1,102,887	443,757	415,446	74,864	69,802
TS12	1,082,910	1,079,730	408,547	409,181	74,122	73,996
TS13	1,114,277	1,208,382	410,335	445,385	71,829	77,951
TS14	1,143,364	1,180,821	444,104	459,547	73,862	76,547
TS15	1,148,879	1,222,171	410,806	438,440	74,513	78,650
TS16	1,117,524	1,241,631	428,456	481,334	71,188	79,693
TS17	1,060,443	1,168,215	417,910	461,523	69,963	76,965

TS18	1,153,954	1,124,198	438,790	422,915	76,500	73,486
TS19	1,106,224	1,138,005	434,001	431,338	72,834	74,249
TS20	1,156,785	1,192,456	456,668	471,520	75,575	77,924
TS21	1,192,742	1,202,974	460,813	465,700	77,238	77,103
TS22	1,161,200	1,216,442	445,467	462,717	74,823	78,358
TS23	1,126,271	1,260,535	418,361	475,394	71,811	80,785
TS24	1,156,553	1,208,227	452,673	453,021	77,934	80,474
TS25	1,086,391	1,083,203	435,977	432,971	72,256	71,995
TS26	1,020,996	1,024,544	433,578	432,201	72,188	71,864
TS27	1,147,312	1,111,131	434,408	418,061	75,226	73,035
TS28	1,195,991	1,127,632	460,339	426,713	78,613	73,156
TS29	1,180,015	1,165,507	459,140	452,644	77,390	76,199
Sub Total	32,490,167	33,192,967	12,637,852	12,862,296	2,148,347	2,188,141

Service Line - 1	Electrical Energy Consumed (kWh)		Energy Regenerated (kWh)		Distance covered (km)	
	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017
TS01	1,034,391	1,097,930	415,210	435,711	70,578	75,715
TS02	1,079,458	1,044,760	428,440	402,002	73,297	72,163
TS03	1,080,960	1,017,883	430,950	390,092	72,614	68,520
TS04	1,093,499	1,080,213	440,942	415,342	74,044	74,061
TS05	1,070,519	1,125,283	433,481	441,970	72,378	76,237
TS06	1,030,420	1,119,958	388,708	417,451	68,996	77,122
TS07	1,123,603	1,081,668	450,623	416,803	75,911	73,061
TS08	1,092,692	1,144,591	455,842	460,984	74,140	77,912
TS09	1,207,453	1,224,742	469,040	465,249	77,266	79,630
TS10	1,145,864	1,155,461	431,599	426,107	76,147	77,691
TS11	1,209,537	1,099,065	470,383	410,208	77,751	71,292
TS12	1,031,612	1,094,687	390,028	398,356	70,210	74,595
TS13	1,144,465	1,110,296	421,587	399,225	73,585	72,743
TS14	1,154,786	1,203,736	448,881	452,605	74,699	78,463
TS15	1,149,182	1,127,480	413,613	387,100	74,271	73,372
TS16	1,165,055	1,062,101	451,234	407,096	74,764	71,734
TS17	1,163,995	1,072,603	461,933	410,988	76,134	71,863
TS18	1,119,580	1,139,793	425,563	413,721	73,911	75,130
TS19	1,163,873	1,060,594	453,343	407,908	76,410	70,493
TS20	1,206,942	1,023,995	479,586	380,970	79,412	66,295
TS21	1,140,967	1,168,713	437,987	433,748	73,188	75,199
TS22	1,181,065	1,219,281	448,582	445,505	76,210	78,655
TS23	1,185,656	1,111,835	449,000	407,157	76,597	73,006
TS24	1,087,614	1,162,964	418,180	442,543	71,965	78,650
TS25	1,178,691	1,035,780	471,890	410,281	78,125	71,435
TS26	1,036,122	1,029,795	430,546	411,048	72,524	72,191
TS27	1,110,644	1,066,674	414,096	400,365	72,673	72,916
TS28	1,199,993	1,079,739	460,333	409,594	78,693	74,083

TS29	1,129,049	987,419	433,008	378,236	73,181	66,334
TS30	-	31,224	-	19,988	-	2,165
TS32	-	337	-	189	-	20
Sub Total	32,717,687	31,980,600	12,724,608	12,098,542	2,159,674	2,142,746

Service Line 2:

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	902,204	940,227	283,189	289,160	53,141	53,651
MC # 02	888,226	993,850	242,857	287,478	51,109	55,698
MC # 03	963,735	1,044,239	317,394	331,716	56,202	58,521
MC # 04	1,027,196	1,055,102	329,879	334,797	58,825	59,020
MC # 05	965,031	1,049,877	312,541	331,672	56,400	59,530
MC # 06	1,001,766	1,033,840	313,139	309,348	58,981	57,791
MC # 07	1,022,887	1,016,248	329,814	303,316	59,174	56,363
MC # 08	852,737	1,061,154	268,326	333,654	48,364	59,569
MC # 09	966,851	1,043,302	294,815	288,734	55,989	58,556
MC # 10	985,760	1,057,280	302,281	322,993	57,466	59,315
TOTAL	9,576,393	10,295,119	2,994,235	3,132,868	555,651	578,014

Service Line - 2	Electrical Energy Consumed (kWh)		Energy regenerated (kWh)		Distance covered (km)	
	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017
MC # 01	1,022,935	814,139	329,232	250,601	60,729	48,269
MC # 02	1,020,270	1,092,597	323,214	339,557	59,086	65,692
MC # 03	944,637	939,153	307,278	288,630	54,960	54,507
MC # 04	983,978	1,074,792	317,127	338,841	56,191	62,394
MC # 05	1,002,940	1,144,987	325,651	320,008	59,361	66,559
MC # 06	1,011,448	1,159,066	322,111	357,527	58,955	69,039
MC # 07	964,081	1,023,816	298,966	306,312	56,026	62,478
MC # 08	1,067,291	1,004,451	344,842	314,078	62,618	59,939
MC # 09	966,318	1,065,564	259,685	321,065	56,072	63,691
MC # 10	1,063,901	1,050,870	334,996	321,621	61,820	62,159
TOTAL	10,047,799	10,369,435	3,163,102	3,158,240	585,818	614,727

Service Line 3 & 4:

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# 1	1,176,335	1,290,385	466,987	509,707	75,096	80,387
TS# 2	1,209,878	1,307,563	453,188	491,645	76,479	80,964
TS# 3	1,245,489	1,324,154	473,359	506,901	79,777	82,947
TS# 4	1,201,777	1,238,724	466,252	477,504	77,375	78,877

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TS# 5	1,198,275	1,311,721	462,146	505,650	77,633	82,851
TS# 6	1,262,626	1,279,966	495,615	502,916	80,706	79,934
TS# 7	1,237,240	1,326,335	493,883	526,139	81,729	85,985
TS# 8	1,250,328	1,311,651	498,693	527,410	80,823	83,164
TS# 9	1,228,325	1,268,468	466,562	476,154	79,519	79,339
TS# 10	1,291,875	1,342,166	472,730	513,314	81,621	83,270
TS# 11	1,156,566	1,155,449	460,300	454,483	76,565	74,691
TS# 12	1,163,232	1,201,417	467,584	475,658	77,797	77,830
TS# 13	1,159,275	1,208,440	467,007	480,731	77,255	78,507
TS# 14	1,128,755	1,261,362	431,186	483,565	75,368	80,699
TS# 15	1,122,281	1,166,591	465,480	480,188	75,262	75,825
TS# 16	1,158,087	1,220,468	488,410	517,653	75,819	78,953
TS# 17	1,107,575	1,195,726	439,324	466,183	74,096	78,220
TS# 18	1,162,529	1,195,354	471,576	487,869	76,676	78,092
TS# 19	1,162,256	1,230,547	463,370	496,992	76,794	80,505
TS# 20	1,130,724	1,241,944	463,640	513,278	75,615	81,909
TS#21	1,150,002	1,211,894	447,072	474,106	76,203	78,535
TS# 22	1,152,763	1,248,907	454,321	504,213	75,878	80,114
TS# 23	1,158,935	1,216,948	488,231	511,505	78,097	80,416
TS# 24	1,177,281	1,242,148	456,199	487,245	77,455	80,709
TS# 25	1,092,123	1,217,199	448,512	509,676	72,049	80,416
TS# 26	986,410	987,021	397,862	406,950	64,151	63,387
TS# 27	979,478	942,681	394,559	394,161	65,558	61,712
TS# 28	932,280	1,014,611	377,987	409,279	59,907	64,985
TS# 29	984,862	1,067,029	390,733	423,797	63,252	67,551
TS# 30	824,306	1,051,132	307,201	419,160	52,188	67,768
TS# 31	1,038,921	1,019,428	423,726	424,275	67,062	65,272
Total	35,230,789	37,297,429	13,953,695	14,858,307	2,303,805	2,393,814

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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 31/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017	01/01/2017 to 30/06/2017	01/07/2017 to 31/12/2017
TS# 301	557,971	1,221,031	202,389	478,752	33,024	79,592
TS# 302	1,072,142	1,234,663	409,290	490,161	67,792	81,937
TS# 303	1,128,423	1,255,964	414,658	489,500	72,048	83,489
TS# 304	1,206,981	999,087	473,266	392,949	78,377	66,079
TS# 305	1,133,426	1,269,379	438,449	498,529	71,701	83,952
TS# 306	1,102,308	1,235,273	430,835	487,239	69,702	81,856
TS# 307	1,114,218	1,166,316	439,591	457,650	72,370	79,730
TS# 308	1,161,550	1,129,124	470,973	464,288	75,038	76,197
TS# 309	1,216,458	1,110,151	457,113	442,659	77,152	73,019
TS# 310	1,178,539	1,327,124	474,996	532,141	74,235	83,739
TS# 311	1,179,554	1,151,873	461,088	457,681	77,454	77,132
TS# 312	1,195,401	1,116,271	478,699	445,748	78,186	74,132
TS# 313	1,173,619	1,111,185	463,347	427,814	76,908	73,327
TS# 314	1,228,111	1,102,616	464,321	419,977	79,605	72,697

TS# 315	1,148,349	1,069,599	473,724	438,204	75,881	71,527
TS# 316	1,122,558	1,111,383	474,966	467,276	73,621	73,287
TS# 317	1,153,006	1,056,124	445,163	413,862	75,536	71,231
TS# 318	1,187,367	1,148,263	481,149	453,994	78,073	75,932
TS# 319	1,154,338	1,097,908	465,462	432,929	75,441	71,707
TS# 320	1,185,949	1,083,196	489,526	434,327	78,789	71,640
TS# 321	1,154,889	1,165,937	455,062	439,875	76,487	76,029
TS# 322	1,206,679	1,135,334	498,809	434,090	79,250	74,310
TS# 323	1,177,493	1,122,492	481,062	437,231	77,037	73,308
TS# 324	1,174,492	1,116,107	460,937	422,577	77,157	73,294
TS# 325	1,171,473	1,134,946	489,771	462,150	77,524	75,256
TS# 326	1,171,406	954,050	468,378	382,155	73,477	63,523
TS# 327	1,067,332	968,718	434,791	372,079	70,723	63,622
TS# 328	1,114,694	1,093,975	450,590	428,404	71,939	70,021
TS# 329	1,098,292	1,125,648	434,621	446,637	70,505	72,169
TS# 330	1,111,467	1,186,218	441,777	467,017	72,144	76,559
TS# 331	1,081,419	1,169,179	460,449	485,324	71,488	76,271
Sub-total	35,129,904	35,169,134	13,985,252	13,903,219	2,278,664	2,316,564

Summary sheet for three lines:

Service Lines	Total Energy Consumed (kWh)	Total Energy Regenerated (kWh)	Total Distance covered (km)
19/01/2016 to 31/12/2016			
Line 1	62,443,966	24,242,606	4,122,634
Line 2	18,891,547	5,824,944	1,077,758
Line 3&4	68,951,484	27,391,136	4,465,956
Total	150,286,997	57,458,687	9,666,348
01/01/2017 to 28/12/2017			
Line 1	64,166,520	24,619,124	4,267,058
Line 2	20,249,421	6,269,386	1,190,678
Line 3&4	69,721,238	27,659,251	4,557,459
Total	154,137,179	58,547,761	10,015,194

Appendix 1.

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>
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
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 GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, 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).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

<i>Version</i>	<i>Date</i>	<i>Description</i>
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