المجلس العالمي للبصمة الكربونية
GLOBAL CARBON COUNCIL

Project Submission Form

V4.0- 2022

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COVER PAGE- Project Submission Form (PSF)	
BASIC INFORMATION	
Title of the Project Activity as per LON/LOA	Kochi Metro India
PSF version number	01
Date of completion / Updating of this form	04/01/2023
Project Owner(s) as per LON/LOA (Shall be consistent with De-registered CDM Type B Projects)	EKI Energy Services Limited
Country where the Project Activity is located	India
GPS coordinates of the project site(s)	9º 42' 38'' N or 9.7145 N 76º 12' 00'' E or 76.2000 E
Eligible GCC Project Type as per the Project Standard (Tick applicable project type)	☒ **Type A:** ☐ Type A1 ☒ Type A2 ☒ Sub-Type 1 ☐ Sub-Type 2 ☐ Sub-Type 3 ☐ Sub-Type 4 ☐ Type A3

	☐ **Type B – De-registered CDM Projects:**[1] ☐ Type B1 ☐ Type B2
Minimum compliance requirements	☒ Real and Measurable GHG Reductions ☒ National Sustainable Development Criteria (if any) ☒ Apply credible baseline and monitoring methodologies ☒ Additionality ☒ Local Stakeholder Consultation Process ☒ Global Stakeholder Consultation Process ☒ No GHG Double Counting ☒ Contributes to United Nations Sustainable Development Goal 13 (Climate Action)
Choose optional and additional requirements (Tick applicable label categories)	☒ Do-no-net-harm Safeguards to address Environmental Impacts ☒ Do-no-net-harm Safeguards to address Social Impacts ☒ Contributes to United Nations Sustainable Development Goals (in addition to Goal 13)
Applied methodologies including version No. (Shall be approved by the GCC or the CDM)	ACM0016 V5.0 - Mass rapid transit projects
GHG Sectoral scope(s) linked to the applied methodology(ies)	07 - Transport

[1] Owners of Type B projects shall fill in the form provided in Appendix 7.

Applicable Rules and Requirements for Project Owners

(Tick applicable Rules and Requirements)

Rules and Requirements		Version
☒ ISO 14064-2		
☒ Applicable host country legal requirements /rules		
☒ GCC Rules and Requirements[2]	☒ Project Standard	03.1
	☐ Approved GCC Methodology (XXXXX)	
	☒ Program Definitions	03.1
	☒ Environment and Social Safeguards Standard	03
	☒ Project Sustainability Standard	03
	☒ Instructions in Project Submission Form (PSF)-template	04
	☒ Clarification No. 01	1.0
	☐ Clarification No. 02	
	☐ Clarification No. 03	
	☒ Clarification No. 04	1.0
	☐ Clarification No. 05	
	☒ Standard on avoidance of double counting	1
	☐ Add rows if required	
☒ CDM Rules[3]	☒ Approved CDM Methodology (ACM0016)	5.0
	☐ TOOL 1- Tool for the demonstration and assessment of additionality	
	☐ TOOL 02- Combined tool to identify the baseline scenario and demonstrate additionality	

[2] GCC Program rules and requirements: http://www.globalcarboncouncil.com/resource-centre/
[3] CDM Program rules: https://cdm.unfccc.int/Reference/index.html

		☒ TOOL 07- Tool to calculate the emission factor for an electricity system	07.0
		☐ TOOL 19- Demonstration of additionality of microscale project activities	
		☐ TOOL 21- Demonstration of additionality of small-scale project activities	
		☐ TOOL 23- Additionality of first-of-its-kind project activities	
		☐ TOOL 24- Common practice	
		☐ TOOL 27- Investment analysis	
		☐ TOOL 32- Positive lists of technologies	
		☐ Guidelines for objective demonstration and assessment of barriers	
		☒ Tool 18 - Baseline emission for modal shift measure in urban passenger transport	1.0
		☒ Tool 5 – Baseline project or leakage emissions from electricity consumption and monitoring of electricity generation	3.0
		☐ Add rows if required	
Choose Third Party Project Verification	☒ GHG emission reductions (i.e., Approved Carbon Credits **(ACCs)**) ☒ Environmental No-net-harm Label (**E+**) ☒ Social No-net-harm Label (**S+**) ☒ United Nations Sustainable Development Goals (**SDG+**)		

by approved GCC Verifiers[4] (Tick applicable verification categories)	☐ Bronze SDG Label ☐ Silver SDG Label ☐ Gold SDG Label ☐ Platinum SDG Label ☒ Diamond SDG Label ☒ CORSIA requirements (**C[+]**) ☒ Host Country Attestation on Double counting
Declaration by the 'Authorized Project Owner[5] and focal point' (Tick all applicable statements[6])	The Project Owner(s) declares that: **Generic Requirements applicable to all Project Types:** ☒ We confirm that the Project Activity complies with the eligibility of the applicable project type (A1, A2, A3, B1 or B2) as stipulated by the Project Standard and relevant clarifications. ☒ We confirm that the Project Activity shall start or have started operations, and shall start or have started generating emission reductions, on or after 1 January 2016. ☒ We confirm that the Project Activity is eligible to be registered under the GCC program. We shall ensure the following for the Project Activity (tick at least one of the two options): ☒ No outcomes (e.g., emission reductions, environmental attributes) generated by the Project Activity under GCC will be claimed as carbon credits or environmental attributes under any other GHG/non-GHG[7] program, either for compliance or voluntary purposes, during the entire GCC crediting period; or ☐ If the project activity has been issued with carbon credits or environmental attributes of compensating nature[8] by any other GHG/ non-

[4] **Note:** GCC Verifiers under the Individual Track are not eligible to conduct verifications for GCC Project Activities whose owners intend to supply carbon credits (ACCs) for use within CORSIA.

[5] The Project Owner means the legal entity or organization that has overall control and responsibility for the Project Activity

[6] **Consequences in case of Non-compliance with declaration statements:**
If at any point in time non-compliance with the declared statements is established as a result of negligence, fraud or wilful misconduct of the GCC Project Owner/s the GCC project activity will be disqualified, and the registration of the proposed Project Activity will be rejected.

[7] Non-GHG programs could be such as I-REC facilitating reliable energy claims with Renewable Energy Certificate (REC) schemes

8 The environmental attributes of compensating nature are those which are used by captive users (e.g., corporates/industries) for offsetting their GHG emissions

	GHG program, either for compliance or voluntary purposes, the ACCs will be claimed only for the remaining crediting period (subject to a maximum of 10 years of crediting period including the periods under other programs and GCC program) for which carbon credits/ environmental attributes of compensating nature have not been issued by any other GHG/ non-GHG program. **Specific requirements applicable to respective Project Types:** ***For Project Type A1:*** ☐ For Project Type A1, we confirm that the Project Activity is NOT registered as a GHG Project Activity in any other GHG/non-GHG program or any other voluntary program and has not issued or will not issue credits under any other program. ***For Project Type A2 (Sub-Type 1):*** ☒ For Project Type A2 Sub-Type 1, we confirm that the Project Activity is NOT registered as a GHG Project Activity in any other GHG/non-GHG program or any other voluntary program and has not issued or will not issue credits under any other program. ***For Project Type A2 (Sub-Type 2 or Sub-Type 3):*** For Project Type A2 Sub-Type 2 or Project Type A2 Sub-Type 3, we confirm that for Project Activity, which has been registered with CDM or any GHG/non-GHG Program and we shall (tick at least one of the two options): ☐ Submit a proof for deregistration from CDM; or ☐ Submit a signed & stamped public undertaking, stating that the Project Owner will never submit any request for Issuance of ACCs or request for renewal of crediting period to CDM-EB or under article 6.4 or any authority after submission to GCC Program and shall formally inform CDM-EB or authority under article 6.4 or any authority after submission to GCC Program. ☐ For Project Type A2 Sub-Type 2 or Project Type A2 Sub-Type 3, we confirm that the Project Activity is NOT included as a component Project Activity (CPA) in any registered GHG Programme of Activities (PoA) or any other functionally equivalent grouped/aggregated activities under any GHG program (such as the CDM or any other voluntary program). ***For Project Type A2 (Sub-Type 4):*** For Project Type A2 Sub-Type 4, we confirm that the Project Activity has been included in a registered CDM-POA and we shall (tick at least one of the two options): ☐ Submit the proof for exclusion of CPA(s) from registered CDM-POA prior to the date of initial submission to the GCC Program; or

	☐ Submit the proof of exclusion of CPA(s) from the registered CDM-PoA after the request for registration has been submitted to GCC Program but before the final decision is made by the GCC Steering Committee. ***For Project Type A3:*** ☐ For Project Type A3, we confirm that the Project Activity is NOT registered as a GHG Project Activity in any other GHG/non-GHG program or any other voluntary program and has not issued or will not issue credits under any other program. ***For Project Type B1 or B2:*** For Project Type B1 or Project Type B2, we confirm that for Project Activity, which has been registered with CDM or any GHG/non-GHG Program and we shall (tick at least one of the two options): ☐ Submit a proof for deregistration from CDM; or ☐ Submit a signed & stamped public undertaking, stating that the Project Owner will never submit any request for Issuance of ACCs or request for renewal of crediting period to CDM-EB or under article 6.4 or any authority after submission to GCC Program and shall formally inform CDM-EB or authority under article 6.4 or any authority after submission to GCC Program. **Requirements to avoid double counting:** We intend to submit or have submitted a written attestation[9] (Host Country Letter of Authorization - HCLOA) from the host country's national focal point or focal point designee for CORSIA eligible units generated beyond 31 December 2020 at the following stages[10] (tick at least one of the three options): ☐ The initial submission for GSC; or ☐ Along with the submission for a request for registration (after Project Verification is completed); or ☒ Along with the submission for a request for the first or subsequent issuance of ACCs. **Project specific requirements:** ***CORSIA specific requirements:*** ☐ We confirm that bundled projects or grouped projects shall have registered crediting period starting on or after 1 Jan 2016 for the grouped/aggregated project as a whole.

9 In case of any change of Host Country Letter of Authorisation (HCLOA) the project owner shall inform the GCC operations team immediately

10 If the host country attestation is not submitted at the initial submission of GSC, the project can be tagged with an indicative CORSIA flag if it's confirmed to be submitted later. If the host country attestation is not submitted at the request for registration, the project can be tagged with an indicative CORSIA flag if at least the PSF and Verification Report confirms to submit this letter, at first issuance. If the host country attestation is not submitted at request for first issuance, the ACCs will not be tagged as CORSIA (C+) compliant if this letter is not submitted.

	☒ We confirm that the Project Activity meets all the requirement of the CORSIA Eligible Emissions Units[11] required for GCC projects and does not fall under the excluded unit types, methodologies, programme elements, and/or procedural classes. ☒ We confirm that the Project Activity aims to achieve at least Silver or higher SDG+ label (i.e., positively impact at least 3 or more United Nations Sustainability Development Goals). ☒ We confirm that the Project Activity will be implemented in a country which is UN member state[12]. Provide details (if any) below for the boxes ticked above:
	The Project Owner(s) declares that: ☒ All the information provided in this document, including any supporting documents submitted to the GCC or its registry operator IHS Markit at any time, is true and correct. ☒ They understand that a failure by them to provide accurate information or data, or concealing facts and information, can be considered as negligence, fraud or willful misconduct. Therefore, they are aware that they are fully responsible for any liability that arises as a result of such actions. Provide details below for the boxes ticked above
Appendixes 1-9	Details about the Project Activity are provided in Appendixes 1 through 9 to this document.
Name, designation, date and signature of the Focal point (as per LON/LOA)	 EKI Energy Services Limited **For and on behalf of** **Name : Manish Dabkara**

[11] CORSIA Eligible Emissions Units containing approval and conditions for GCC Program: https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Emissions-Units.aspx

[12] The list of UN member states countries can be found at https://www.un.org/en/about-us/member-states

	Designation :MD and CEO **Date : 04/01/2023**

1. PROJECT SUBMISSION FORM

Section A. Description of the Project Activity

A.1. Purpose and general description of the Project Activity

The Mass Rapid Transit System (MRTS) of Kochi Metro Rail Limited is an elevated heavy duty metro. The proposed project has route from Alwaye to Peta managed by KMRL (Kochi Metro Rail Ltd.).

Core aspects of Kochi Metro are:

- A new infrastructure consisting of 25.612 kilometres of state-of-the art metro with new trains, and pre-board ticketing using rechargeable electronic cards.
- Equipment and turnstiles at the entrance to each station will deduct the corresponding fare.
- Centralized coordinated train control providing monitoring and communications to schedule servicesand real-time response to contingencies.

For implementation and subsequent operation of Kochi Metro MRTS, a company under the name Kochi Metro Rail Ltd. (KMRL) was registered on 02/08/2011 under the Companies Act, 1956. KMRL has equal equity participation from GOI (Government of India) and Government of Kerala.

The baseline situation is a continuation of traditional modes of transport including buses, taxis, private cars, rickshaws, motorcycles and public transport. In absence of the project the passengers move from their trip origination to their trip destination by buses, by taxis, by motorized rickshaws and by NMT (Non-Motorized Transport). In the baseline situation, these modes oftransport would continue to operate and transport passengers from their trip origin to their trip destination.

In the project situation, the metro complements other modes of transport and replaces partially trips made byconventional or traditional means of transit by metro. The proposed project replaces trips made by conventional transport modes with metro, being a more efficient, faster, safer and more reliable transport means. The baseline scenario is comparable to the situation prior to the project. The baseline scenario however incorporates technological advancements in terms of emissions per distance driven of various modes of transport as well as eventual fuel changes of baseline modes of transport during the project activity.

Emission reductions are achieved through reducing GHG emissions per passenger-kilometre, comparing conventional modes of transport with metro. The metro has a main environmental aspect that the resource efficiency of transporting passengers in Kerala is improved i.e.

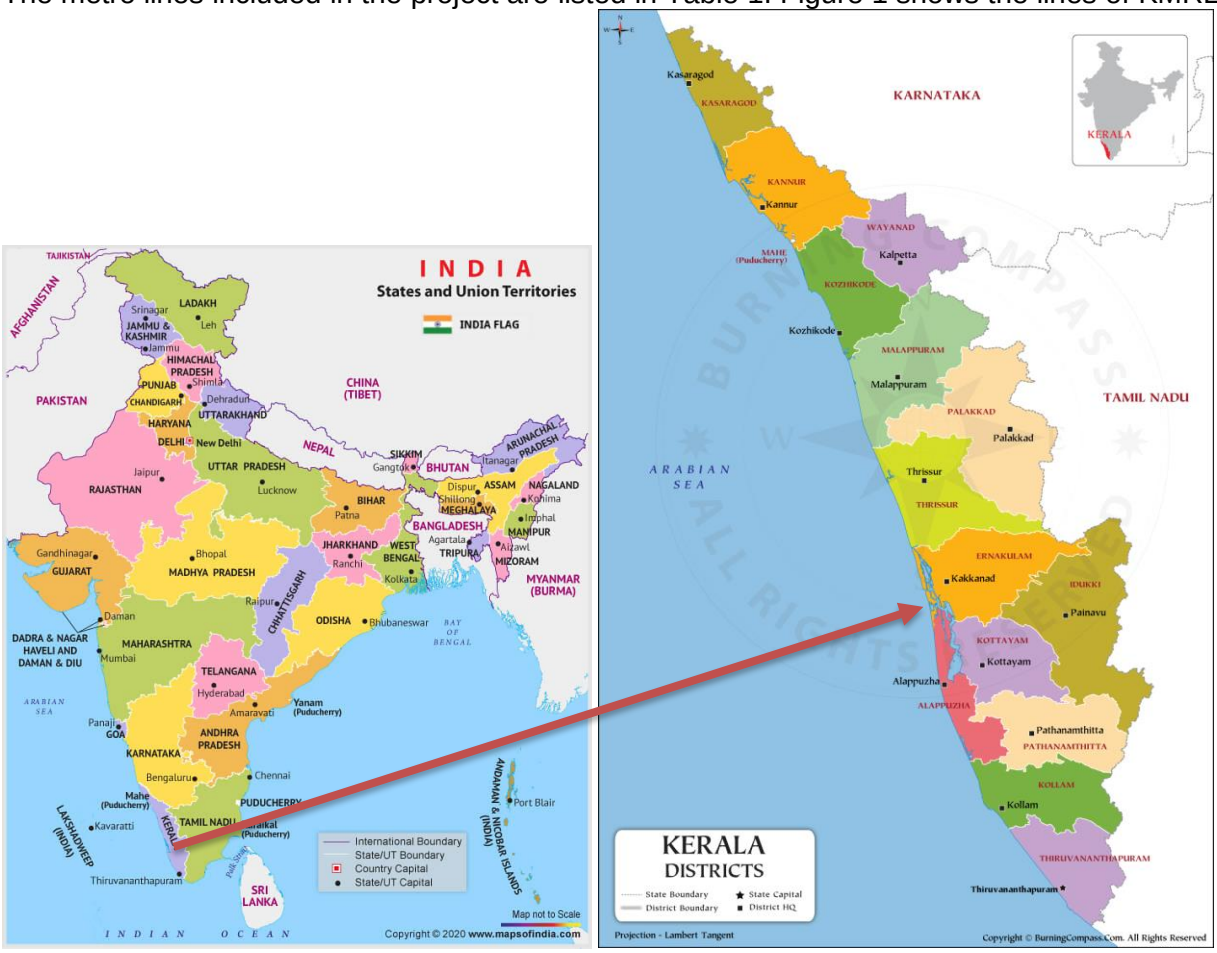
emissions per passenger kilometre are reduced compared to the situation without project.

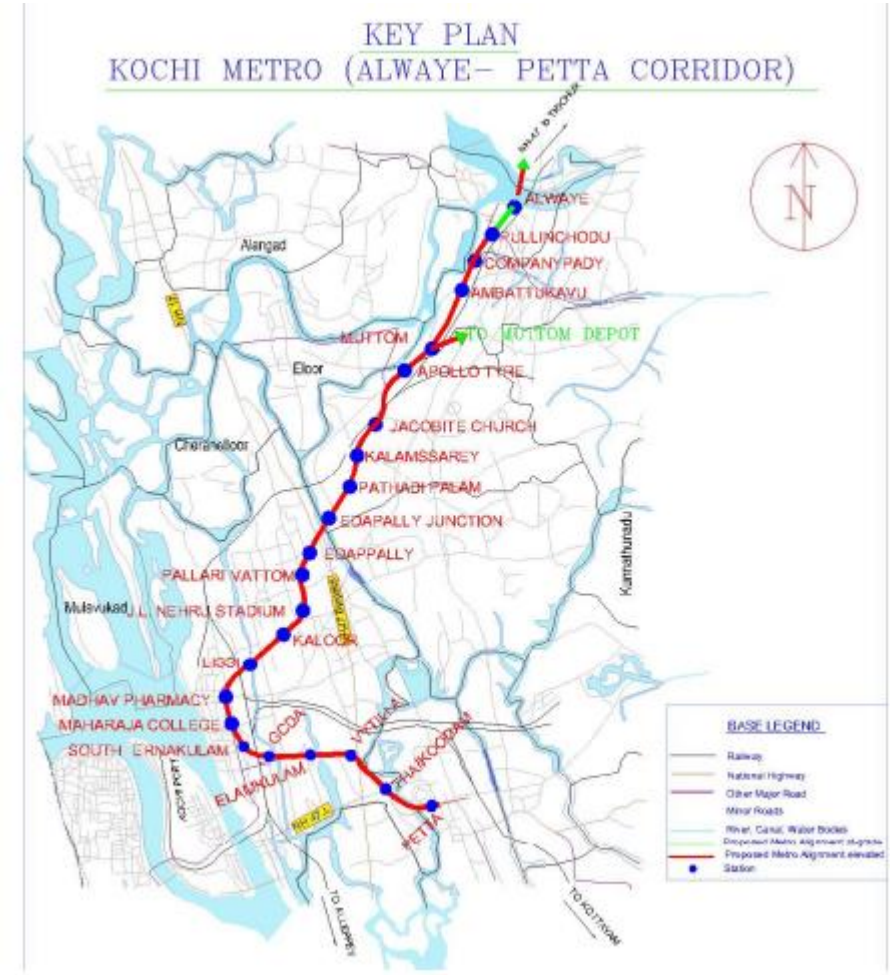
A.2. Location of the Project Activity

Host country: India
Region/State/Province: Kerala
City/Town/Community: Kochi

The spatial extent of the project is, according to the methodology, the metropolitan area of Kochi, Kerala. The spatial area includes the trip origins and destinations of passengers using Kochi Metro. Inter-urban traffic is not included in the spatial project boundary. The geographical coordinates of Kochi are Latitude 9º 42' 38'' North and 76º 12' 00'' East.

The metro lines included in the project are listed in Table 1. Figure 1 shows the lines of KMRL.





Address and geodetic coordinates of the physical site of the Project Activity		
Physical address	**Latitude***	**Longitude***
Kochi Metro Rail Limited JLN Metro Station, 4th Floor, Kaloor Kochi, Ernakulam - 682017, Kerala, India	9º 42' 38'' N or 9.7145 N	76º 12' 00'' E or 76.2000 E

The total length of metro tracks included in the project is 102.23 km. The following table lists all metrocorridors part of the GCC project.

Table 1: Corridors of the Kochi Metro, India

Corridor	Length (km)	Commissioning date
Alwaye – Peta	25.612	17/06/2017

A.3. Technologies/measures

In absence of the project the passengers move from their trip origination to their trip destination by buses, by taxis, by passenger cars, by motorcycles, by motorized rickshaws and by NMT (Non-Motorized Transport). The proposed project replaces partially these trips made by using, at least for part of the trip, a more efficient, faster, safer and more reliable transport means. The baseline scenario is comparable to the situation prior the project. The baseline scenario however incorporates technological advancements in terms of emissions per distance driven of various modes of transport as well as eventual fuel changes of baseline modes of transport during the project activity.

The total length of metro tracks included in the project is 25.617 km (see table 1). In total the project has 23 stations.

The corridors consist of two standard gauge lines at 4.1 m centre to centre on elevated sections. Track structure on the main lines is standard gauge (1435mm) with 60-kg UIC wear resistant rails. On elevated alignment, the track is of ballast less type.

Traction system is 25kV ac 50Hz single phase Over Head Equipment. The entire system of power supply (receiving, traction & auxiliary supply) is monitored and controlled from a centralized Operation Control Centre (OCC) through SCADA system. Modern SCADA system with intelligent remote terminal units (RTUs) are provided. Optical fiber provided for telecommunications will be used as communication carrier for SCADA system. Digital Protection Control System (DPCS) is proposed for providing data acquisition, data processing, overall protection control, interlocking, intertripping and monitoring of the entire power supply system consisting of 33kV ac switchgear, transformers, 25kV ac switchgear and associated electrical equipment. DPCS will utilize microprocessor-based fast-acting numerical relays & Programmable Logic Controllers (PLCs) with suitable interface with SCADA system.

Energy Saving Measures:

Energy charges of any metro system constitute a substantial portion of its operation & maintenance (O & M) costs. Therefore, it is imperative to incorporate energy saving measures in the system design itself. The auxiliary power consumption of metros is generally more than the traction energy consumed by train movement during initial years of operation. Subsequently, traction power consumption increases with increase in train frequency/composition in order to cater more traffic. The proposed system of Kochi Metro includes the following energy saving features:

(i) Modern rolling stock with 3-phase VVVF drive and lightweight stainless steel coaches are used, which have the benefits of low specific energy consumption and almost unity power factor.

(ii) Rolling stock has regeneration features and it is expected that 30% of total traction energy will be regenerated and fed back to 25kV ac OHE to be consumed by nearby trains.

(iii) Effective utilization of natural light is along wth the lighting system of the stations will be provided with different circuits (33%, 66% & 100%) and the relevant circuits can be switched on based on the requirements (day or night, operation or maintenance hours etc).
(iv) Machine-room less type lifts with gearless drive has been proposed with 3-phase VVVF drive. These lifts are highly energy efficient.
(v) The proposed heavy-duty public services escalators will be provided with 3-phase VVVF drive, which is energy efficient & improves the power factor. Further, the escalators will be provided with infrared sensors to automatically reduce the speed (to idling speed) when not being used by passengers.
(vi) The latest state of art and energy efficient electrical equipment (e.g. transformers, motors, light fittings etc) have been incorporated in the system design.
(vii) Efficient energy management is possible with the modern SCADA system by way of maximum demand (MD) and power factor control.

The metro runs entirely on elevated corridor. Each train has 3 cars and runs frequencies between 3 and 15 minutes depending on time of the day and passenger demand. 22 standard trains have been acquired (total 66 cars). The cars are indigenous and procured from BEML. Coaches have longitudinal seats with a seating capacity of 35 and 156 standees per motor coach and 44 seating and 174 standees per trailer coach, thus total dense crush capacity of 191 (MC) to 218 (TC).

Metro carries large number of passengers at a very close headway requiring a very high level of safety enforcement and reliability. At the same time heavy investment in infrastructure and rolling stock necessitates optimization of its capacity to provide the best services to the public. These requirements of the metro are planned to be achieved by adopting 'Distance to go' ATP (Automatic Train Protection) and ATS (Automatic Train Supervision) sub-systems. This will:

• Provide high level of safety with trains running at close headway ensuring continuous safe train separation.

• Eliminate accidents due to driver passing Signal at Danger by continuous speed monitoring and automatic application of brake in case of disregard of signal / warning by the driver.

• Provides safety and enforces speed limit on section having permanent and temporary speed restrictions.

• Improve capacity with safer and smoother operations. Driver will have continuous display of Target Speed / Distance to Go status in his cab enabling him to optimize the speed potential of the track section. It provides signal / speed status in the cab even in bad weather.

• Increased productivity of rolling stock by increasing line capacity and train speeds, and enabling train to arrive at its destination sooner. Hence more trips will be possible with the same number of rolling stock.

• Improve maintenance of Signaling and telecommunication equipments by monitoring system status of trackside and train born equipments and enabling preventive maintenance.

• Signaling & Train Control system on the line shall be designed to meet the required headway during peak hours

Fare Collection System:

The proposed ticketing system will be a combination of smart card and computerized paper ticket issued through the same ticket office machines (TOM) provided at each station counter/ booking office and at convenient locations. These TOMs will be connected to a local area network with a computer in the
Station Master's room, which will be further connected to central computer. For smart cards, simple turnstile type gates will be used. Smart cards will have provision for future applications such as bus, parking, toll etc. Manual checking will be done for paper tickets.

Ticketing System proposed is a foolproof system to avoid chances of ticketless travel. If so desired, a manual ticketing system similar to that of Indian Railways can also be adopted to reduce cost of ticketing system which may come down to about 15% to 20% of the automatic fare collection system proposed above.

However, it will have its own inherent disadvantage of leakage of revenue due to chances of ticketless travel. Moreover manpower requirement will also go up.

Rolling Stock:

Rolling stock for Kochi Metro has been selected based on the following criteria:

• Proven equipment with high reliability;
• Passenger safety features, including fire resistance;
• Energy efficiency;
• Light weight equipment and coach body;
• Optimized scheduled speed;
• Aesthetically pleasing Interior and Exterior;
• Low life cycle cost; and
• Flexibility to meet increase in traffic demand.
• Anti -telescopic

The controlling criteria are reliability, low energy consumption, light weight and high efficiency, leading to lower annualized cost of service. The coach should have high rate of acceleration and deceleration.

Keeping the above features in mind, 2.7 m wide stainless steel light weight coaches are proposed for Kochi Metro, with length of 17.86 m for trailer coach and 18.00 m for motor coach (including couple buffers). Height of coach is 3.9 m. Train length for 3 coach train is 55.5 m. The axle load is 13 t for which the structures are to be designed.

8 Traction motors with about 180 KW installed and propulsion system is 3-phase drive with variable voltage and variable frequency (VVVF) control. Trains will have regenerative braking system to save energy cost. Trains will be air-conditioned and provided with automatic door closing and opening system with 3 wide doors per coach on each side. The trains will have passenger information and

announcement
system. The rolling stock is provided with Train Protection and warning system to prevent driver passing the signals at danger. It is an accepted fact that 60-70% of accidents take place on account of human error. Adoption of this system will reduce the possibility of human error.

The rolling stock proposed shall have design speed of 90 kmph and maximum running speed of 80 kmph. Maximum acceleration and deceleration is 01.0m/s2 and 1.1 m/s2. During emergency braking deceleration shall be 1.3m/s2. Average commercial speed will be 33 kmph with station dwelling time of 30 seconds.

A.4. Project Owner(s)

Location/ Country	Project Owner(s)	Where applicable[13], indicate if the host country has provided approval (Yes/No)
India	EKI Energy Services Limited	No

A.5. Declaration of intended use of Approved Carbon Credits (ACCs) generated by the Project Activity

The Project Activity is expected to generate ACCs for a full 10-year crediting period and supply the credits to offset as following:

Period		Name of the Entities	Purpose and Quantity of ACCs to be supplied
From	To		
17/06/2017	16/06/2027	EKI Energy Services Limited	Project activity will supply the credits to offsetting. 155,574 tCO2e/annum. The project is expected to result in 1,555,740 tCO2e over the period of 10 years

Project owner confirms that the carbon credits (ACCs) from the Project Activity shall not be double counted. The project activity is being registered only with GCC and no other carbon standard

A.6. Additional requirements for CORSIA

[13] For example, *Project Coordination Form* is to be filled-in by Project Owners for projects located in Qatar. A written attestation from the host country's national focal point or the focal point's designee, as required by CORSIA (Refer section A.5 of the PSF guidelines).

The Project Owner intend to use/sell/transfer/retire the carbon credits (ACCs) generated by the Project Activity for offsetting purposes to Airlines under ICAO's CORSIA requirements, the Project Owner has confirmed:

(a) The start of Project Activity operation and the start of crediting period is 13/08/2021 which in after 1 January 2016 and complies with all the applicable GCC rules and requirements as described above.

(b) The Project Activity is likely to result in GHG emission reductions as a result of implementation of the registered GCC project activity.

(c) The Project Activity has not caused any net harm to the environment and/or society and therefore achieves Environmental No-net-harm Label (E +) and Social No-net harm Label (S +).

(d) The Project Activity has made contributions for achieving United Nations Sustainability Development Goals (SDGs) and has contributed to achieving at least three SDGs and therefore targets to achieve Silver or higher SDG certification label (SDG+); and

(e) The project meets all the requirement of the CORSIA Eligible Emissions Units[14] required for GCC projects and does not fall under the excluded unit types, methodologies, programme elements, and/or procedural classes.

If GCC Program receives the approval to issue CORSIA eligible units beyond 31 December 2020, the Project owner shall ensure that there is no double counting for Emission units generated after 31 December 2020:

(i) A written attestation, expressing the intention, from the host country's national focal point or focal point designee shall be provided prior to submission of request for registration to the GCC Program; and

(ii) A self-declaration from the Project Owner in the PSF that written attestation from the host country's national focal point or focal point designee will be provided at the earliest opportunity, but prior to submission of requesting issuance to the GCC Program

Section B. Application of selected methodology(ies)

B.1. Reference to methodology(ies) and tools applied in the project

[14]ICAO Document "CORSIA Emission unit Eligibility Criteria"

Methodology Title and reference: ACM0016: Baseline Methodology for Mass Rapid Transit Projects; Version 05.0

The applied methodology draws upon the following tools:
Tool 07 - Tool to calculate the emission factor for an electricity system (Version 07.0, EB 100, Annex 4)
Tool 18 – Common practice (Version 03.1, EB 84, Annex 7)

B.2. Applicability of methodology(ies) and tools applied in the project

Methodology Title and reference: ACM0016: Baseline Methodology for Mass Rapid Transit Projects; Version 05.0

Applicability condition	Project situation
The project constructs a new rail-based infrastructure or segregated bus lanes. In the case of rail systems, the project needs to provide new infrastructure (new rail lines). The segregated bus lanes or the rail-based MRTS replace existing bus routes operating under mixed traffic conditions (applicability conditions 4a and 5 of ACM0016 version 05)	The MRTS is new rail-based mass transit system and replaces partially bus operations operating under mixed traffic conditions. The rail infrastructure is new. Bus routes and schedules are adapted to metro. Evidence of this is the listing of bus routes to be eliminated along Kochi Metro as well as urban planning documents for multi-mode transport schemes coordinating bus and metro services.
The methodology is not applicable for operational improvements (e.g., new or larger buses) of an already existing and operating bus lane or rail- based MRTS. (Applicability condition 10a of ACM0016 version 05)	The MRTS is a new metro with new infrastructure.
The methodology is not applicable for bus lanes replacing an existing rail-based system. (Applicability condition 10b of ACM 0016 version 05)	The MRTS is rail-based.
Any fuels including electricity, (liquefied) natural gas and biofuel blends can be used in the baseline or project case. Project buss shall use the same biofuel blend as comparable urban buses and not a higher biofuel blends than cars and taxis (applicability condition 6 of ACM0016 version 05).	The project is rail-based only and uses electricity. Baseline transport fuels are diesel, gasoline and gaseous fuels. No bio-fuels are used in the baseline or project case. Baseline buses use CNG while the project uses electricity. Thus, more natural gas is used in the baseline than in the project case as passengers switch partially from buses to metro. The project does not operate any buses (no project buses).
The methodology is not applicable for the implementation of air and water-based transport systems. (Applicability condition 10c of ACM 0016 version 05)	No air or water-based transport is included. The MRTS is rail based.

The methodology is applicable for urban or suburban trips. It is not applicable for inter-urban transport. (applicability condition 7 of ACM 0016 version 05)	The MRTS is purely urban transport.
The methodology is only applicable if the application of the procedure to identify the baseline scenario results in that a continuation ofthe current public transport system is the most plausible baseline scenario. (Applicability condition 9 of ACM 0016 version 05)	The identified baseline is a continuation of the current urban transit system.

Applicability Conditions	**Justification of eligibility**
Tool 07: Tool to calculate the emission factor for an electricity system (Version 07.0)	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This condition of applicable, OM, BM and CM are estimated using this tool (under section B.6.1) for calculating of the baseline emission.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in “Appendix 1: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	Since the project activity is grid connected, the condition is applicable and emission factor has been calculated accordingly.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, a Non-Annex I country. Therefore, this condition is not applicable to the project activity.
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The project activity is a green field solar power plant and hence the condition of biofuel emission factor is not applicable.

All applicability conditions for using the methodology and tools are thus fulfilled.

B.3. Project boundary, sources and greenhouse gases (GHGs)

The table below provides an overview of the emissions sources included or excluded from the project boundary for determination of baseline and project emissions.

The table below provides an overview of the emissions sources included or excluded from the project boundary for determination of baseline and project emissions.

Source		GHG	Included?	Justification/Explanation
Baseline	Mobile source emissions of different modes of transport for passengers using MRTS	CO_2	Yes	Major emission source
		CH_4	No	Included for gaseous fuels used. For liquid fuels vehicle tailpipe CH4 emissions are excluded. Combined CH4 and N2O emissions make in diesel/gasoline vehicles less than 2% of total CO2eq emissions. Its omittance in baseline as well as project emissions is conservative as fuel consumption and thus also CH4 emissions are reduced through the project.
		N_2O	No	Combined CH4 and N2O emissions make in diesel/gasoline vehicles less than 2% of total CO2eq emissions. Its omittance in baseline as well as project emissions is conservative as fuel consumption and thus also N2O emissions are reduced through the project
Project Activity	Project transport system (MRTS)	CO_2	Yes	Major source
		CH_4	No	Not included as MRTS does not usegaseous fuels.
		N_2O	No	See argument above.
	Mobile source emissions of different modes of transport for passengers using MRTS from trip origin to MRTS and from MRTS to trip destination	CO_2	Yes	Major source
		CH_4	No	Included for gaseous fuels used. Seeargument above.
		N_2O	No	See argument above.

B.4. Establishment and description of the baseline scenario

Step 1: Identification of alternative scenarios to the proposed project activity that are consistent with current laws and regulations

All options are identified that meet the same requirement as the proposed project activity. Alternatives assessed are public transport systems which are complemented with other modes of transport such as passenger cars, taxis, motorcycles, motorized rickshaws and non-motorized transport:

- The establishment of a BRT (Bus Rapid Transit);
- The establishment of a LRT (Light Rail Transit);
- The continuation of the current public and individual transport systems, including (future) investments in road-based infrastructure if applicable;
- The proposed project activity being implemented at a later date in the future, without being registered as a GCC project activity;
- The project proposal not implemented as a Carbon Credit project activity i.e. the continuous construction of metro after Phase I.

Metro Lines of Kochi is not a baseline mode of transport as the lines are not substituted by the project i.e. the passenger cannot, in absence of the project, use metro lines to make the trip as these do not operate in the area of metro lines. Passengers will require for this purpose transit modes which actually perform this trip segment such as buses, cars, taxis etc. The project metro do not replace nor can the passenger use in absence of metro lines. Therefore, the metro lines is not a baseline mode of transport.

All alternatives are consistent with current laws and regulations.

Step 2: Assessment of Options

The analysis of options identified in Step 1 is based on the “Tool for the demonstration and assessment of additionality” Version 05.2

ALTERNATIVE 1: ESTABLISHMENT OF A BRT

A BRT is being considered but due to high increasing load on traffic it could not be found feasible. Based on the above consideration a BRT is not considered asa technically viable solution due to the passenger demand on the corridors on which the metro is built.

ALTERNATIVE 2: ESTABLISHMENT OF A LRT

Light rail transit (LRT) includes also trams and monorails. LRTs operate as a single rail car or as a short train of cars typically on exclusive right-of-way lanes at surface levels. This alternative has similar if not more severe constraints than a BRT. LRTs typically have a capacity upto 25,000 phd or far less than the required capacity for the route of Kochi Metro. Also, they reach only about half the average speed of metro (this is also true of normal BRT systems) thus not offering the same level of convenience as metro. Based on above consideration a LRT is not considered as a technically viable solution due to the passenger demand on the corridors on which the metro is built.

Table 3 shows differences between BRTs/Bus Lane systems, LRTs and metros and table 7 gives examples of the carrying capacity of various MRTS worldwide. The two tables clearly show that the options of BRT andLRT are not adequate for the expected passenger demand along the metro lines of Kochi and that metro is the only viable alternative option to the current transport system based on mixed traffic conditions along a variety of roads offering users a wide spectrum of transport options and routes. LRTs and BRTs can howeverplay an important role on segments

with lower passenger demand and Kochi is assessing these alternatives for other routes, embarking already on a comprehensive BRT program as well as planning Light-Train Systems for other routes.

Table 3: Comparison BRTs, LRTs and Metros

Characteristic	BRT / Bus Lane	LRT / Tram /Monorail	Metro
Passenger carrying capacity(phd)	15-35,000	10-25,000	up to 80,000
Average operating speed (km/h)	15-25	15-25	30-40
Space requirement	2-4 lanes taken away from existing road space	2-4 lanes taken away from existing road space	Separate from roadway corridors

Sources: IEA, Bus Systems for the Future, 2002, Table 2.1. and Table 5

Table 4: Passenger Carrying Capacity of Various BRTs, LRTs and Metros (phd)

System/City	phd (passenger per hour per direction) capacity
Metro Hong Kong	81,000
Metro Sao Paulo	60,000
Metro Bangkok	50,000
LRT Kuala Lumpur	30,000
LRT Tunis	12,000
BRT Bogota	33,000
BRT Quito	15,000
BRT Curitiba	15,000

Source**:** GTZ/ITDP sustainable transport sourcebook 3A, Mass Transit Options, 2005, table 10

ALTERNATIVE 3: CONTINUATION OF THE CURRENT SYSTEM INCL. FUTURE INVESTMENTS

A continuation of the current transport system complies with all applicable legal and regulatory requirements. A continuation of the current system has various advantages compared to all other options:

- No large-scale public investment requiring additional income/tax sources.
- Lowest technical and financial risk of all options.

The carrying capacity of the current public transport system is in line with the actual transport demand. Increasing passenger demand can be accommodated through the establishment of new routes using also alternate roads, which might imply potentially longer travel distances complying however with the purpose of transporting passengers from their trip origin to their trip destination.

Additional transit demand might also lead to increased trip times due to increased congestion. The existing transport system relies not on single or fixed routes like a BRT, metro or LRT but on a multitude of possible routes and modes of transport using the existing road infrastructure and modes of transit. It is thus highly flexible and can accommodate passenger flows in excess of any single-route based MRTS.

The current mixed transit system as established in Kochi is continuously expanded i.e. new roads, intersections, flyovers or road extensions are built. The mixed road conditions are continuously upgraded to meet with increasing traffic demand as a result of increased population and economic wellbeing resulting in more trips as well as a rapidly increasing number of private vehicles using additional road space. As of end 2003 Kochi had nearly 4.46 lakh vehicles including 71 thousand private cars, more than 9700 buses, 33,000 motorized rickshaws and nearly 2.83 lakh motorcycles. During the last two decades Kochi had an exponential growth in the vehicular population. More than 90% of vehicles circulating are personal vehicles. This huge growth is partially due to the increased income but primarily due to a continuation of inefficient, uncomfortable, unreliable and undignified public transport system. To accommodate for this increasing number of vehicles mixed roads are expanded.

In choosing this alternative, public authorities do not embark upon risky structural changes. The continuation of the current situation is thus clearly a realistic and attractive alternative.

ALTERNATIVE 4: THE PROJECT BEING REALIZED IN A LATER DATE WITHOUT CARBON CREDITS

Kochi follows a strategy of multi-modal public transit systems including metro and conventional bus. Various technological options are thus possible and no national or local policy mandates the implementation of a metro. The 9th 5-year plan (1997- 2002) of the Government of India has no policy mandating a metro. Chapter 7.1.20 indicates:
“It is necessary to encourage such modes of transport which are not heavily dependent on scarce land resources and to adopt construction procedures and practices which do not disfigure the land and do not create ecological problems.” The section on strategy states in 7.1.23. “The length and breadth and the quality of the highways must be improved greatly as part of a national grid to provide for speedy, efficient and economical carriage of goods and people. Road transport needs to be regulated for better energy efficiency and pollution control, while the mass transport network needs to be made viable through a rational tariff policy and a refurbishment of the fleet.” The Transport Department of the Government Kerala in its Operating Plan for Kochi, 10.2002 with the title “Tackling Urban Transport” has a policy for mass transit in Kochi:”With the objective of achieving a balanced modal mix and to discourage personalized transport, it is proposed to augment mass transport by massive investments accompanied by institutional improvements. The focus, therefore, will be on increasing mass transport options by providing adequate, accessible and affordable modes like buses, mini-buses, electric trolley buses complemented by a network of a rail-based mass rapid transit systems like metro and commuter rail. Para transit modes like autos and taxis are envisaged

to provide feeder services in designated areas catering to work and leisure trips. Non-motorized transport like bicycles and cycle rickshaws will be accommodated." The Master Plan of Kochi 2001 also included various options for Kochi urban transportation: "(The) Mass Transportation System (is) to be Multi Modal e.g. MRTS, Ring Rail and Road based public transportation system." Various MRTS options are thus included and no specific policy mandating metro exists. There are thus no concrete plans which lead to the construction of a metro in absence of Carbon Credits and a multitude of transport options are assessed. The continuation of current practice with mixed traffic systems i.e. private as well as public transport means is thus the core strategy also for the future of Kochi. Implementing the metro in absence of the Carbon Credits is also studied in Alternative 5.

ALTERNATIVE 5: THE PROJECT WITHOUT Carbon Credit Revenue

The implementation of the proposed project activity in absence of the GCC registration is considered as non-feasible due to financial reasons. The details are given in chapter B5 and are not repeated here to avoid duplication.

Step 3: Determination of the baseline scenario

If Step 2 results in more than one possible alternative baseline scenario, the most likely baseline scenario is the scenario with the lowest baseline emissions. Alternatives 1 (BRT), 2 (LRT), 4 (Future metro in absence of the GCC) and 5 (project without GCC) are not feasible. The most probable alternative in the future in absence of the project is therefore a continuation of the current transport system. This is thus the baseline for this project.

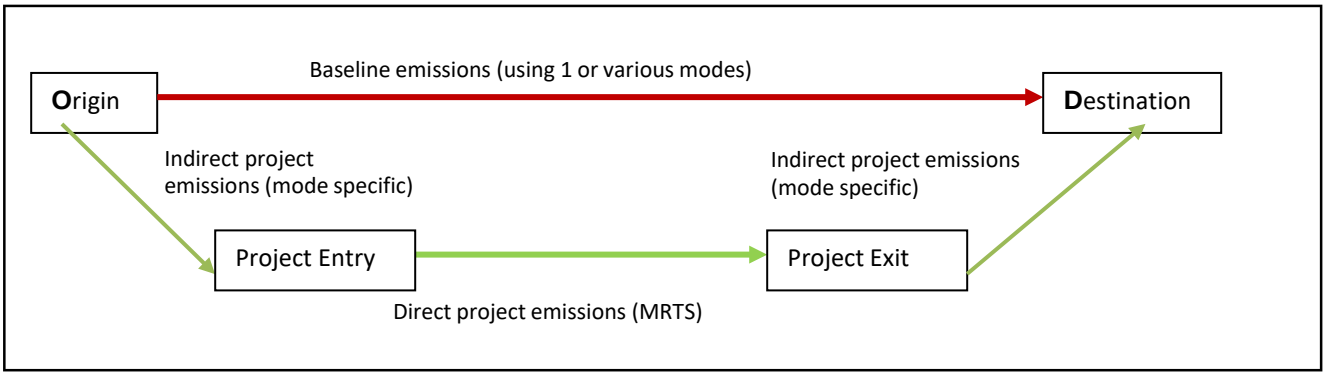
Baseline Scenario

Baseline emissions include the emissions that would have happened due to the transportation of the passengers who use the project activity, had the project activity not been implemented. This is differentiated according to the modes of transport (relevant vehicle categories) that the passengers would have used in the absence of the project. The baseline is a continuation of the current transport system consisting of various transport modes between which the population chooses:

Sub-urban rail does not compete with the proposed metro as it does not offer similar route destinations. However, users of the metro may potentially realize in the baseline or in the project case part of their trip on the suburban rail system. This mode is thus included as mode of transport. For all above listed transport modes the emissions per passenger kilometre (PKM) are calculated. To adjust for emission improvement under BAU, a technology improvement factor is applied.

Baseline emissions are calculated per passenger surveyed. For each passenger surveyed the individual baseline emissions are calculated and multiplied with the individual expansion factor thus getting the baseline emissions of all passengers of the specific week surveyed.

Figure. 2 gives an overview of baseline and project emissions differentiated in indirect and direct project emissions.



B.5. Demonstration of additionality

The additionality of the GCC Project shall be demonstrated by applying the following approach, consisting of two components:

(i) A Legal Requirement Test; and
(ii) An Additionality Test either based on a Positive List test or a projects-specific additionality test.

The project is not mandated/enforced by law and is entirely a voluntary activity. Since voluntary commitments/agreements within a sector or by an entity do not constitute the legal requirement, the project is additional as per paragraph 46 of GCC Project Standard

The project additionality is demonstrated as per the methodology ACM0016 Version 5.

Step 1: Country level assessment

As per paragraph 25 in the methodology, this step aims to determine whether the proposed GCC project activity is common practice in the host country where the project is proposed to be implemented. For this purpose, project participants shall assess whether there are less than three cities with MRTS that started commercial operation in the host country of the proposed carbon credit project activity prior to the start of the carbon credit project activity.

India is host country and there are more than 3 three cities with MRTS that started commercial operation prior to the start of the proposed GCC project activity.

As per paragraph 26, the project participants shall:

a) Identify all cities with MRTS that have started commercial operation in the host country prior to the start of the proposed project activity. Project participants shall include a brief description of each system in the PSF.

List of cities having metro being operational in India is given below: Total 10 cities are having metro operational before the start of proposed GCC project activity

CITY & STATE	OPERATIONAL NETWORK	UNDER CONSTRUCTION NEW ROUTES	APPROVED NEW ROUTES	PROPOSED NEW ROUTES	OPERATOR	START DATE
Bangalore Metro, Karnataka	55.6 km	115.86 km	0 km	105.55 km	BMRCL	20-Oct-11
Chennai Metro, Tamil Nadu	54.1 km	83.90 km	35 km	15.30 km	CMRL	29-Jun-15
Delhi Metro, Delhi-NCR	349 km	40.85 km	24.99 km	57.3 km	DMRC	24-Dec-02
Gurgaon Rapid Metro, Haryana	12.1 km	0 km	0 km	200 km	RMRG (now DMRC)	14-Nov-13
Hyderabad Metro, Telangana	67 km	0 km	0 km	58 km	HMRL	29-Nov-17
Jaipur Metro, Rajasthan	11.98 km	0 km	0 km	26.36 km	JMRC	03-Jun-15
Kochi Metro, Kerala	26.8 km	1.1 km	12.36 km	0 km	KMRL	19-Jun-17
Kolkata Metro, West Bengal	41.35 km	54.22 km	28.2 km	15.7 km	Metro Railway & KMRL	24-Oct-84
Lucknow Metro, Uttar Pradesh	22.90 km	0 km	0 km	85 km	UPMRCL	06-Sep-16
Mumbai Metro, Maharashtra	30.15 km	150 km	21.29 km	136.40 km	MMOPL, MMRC & MMMOCL	08-Jun-14

b) Identify which MRTS were developed as carbon credit project activities in the host country (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) and exclude all MRTS developed as carbon credit project activities from the assessment of common practice in this step.

As per paragraph 27, If the number of cities with MRTS (excluding systems developed as carbon credit project activities) is equal to or exceeds three cities, then projects participants should proceed to Step 2, otherwise project participants should proceed to Step 3.

India is host country of this project activities and thee more 3 cities where metro is implemented before start date of this project activity. Hence Step -2 will be followed to demonstrate additionality as per methodology.

Registered	Title	Host Parties	Other Parties	Methodology *	Reductions **	Ref
30 Jun 11	Metro Delhi, India	India	Switzerland	ACM0016 ver. 4	529043	4463
04 Oct 11	Mumbai Metro One, India	India	Switzerland	ACM0016 ver. 2	195547	4670
22 Nov 12	Mode-shift of passengers from private vehicles to MRTS for Gurgaon metro	India	Switzerland	ACM0016 ver. 2	105863	6430

Step 2: City level assessment

As per paragraph 28, this step aims to determine whether the proposed project activity is common practice in the host city where the proposed GCC project activity is intended to be implemented. For this purpose, project participants shall assess whether the share of trips realized on the existing public transport system(s) in the host city, which belong to the same public transport category as the proposed GCC project activity, is less than or equal to 20 percent of total public transport trips in the host city.

As per paragraph 29, The project participants shall:

(a) Provide a breakdown of the total public transport trips realized in the host city by the shares of trips realized on different public transport categories, distinguishing between the following public transport categories:

(i) Metro;
(ii) Sub-urban rail;
(iii) Light rail transit including trams;
(iv) Conventional bus system;
(v) BRTs;

(b) Describe in the GCC-PSF the existing public transport systems and identify to which of the public transport categories they belong. Identify also to which public transport category the proposed project activity belongs. Determine and document in the GCC-PSF the shares of trips realized on each relevant public transport system and on each public transport category, expressed in percentages of the total public transport trips realized on all public transport systems in the host city.

As per paragraph 30, If the share of motorized trips realized on the existing systems which belong to the same public transport category as the proposed project activity exceeds 20 per cent of total motorized public transport trips in the host city, then the proposed GCC project activity is not

additional. If the share of trips is less than or equal to 20 per cent, then project participants should proceed to Step 3.

Outcome of step-2
Kochi is not having any Metro before this project activity, hence the share of trips realized on the existing public transport system(s) in the host city, which belong to the same public transport category as the proposed GCC project activity, is 0 percent which less than 20 percent of total public transport trips in the host city.

Step 3: System level assessment

As per paragraph 31, two options are provided for the system level assessment of the proposed project activity.
(a) Conduct an investment analysis following the procedure under section 5.2.3.1 below; or
(b) Conduct a performance analysis, following the procedure under section 5.2.3.2 below.

The proposed GCC project activity has chosen to conduct a performance analysis for the system level assessment.

As per paragraph 36, The MRTS project shall demonstrate that for road-based systems, forecasted emissions from the project MRTS is less than or equal to 50 gCO2/pkm6 and, forecasted electricity consumption of the rail-based systems is less than or equal to 0.1 kWh/pkm, to demonstrate that the project is additional

The proposed GCC project activity is a rail based system. Energy Performance of this proposed GCC project activity is 0.00898 kWh / PKM which is less than 0.1 KWh / PKM. Hence this project is found deemed to be additional.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

BASELINE EMISSION CALCULATIONS

Baseline emissions are calculated per passenger surveyed. For each passenger surveyed the individual baseline emissions are calculated and multiplied with the individual expansion factor thus getting the baseline emissions of all passengers of the specific week surveyed. These are multiplied with the total of the passengers of the period to arrive at baseline emissions.

The following steps are made:

Step 1: Conduct a survey, following the procedures presented in Annex 3, in which for each surveyed passenger, the trip distance per transport mode that would have taken place in the baseline is determined.

Step 2: Calculate the individual baseline emissions for each surveyed passenger.

Step 3: Apply an individual expansion factor to each surveyed passenger in accordance with the survey sample design (as defined in Annex 3), and summarize these to get the total baseline emissions of the period (week) surveyed. To get the annual (or monitoring period) baseline emissions the baseline emissions of the surveyed period (week) are calculated per passenger of the period (week) and multiplied with the total passengers transported per year (or monitoring period).

Step 4: Take the lower limit of the 95% confidence interval as total baseline emissions.'

Baseline emissions are calculated based on the latest version of the TOOL18, from section 5.4, equation (4)

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Equation (4)

$$BE_y = (\sum_{\text{i}}(IR_{\text{i}})^{t+y-1} \times EF_{PKM,\text{i},x} \times D_{\text{i}} \times S_{\text{i}}) \times P_y \times 10^{-6}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2eq)
IR_{i}	=	Technology improvement factor[5] for vehicle category *i* per year (ratio)
T	=	Time difference (in years) between the year for which data is available for vehicle category i and the year of establishing standardized baseline or start date of CDM project in case the tool is used to determine baseline emissions of CDM project
$EF_{PKM,\text{i},x}$	=	Emission factor per passenger-kilometre for electricity-based or road-based vehicle category *i* in year *x* (g CO_2eq/PKM)
D_{i}	=	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category *i* (km)
P_y	=	Number of passengers travelled by the project system in year *y*
S_{i}	=	Share of passengers who shifted from electricity-based or road-based vehicle category *i* (%)
I	=	Vehicle categories (such as passenger car (C), bus (B), motorcycle (M) or rail based urban transit (R)
Y	=	Crediting year when emissions reductions are estimated

The baseline emission per surveyed passenger is calculated based on the mode used, the trip distance permode and the emission factor per mode:

$$BE_y = (\sum_{\mathrm{i}} (IR_{\mathrm{i}})^{t+y-1} \times EF_{PKM,\mathrm{i},x} \times SD_{\mathrm{i}}) \times PD_y \times 10^{-6} \quad \text{Equation (5)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2eq)
IR_{i}	=	Technology improvement factor[6] for vehicle category *i* per year (ratio)
T	=	Time difference (in years) between the year for which data is available for vehicle category *i* and the year of establishing standardized baseline or start date of CDM project in case the tool is used for determine baseline emissions of CDM project
$EF_{PKM,\mathrm{i},x}$	=	Emission factor per passenger-kilometre for electricity-based or road-based vehicle category *i* in year *x* (g CO_2eq/PKM)
PD_y	=	Number of passenger-kilometres travelled by the project system in year *y* (PKM)
SD_{i}	=	Share of passenger-kilometres who shifted from electricity-based or road-based vehicle category *i* (%)
I	=	Vehicle categories (such as passenger car (C), bus (B), motorcycle (M) or rail based urban transit (R)
Y	=	Crediting year when emissions reductions are estimated

(**1) Identification of the relevant vehicle categories (modes of transport)**

The baseline is a continuation of the current transport system consisting of various transport modes betweenwhich the population chooses:

- NMT (Non-Motorized Traffic) with bikes and per foot;
- Private passenger car;
- Taxis;
- Motorcycles;
- Motorized auto-rickshaws (used as taxis);
- Buses;
- Suburban rail.

The survey includes also induced traffic i.e., trips which in absence of the project would not have been made.

Suburban rail is not operational in Kochi, hence this mode is eliminated from study. All other possible

vehicle categories are thus included in the baseline emission calculations.

(1) Determination of the emission factor per passenger-kilometer ($EF_{PKM,i,x}$)

Passenger-kilometer (PKM) is defined as the average passenger trip distance multiplied by the number of passengers. The emission factors per PKM are determined *ex ante* for each vehicle category. Any change inthe occupancy rate of taxis and buses influencing the corresponding emission factors is monitored as leakage.

For fuel-based vehicle categories, the emission factor per PKM is calculated the following equation is used from the tool 18 (version 05) equation (03)

$$EF_{PKM,i,x} = \frac{EF_{KM,i,x}}{OC_{i,x}}$$ Equation (3)

Where:

$EF_{PKM,i,x}$	=	Emission factor per passenger-kilometre of vehicle category *i* in year *x* (g CO_2/PKM)
$EF_{KM,i,x}$	=	Emission factor per kilometre of vehicle category *i* in year *x* (g CO_2/km)
$OC_{i,x}$	=	Average occupancy rate of vehicle category *i* in year *x* (passengers)
I	=	Road-based vehicle categories (such as passenger car (C), bus (B), motorcycle (M))
X	=	Most recent calendar year for which data is available. Data not older than three years

2.1.) Determination of the average occupation rate (OC_i)

The average occupation rate of vehicle category *i* is determined based on visual occupation studies. In the case of taxis, the driver is not included. Formula (5) of the methodology is not required as also for buses theoccupation rate has been determined based on visual occupation studies.

(2.2) Determination of the emission factors per kilometre ($EF_{KM,i,x}$)

Relevant fuel types, for each vehicle category, have to be identified. The emission factor per kilometre is re-calculated annually based on the recorded share of fuels per category. In case biofuel blends are used the biofuel share of the blend is accounted for with zero emission factor ($EF_{CO2,x,y}$). Buses operating in Kochi are all large units. Formula (8) of the methodology is thus not used. No BRT bus lane was operational prior to project start.

The emission factor per kilometer is not constant but annually updated. Rail-based vehicles must monitor annually the electricity consumption plus passengers transported (see formula 1 in tool 18, version 05).

$$EF_{KM,i,x} = \left[\sum_{n}[SFC_{i,n,x} \times NCV_{i,n} \times EF_{CO2,n} + SEC_{i,x} \times EF_{CO2,x}] \times \frac{N_{i,n,x}}{N_{i,x}}\right] \qquad \text{Equation (1)}$$

Where:

$EF_{KM,i,x}$	=	Emission factor per kilometre of vehicle category *i* in year *x* (g CO_2/km)
$SFC_{i,n,x}$	=	Specific fuel consumption of vehicle category *i* using fuel type *n* in year *x* (mass or volume units of fuel/km)
$NCV_{i,n}$	=	Net calorific value of fuel *n* used in vehicle category *i* (MJ/mass or volume units of fuel)
$EF_{C02,n}$	=	Emission factor for fuel type *n* (g CO_2/MJ)
$SEC_{i,x}$	=	Specific electricity consumption of vehicle category *i* using electricity in year *x* (kWh/km)
$EF_{C02,x}$	=	Emission factor for electricity in year *x* (g CO_2/kWh)
$N_{i,x}$	=	Number of vehicle-kilometers of category *i* driven in year *x* (VKM) or number of vehicles of category *i* in year *x* (units)
$N_{i,n,x}$	=	Number of vehicle-kilometres vehicle category *i* using fuel type n^2 driven in year *x* (VKM) or number of vehicles in vehicle category *i* using fuel type n^3 in year *x* (units)
N	=	Fuel types used by vehicle category *i* in year *x*
I	=	Road-based vehicle categories (passenger car (C), bus (B), motorcycle (M), etc.
X	=	Most recent calendar year for which data is available. Data not older than three years

The alternative of the Combined Margin (CM) is chosen, determined ex-ante for the entire crediting period. The CM is calculated based on the "Tool to calculate the emission factor for an electricity system", Version 01.1 and the Tool05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation. Scenario A of this tool applies as the electricity consumed is from the grid. Option A1 is used to calculate the emission factor of the grid based on the CM.

The technology improvement factor is taken from the methodology.

Baseline emissions cover the entire emissions which would have been caused by the project passenger in absence of the project from his trip origin to his trip destination. The origin and

destination of the trip is assumed to be equal for the baseline as for the project case with exception of induced traffic included only as project but not as baseline trips. The trip distance and the modes used between O and D are however different in the baseline than in the project case. The trip distance may vary as some passengers using the project MRTS may be willing e.g. to make detours due to the higher speed of the MRTS versus conventionalbus transport. To fully capture all potential changes the methodology thus compares emissions per O-D trip of the baseline with emissions per O-D trip of the project. The data to determine O-D mode(s) and distancesper mode are derived from a representative survey of project passengers realized annually. Total baseline emissions are calculated thereafter annually based on these parameters, the emissions per PKM and the amount of passengers transported by the project.

Project passengers are those which enter stations of the project metro lines as included in the PDD. For stations shared by a non-project metro line (e.g. currently metro lines of Phase I) as well as a project metro line the passengers are distributed proportionally i.e. if the station is used by a line of Phase I plus a project metro line then the passengers are distributed 50:50, if the station is used by metro lines 1, 2 of Phase I plusa project line then the passengers are distributed 66:33 i.e. 33% are considered as project passengers.

PROJECT EMISSION CALCULATIONS

Project emissions are based on the electricity consumed by the metro for train traction (direct project emissions) plus emissions caused by project passengers from their trip origin to the entry station of the metroand from the exit station of the metro to their final destination (indirect project emissions).

Project emissions are calculated as follows:

$$PE_y = DPE_y + IPE_y \quad \text{Equation (1)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
DPE_y	=	Direct project emissions in year *y* (tCO_2)
IPE_y	=	Indirect project emissions in year *y* (tCO_2)

Determination of direct project emissions (DPEy)

The project activity involves an electricity-based transport system. The emissions from electricity consumption are based on the Tool05 “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Only electricity consumed for train propulsion isincluded in rail-based MRTS.

Determination of indirect project emissions (IPEy)

Indirect project emissions are those caused by passengers from their trip origin up to the project activity entrystation, and from the project activity exit station up to the trip final destination. The survey realized identifies the origin, the project entry station, the project exit station and the final destination of the passenger plus the modes used between the different points, e.g. bicycle from

origin to project entry station and taxi from projectexit station to final destination. The distances between origin and entry and between exit and destination are calculated based, e.g. on public transit routes, electronic maps and GPS (Global Positioning System) (identical to baseline trip determination). The emission factors per passenger-kilometre used for indirect project emissions are identical to the baseline passenger-kilometre factors (EFPKM,i,y).

Following core steps are realized:

Step 1: Realize a survey in which for each surveyed passenger the trip distance per mode used to/from theMRTS is determined.

Step 2: Calculate for each surveyed passenger his indirect project emissions.

Step 3: Apply to each surveyed passenger an individual expansion factor in accordance with the survey sample design and summarize these to get the total indirect project emissions of the week surveyed. To get the annual (or monitoring period) indirect project emissions the indirect project emissions of the surveyed week are calculated per passenger of the week and multiplied with the total passengers transported per

Step 4: Application of the upper 95% confidence interval to the total indirect project Emission. The detailed corresponding formulas are included in Annex 3.

$$IPE_y = P_y \times \sum_i \left(D_{ind,i,1-4} \times EF_{pkm,i,1-4} \times 10^{-6} \right)$$ Equation (9)

Where:

IPE_y	=	Indirect project emissions in year *y* (tCO_2)
P_y	=	Total number of passengers transported in year *y*
$EF_{pkm,i,1-4}$	=	Emission factor per passenger-kilometer of mode *i* in years 1 and 4 of the crediting period (gCO_2/pkm)
$D_{ind,i,1-4}$	=	Average indirect project trip distance of surveyed passengers using mode *i* in years 1 and 4 of the crediting period (km)

The indirect project emissions per surveyed passenger are calculated based on the transport mode used, the trip distance per mode and the emission factor per mode.

Based on the surveyed passenger and the survey design the corresponding expansion factors are applied to calculate total indirect project emissions. Total indirect project emissions are determined based on the upper limit of the 95% confidence interval as results are based on a sample/survey. For

the entire survey design see Annex 3. The same method of expansion factors is used as outlined in the baseline section.

Indirect project emissions are only included for the project passengers. Passengers transported are based on passengers entering stations. Project passengers are those which enter stations of the project metro lines as included in the PDD. For stations used by a non-project metro line (e.g. currently metro lines Phase I) as well as a project metro line the passengers are distributed proportionally.

LEAKAGE EMISSION CALCULATIONS

Leakage emissions include the following sources:

- Emissions due to changes of the load factor of taxis and buses of the baseline transport system due to the project; and,

- Emissions due to reduced congestion on affected roads, provoking higher average vehicle speed, plus a rebound effect.

- Upstream emissions of gaseous fuels ($LE_{UP,y}$).

The impact on traffic (additional trips) induced by the new transport system is included as project emissions and thus is not part of leakage. This is addressed by including, as project emissions, the emissions from the trips of passengers who would not have travelled in the absence of the project.

Leakage emissions are calculated as follows:

$$LE_y = LE_{LF,Z,y} + LE_{LFT,y} + LE_{CONG,y} + LE_{UP,y} \quad \text{Equation (2)}$$

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2)
$LE_{LF,Z,y}$	=	Leakage emissions due to change of load factor of buses in year *y* (tCO_2)
$LE_{LFT,y}$	=	Leakage emissions due to change of load factor of taxis in year *y* (tCO_2)
$LE_{CONG,y}$	=	Leakage emissions due to change in congestion in year *y* (tCO_2)
$LE_{UP,y}$	=	Leakage emissions due to upstream emissions of gaseous fuels in year *y* (tCO_2)

For each component leakage is only included if it has a positive value.

Determination of emissions due to change of load factor of buses ($LE_{LF,Z,y}$)

The project could have a negative impact on the load factor of the conventional bus fleet. Load factor changes are monitored for the entire city as the potential impact is not necessarily in the proximity of the project MRTS (buses can be used in other parts of the city). The load factor of buses is monitored in the years 1 and 4 of the crediting period. Leakage from load factor change of buses is only included if the load factor of buses has decreased by more than 10 percentage points comparing the monitored value with the baseline value, the equation is taken from the tool 18 (version 5) and are calculated as:

$$LE_{LF,Z,y} = max\left[\frac{N_{Z,1-4} \times AD_Z \times EF_{km,Z,y} \times \left(1 - \frac{ROC_{Z,1-4}}{ROC_{Z,x}}\right)}{10^6} ; 0\right] \quad \text{Equation (11)}$$

Where:

$N_{Z,1-4}$	=	Number of buses in years 1 and 4 of the crediting period (buses)
AD_Z	=	Average annual distance driven by baseline buses (km/bus)
$EF_{km,Z,y}$	=	Emission factor per kilometer for baseline buses in year *y* (gCO_2/km)
$ROC_{Z,1-4}$	=	Average occupancy rate relative to the capacity of baseline buses in years 1 and 4 of the crediting period (%)
$ROC_{Z,x}$	=	Average occupancy rate relative to the capacity of baseline buses in year *x* (%)
x	=	Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the CDM-PDD for validation, whichever is earlier

The occupancy rate of buses is monitored through visual occupation studies (see Annex 3).

Determination of emissions due to change of load factor of taxis ($LE_{LFT,y}$)

The project could have a negative impact on the load factor of taxis. Taxis include cars as well as motorized rickshaws realizing taxi services. For both types of services, the load factor change is monitored separately. Load factor changes are monitored for the entire city as taxis operate all over the city and are not confined to deliver their services in certain areas. The load factor of taxis is monitored in the years 1 and 4 of the crediting period. the equation is taken from the tool 18 (version 5).This leakage is calculated as:

$$LE_{LFT,y} = max\left[\frac{N_{T,1-4} \times AD_T \times EF_{km,T,y} \times \left(1 - \frac{ROC_{T,1-4}}{ROC_{T,x}}\right)}{10^6} ; 0\right] \quad \text{Equation (14)}$$

Where:

$LE_{LFT,y}$	=	Leakage emissions due to a change in load factor of taxis in year *y* (tCO_2)
$N_{T,1-4}$	=	Number of taxis in years 1 and 4 of the crediting period (taxis)
AD_T	=	Average annual distance driven by baseline taxis (km/taxi)
$EF_{km,T,y}$	=	Emission factor per kilometer for baseline taxis in year *y* (gCO_2/km)
$ROC_{T,1-4}$	=	Average occupancy rate relative to the capacity of baseline taxis in years 1 and 4 of the crediting period (%)
$ROC_{T,x}$	=	Average occupancy rate relative to the capacity of baseline taxis in year *x* (%)
x	=	Most recent calendar year prior to the start of commercial operation of the project system or prior to the submission of the CDM-PDD for validation, whichever is earlier

The maximum load factor change attributed to taxis is the emission reductions due to passengers switching from taxis to the project (calculated by the emission factor per passenger-kilometre for taxis, the trip distance and the number of passengers transported by the project, which would have used taxis in absence of the project). This maximum condition is established as load factors might worsen citywide also due to factors external to the project and leakage from a load factor change taxis due to the project can at maximum be according to the number of passengers transported by the project which in absence of latter would have taken a taxi.

The occupancy rate of taxis is monitored through visual occupation studies counting the number of passengers (see Annex 3).

The parameter emission factor per kilometre of baseline taxis in the year y (EFKM,T,y) is calculated using the equation for EFKM,i,y presented in the baseline emissions section, substituting i for T (taxis).

Determination of emissions due to reduced congestion ($LE_{CONg,y}$)

In the case that the implementation of the project activity leads to a reduction of road capacity available for individual motorised transport modes, the impact of changes in congestion shall be monitored in the year 1 and 4 of the crediting period. In other cases (e.g. the project provides a new road infrastructure not taken from the existing road space in the city), monitoring of these changes is not required.66

KMRL has not taken away any existing road space. Therefore, based on ACM0016 Version 05.0 no monitoring is required. In Equation 11 of the methodology RSBL (road space baseline) is identical to RSPJ (road space project). Therefore ARS (additional road space available) cannot be negative.

Upstream emissions from gaseous fuels ($LE_{UP,y}$)

Upstream leakage of gaseous fuels shall be only included if the project vehicles consume more gaseous fuels than baseline vehicles. Project metro only consumes electricity. Therefore, in the baseline more gaseous fuels are used than in the project situation. Upstream emissions from gaseous fuels are therefore not considered.

EMISSION REDUCTIONS

$$ER_y = BE_y - PE_y - LE_y$$ Equation (3)

Where:

ER_y = Emissions reductions in year *y* (tCO_2)

BE_y = Baseline emissions in year *y* (tCO_2)

PE_y = Project emissions in year *y* (tCO_2)

LE_y = Leakage emissions in year *y* (tCO_2)

If for a certain year LEy < 0, then leakage is not be included in the calculation of emissions reductions. If $LE_y > 0$, then it is included

B.6.2. Data and parameters fixed *ex ante*

Data / Parameter Table 1.

Data / Parameter:	**$SFC_{i,n,x}$**
Methodology reference	Tool 18 Version 1.0
Data unit	L/km
Description	Specific fuel consumed of passenger cars (C) and taxis (T) using gasoline or diesel
Measured/calculated /default	Default
Data source	UNFCCC CDM Tool 18 Methodological tool: Baseline emissions for modal shiftmeasures in urban passenger transport
Value(s) of monitored parameter	-

Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Baseline and project emissions
Additional comments	NA

Data / Parameter:	$Ni_{,n,x}$ / $N_{i,x}$
Methodology reference	Tool 18 Version 1.0
Data unit	-
Description	Share of vehicle-kilometers or vehicles in vehicle category *i* using fuel type *n* in year *x*
Measured/calculated /default	-
Data source	Not Applicable
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$NCV_{i,n}$
Methodology reference	Tool 18 Version 1.0

Data unit	MJ/km
Description	Net calorific value of fuel n used in vehicle category i
Measured/calculated /default	Default
Data source	IPCC 2006
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$OC_{i,x}$
Methodology reference	Tool 18 Version 1.0
Data unit	Passenger
Description	Average occupancy rate of vehicle category i in year x
Measured/calculated /default	Not Applicable
Data source	Baseline survey
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>

Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$EF_{CO2,n}$
Methodology reference	Tool 18 Version 1.0
Data unit	g CO_2/J
Description	Emission factor for fuel type n
Measured/calculated /default	Default
Data source	IPCC 2006
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$EF_{KM,i,x}$
Methodology reference	Tool 18 Version 1.0
Data unit	g CO_2/km
Description	Emission factor per kilometre of vehicle category i in year x
Measured/calculated /default	Calculated
Data source	Not applicable
Value(s) of monitored parameter	Gasoline: 62.6% Diesel: 25.8% CNG: 11.6%

Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	IR_i
Methodology reference	Tool 18 Version 1.0
Data unit	-
Description	Technology improvement factor for vehicle category i per year
Measured/calculated /default	Default
Data source	Tool 18 Version 1.0
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$EF_{grid,CM,y}$
Methodology reference	Tool 18 Version 1.0
Data unit	tCO_2 e/MWh
Description	Combined margin CO_2 emission factor for the project electricity system in year y
Measured/calculated /default	Calculated
Data source	”CO_2 Baseline database for the Indian Power Sector“ Version 17.0, October 2021
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$TDL_{j,y}$
Methodology reference	Tool 18 Version 1.0
Data unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Measured/calculated /default	Not Applicable
Data source	NLDC data
Value(s) of monitored parameter	-

Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$DD_{z,s,x}$
Methodology reference	ACM0016 V5.0
Data unit	Km
Description	Total distance driven by bus size s in year x
Measured/calculated /default	Measured
Data source	Data from bus companies (company records), municipal transit authorities or specific studies done by the project proponent or a third party.
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$N_{Z,s,x}$
Methodology reference	ACM0016 V05.
Data unit	Number of buses bus size s in year x
Description	Number of buses in use in the baseline
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities based on vehicle registration statistics from the respective city or data from vehicle control stations (technical and emission control stations).
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed. Bus sizes: small (S), medium (M) and large (L).

Data / Parameter:	RS_x
Methodology reference	ACM0016 V05.
Data unit	Km
Description	Total road space available in year x
Measured/calculated /default	Not Applicable
Data source	Official statistics or studies conducted by the project proponent or a third party
Value(s) of monitored parameter	-

Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions
Additional comments	This is ex-ante fixed. Road space baseline based on official information. Reduced road space based on construction plans (reduced road space is lanes which were eliminated due to dedicating bus lanes to the project system)

Data / Parameter:	RS_y
Methodology reference	ACM0016 V05.
Data unit	Km
Description	Total road space available due to the project activity
Measured/calculated /default	Not Applicable
Data source	Official statistics or studies conducted by the project proponent or a third party.
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions
Additional comments	This is ex-ante fixed.

	Road space based on official information and on construction plans. During the crediting period the actual RSy implemented should be checked against the ex-ante expectation. If there are differences, the Project Proponent should demonstrate why it does not affect the project design (i.e. by applying equation 9 again), or request a Post Registration Change to incorporate or eliminate the leakage calculation

Data / Parameter:	AD_T
Methodology reference	ACM0016 V5.0
Data unit	Km/taxi
Description	Average annual distance driven by taxis
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities or taxi operators.
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	Type of meter: NA Location of meter: NA Accuracy of meter: NA Serial number of meters: NA
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	V_B
Methodology reference	ACM0016 V5.0
Data unit	Km/h
Description	Average total speed and average speed under circulation is measured
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities or studies ordered by project proponent. Vintage maximum three years, if no major infrastructure or policy (e.g. licence plate scheme or new traffic signalling) changes have occurred since the last major change

Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

Data / Parameter:	$TD_{Z,x}$, $TD_{T,x}$, $TD_{C,x}$
Methodology reference	ACM0016 V5.0
Data unit	Km
Description	$TD_{Z,x}$: Total distance driven by public transport buses in year x $TD_{T,x}$: Total distance driven by public transport taxis in year x $TD_{C,x}$: Total distance driven by passenger cars in year x
Measured/calculated /default	Not Applicable
Data source	Official statistics (vehicle registration data; transportation statistics)
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.

Additional comments	This is ex-ante fixed. Data can be either with or without informal transport as long as the above mentioned parameters are from the same data source. In general, data including only formal transport is of a better data quality and should thus be taken

Data / Parameter:	$N_{i,x}$
Methodology reference	ACM0016 V5.0
Data unit	Number of vehicles
Description	Number of vehicles of vehicle category i per annum using the affected roads in year x
Measured/calculated /default	Number of vehicles of vehicle category i per annum using the affected roads in year x
Data source	Municipal transit authorities or studies ordered by project proponent. Vintage maximum three years
Value(s) of monitored parameter	-
Measurement/ Monitoring equipment (if applicable)	<table><tr><td></td><td></td></tr><tr><td>Type of meter</td><td>NA</td></tr><tr><td>Location of meter</td><td>NA</td></tr><tr><td>Accuracy of meter</td><td>NA</td></tr><tr><td>Serial number of meters</td><td>NA</td></tr></table>
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	This is ex-ante fixed.

B.6.3. Ex-ante calculation of emission reductions

Baseline Emissions

Equation (4)

$$BE_y = (\sum_i (IR_i)^{t+y-1} \times EF_{PKM,i,x} \times D_i \times S_i) \times P_y \times 10^{-6}$$

Where:

BE_y = Baseline emissions in year *y* (t CO_2eq)

IR_i	=	Technology improvement factor[5] for vehicle category *i* per year (ratio)
T	=	Time difference (in years) between the year for which data is available for vehicle category i and the year of establishing standardized baseline or start date of CDM project in case the tool is used to determine baseline emissions of CDM project
$EF_{PKM,i,x}$	=	Emission factor per passenger-kilometre for electricity-based or road-based vehicle category *i* in year *x* (g CO_2eq/PKM)
D_i	=	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category *i* (km)
P_y	=	Number of passengers travelled by the project system in year *y*
S_i	=	Share of passengers who shifted from electricity-based or road-based vehicle category *i* (%)
I	=	Vehicle categories (such as passenger car (C), bus (B), motorcycle (M) or rail based urban transit (R)
Y	=	Crediting year when emissions reductions are estimated

The baseline emission per surveyed passenger is calculated based on the mode used, the trip distance per mode and the emission factor per mode:

$$BE_y = (\sum_i (IR_i)^{t+y-1} \times EF_{PKM,i,x} \times SD_i) \times PD_y \times 10^{-6} \quad \text{Equation (5)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2eq)
IR_i	=	Technology improvement factor[6] for vehicle category *i* per year (ratio)
T	=	Time difference (in years) between the year for which data is available for vehicle category *i* and the year of establishing standardized baseline or start date of CDM project in case the tool is used for determine baseline emissions of CDM project
$EF_{PKM,i,x}$	=	Emission factor per passenger-kilometre for electricity-based or road-based vehicle category *i* in year *x* (g CO_2eq/PKM)
PD_y	=	Number of passenger-kilometres travelled by the project system in year *y* (PKM)
SD_i	=	Share of passenger-kilometres who shifted from electricity-based or road-based vehicle category *i* (%)

I	=	Vehicle categories (such as passenger car (C), bus (B), motorcycle (M) or rail based urban transit (R)
Y	=	Crediting year when emissions reductions are estimated

For all other fuel-based vehicle categories, the emission factor per PKM is calculated the following equation is used from the tool 18 (version 05) equation (02)

$$EF_{PKM,i,x} = \frac{EF_{KM,i,x}}{OC_{i,x}}$$ Equation (3)

Where:

$EF_{PKM,i,x}$	=	Emission factor per passenger-kilometre of vehicle category *i* in year *x* (g CO_2/PKM)
$EF_{KM,i,x}$	=	Emission factor per kilometre of vehicle category *i* in year *x* (g CO_2/km)
$OC_{i,x}$	=	Average occupancy rate of vehicle category *i* in year *x* (passengers)
I	=	Road-based vehicle categories (such as passenger car (C), bus (B), motorcycle (M))
X	=	Most recent calendar year for which data is available. Data not older than three years

Determination of the emission factors per kilometre ($EF_{KM,i,x}$)

$$EF_{KM,i,x} = \left[\sum_{n}[SFC_{i,n,x} \times NCV_{i,n} \times EF_{CO2,n} + SEC_{i,x} \times EF_{CO2,x}] \times \frac{N_{i,n,x}}{N_{i,x}}\right]$$ Equation (1)

Where:

$EF_{KM,i,x}$	=	Emission factor per kilometre of vehicle category *i* in year *x* (g CO_2/km)
$SFC_{i,n,x}$	=	Specific fuel consumption of vehicle category *i* using fuel type *n* in year *x* (mass or volume units of fuel/km)
$NCV_{i,n}$	=	Net calorific value of fuel *n* used in vehicle category *i* (MJ/mass or volume units of fuel)
$EF_{C02,n}$	=	Emission factor for fuel type *n* (g CO_2/MJ)
$SEC_{i,x}$	=	Specific electricity consumption of vehicle category *i* using electricity in year *x* (kWh/km)
$EF_{C02,x}$	=	Emission factor for electricity in year *x* (g CO_2/kWh)

$N_{i,x}$	=	Number of vehicle-kilometers of category *i* driven in year *x* (VKM) or number of vehicles of category *i* in year *x* (units)
$N_{i,n,x}$	=	Number of vehicle-kilometres vehicle category *i* using fuel type n^2 driven in year *x* (VKM) or number of vehicles in vehicle category *i* using fuel type n^3 in year *x* (units)
N	=	Fuel types used by vehicle category *i* in year *x*
I	=	Road-based vehicle categories (passenger car (C), bus (B), motorcycle (M), etc.
X	=	Most recent calendar year for which data is available. Data not older than three years

The EF i.e. also cars, taxis, buses, motorcycles and motorized rickshaws is updated based on ACM0016:

- If the bio-fuel share changes;
- If the share of fuel types used per vehicle category changes;
- If NCV or EF data changes.

The following table shows the bio-fuel shares projected for the 2nd crediting period are based on the last approved monitoring report for the period 2016-2018.

- Diesel: 0.1%
- Gasoline: 3.2%

The following table shows projected EF for baseline modes of transport.

Detail	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Emission factor per pkm car	64	64	64	64	64	64	64	64	64	64
Emission factor per pkm taxi	145	145	145	145	145	145	145	145	145	145
Emission factor per pkm motorcycle	28	28	28	28	28	28	28	28	28	28
Emission factor per pkm rickshaw	55	55	55	55	55	55	55	55	55	55
Emission factor per pkm bus	27	27	27	27	27	26	26	26	25	25

Source: CER Sheet

Constant passenger numbers (based on the average recorded previous years) and constant modes shares as well as trip distances per mode are assumed for the entire 2nd crediting period for the purpose of projections of baseline emissions. Baseline emissions are projected with the transport model estimates of baseline emissions per passenger which is lower than the average of the last 2 surveys.

Parameter	**unit**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Passengers	passengers	139,381,820	139,381,820	139,381,820	139,381,820	139,381,820	139,381,820
Baseline emission factor based on transport model	gCO_2 /passenger	1,842	1,842	1,842	1,842	1,842	1,842
Baseline emissions	tCO2	256,741	256,741	256,741	256,741	256,741	256,741

2023	**2024**	**2025**	**2026**	**Average**	**Total**
139,381,820	139,381,820	139,381,820	139,381,820	139,381,820	1,393,818,200
1,842	1,842	1,842	1,842	1,842	
256,741	256,741	256,741	256,741	256,741	2,567,413

Source: CER spreadsheet

Project Emissions

Project emissions are calculated as follows:

$$PE_y = DPE_y + IPE_y \quad \text{Equation (4)}$$

Where:

PE_y = Project emissions in year *y* (tCO_2)

DPE_y = Direct project emissions in year *y* (tCO_2)

IPE_y = Indirect project emissions in year *y* (tCO_2)

Determination of direct project emissions (*DPE_y*)

$$DPE_y = DPE_{FC,y} + DPE_{EC,y}$$ Equation (5)

Where:

$DPE_{FC,y}$ = Direct project emissions from fuel consumption in year *y* (tCO_2)

$DPE_{EC,y}$ = Direct project emissions from electricity consumption in year *y* (tCO_2)

Determination of indirect project emissions (*IPE_y*)

$$IPE_y = P_y \times \sum_i \left(D_{ind,i,1-4} \times EF_{pkm,i,1-4} \times 10^{-6}\right)$$ Equation (6)

Where:

IPE_y = Indirect project emissions in year *y* (tCO_2)

P_y = Total number of passengers transported in year *y*

$EF_{pkm,i,1-4}$ = Emission factor per passenger-kilometer of mode *i* in years 1 and 4 of the crediting period (gCO_2/pkm)

$D_{ind,i,1-4}$ = Average indirect project trip distance of surveyed passengers using mode *i* in years 1 and 4 of the crediting period (km)

Constant passenger numbers and electricity usage of metro (based on the average recorded previous years) and constant modes shares as well as trip distances per mode to/from the metro (indirect project emissions) are assumed for the entire 2nd crediting period for the purpose of projections of baseline emissions.

Parameter	Unit	2017	2018	2019	2020	2021	2022
Passengers	passengers	139,381,820	139,381,820	139,381,820	139,381,820	139,381,820	139,381,820
Electricity usage	kWh	41,000,000	41,000,000	41,000,000	41,000,000	41,000,000	41,000,000
Indirect project emission factor per passenger	gCO_2/passenger	445	445	445	445	445	445

Project emissions	**tCO_2**	**101,167**	**101,167**	**101,167**	**101,167**	**101,167**	**101,167**

2023	2024	2025	2026	Average	Total
139,381,820	139,381,820	139,381,820	139,381,820	139,381,820	975,672,740
41,000,000	41,000,000	41,000,000	41,000,000	41,000,000	328,000,000
445	445	445	445	445	
101,167	**101,167**	**101,167**	**101,167**	**101,167**	**1,011,673**

Leakage Emissions

Leakage emissions include the following sources:

- Emissions due to changes of the load factor of taxis and buses of the baseline transport system due to the project; and,
- Emissions due to reduced congestion on affected roads, provoking higher average vehicle speed, plus a rebound effect.
- Upstream emissions of gaseous fuels ($LE_{UP,y}$).

Determination of emissions due to change of load factor of buses, taxis or rickshaws

The load factor of buses, taxis and rickshaws is only monitored in the years 1 and 4 in accordance with the methodology. This has its logic as the leakage was to determine if the project has a short- or medium-term impact on load factors of other modes of transport. Long-term changes cannot be attributed to the metro in a cause-effect manner but are due to urban development affecting and transportation changes affecting transport modes (e.g. rising of ride-hailing services). No leakage monitoring therefore takes place in the 2nd crediting period and leakage is taken as 0.

Determination of emissions due reduced congestion ($LE_{CON,y}$)

KMRL has not taken away any existing road space. Therefore, based on ACM0016 Version 05.0 no monitoring is require and leakage is taken as 0.

Upstream emissions from gaseous fuels

Upstream leakage of gaseous fuels shall be only included if the project vehicles consume more gaseous fuels than baseline vehicles. Project metro only consumes electricity. Therefore, in the baseline more gaseous fuels are used than in the project situation. Upstream emissions from gaseous fuels are therefore not considered and leakage is taken as 0.

Leakage for each year and entire period: 0

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 1	256,741	101,167	0	155,574
Year 2	256,741	101,167	0	155,574
Year 3	256,741	101,167	0	155,574
Year 4	256,741	101,167	0	155,574
Year 5	256,741	101,167	0	155,574
Year 6	256,741	101,167	0	155,574
Year 7	256,741	101,167	0	155,574
Year 8	256,741	101,167	0	155,574
Year 9	256,741	101,167	0	155,574
Year 10	256,741	101,167	0	155,574
Total	2,567,413	1,011,673	0	1,555,740
Total number of crediting years	10			
Annual average over the crediting period	256,741	101,167	0	155,574

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored *ex-post*

Data / Parameter Table 2.

Data / Parameter:	D_i
Methodology reference	Tool 18 Version 1.0
Data unit	Kilometers
Description	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category i
Measured/calculated /default	Not Applicable
Data source	Survey

Value(s) of monitored parameter applied with basis	-
Measurement/ Monitoring equipment	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Survey of the project passengers in year 1 and 4 of the first crediting period asking about the entry and exit stations in the project system and noting electricity-based or road-based vehicle category i each surveyed passenger used prior to shifting to the project system (Si)
Recording frequency	-
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	-

Data / Parameter:	S_i
Methodology reference	Tool 18 Version 1.0
Data unit	%
Description	Share of passengers who shifted from electricity based or road-based vehicle category i
Measured/calculated /default	Not Applicable
Data source	Survey
Value(s) of monitored parameter applied with basis	-

<table>
<tr><td>Measurement/ Monitoring equipment</td><td><table>
<tr><td colspan="2"></td></tr>
<tr><td>Type of meter(s)</td><td>-</td></tr>
<tr><td>Location of meter(s)</td><td>-</td></tr>
<tr><td>Accuracy of meter(s)</td><td>-</td></tr>
<tr><td>Serial number of meter(s)</td><td>-</td></tr>
<tr><td>Calibration frequency</td><td>-</td></tr>
<tr><td>Date of Calibration/ validity</td><td>-</td></tr>
<tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr>
<tr><td>Calibration Status</td><td>-</td></tr>
</table></td></tr>
<tr><td>Frequency of Measuring/reading</td><td>Survey of the project passengers in year 1 and 4 of the first crediting period asking about electricity-based or road-based vehicle category i each surveyed passenger used prior to shifting to the project system and noting the entry and exit stations in the project system (Di,y). The data from the survey in year 1 shall be used for the first three years of the first crediting period while the data from the survey in year 4 shall be used until the end of the crediting periods of the project activity</td></tr>
<tr><td>Recording frequency</td><td>-</td></tr>
<tr><td>Calculation method (if applicable)</td><td>NA</td></tr>
<tr><td>QA/QC procedures</td><td>NA</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions.</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data / Parameter:	P_y
Methodology reference	Tool 18 Version 1.0
Data unit	Passengers
Description	Number of passengers travelled by the project system in year y
Measured/calculated /default	Measured
Data source	Automated fare collection system
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Annually
Recording frequency	Annually
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions.
Additional comments	-

Data / Parameter:	$EC_{PJ,j,y;}$
Methodology reference	Tool 05 Version 3.0
Data unit	MWh/yr
Description	Quantity of electricity consumed by the project electricity consumption source j in year y
Measured/calculated /default	Measured
Data source	Direct measurement or calculated based on measurements from more than one electricity meters
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Continuous measurement
Recording frequency	monthly recording
Calculation method (if applicable)	NA
QA/QC procedures	When the Main Metering System and/or any component thereof is found to be outside the acceptable limit of accuracy or otherwise not functioning properly, energy meters will be repaired, re-calibrated or replaced as soon as possible. This will be done by the relevant agency of the state with project owner having no control over the procedure and timing.
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter:	$EF_{pkm,i,1-4}$
Methodology reference	ACM0016 V5.0
Data unit	tCO_2/pkm
Description	Emission factor per passenger-kilometer of mode i in years 1 and 4 of the crediting period y
Measured/calculated /default	Calculated
Data source	Calculated based on equations 2 and 3 from the “TOOL18: Baseline emissions for modal shift measures in urban passenger transport”.
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Calculated based on the “TOOL18: Baseline emissions for modal shift measures in urban passenger transport”, through surveys conducted in the end of years 1 and 4 of the crediting period,.
Recording frequency	-
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter:	$DPE_{EC,y}$
Methodology reference	ACM0016 V5.0
Data unit	tCO_2
Description	Direct project emissions from electricity consumption in year y
Measured/calculated /default	Calculated
Data source	Calculated based on the TOOL05
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	As per the TOOL05
Recording frequency	As per the TOOL05
Calculation method (if applicable)	As per the TOOL05
QA/QC procedures	As per the TOOL05
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter:	$N_{i,1\text{-}4}$
Methodology reference	ACM0016 V5.0
Data unit	Number of vehicles
Description	Number of vehicles category i in years 1 and 4 of the crediting period
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities based on vehicle registration statistics from the respective city or data from vehicle control stations (technical and emission control stations)
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Studies conducted at the end of years 1 and 4 of the crediting period
Recording frequency	-
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter:	$EF_{km,i,1-4}$
Methodology reference	ACM0016 V5.0
Data unit	gCO_2/km
Description	Emission factor per kilometer for vehicle category i in years 1 and 4 of the crediting period
Measured/calculated /default	Calculated
Data source	Calculated based on equation 1 from the TOOL18
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Calculated based on surveys conducted at the end of years 1 and 4 of the crediting period, based on the TOOL18.
Recording frequency	-
Calculation method (if applicable)	As per the TOOL18
QA/QC procedures	As per the TOOL18
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter:	$OC_{i,t}$
Methodology reference	ACM0016 V5.0
Data unit	Passengers
Description	Average occupancy of vehicle category i in the period of time t
Measured/calculated /default	Measured
Data source	KMRL
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Studies/surveys conducted at the end of years 1 and 4 of the crediting period
Recording frequency	-
Calculation method (if applicable)	NA
QA/QC procedures	Emissions are calculated per passenger and then expanded to the total passengers transported based on the expansion factor per passenger.
Purpose of data	Calculation of project emissions.
Additional comments	Based on visual occupancy studies for all vehicle categories. For buses the occupancy rate is based on boarding-alighting studies, electronic smart tickets or on visual occupancy studies with expansion factors for routes served to determine the average occupancy rate along the entire route. As an alternative for buses, the occupancy rate can be based on average trip distance of bus passengers, total passengers and total distance driven of buses. For taxis, the driver should not be counted.

Data / Parameter:	$CV_{i,t}$
Methodology reference	ACM0016 V5.0
Data unit	Passengers
Description	Average capacity of vehicle category i in the period t (passengers)
Measured/calculated /default	Measured
Data source	Official statistics
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Studies/surveys conducted at the end of years 1 and 4 of the crediting period
Recording frequency	-
Calculation method (if applicable)	NA
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	-

Data / Parameter:	$BSCR_y$
Methodology reference	ACM0016 V5.0
Data unit	Number of vehicles
Description	Cumulative bus units displaced by the project on the trunk lanes as a result of the project in year y
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities, official statistics or studies ordered by project proponent
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Yearly
Recording frequency	Yearly
Calculation method (if applicable)	NA
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	Used to calculate ARS_y. The number of buses circulated in trunk lanes prior to the construction of the project activity that have ceased to circulate in trunk lanes due to the project activity are to be considered. These buses can be retired or used in another part of the network

Data / Parameter:	$TD_{i,1-4}$
Methodology reference	ACM0016 V5.0
Data unit	Km
Description	Average trip distance driven by vehicle category i on the affected roads in years 1 and 4 of the crediting period
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities or project owner
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><td colspan="2"></td></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Surveys conducted at the end of years 1 and 4 of the crediting period
Recording frequency	-
Calculation method (if applicable)	NA
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	Electronic or visual tracking of samples of vehicles entering/exiting the affected roads registering the entry and the exit point and measuring the distance by GPS or other means

Data / Parameter:	$MS_{i,1-4}$
Methodology reference	ACM0016 V5.0
Data unit	%
Description	Net share of passengers using the Urban rail which would have used mode i in the years 1 and 4 of the crediting period
Measured/calculated /default	Measured
Data source	Survey conducted by an external survey company
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	The survey is conducted at the end of years 1 and 4 of the crediting period
Recording frequency	-
Calculation method (if applicable)	NA
QA/QC procedures	As per ACM0016 Version 05 for the survey design.
Purpose of data	Calculation of project emissions.
Additional comments	Only used for leakage calculation of rebound effect (reduced amount of cars and taxis)

Data / Parameter:	$V_{P,1-4}$
Methodology reference	ACM0016 V5.0
Data unit	Km/h
Description	Average trip distance driven by vehicle category i on the affected roads in years 1 and 4 of the crediting period
Measured/calculated /default	Not Applicable
Data source	Municipal transit authorities or project owner
Value(s) of monitored parameter applied with basis	-

Measurement/ Monitoring equipment	<table><tr><th colspan="2"></th></tr><tr><td>Type of meter(s)</td><td>-</td></tr><tr><td>Location of meter(s)</td><td>-</td></tr><tr><td>Accuracy of meter(s)</td><td>-</td></tr><tr><td>Serial number of meter(s)</td><td>-</td></tr><tr><td>Calibration frequency</td><td>-</td></tr><tr><td>Date of Calibration/ validity</td><td>-</td></tr><tr><td>Reference No. of Calibration Certificates</td><td>-</td></tr><tr><td>Calibration Status</td><td>-</td></tr></table>
Frequency of Measuring/reading	Yearly
Recording frequency	Yearly
Calculation method (if applicable)	NA
QA/QC procedures	-
Purpose of data	Calculation of project emissions.
Additional comments	-

For Parameters to be monitored for E+/S+ assessments and SDG labels (positive impacts)

Data / Parameter:	**CO_2 emissions (EA03)**
Purpose:	To demonstrate the positive impact and do-no-net-herm, associated with CO2 emission, on environment with respect to the baseline scenario.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	CO2 emission reduction causes a positive impact and positively contributes to SDG 13 as the project activity involves generation of electricity from clean solar energy.
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG	<table><tr><th colspan="2"></th></tr><tr><td>Parameter to be monitored</td><td>CO_2 emissions</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>

Remarks	NA

Data / Parameter:	**Long-term jobs (> 10 year) created/ lost (SJ01)**
Purpose:	Number of persons employed due to the project activity for more than 10 years.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	This aspect has a positive impact. There is no associated environment /social/ SDG risk.
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Long term jobs</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>
Remarks	NA

Data / Parameter:	**New short-term jobs (< 1 year) created/ lost (SJ02)**
Purpose:	Number of persons employed due to the project activity for less than a year.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	This aspect has a positive impact. There is no associated environment /social/ SDG risk.
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Short term jobs</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>

Remarks	NA

Data / Parameter:	**Sources of income generation increased / reduced (SJ03)**
Purpose:	Number of persons have increased their daily income generation due to the project activity for less than a year.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Additional employment and O&M services in the project region
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Employee records, O&M contracts</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>Minimum wages in compliance with the Labour Act</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>
Remarks	NA

Data / Parameter:	**Disease prevention (SHS01)**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	The project activity conducts health camps for stakeholders and improves efficiency of health services. Thus, contribute to positive social impact and justify SDG 3.8

Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Health Camps</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>-</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>
Remarks	NA

Data / Parameter:	**Reducing / increasing accidents/Incidents/fatality (SHS03)**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Cause of Physical hazards in project sites due to human intervention or technical failure or emergency
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of trainings & physical hazards/incidents</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>In compliance with the EHS policy</td></tr><tr><td>QA/QC</td><td>Records will be maintained and archived till the end of the crediting period</td></tr></table>
Remarks	NA

Data / Parameter:	**Specialized training / education to local personnel (SE01)**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.

Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	The project activity conducts skill development training and occupational safety trainings for both in house and new qualified people. Trainings also help in effective knowledge dissemination. Thus, contribute to positive social impact and justify SDG 4.4
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of Persons Trained</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>-</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>
Remarks	NA

Data / Parameter:	**Educational services improved or not (SE02)**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	The project activity conducts educational camps that also help in effective knowledge dissemination. Thus, contribute to positive social impact and justify SDG 4.4
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of Persons benefited</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>-</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>
Remarks	NA

Data / Parameter:	**Poverty alleviation (more people above poverty level) (SW03)**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	The project activity will lead to the employment generation
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of locals employed</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>-</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>
Remarks	NA

Data / Parameter:	**Women's empowerment (SW06)**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	The project activity generates permanent and temporary women employment opportunities to the local communities, thus contributing to positive social impact and justify SDG 1.
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of women employed</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>-</td></tr><tr><td>QA/QC</td><td>-</td></tr></table>

Remarks	NA

SDG Mapping

Data / Parameter:	**SDG 1: End poverty in all its forms everywhere**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Number of persons employed considering both direct and indirect (engagement of persons through contracting agency).
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of persons employed</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr><tr><td>QA/QC</td><td>The number of persons employed is mentioned in the employment register.</td></tr></table>
Remarks	NA

Data / Parameter:	**SDG 3: Ensure healthy lives and promote well-being for all at all ages**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Improved health services and medicines availability.

Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of death or Injuries in road accidents</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr><tr><td>QA/QC</td><td>Record from District office</td></tr></table>
Remarks	NA

Data / Parameter:	**SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Skill Improvement
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	<table><tr><td colspan="2"></td></tr><tr><td>Parameter to be monitored</td><td>Number of persons trained</td></tr><tr><td>Frequency of monitoring</td><td>Yearly</td></tr><tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr><tr><td>QA/QC</td><td>The number of persons trained will be obtained from the training record</td></tr></table>
Remarks	NA

Data / Parameter:	**SDG 5- Achieve gender equality and empower all women and girls**
Purpose:	To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.

<table>
<tr><td>Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.</td><td>Improved gender equality.</td></tr>
<tr><td>Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG</td><td><table>
<tr><td colspan="2"></td></tr>
<tr><td>Parameter to be monitored</td><td>No of female employee at leading position</td></tr>
<tr><td>Frequency of monitoring</td><td>Yearly</td></tr>
<tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr>
<tr><td>QA/QC</td><td>The number of female employee will be obtained from the employee record</td></tr>
</table></td></tr>
<tr><td>Remarks</td><td>NA</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>SDG 7. Ensure access to affordable, reliable, sustainable, and modern energy for all</td></tr>
<tr><td>Purpose:</td><td>To ensure and quantify the impact towards SDG goal 07 by implementation of this project activity</td></tr>
<tr><td>Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.</td><td>Generation and consumption of electricity by implementation of clean technology which would otherwise have been drawn from the grid (the Indian grid being mainly dominated by fossil fuel). The project increases the renewable energy share in India’s energy production mix.</td></tr>
<tr><td>Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG</td><td><table>
<tr><td colspan="2"></td></tr>
<tr><td>Parameter to be monitored</td><td>Quantity of electricity generated</td></tr>
<tr><td>Frequency of monitoring</td><td>Monthly</td></tr>
<tr><td>Legal /regulatory / corporate limits (if any)</td><td>There is no legal regulatory and corporate limit</td></tr>
<tr><td>QA/QC</td><td>Would be provided during verification</td></tr>
</table></td></tr>
<tr><td>Remarks</td><td>Enhances the share of installed electricity generation from renewable energy source</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>SDG 8- Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</td></tr>
<tr><td>Purpose:</td><td>To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.</td></tr>
<tr><td>Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.</td><td>Improved living standard of localities.</td></tr>
<tr><td>Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG</td><td><table>
<tr><td colspan="2"></td></tr>
<tr><td>Parameter to be monitored</td><td>Number of local employment generation including both direct or indirect employment during project construction and project operation</td></tr>
<tr><td>Frequency of monitoring</td><td>Yearly</td></tr>
<tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr>
<tr><td>QA/QC</td><td>Employee logbook or register and confirmation from contractual service agency</td></tr>
</table></td></tr>
<tr><td>Remarks</td><td>NA</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>SDG 9- Industry, innovation and infrastructure (9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all)</td></tr>
<tr><td>Purpose:</td><td>To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.</td></tr>
<tr><td>Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.</td><td>Improved living standard of localities.</td></tr>
</table>

<table>
<tr><td>Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG</td><td><table>
<tr><td colspan="2"></td></tr>
<tr><td>Parameter to be monitored</td><td>Passenger and freight volumes, by mode of transport</td></tr>
<tr><td>Frequency of monitoring</td><td>Yearly</td></tr>
<tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr>
<tr><td>QA/QC</td><td>E logbook or E register</td></tr>
</table></td></tr>
<tr><td>Remarks</td><td>NA</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>SDG 13- Take urgent action to combat climate change and its impacts (same parameter is used to monitor EA03)</td></tr>
<tr><td>Purpose:</td><td>To demonstrate positive impacts of aspects wrt baseline scenario / BAU / pre-existing scenario and to demonstrate that they do not cause any net harm to environment / society or have an impact on SDG as per selected indicators.</td></tr>
<tr><td>Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.</td><td>Mitigation of climate change. Reduction global warming</td></tr>
<tr><td>Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG</td><td><table>
<tr><td colspan="2"></td></tr>
<tr><td>Parameter to be monitored</td><td>Emission reductions achieved per year, tCO_2/year</td></tr>
<tr><td>Frequency of monitoring</td><td>Yearly</td></tr>
<tr><td>Legal /regulatory / corporate limits (if any)</td><td>NA</td></tr>
<tr><td>QA/QC</td><td>-</td></tr>
</table></td></tr>
<tr><td>Remarks</td><td>NA</td></tr>
</table>

B.7.2. Data and parameters to be monitored for E+/S+ assessments (negative impacts)

<table>
<tr><td>Data / Parameter:</td><td>Solid Waste Pollution Hazardous wastes (EL02)</td></tr>
<tr><td>Purpose:</td><td>To mitigate/reduce an environmental impact identified as Harmful in the risk assessment and to develop a Program of Risk Management Actions plan to address the risk EL02</td></tr>
<tr><td>Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.</td><td>Improper disposal of generated hazardous waste may create soil contamination.</td></tr>
<tr><td>Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate “harmless” condition or demonstrate Impact on SDG</td><td>
<table>
<tr><td colspan="2"></td></tr>
<tr><td>Parameter to be monitored</td><td>Hazardous wastes</td></tr>
<tr><td>Frequency of monitoring</td><td>Yearly</td></tr>
<tr><td>Legal /regulatory / corporate limits (if any)</td><td>Not Applicable</td></tr>
<tr><td>QA/QC</td><td>Record will be maintained and summited during verification.</td></tr>
</table>
</td></tr>
<tr><td>Program of Risk Management Actions to mitigate risk related to aspect (if any for aspects assessed to be harmful)</td><td>
<table>
<tr><th>S.No.</th><th>Action and targets</th><th>Responsibility</th><th>Resource Requirement</th><th>Target to be Achieved by (insert date)</th><th>Key Performance Indicators (KPI)</th><th>Targets achieved on (insert date)</th></tr>
<tr><td>1</td><td>Hazardous records of storage and disposal</td><td>Project owner</td><td>01</td><td>16/06/2027</td><td>Hazardous waste records.</td><td></td></tr>
<tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="3">Date of Closing the Program:</td><td></td><td colspan="3"></td></tr>
<tr><td colspan="7"></td></tr>
</table>
</td></tr>
</table>

Data / Parameter:	**E - Waste (EL04)**
Purpose:	To mitigate/reduce an environmental impact identified as Harmful in the risk assessment and to develop a Program of Risk Management Actions plan to address the risk of EL04

Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Improper disposal of generated e-waste may create soil contamination.
Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	

Parameter to be monitored	E-Waste (EL04)
Frequency of monitoring	Yearly
Legal /regulatory / corporate limits (if any)	Not Applicable
QA/QC	Record of will be maintained and summited during verification.

Program of Risk Management Actions to mitigate risk related to aspect (if any for aspects assessed to be harmful)

S.No.	Action and targets	Responsibility	Resource Requirement	Target to be Achieved by *(insert date)*	Key Performance Indicators (KPI)	Targets achieved on *(insert date)*
1	E-waste records of storage and disposal	Project owner	01	16/06/2027	E-waste records	
2						
3						
4						
5						
6						
Date of Closing the Program:						

Data / Parameter:	**Solid waste Pollution from Batteries (EL05)**
Purpose:	To mitigate/reduce an environmental impact identified as harmful in the risk assessment and to develop a Program of Risk Management Actions plan to address the risk of EL05.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Improper disposal of generated Batteries waste may create soil contamination.

Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	

Parameter to be monitored	Waste from Batteries (EL05)
Frequency of monitoring	Yearly
Legal /regulatory / corporate limits (if any)	Not Applicable
QA/QC	Record of will be maintained and summited during verification.

Program of Risk Management Actions to mitigate risk related to aspect (if any for aspects assessed to be harmful)

S.No.	Action and targets	Responsibility	Resource Requirement	Target to be Achieved by *(insert date)*	Key Performance Indicators (KPI)	Targets achieved on *(insert date)*
1	Batteries -waste records of storage and disposal	Project owner	01	16/06/2027	Batteries-waste generated	
2						
3						
4						
5						
6						
Date of Closing the Program:						

Data / Parameter:	**Solid waste Pollution from end-of-life products/ equipment (EL06)**
Purpose:	To mitigate/reduce an environmental impact identified as harmful in the risk assessment and to develop a Program of Risk Management Actions plan to address the risk of EL06.
Describe the related environment /social/ SDG risk or SDG impact as a function of likelihood of occurrence and severity of impact.	Improper disposal of generated End of life products/ equipment may create soil contamination.

Describe the parameters to be monitored to demonstrate compliance with requirements to demonstrate "harmless" condition or demonstrate Impact on SDG	

Parameter to be monitored	End-of-life products/ equipment (EL06)
Frequency of monitoring	Yearly
Legal /regulatory / corporate limits (if any)	Not Applicable
QA/QC	Record of will be maintained and summited during verification.

Program of Risk Management Actions to mitigate risk related to aspect (if any for aspects assessed to be harmful)

S.No.	Action and targets	Responsibility	Resource Requirement	Target to be Achieved by *(insert date)*	Key Performance Indicators (KPI)	Targets achieved on *(insert date)*
1	End of life shall be stored and disposed-off as per the guidance of national/ local laws.	Project owner	01	16/06/2027	End of life waste generated	
2						
3						
4						
5						
6						
Date of Closing the Program:						

B.7.3. Sampling plan

Sampling is used for the following parameters:

1. Passenger survey to determine indirect project emissions as well as baseline emissions. This includes the parameters MSi, FEX, BTD, and IPTD.
2. Occupation rate surveys for taxis and motorized rickshaws

1. A. SURVEY

The methodological design of the survey is presented in detail.

2. Table 18: Technical Summary Data Sheet of the Survey Strategy and Sample Design Metro Delhi Passenger Survey

Parameters	Main parameters: • Baseline emissions; • Indirect project emissions. Secondary parameters and inputs: • Proportion of passengers using each mode of transport, with the project and in absence of the project; • The average distance travelled by these modes with the project and in absence of the project
Target population	Passengers over 12 years using the Metro Delhi.
Sample frame	Passenger flow in all the stations Phase II of the Metro Delhi.
Sample design	Two staged probabilistic design: First stage: stratified – simple random sampling (SRS); Second stage: systematic sampling based on passenger's flow per station. Stratum: Lines and Stations. Sub stratum: Days in the week and hours.
Relative error level (CV)[15]	For the survey a global desired level of precision (relative standard error or coefficient of variation – CV) between 5% and 10% for the parameters of interest is targeted, which implies at the same time having precision levels of 90/10. Results obtained are based on a 95% confidence level using the more conservative boundary.
Coverage	Urban area where the Metro Delhi operates.
Size of Universe	Generally, in one day Metro Delhi transports around 1.4 million passengers on the Phase II lines69.
Sample size	The sample size is around 2,000 surveys in each survey.
Pilot Test	The pilot test corresponds to a survey realized July 2008 during an entire week in a continuous manner. 804 passengers of Delhi Metro were interviewed. Since the project start 6 surveys (2 per annum) have already been carried out which allowed to adjust the survey sample size based on the calculated CV.

[15] Relative error level refers to the coefficient of variation (CV), which is calculated as the ratio between the standard deviation of the average and the population average.

Sample frequency	2x annually during an entire week (compulsory based on the methodology is for year 4 only 1 survey).
Method of information collection	The information is obtained through the face-to-face application of the established questionnaire on a random base.

Survey Objective

The survey objective is to determine:

- The baseline emissions caused by passengers which use Metro Kochi Phase I and in absence of latter would have used other modes of transport to realize their trip;

- The indirect project emissions of passengers using Metro Kochi Phase II which correspond to the emissions caused from the trip origin to the metro entry station and from the metro exit station to the final destination.

3. Target Population

The target population are passengers over 12 years of age. Smaller children are excluded due to problems in answering the questions. Also, smaller children in general are accompanied by their parents or an adult and thus have the same trip sequence as the adult person.

4. Geographical Coverage

The geographical coverage is the area where metro Kochi operates (project boundary).

5. Sample Frequency

The surveys take place during an entire week. The selected weeks do not correspond to a public holiday and are representative for the average demand for transport services in the considered year.

6. Sample Frame

The simple frame is the passenger flow in all the stations of Phase II Metro Kochi. Data for the passenger frame is obtained from the system manager.

7. Survey Design

The survey was conducted among Kochi Metro commuters at KMRL phase-2 stations. The survey design is identical to previously realized surveys. To get a better representation and complete coverage of target population, this target sample was distributed among stations, days and time slots:

- Target Population: KMRL Commuters (Above 12 years)
- Total Sample Size: 2,000 per survey
- Sampling Frame: Passenger flow at the stations (as per the passenger flow data given)
- Coverage: 84 Metro stations of KMRL phase-2
- Sampling Method: Two stage stratified sampling

o Stratum: Stations

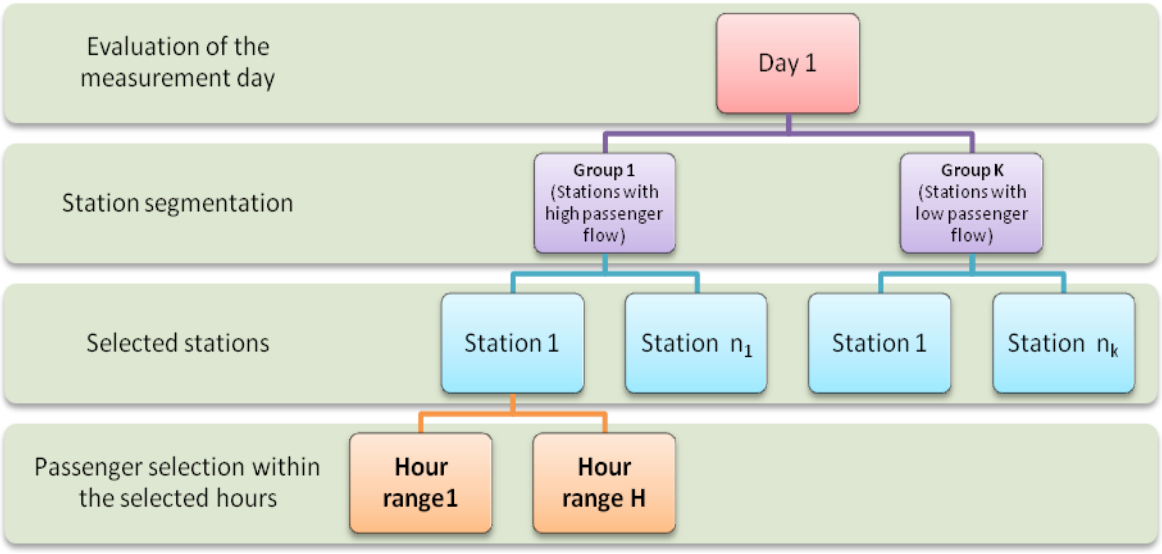
o Sub-Stratum: Days in the weeks & hours

o Proportionate allocation of passenger flow among these stratum

At first the relevant stratums i.e. “station” & “timeslots” and their actual representation in the population were identified. After stratification, a probability sample was determined for each stratum. The proportionate allocation was used for determining the sample size of each stratum, i.e. the sample size for each stratum (station/timeslot) is proportionate to the population size of that stratum. Thus, each stratum has a “sampling fraction”.

The given weekly passenger was partitioned into groups i.e. stations, days and timeslots. The stratification model used is represented by the following scheme, where the process for a specific day is shown which applies routinely for the seven measurement days.

8. Figure 3: Survey Stratification Model



The stations were stratified into three strata i.e. heavy, medium and low traffic. This stratification was done through the 3-cluster solutions. On the basis of that distribution, the sampling fraction for each stratum was determined.

For the timeslot stratification, the average hourly traffic flow for all 7 days was calculated. The timeslots were classified based on the variations in the average traffic flow. On the average traffic flow data, a 5-cluster solution was performed and the 5 time slots (stratums) were defined. Proportionate allocation uses the sampling fraction in each of the strata that is proportional to that of the total population. The size of the sample in each stratum is taken in proportion to the size of the stratum.

The sampling fraction of the day is the ratio between the total traffic flow of that day and total traffic flow of the week. The sample of one day is allocated to the pre-defined stratum (stations and time slots). Sampling

Fraction for n1 station at t1 hour = (Traffic flow at n1 station during t1 hour for total week) / (total traffic follow of the week)

9. Sample Selection

The selection method guarantees a random and non-biased selection process especially important in face- to-face interviews. The random distribution allows that the sample mirrors the total population in any other non-observed variables such as age, gender, religion, personal preferences etc. The selection of stations is carried out according to a SRS design, through the negative coordinated algorithm. The same happens for the defined hour ranges: within each range a specific hour is selected under this method for the sample selection. Given that there is no reference frame or list frame for the identification of KMRL users, the selection of the sample in the last stage is performed according to the systematic sampling design, replicated identically for each stratum and considering the following steps:

- A random starting point is generated according to the statistics tables of uniform distribution between 1 and the average flow of passengers in the evaluation hour;
- Systematic selection of passengers: every n passenger entering the station, starting with the random number. In this way, if the random number is 10, the first passenger selected is the 10th that enters the station, the 2nd n+10 and thus successively every n passenger. The number n, called selection interval is determined based on the passenger flow per hour and the sample distribution of the specific measurement day.

10. Method for Information Collection

The information is obtained through the face-to-face application of the established questionnaire. In a briefing session, the questionnaire was explained in the detail and mock sessions were taken by the supervisors to ensure the understanding of interviewers.

11. Sample Size Determination

The results of the 6 surveys since 2011 were used to determine the size of the sample. The estimated coefficient variation for the baseline and the project emissions was calculated for this purpose. The sample size of 2,000 users of Metro showed to be sufficient based on the CV and the statistical analysis of the surveys realized previously.

12. Data Verification and Validation Including QA and QC

Criteria for Evaluating Data Consistency

Considering that in each one of the years there will be at least two measurements, the weekly measurement and the test-retest, through these the consistency on information collection is guaranteed. The assessment of consistency can be carried out by three supplementary statistical methods

13. A mean difference test is performed through a t – Student test, where the differences presented between both measurements are evaluated, for: 1.Proportion of users that use each type of modes of transport and 2. Average trip travel distance.

To perform the mean difference test, it is necessary to determine beforehand, if the two samples come from the same population. Thereafter a F test is carried out to determine the variability difference between one and the other. To assess that data used to estimate the study parameters follow the same distribution the Mann Whitney non-parametric U test and the Wilcoxon T test can be used.

14. To evaluate the users proportion per modes of transport, the Pearson's Chi Square can be used, where categories are defined for each mode of transport.

15. Globally and internally in each survey realized, consistency of data reported in the survey may be assessed through the Cronbach alpha coefficient. In practice it is assumed that values higher than 0.7 in the coefficient indicate an adequate consistency degree. Values over 0.9 should be rechecked to avoid redundancy of data.

For the internal consistency the Cronbach alpha coefficient is used whilst to test for consistency between different periods of measurement the first two options of testing are used.

The Cronbach alpha coefficient will be calculated for each stratum established as these a priori control the variations in the responses and therefore the control eliminates biases which could be generated due to hetereogenity and inconsistency in information.

With the goal of evaluating the possible correlation between BE and IPE a hypothesis test based on the Pearson or Spearman coefficient is made. The parameter to determine the existence of correlation is the *p* value. If the *p* value is less than 0.05 (significance value) it is concluded that the correlation is significant.

If a correlation between BE and IPE exists 70 the variance associated to the estimator (defined as the difference between the two parameters) would have a covariance different from 0. If the variables *x* and *y* are correlated then:

Var(X-Y) = Var(X) + Var(Y) – 2 Cov (X,Y), where COV (X,Y) is not 0.

If the correlation is significant complex estimators and alternative methods of variance need to be used which do not guarantee however that the estimators are unbiased and have a minimal variance. On the other hand if the correlation is non-significant the estimation of the two parameters BE and IPE separately leads to the same result as calculating them jointly.

Realizing the estimation of BE and IPE guarantees that even in the case of correlation we have no problem with the bias in the variance of the estimators i.e. even if we determine correlation the results are correct and no additional step needs to be taken. In the case of having no correlation we could also determine directly the difference between BE and IPE per passenger reaching the same result (in the case of correlation it is necessary in all cases to make the estimation of BE and IPE separately).

Therefore it is preferable, as suggested in these procedures, to calculate the two parameters separately and to determine for each one an unbiased level of error. Additionally for each parameter separate confidence levels can thus be constructed. If the two confidence intervals overlap we have an indication of non- significant differences between BE and IPE.

Survey Realization

The survey must be realized through a company with minimum 3 years of experience in comparable surveys in the respective country to ensure a professional survey execution. Following principles are to be followed in the survey realization:

- Non-responses should be recorded;
- Record and store all original surveys;
- Surveys are conducted at KMRL stations when people wait for KMRL-boarding. It should be avoided to realize the survey with people de-boarding the KMRL as latter will not want to invest time in a survey thus potentially giving wrong answers.

16. Calculation of Trip Distance in the Survey

Trip distances need to be determined for each surveyed passenger. The following procedures are applied:

- For NMT, others and induced traffic this is not required as the applied EF is “0”

- For users of buses either

o the shortest possible geographical distance based on electronic maps or measuring the distance between the two points with GPS or a comparable mean or through distance measurement on maps.

or

o Measuring the actual distance from the bus entry station to the bus exit station based on (electronic) route maps of the bus operators with official distances or measuring e.g. with GPS the distances between the involved stations

- For users of passenger cars, taxis, motorcycles, motorized rickshaws and other modes of motorized transport except buses based on the shortest possible geographical distance based on electronic

B.7.4. Other elements of the monitoring plan

Data Verification and Validation Including QA and QC Criteria for Evaluating Data Consistency

Considering that in each one of the years there will be at least two measurements, the weekly measurement, and the test-retest, through these the consistency on information collection is guaranteed.
The assessment of consistency can be carried out by three supplementary statistical methods:
1. A mean difference test is performed through a t – Student test, where the differences presented between both measurements are evaluated, for: 1. Proportion of users that use each type of modes of transport and 2. Average trip travel distance.

To perform the mean difference test, it is necessary to determine beforehand, if the two samples come from the same population. Thereafter a F test is carried out to determine the variability difference between one and the other. To assess that data used to estimate the study parameters follow the same distribution the Mann Whitney non-parametric U test and the Wilcoxon T test can be used.
2. To evaluate the users proportion per modes of transport, the Pearson's Chi Square can be used, where categories are defined for each mode of transport.
3. Globally and internally in each survey realized, consistency of data reported in the survey may be assessed through the Cronbach alpha coefficient. In practice it is assumed that values higher than 0.7 in the coefficient indicate an adequate consistency degree. Values over 0.9 should be rechecked to avoid redundancy of data.
For the internal consistency the Cronbach alpha coefficient is used whilst to test for consistency between different periods of measurement the first two options of testing are used.
The Cronbach alpha coefficient will be calculated for each stratum established as these a priori control the variations in the responses and therefore the control eliminates biases which could be generated due to hetereogenity and inconsistency in information.

With the goal of evaluating the possible correlation between BE and IPE a hypothesis test based on the Pearson or Spearman coefficient is made. The parameter to determine the existence of

correlation is the *p* value. If the *p* value is less than 0.05 (significance value) it is concluded that the correlation is significant.
If a correlation between BE and IPE exists70 the variance associated to the estimator (defined as the difference between the two parameters) would have a covariance different from 0. If the variables *x* and *y* are correlated then:
Var(X-Y) = Var(X) + Var(Y) – 2 Cov (X,Y), where COV (X,Y) is not 0.
If the correlation is significant complex estimators and alternative methods of variance need to be used which do not guarantee however that the estimators are unbiased and have a minimal variance. On the other hand if the correlation is non-significant the estimation of the two parameters BE and IPE separately leads to the same result as calculating them jointly.
Realizing the estimation of BE and IPE guarantees that even in the case of correlation we have no problem with the bias in the variance of the estimators i.e. even if we determine correlation the results are correct and no additional step needs to be taken. In the case of having no correlation we could also determine directly the difference between BE and IPE per passenger reaching the same result (in the case of correlation it is necessary in all cases to make the estimation of BE and IPE separately).
Therefore it is preferable, as suggested in these procedures, to calculate the two parameters separately and to determine for each one an unbiased level of error. Additionally for each parameter separate confidence levels can thus be constructed. If the two confidence intervals overlap we have an indication of non-significant differences between BE and IPE.

Survey Realization

The survey must be realized through a company with minimum 3 years of experience in comparable surveys in the respective country to ensure a professional survey execution. Following principles are to be followed in the survey realization:

- Non-responses should be recorded;
- Record and store all original surveys;
- Surveys are conducted at KMRL stations when people wait for KMRL-boarding. It should be avoided to realize the survey with people de-boarding the KMRL as latter will not want to invest time in a survey thus potentially giving wrong answers.

Calculation of Trip Distance in the Survey

Trip distances need to be determined for each surveyed passenger. The following procedures are applied:

- For NMT, others and induced traffic this is not required as the applied EF is “0”
- For users of buses either
  - the shortest possible geographical distance based on electronic maps or measuring the distance between the two points with GPS or a comparable mean or through distance measurement on maps.

or

  - Measuring the actual distance from the bus entry station to the bus exit station based on (electronic) route maps of the bus operators with official distances or measuring e.g. with GPS the distances between the involved stations
- For users of passenger cars, taxis, motorcycles, motorized rickshaws and other modes of motorized transport except buses based on the shortest possible geographical distance based on electronic

maps or measuring the distance between the two points with GPS or a comparable mean or through distance measurement on maps.

- For non-project rail systems based on official or GPS distances between the entry and exit station of the rail-systems.
  A default questionnaire to be used is included below. This questionnaire should be used by all projects except if valid arguments exist to change the questionnaire and to adapt it to local circumstances. The questionnaire must be realized in the local language. The questionnaire needs to be adapted to national or local circumstances, the wording needs to be checked locally and local test-runs should be performed to ensure that the questions are simple, easily understood, cannot be misinterpreted and lead to reliable results. The questionnaire used in included in the Annex

Section C. Start date, crediting period type and duration

C.1. Start date of the Project Activity

17/06/2017

C.2. Expected operational lifetime of the Project Activity

25 Years

C.3. Crediting period of the Project Activity

10 Years

C.3.1. Start and end date of the crediting period

17/06/2017 to 16/06/2027

C.3.2. Duration of crediting period

10 Years (17/06/2017 to 16/06/2027)

Section D. Environmental impacts

D.1. Analysis of environmental impacts

The main aim of the EIA study is to ascertain the existing baseline conditions and to assess the impacts of all the factors as a result of the proposed corridor during its construction and operation phases. The changes likely to occur in different components of the environment. Environment includes water, land, air, ecology, noise, socio-economic issues, etc. The information presented in this section stems from various sources such as reports, field surveys and environment monitoring. Majority of data on water quality, vegetation, air and noise quality was collected during field studies in DPR. This data has been utilized to assess incremental impact, if any, due to the project. Collection and compilation of environmental baseline data is essential to assess the impact on environment due to the project.

WATER AND SOIL

The water samples were collected from dug wells in households / institutions to understand the water quality along the proposed project route. The surface water in the crossings of the main backwater inlets were also monitored. Water analysis was done for the physico-chemical and biological parameters as per standard methods. The results are presented in DPR for GCC verifier. The quality of the well water was inferred in comparison with the National Standards of Drinking Water Quality (IS: 10500, 1992). All the well water samples were colourless, odourless and with agreeable taste. One sample had high turbidity and 2 samples showed low pH. The chemical characteristics such as total hardness, chlorides, dissolved solids, sulphates and nitrates were within limits. Among the metals analysed iron, copper, zinc, chromium, magnesium, cadmium, selenium, mercury and arsenic were not detected or were within stipulated limits. The level of manganese exceeded the limits in 3 wells. The bacteriological quality of the ground water was found to be poor. All the wells had coliform bacteria to varying extent. The ICMR standard for drinking water stipulates that in individual or small community supplies the coliform should not exceed 10 per 100 mL. In this survey only one well conforms to this level. Salmonella a reported pathogen is present in 12 out of 16 wells. The quality of the surface water is compared to the Class SW V waters for Navigation and controlled waste disposal. The pH and Dissolved oxygen are within the stipulated limits of navigational waters. There is no floating scum in the water surface.

The proposed metro corridor generally runs through commercial area and a few patches have residential areas. Hence there is very little exposed soil along the route. However, soil samples were collected and analysed

GREEN COVER

Tree survey was carried out along the proposed alignment. The trees that could be affected by the implementation of the project were enumerated within 10 m(5m on either side from the center of the alignment). The tree volume and biomass were determined according to the standard methods of forest mensuration

The trees along the sides of the proposed alignment are mostly planted for shade purpose and a few are fruit bearing trees or coconut trees in private holdings.

The major tree species are Coconu*t,* Peltaphorum ferrugineum, Samanea saman, Mangifera indica and Artocarpus integrifolia. Tectona grandis is the only commercially valued tree in the locality which falls under the definition of The Kerala Preservation of Trees Act, 1986. It is observed that majority of the trees have been planted on the sides, which need to be cut. Most of the trees have girth greater than 70 cm. About 477 trees exist on the proposed alignment. No rare or endangered species of trees were noticed during field studies. No forest area exists along the alignment. The estimated biomass of 477 individuals is 97 tonnes.

AIR QUALITY
As part of the study, ambient air quality monitoring has been carried out by setting up ambient air quality monitoring stations at 8 locations for the parameters SPM, RPM, SO2 and NOx. The ambient air quality stations were selected taking into the view of traffic flow and strategic locations on the proposed metro rail route As there is no provision for commercial / traffic related standards for the ambient air quality in National Air Quality Standards (NAAQS) for the parameters under study, the standards related to the residential / others in the NAAQS has been taken for evaluating the results from the present study. The NAAQ standards are presented as Table 9.6. The discussions are also based on Air Quality Index (AQI), a popular way of representing the air quality on an international scale. The categorization of the air quality as per the air quality index with the colour codes

Air Quality Status of Kochi
The station wise monitoring results for each parameter are presented in Table 9.9. The review of the results in general shows that the RPM values have exceeded the NAAQS limits at a few stations. The concentration of NOx exceeded the limit at two locations. SO2 and SPM concentrations were found to be well within the NAAQS limits at all the stations. The overall air quality index is in the range of moderate to unhealthy in the study region.

NOISE
The noise levels were measured at 8 locations along the project alignment at 2.0 m away from the source as per standard practice. The noise levels so recorded as hourly Leq values are presented in Annexure I. The noise level ranges are summarized in Table 9.10. It could be concluded that the noise levels recorded at various stations are generally higher than the permissible levels of 65 dBA (day) and 55 dBA (night) for commercial areas and 55 dBA (day) and 45 dBA (night) for residential areas

D.2. Environmental impact assessment and management action plans

Based on the project particulars and existing environmental conditions potential impacts have been identified that are likely to result from the proposed metro rail project. The positive environmental impacts are as follows;

- Reduction in traffic congestion
- Quick service and safety
- Less fuel consumption
- Reduction in air pollution
- Reduction of noise level
- Better roads
- Employment opportunities

Section E. Environmental and social safeguards

The main purpose of the environment and social safeguard assessment is to identify, evaluate and manage environmental and social impacts that may arise due to implementation and operation of the project. The document has been made to comply with the requirements of Environmental and Social commitment, Environment & social safeguard standard (version.02) of GCC, Health and Safety (EHS) Guidelines, as well as applicable local and national regulations.

E.1. Environmental safeguards

Impact of Project Activity on		**Information on Impacts, Do-No-Harm Risk Assessment and Establishing Safeguards**								**Project Owner's Conclusion**		**GCC Project Verifier's Conclusion** **(To be included in Project Verification Report only)**
		Description of Impact *(positive or negative)*	**Legal/ voluntary corporate requirement / regulatory/ voluntary corporate threshold Limits**	**Do-No-Harm Risk Assessment (choose which ever is applicable)**			**Risk Mitigation Action Plans for aspects marked as Harmful**		**Performance indicator for monitoring of impact**	***Ex-ante* scoring of environmental impact**	***Explanation of the Conclusion***	**3rd Party Audit**
				Not Applicable	**Harmless**	**Harmful**	**Operational Controls**	**Program of Risk Management Actions**	**Monitoring parameter and frequency of monitoring**	**Ex- Ante scoring of the environmental impact (as per scoring matrix Appendix-02)**	**Ex- Ante description and justification/explanation of the scoring of the environmental impact**	**Verification Process**
Environmental Aspects on the identified categories [16] ***indicated below.***	*Indicators for environmental impacts*	*Describe and identify anticipated and actual significant environmental impacts, both positive and negative from all sources (stationary and mobile) during normal and abnormal/emergency conditions, that may result from the construction and operations of the Project Activity, within and outside the project boundary, over which the Project Owner(s) has/have control.*	*Describe the applicable national regulatory requirements /legal limits / voluntary corporate limits related to the identified risks of environmental impacts.*	*If no environmental impacts are anticipated, then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as* ***Not Applicable***	*If environmental impacts exist but are expected to be in compliance with applicable national regulatory /stricter voluntary corporate requirements and will be within legal/ voluntary corporate limits by way of plant design and*	*If negative environmental impacts exist that will not be in compliance with the applicable national legal/ regulatory requirements or are likely to exceed legal limits, then the Project Activity is likely to cause harm*	*Describe the operational controls and best practices, focusing on how to implement and operate the Project Activity, to reduce the risk of impacts that have been identified as '****Harmful*** *at least to a level that is in compliance with applicable legal/regulatory requirements or industry best practice or stricter voluntary corporate requirements*	*Describe the Program of Risk Management Actions (refer to Table 3), focusing on additional actions (e.g., installation of pollution control equipment) that will be adopted to reduce or eliminate the risk of impacts that have been identified as* ***Harmful****.*	*Describe the monitoring approach and the parameters (KPI) to be monitored for each impact irrespective of whether it is harmless of harmful. The frequency of monitoring to be specified as well including the data source.*	*-1* *0* *+1*	*Confirm the score of environmental impact of the project with respect to the aspect and its monitored value in relation to legal /regulatory limits (if any) including basis of conclusion.*	*Describe how the GCC Verifier has assessed that the impact of the Project Activity against the particular aspect and in case of "harmful impacts" how has the project adopted Risk Mitigation Action Plans to mitigate the risks of negative environmental impacts to levels that are unlikely to cause any harm as well as the net positive impacts of the project with respect to the most likely baseline alternative.* *.*

[16] sourced from the CDM SD Tool and the sample reports are available (https://www4.unfccc.int/sites/sdcmicrosite/Pages/SD-Reports.aspx)

					operating principles, then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as ***Harmless*** */If the project has a positive impact on the environment mark it as "harmless" as well.*	*(may be un-safe) and shall be indicated as* ***Harmful***						
Reference to paragraphs of Environmental and Social Safeguards Standard		*Paragraph 12 (a)*	*Paragraph 13 (c)*	*Paragraph 13 (d) (i)*	*Paragraph 13 (d) (ii)*	*Paragraph 13 (d) (iii)*	*Paragraph 13 (e) (i)*	*Paragraph 13 (e) (ii)*	*Paragraph 12 (c) and Paragraph 13 (f)*	*Paragraph 22*		*Paragraph 24 and Paragraph 26 (a) (i)*
Environment - *Air*	*SO_x emissions (EA01)*	*The solar PV power project does result in emission of SOx in the project scenario. However, in the baseline scenario (grid) some of the fossil fuel power plants may have emitted SOx, on which data is not available and can't be quantified.*	*The Air (Prevention & Control of Pollution) Act 1981 stipulates thresholds for both ambient air quality as well as stack emissions.*	*Not Applicable as no emissions occur in the project scenario and therefore is not expected to or does not cause any harm.*	*Not Applicable. No Action Required*	*Not Applicable. No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	

	NO_x emissions (EA02)	*The solar PV power project does result in emission of NOx in the project scenario. However, in the baseline scenario (grid) some of the fossil fuel power plants may have emitted NOx, on which data is not available and can't be quantified.*	*The Air (Prevention & Control of Pollution) Act 1981 stipulates thresholds for both ambient air quality as well as stack emissions.*	*Not Applicable as no emissions occur in the project scenario and therefore is not expected to or does not cause any harm.*	*Not Applicable. No Action Required*	*Not Applicable. No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	CO_2 emissions (EA03)	Project activity is generating electricity through brake generator. Making this MRTS the best efficient vehicle.	*The Air (Prevention & Control of Pollution) Act 1981stipulates thresholds for both ambient air quality as well as stack emissions.*	*Not Applicable as no emissions occur in the project scenario*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	tCO_2 , Annual	+1	*With reference to the CPCB modified direction No. B29012 /ESS(CPA)/ 2015-16; dated March 07, 2016 (Appendix A) solar power project falls in White category and it is mentioned in the notification that there shall be no necessity of obtaining the Consent to Operate" for White category of industries.* *However, in the baseline scenario (grid) the fossil fuel power plants result in CO2 emissions, which has been calculated as the combined margin emission factor and mentioned in the PSF. Therefore, emission reductions are expected to be*	

											reduced which will be regularly monitored and verified ex-post and therefore is eligible to be scored.	
	CO emissions (EA04)	*The solar PV power project does result in emission of CO in the project scenario. However, in the baseline scenario (grid) some of the fossil fuel power plants may have emitted CO, on which data is not available and can't be quantified.*	*The Air (Prevention & Control of Pollution) Act 1981 stipulates thresholds for both ambient air quality as well as stack emissions.*	*Not Applicable as no emissions occur in the project scenario and therefore is not expected to or does not cause any harm.*	*Not Applicable. No Action Required*	*Not Applicable. No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Suspended particulate matter (SPM) emissions (EA05)	*The solar PV power project does result in emission of SPM under the project scenario. However, in the baseline scenario (grid) some of the fossil fuel power plants may have emitted SPM, on which data is not available and can't be quantified.*	*The Air (Prevention & Control of Pollution) Act 1981 stipulates thresholds for both ambient air quality as well as stack emissions.*	*Not Applicable as no emissions occur in the project scenario and therefore is not expected to or does not cause any harm.*	*Not Applicable. No Action Required*	*Not Applicable. No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Fly ash generation (EA06)	*The solar PV power project does result in fly ash generation under the project scenario. However, in the baseline scenario (grid) some of the fossil fuel power plants may have resulted in fly ash generation, on*	*The Air (Prevention & Control of Pollution) Act 1981 stipulates thresholds for both*	*Not Applicable*	*Not Applicable. No Action Required*	*Not Applicable. No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	

		which data is not available and can't be quantified.	*ambient air quality as well as stack emissions.*									
	Non-Methane Volatile Organic Compounds (NMVOCs) (EA07)	*The solar PV power project does result in emission of NMVOCs under the project scenario. However, in the baseline scenario (grid) some of the fossil fuel power plants may have emitted NMVOCs, on which data is not available and can't be quantified.*	*The Air (Prevention & Control of Pollution) Act 1981 stipulates thresholds for both ambient air quality as well as stack emissions.*	*Not Applicable as no emissions occur in the project scenario and therefore is not expected to or does not cause any harm.*	*Not Applicable. No Action Required*	*Not Applicable. No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Odor (EA08)	*The solar PV power project does result in emission of odor under the project scenario.*	*The Air (Prevention & Control of Pollution) Act 1981*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Noise Pollution (EA09)	*The solar PV power project does result in generation of noise pollution under the project scenario.*	*Noise (Regulation and Control) Rules 2000 amended in 2010)*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Others (EA10)	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	
	Add more rows if required and corresponding notation with EA as prefix)											
	Solid waste	*The solar PV power project is not likely to*	*Plastic Waste*	*Not Applicable*		*No Action*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable.*	*Not Applicable*	

Environment - *Land*	*Pollution from Plastics (EL-01)*	*result in generation of solid waste.*	*(Management and Handling) Rules, 2016*		*No Action Required*	*Required*						
	Solid waste Pollution from Hazardous wastes (EL02)	*Damaged solar PV modules at site might have negative environment impacts if not managedwell*	*Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016*	-	*Harmless (no action required)*	Not applicable	Not applicable	*The damaged/ defunct solar PV modules shall be stored and disposed-off as per the national/local law.*	Nos, Annual	+1	*The project owner undertakes to manage solar PV modules waste in an appropriate manner and in compliance to the prevailing laws and regulations*	
	Solid waste Pollution from Bio-medical wastes (EL03)	*Negative*	*Bio-medical Waste Management Rules, 2016*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Solid waste Pollution from E-wastes (EL04)	*No e-waste pollution is anticipated through the operation of the project.*	*E-waste (Management and Handling) Rules*	-	*Harmless*	*Not Applicable*	*Records all electrical & electronics waste of projects sites and filling of return*	*Project owner is responsible to maintain records and filling of records as per applicable law*	Nos, Annual	+1	*Although generation of e-waste is not anticipated from the project, the project owner will ensure that in case waste is generated during maintenance and breakdowns the same will be disposed-off as per the waste management plan and*	

											applicable E-waste rules. Project owner will be responsible to maintain records and filling of records as per applicable law and will not have no significant impact.	
	Solid waste Pollution from Batteries (EL05)	*No battery waste is Anticipated through the operation of the project*	*Batteries (Management and Handling) Rules*	-	*Harmless*	*Not Applicable*	*Records all electrical & electronics waste of projects sites and filling of return*	*Project Owner is responsible to maintain records and filling of returns as per applicable law*	Nos, Annual	+1	*Although generation of battery waste is not anticipated from the project, the project owner will ensure that in case battery waste is generated during the same will be disposed-off as per the waste management plan and applicable national/ local laws. Project owner will be responsible to maintain records and filling of records as per applicable law and will not have no significant impact.*	
	Solid waste Pollution from end-of-life products/ equipment (EL06)	*Damaged/ disposed Solar PV modules at site might have negative environmental impacts if not managed well after their end of- life*	*Solid Waste Management Rules, 2016*	*Not Applicable*	*Harmless*	*Not Applicable*	*Solid waste from the project activity must be disposed as applicable law*	*Project Owner is responsible to maintain records and dispose all products after ending lifecycle as per*	Nos, Annual	+1	*Project Owner is responsible to maintain records and dispose all products after ending lifecycle as per applicable law. Project owner will be*	

								applicable law			responsible to maintain records and filling of record as per applicable law and will not have no significant impact.	
	Soil Pollution from Chemicals (including Pesticides, heavy metals, lead, mercury) (EL07)	*The solar PV power project is not likely to result in Soil Pollution from Chemicals*	*In India, there are no comprehensive soil quality regulations and standards to ascertain the seriousness of contamination*	*'Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable.*	*Not Applicable*	
	land use change (change from cropland /forest land to project land) (EL08)											
	Others (EL09)	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	
	Add more rows if required											

Environment - *Water*	*Reliability/ accessibility of water supply (EW01)*	*Not Applicable*	*The Water (Prevention & Control of Pollution) Act 1974*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Water Consumption from ground and other sources (EW02)	*Ground water is consumed for the purpose of module cleaning.*	*Permission for abstraction of Ground water under Environmental (Protection) Act 1986*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Generation of wastewater (EW03)	*Solar power project does not result in generation of waste water.*	*The Water (Prevention & Control of Pollution) Act 1974*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Wastewater discharge without/with insufficient treatment (EW04)	*Solar power project does not result in generation of waste water therefore discharge of waste water without/with insufficient treatment is not applicable. .*	*The Water (Prevention & Control of Pollution) Act 1974*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Pollution of Surface, Ground and/or Bodies of water (EW05)	*Negative*	*The Water (Prevention & Control of Pollution) Act 1974*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Discharge of harmful chemicals like marine pollutants / toxic waste (EW06)											

	Others (EW07)	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	
	Add more rows if required											
Environment – *Natural Resources*	*Conserving mineral resources (ENR01)*	*Not Applicable*	*In India, there are no conserving mineral resources regulations and standards to ascertain the said condition.*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Protecting/ enhancing plant life (ENR02)	*Not Applicable*	*In India, there are no conserving mineral resources regulations and standards to ascertain the said condition.*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Protecting/ enhancing species diversity (ENR03)	*Not Applicable*	*Not Applicable*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	

	Protecting/ enhancing forests (ENR04)	*Not Applicable*	*The Forest (Conservation) Act 1980 & 1981*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Protecting/ enhancing other depletable natural resources (ENR05)	*Not Applicable*	*National Forest Policy (Revised) 1988*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Conserving energy (ENR06)	*Not Applicable*	*Energy Conservation Act 2001*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Replacing fossil fuels with renewable sources of energy (ENR07)	*The project activity involves generation of power using solar energy resources which would have been otherwise generated from the fossil fuel dominant grid connected power plants in the absence of the project activity.*	*Energy Conservation Act 2001*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Replacing ODS with non-ODS refrigerants (ENR08)	*Not Applicable*	*In India, there are no comprehensive regulations and standards to ODS & non ODS*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Others (ENR09)	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	
	Add more rows if required											
Net Score:			**+5**									

Project Owner's Conclusion in PSF:		The Project Owner confirms that the Project Activity will not cause any net harm to Environment.
GCC Project Verifier's Opinion:		The GCC Verifier certifies that the Project Activity [is not likely to cause any] or [is likely to cause] net harm to the environment...

E.2. Social Safeguards

Impact of Project Activity on		Information on Impacts, Do-No-Harm Risk Assessment and Establishing Safeguards							Project Owner's Conclusion		GCC project Verifier's Conclusion (To be included in Project Verification Report only)
		Description of Impact (*positive or negative*)	**Legal requirement /Limit, Corporate policies / Industry best practice**	**Do-No-Harm Risk Assessment** **(Choose which ever is applicable)**			**Risk Mitigation Action Plans (for aspects marked as Harmful)**	**Performance indicator for monitoring of impact.**	**Ex-ante scoring of environmental impact**	**Explanation of the Conclusion**	**3rd Party Audit**
				Not Applicable	**Harmless**	**Harmful**	**Operational / Management Controls**	**Monitoring parameter and frequency of monitoring (as per scoring matrix Appendix-02)**	**Ex- Ante scoring of social impact of the project**	**Ex- Ante description and justification/explanation of the scoring of social impact of the project**	**Verification Process** **Will the Project Activity cause any harm?**
Social Aspects on the identified categories[17] indicated below.	*Indicators for social impacts*	*Describe and identify actual and anticipated impacts on society and stakeholders, both positive or negative, from all sources during normal and abnormal/emergency conditions that may result from constructing and operating of the Project Activity within or outside the project boundary, over which the project Owner(s) has/have control*	*Describe the applicable national regulatory requirements / legal limits or organizational policies or industry best practices related to the identified risks of social impacts*	*If no social impacts are anticipated, then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as* ***Not Applicable***	*If social impacts exist but are expected to be in compliance with applicable national regulatory requirements/ stricter voluntary corporate limits by way of plant design and operating principles then the Project Activity is unlikely to cause any harm (is safe) and shall be indicated as* ***Harmless****),*	*If negative social impacts exist that will not be in compliance with the applicable national legal/ regulatory requirements or are likely to exceed legal limits, then the Project Activity is likely to cause harm and shall be indicated as* ***Harmful***	*Describe the operational or management controls that can be implemented as well as best practices, focusing on how to implement and operate the Project Activity, to reduce the risk of impacts that have been identified as* ***Harmful****.*	*Describe the monitoring approach and the parameters (KPI) to be monitored for each impact irrespective of whether it is harmless of harmful. The frequency of monitoring to be specified as well. Monitoring parameters can be quantitative or qualitative in nature along with the data source*	*-1* *0* *+1*	*Confirm the score of the social impacts of the project with respect to the aspect and its monitored value in relation to legal/regulatory limits (if any) including basis of conclusion*	*Describe how the GCC Verifier has assessed that the impact of Project Activity on social aspects (based on monitored parameters, quantitative or qualitative) and in case of "harmful aspects how has the project owner adopted Risk Mitigation Action / management actions plans and policies to mitigate the risks of negative social impacts to levels that*

[17] sourced from the CDM SD Tool and the sample reports are available (https://www4.unfccc.int/sites/sdcmicrosite/Pages/SD-Reports.aspx)

					project having positive impact on society. To the BAU / baseline scenario must also mark their aspect as ***"harmless"***						*are unlikely to cause any harm.* *Also describe the positive impacts of the project on the society as compared to the baseline alternative or BAU scenario.*
Reference to paragraphs of Environmental and Social Safeguards Standard		*Paragraph 12 (a)*	*Paragraph 13 (c)*	*Paragraph 13 (d) (i)*	*Paragraph 13 (d) (ii)*	*Paragraph 13 (d) (iii)*	*Paragraph 13 (e) (i)*	*Paragraph 12 (c) and Paragraph 13 (f)*	*Paragraph 23*		*Paragraph 24 and Paragraph 26 (a) (ii)*
Social - *Jobs*	*Long-term jobs (> 10 year) created/ lost (SJ01)*	*The project activity leads to the employment generation*	*No regulation / legal requirement*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*There are no harmful impacts of the project activity as it leads to the employment generation.*	*Nos, Annual*	+1	Although there is no mandatory law to generate permanent employment from the project activity, however, project proponent has been decided to provide training to the local people & generate permanent employment for local people Therefore this	

										parameter will be scored. Since the project activity is already operational the project activity has already resulted in employability. No risks have been identified and hence no risk mitigation action is required	
	New short-term jobs (< 1 year) created/ lost (SJ02)	*The project activity leads to the employment generation*	*No regulation / legal requirement*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*There are no harmful impacts of the project activity as it leads to the employment generation.*	*Nos, Annual*	+1	Since the project activity is already operational the project activity has already resulted in temporary employment during its construction phase. . No risks have been identified and hence no risk mitigation action is required	
	Sources of income generation increased / reduced (SJ03)	*There is a positive impact of the project activity on the creation of jobs during its construction and operational life time resulting in increase of income*	*There is no legal requirement from local authority to create permanent employment from the project activity*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Nos, Annual*	+1	*The income has been increased due to local employment generation from the project*	

										activity. Hence this parameter is be scored. The parameters will be monitored form the current entitlement of the staffs and previous entitlement certified by the staff.	
	Avoiding discrimination when hiring people from different race, gender, ethnics, religion, marginalized groups, people with disabilities (SJ04) *(Human rights)*										
	Disease preventio	*Although the implementation of the project activity will not*	*The Factories Act, 1948*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Nos of health camp, Annual*	+1	*It should be ensured that proper*	

Social - *Health & Safety*	*n (SHS01)*	*result in diseases preventions project owner will endeavor towards providing medical facilities in the project vicinity village through periodic health camps.*								*and adequate number of toilets is constructed for the Laboure's so that hygienic conditions prevail in the site area. The project owner will endeavor towards providing medical facilities in the project vicinity village through periodic health camps and the number of health camps conducted will be monitored.*	
	Occupational health hazards (SHS02)										
	Reducing / increasing accidents /Incidents/fatality (SHS03)	*Training provided by the project owner to the employee and staffs will reduce accidents*	*The Factories Act, 1948 & EHS policy*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Nos, Annual*	+1	*The project owner will provide regular safety training to their workers about the accident hazards and risk related to specific*	

										works and preventive measures for avoiding accidents at site. Number of training provided to the plant staff/employee will be recorded.	
	Reducing / increasing crime (SHS04)	*Not Applicable*	*Crime comes under law & order of local government authority and there is no legal requirement from local authority to project owner to liable to reduce crime.*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Reducing / increasing food wastage (SHS05)	*Not Applicable*	*The Compulsory Food Waste Reduction Bill, 2018*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Reducing / increasing indoor air pollution (SHS06)	*Not Applicable*	*The Air (Prevention & Control of Pollution) Act 1981*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Efficiency of health services (SHS07)	*Not Applicable*	*No local regulation available*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	

	Sanitation and waste management (SHS08)	*Not Applicable*	Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Other health and safety issues (SHS09)	*Not Applicable*	EHS policy	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Add more rows if required										
Social - *Education*	*specialized training / education to local personnel (SE01)*	*The project activity leads to the enhanced skill*	The created permanent employee will receive specific job training by the project owner as per CSR policy of Project implementer	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Nos, Annual*	+1	*Project Owner will take Initiative towards provisioning of training to employee*	
	Educational services improved or not (SE02)	*The project activity leads to the enhanced skill*	The created permanent jobs will receive specific job training by the project owner as per CSR policy of Project implementer	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Nos, Annual*	+1	*Project owner will take initiative towards promotion of education, including special education and employment enhancing vocation skills especially among youth and, elderly under*	

										livelihood enhancement projects.	
	Project-related knowledge dissemination effective or not (SE03)	*Not Applicable*	*CSR policy*	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	Not Applicable	*Not Applicable*	Not Applicable	
	Other educational issues (SE03)	*Not Applicable*	CSR policy	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Add more rows if required (SE04)										
Social - *Welfare*	*Improving/ deteriorating working conditions (SW01)*	*Not Applicable*	EHS policy	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Community and rural welfare (indigenous people and communities)	*Not Applicable*	CSR policy	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	

	(SW02)										
	Poverty alleviation (more people above poverty level) (SW03)	*The initiatives of the project owner will result in poverty alleviation in the local areas*	No local regulation	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Nos, Annual*	+1	The Project Owner will assist towards reduction of poverty and enhance economic growth, human well-being, and development effectiveness by addressing the gender disparities and inequalities that are barriers to development, and by assisting member countries in formulating and implementing their gender and development goals.	
	Improving / deteriorating wealth distribution/ generation of income and assets (SW04)	*Not Applicable*	No local regulation	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	

	Increased or / deteriorating municipal revenues (SW05)	*Not Applicable*	No local regulation	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Women's empowerment (SW06) *(Human rights)*	*The initiatives of the project owner will result in women empowerment in the local areas*	*No regulation / legal requirement*	*Not Applicable*	*Not Applicable*	*No Action Required*	*There are no harmful impacts of the project activity as it leads to empowerment of women*	*Nos, Annual*	+1	Since the project activity is already operational the project activity has already resulted in employment generation for women. Since the project owner has been promoting livelihood opportunity towards women empowerment the same is addressed. No risks have been identified and hence no risk mitigation action is required	

	Reduced / increased traffic congestion (SW07)	*Negative*	No local regulation	*Not Applicable*	*No Action Required*	*No Action Required*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	
	Exploitation of Child labour *(Human rights)* *(SW08)*										
	Minimum wage protection *(Human rights) (SW09)*										
	Abuse at workplace. (With specific reference to women and people with special disabilities / challenges) *(Human rights) (SW10)*										
	Other social welfare issues (SW11)										

	Avoidance of human trafficking and forced labour *(Human rights)* *(SW12)*										
	Avoidance of forced eviction and/or partial physical or economic displacement of IPLCs *(Human rights)* *(CW13)*										
	Provisions of resettlement and human settlement displacement *(Human rights)*										

	(CW14)										
	Add more rows if required										
Net Score:	**+9**										
Project Owner's Conclusion in PSF:	The Project Owner confirms that the Project Activity will not cause any net harm to society.										
GCC Project Verifier's Opinion:	The GCC Verifier certifies that the Project Activity [is not likely to cause any] or [is likely to cause] net harm to society.										

Section F. United Nations Sustainable Development Goals (SDG)

UN-level SDGs	UN-level Target	Declared Country-level SDG	Defining Project-level SDGs	GCC Project Verifier's Conclusion (To be included in Project Verification Report only)

			Project-level SDGs	**Project-level Targets/Actions**		**Contribution of Project-level Actions to SDG Targets**	**Monitoring**	**Verification Process**	**Are Goal/ Targets Likely to be Achieved?**
Describe UN SDG targets and indicators *See: https://unstats.un.org/sdgs/indicators/indicators-list/*	*Describe the UN-level target(s) and corresponding indicator no(s)*	*Has the host country declared the SDG to be a national priority? Indicate Yes or No*	*Define project-level SDGs by suitably modifying and customizing UN/ Country-level SDGs to the project scope or creating a new indicator(s). Refer to previous column for guidance.*	*Define project-level targets/actions in line with nee project level indicators chosen. Define the target date by which the project Activity is expected to achieve the project-level SDG target(s).*		*Describe and justify how actions taken under the Project Activity are likely to result in a direct positive effect that contributes to achieving the defined project-level SDG targets*	*Describe the monitoring approach and the monitoring parameters to be applied for each project-level SDG indicator and its correspondi ng target, frequency of monitoring and data source*	*Describe how the GCC Verifier has verified the claims that the project is likely to achieve the identified Project level SDGs target(s).*	*Describe whether the project-level SDG target(s) is likely to be achieved by the target date (Yes or no)*
Goal 1: End poverty in all its forms everywhere	End poverty in all its forms every h where	Yes	Improved earnings of personnel (including persons from below poverty line (BPL) category) because of the direct and/or indirect engagement during project construction (temporary employment direct and indirect) and project operation (direct and indirect employment).	Project activity will result in both direct and indirect including engagement of persons through contracting agency.	16/06/2027	Provisioning of employment has direct linkage with increased earning and eradication of poverty especially in case of BPL person employed (directly /indirectly)	As per section B.7.1 of this PSF		

						under the project			
Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture									
Goal 3. Ensure healthy lives and promote well-being for all at all ages	Target 3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents Indicator 3.6.1 Death rate due to road traffic injuries	Yes	Access to safe mode of travel to all category of person independent of gender.	Project owner will facilitate safe travel by running Metro rail	16/06/2027	Implementing safety measure and operation of MRTS (Metro rail)	As per section B.7.1 of this PSF		
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	4.3 Ensure equal access for all women and men to affordable and quality technical, vocational and tertiary educatio	Yes	Access to quality education has always been a challenge in the rural setup. Project owner will identify key knowledge gap and will design priority programme in line.	Project owner will endeavour towards ensuring access to quality education by provisioning infrastructure support in the existing education facilities, undertake relevant training	16/06/2027	Infrastructure support and training will help in ensuring access to quality educations	As per section B.7.1 of this PSF		

	n, including university Indicator – 4.3.1								
Goal 5. Achieve gender equality and empower all women and girls	Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life Indicator – 5.5.2	Yes	Project owner Organization identifies equal opportunities and pay for work of equal value for both men and women. Moreover, project owner will endeavor towards creating livelihood opportunities for women.	No discrimination against women in terms of engagement and pay within the organization. Project owner will select key livelihood initiatives and promote the same in the villages around the project site though awareness and handholding support.	16/06/2027	Contribute to achieve equal rights for men & women and empowerment of women/girls	As per section B.7.1 of this PSF		
Goal 6. Ensure availability and sustainable management of water and sanitation for all									
Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all	7.2 By 2030, increase substantially the share of renewabl	Yes	The project activity includes the installation of MRTS Rail . Which is the most energy efficient system of public transportation. And will provide the cheapest option to public.	This Metro rail is consuming only 0.00898 kwh/PKM	16/06/2027	Contribute renewable energy share in total grid energy consumption	As per section B.7.1 of this PSF		

	e energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption								
Goal 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all	Target 8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value Indicator 8.5.1: Average hourly	Yes	Number of local employment generation. The project activity will create both direct or indirect employment during project construction and project operation	The project owner will enhance the capacity of the persons through on job 5 nos. of training of direct and indirect employee engaged during operation of the project activity.	16/06/2027	The solar power plant contributes directly to achieve the SDG target, because the project activity activity has created jobs in the renewable energy sector, which diversify and upgrades employee's knowledge and capacity over and above the the commonly used technology in the energy sector of India.	As per section B.7.1 of this PSF		

	earnings of employees, by sex, age, occupation and persons with disabilities								
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	SDG Target 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on	Yes	Project owner will develop quality, reliable, sustainable and resilient infrastructure, regional infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	-	29/03/2028.	Transport of 381868 Passenger /day	As per section B.7.1 of this PSF		

	affordable and equitable access for all Indicator 9.1.2 Passenger and freight volumes, by mode of transport								
Goal 10. Reduce inequality within and among countries									
Goal 11. Make cities and human settlements inclusive, safe, resilient, and sustainable									
Goal 12. Ensure sustainable consumption and production patterns									
Goal 13. Take urgent action to combat climate change and its impacts	Target 13.2: Integrate climate change measures into national policies, strategies and planning Indicator 13.2.2: Total greenhouse gas	Yes	Project activity through self generation of electricity and already a best efficient reduction of power generated from the fossil fuel-based generation unit supplying electricity to the grid and thereby abate associated emission.	The project activity through implementation of Energy Efficient MRTS will result in reduction of 155,574 tCO2e /year	16/06/2027	Emission reductions achieved per year	As per section B.7.1 of this PSF		

	emissions per year								
Goal 14. Conserve and sustainably use the oceans, seas, and marine resources for sustainable development									
Goal 15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss									
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels									
Goal 17. Strengthen the means of implementation and									

revitalize the global partnership for sustainable development									

SUMMARY	**Targeted**	**Likely to be Achieved**
Total Number of SDGs	**8**	**8**
Certification label (Bronze, Silver, Gold, Platinum, or Diamond) for the ACCs as defined in the PSF	**Diamond**	**Diamond**

Section G. Local stakeholder consultation

G.1. MODALITIES FOR LOCAL STAKEHOLDER CONSULTATION

First meeting - Sri. Sudhir Krishna, Secretary, Ministry of Urban Development and Chairman, Kochi Metro Rail Limited presided over the meeting and the 18 members were present. Meeting was conducted on 19/10/2012. Stake holders were invited as per Govt protocol of call Stake holder meeting.

Second meeting – Second meeting was conducted on 04/06/2022. Meeting was call through a invitation letter sent to all stake holders. Members from Municipality, officials of KMRL, CWRDM and Residential Association, total 19 members participated in the meeting.

Stake holder were informed about the contribution of the project activity's contribution to achieving Sustainable Development Goals and the impacts of project activity on the environment and society.

Category of Stakeholder who attended the meeting:

1. Residential association
2. Employee of KMRL
3. Respective government department – Municipality, CWRDM
4. Members from Municipality
5. Contractor
6. Consultant

Attendance list of stake holder is attached

Sl No.	Name	Designation
	Thripunithura Municipality	
1	Mrs. Rema Santhosh	Municipal Chair person
2	Mr. Abhilash	Municipal Secretary
3	Mrs. Shylaja	AE
4	Mr. Madhusoodanan	Councillor
5	Mr. Antony	Councillor
	Officials of KMRL	
6	Mr. Vinu C Koshy	GM (Projects)
7	Mr. Arun K A	Manager (Projects)
8	Mr. Maxwell Fernandez	Safety Consultant
9	Ms. Shalu	Junior Engineer
	Consultant – Aarvee Associates Team	
10	Mr. K. Rajendran	Deputy Team Leader
	Contractor- KEC-VNC JV	
11	Mr. Lalichan Antony	Project Manager
	Centre for Water Resource Development and management	
12	Dr. Celine George	Senior Principal Scientist
13	Dr. Drissia T K	Senior Scientist (Team Leader)
14	Dawn Emil Sebastin	Scientist B
15	Ms. Karthika	Project Fellow
	Residential Association	
16	Mr. Balachandran	RSA
17	Mr. Saji Varkey	MKK
18	Mr. Gogulnathan	RSR
19	Mr. Induchoodan	PRA

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G.2. SUMMARY OF COMMENTS RECEIVED

Following comments received during the meeting

1. Existing and future drainage required
2. Cross culverts across the railway for carrying the water are sufficient or not

3. Municipality raised concern to provide pipe culverts
4. Municipality requested to submit the drainage plan
5. Residence association raised a concern on Piling activities performed in night due to the sound disruption.
6. Metro is not only a point-to-point connection but it brings complete development of the city in all areas

G.3. CONSIDERATION OF COMMENTS RECEIVED

All comments are taken into account and addressed satisfactorily. Secretary, Ministry of Urban Development (MoUD) addressed everyone and mentioned the importance of the metro coming to Kochi city. Every comments was responded well, the meeting was closed with satisfaction of each stakeholder.

Section H. Approval and authorization

As per the guideline available in this regard, submission of Host Country Attestation (HCA) on Double Counting as and when required by CORSIA

APPENDIX 1. CONTACT INFORMATION OF PROJECT OWNERS

Project Owner name (as per LON/LOA)	EKI Energy Services Limited
Country	India
Address	EKI Energy Services Limited, EnKing Embassy, Plot 48, Scheme 78 Part-2, Vijay Nagar, Indore-452010, Madhya Pradesh, India
Telephone	990734900
Fax	-
E-mail	manish@enkingint.org, regisry@enkingint.org
Website	www.enkingint.org
Contact person	Manish Dabkara

APPENDIX 2. AFFIRMATION REGARDING PUBLIC FUNDING

Kochi Metro Rail Pvt. Ltd. confirms that there would be no divergence of Official Development Assistance (ODA) in any of the project activity. This would be confirmed through undertaking / declaration from the project owner

APPENDIX 3. APPLICABILITY OF METHODOLOGY(IES)

Please refer to section B.2

APPENDIX 4. FURTHER BACKGROUND INFORMATION ON EX ANTE CALCULATION OF EMISSION REDUCTIONS

Please refer to section B.6.2

APPENDIX 5. FURTHER BACKGROUND INFORMATION ON MONITORING PLAN

Please refer to section B.7

APPENDIX 6. SUMMARY REPORT OF COMMENTS RECEIVED FROM LOCAL STAKEHOLDERS

Please refer to section G.2

APPENDIX 7. SUMMARY OF DE-REGISTERED CDM PROJECT OR PROJECTS FROM OTHER GHG / NON-GHG PROGRAMS (TYPE B)

NA

Program Name	
Project registration number	
Date of registration in the program	
Title of the Project Activity	
Project de-registration reference number	
Date of de-registration of the Project	
Project Participants (Authorized by the host / annex 1 country letter of approval)	
Country where the project is located	
Applied methodology(ies) (Provide reference and version number(s))	

Pre-registration changes to the Project Activity

(Tick as applicable)

Pre-registration Changes	Reference number	Approved	Provide a summary of pre-registration changes
Deviations from approved baseline and monitoring methodology		☐	
Deviations from applied Tool & Guidance		☐	
Deviations from the rules		☐	
Other…….		☐	

Post-registration changes to the Project Activity

(Tick as applicable)

Post registration Changes	Reference number	Approved	Provide a summary of post-registration changes
Change in project design		☐	
Request for revision of monitoring plan		☐	
Request for change in start date of crediting period		☐	
Renewal of crediting period		☐	
Temporary deviations		☐	
Other…….		☐	

Crediting Period(s)

Crediting period(s)			Period (start & end dates)	ERs as per registered PDD/MR/Project documents	Credits issued
Crediting Period (Shall start on or after 1 Jan 2016)	Fixed 10 year				
	Renewable (7 years, with 2 approved renewals)	1st			
		2nd			
		3rd			
Period for which Credits have been issued					
Period for which Credits have been requested but not issued					-
Period for which Credits have never been requested for issuance (No monitoring reports submitted)					-
Period for which Credits have never been requested for issuance prior to CDM de-registration					-
Remaining Crediting period, after de-registration, for which Credits have not been issued by the program , subject to a ceiling of 10 years as allowed under the GCC Program					-

<table>
<tr><td>Details of Previous Issuance Requests</td><td>
<table>
<tr><th>Issuance Request</th><th>Period
(start & end dates)</th><th>ERs as per registered PDD</th><th>Quantity of Credits requested to be issued</th><th>Quantity of Credits issued</th></tr>
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</td></tr>
<tr><td>List any open issues in the Validation and last Verification Report (e.g., FARs, if any) and how they have been addressed</td><td></td></tr>
<tr><td>Any other relevant information that has not been reported in the registered documents and that may have adverse impacts on the environmental integrity of the Project Activity</td><td></td></tr>
<tr><td>Provide the list of all the registered documents related to this project, as available on the program’s website and the</td><td></td></tr>
</table>

corresponding URLs.	

Appendix 8. FURTHER INFORMATION ON DETERMINATION OF BUNDLE IN PROJECT ACTIVITY.

Appendix 9. PUBLIC DECLARATION FOR A2 (Sub Type 2 and 3), B1 & B2 PROJECTS ON NON CONTINUATION FROM CDM/GHG/NON-GHG PROGRAMS.

DOCUMENT HISTORY

Version	Date	Comment
V 4.0	27/09/2022	▪ Revised version released on approval by Steering Committee as per GCC Program Process. ▪ Revised version contains following changes: ○ Introduced A3 type projects A2 project sub-types. ○ Included revised Declaration by the 'Authorized Project Owner and focal point' on GCC requirements. ○ Included modified format for E+/S+/ SDG assessment. ○ Revised instructions for filling in the PSF. ○ Editorial changes to the document.
V 3.2	31/12/2020	▪ The name of GCC Program's emission units has been changed from "Approved Carbon Reductions" or ACRs to "Approved Carbon Credits" or ACCs.
V 3.1	17/08/2020	▪ Editorial revisions made ○ Revised Table in section B.7.2 on Monitoring-program of risk management actions ○ Revised Table in section E.1 on Environmental Safeguards ○ Revised Table in section E.1 on Social Safeguards ○ Revised Table in section F on United Nations Sustainable Development Goals (SDG)
V 3.0	05/07/2020	▪ Revised version released on approval by Steering Committee as per GCC Program Process. ▪ Revised version contains following changes: ○ Change of name from Global Carbon Trust (GCT) to Global Carbon Council (GCC). ○ Considered and addressed comments raised by Steering Committee: ➢ during physical meeting (SCM 01, dated 29 Oct 2019, Doha Qatar); and ➢ electronic consultations EC01-Round 01 (15.09.2019 – 25.09.2019), EC01-Round 02 (27.03.2020 – 27.06.2020). ○ Feedback from Technical Advisory Board (TAB) of ICAO on GCC submission for

		approval under CORSIA[18];
V 2.0	25/06/2019	▪ Revised version released for approval by the GCC Steering Committee. ▪ Revised version includes additional details and instructions on the information to be provided, consequent to the latest developments world-wide (e.g., CORSIA EUC).
V 1.0	01/11/2016	Initial version released under the GCC Program Version 1

[18]See ICAO recommendation for conditional approval of GCC at https://www.icao.int/environmental-protection/CORSIA/Documents/TAB/Excerpt_TAB_Report_Jan_2020_final.pdf

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