Verified Carbon Standard

Cycling the Change

tembici

Document Prepared by Tembici Participações S.A.

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The main objective of the project Cycling the Change is to promote the sustainable mobility at the cities covered by the grouped project through the implementation of new bicycle sharing programs with sharing stations. Beyond that the program aims at the expansion of the existing parking areas, expansion of existing bikes and introduction of e-bikes.

The great majority of the population of Latin America live in urban centres, therefore, the cities face increasingly problems related to traffic and air pollution. Thus, the project contributes to the reduction of traffic, fossil fuel-base vehicles displacement, and reduction of GHG emissions and polluting gases in the cities where the program will be implemented.

The bike sharing system offered by Tembici is a dock based model, which consists of stations, where the users must begin and end their trips, and bikes specially designed for sharing purposes.. The stations are installed around the city considering proximity to public transportation, demand for bike usage, presence of cycling infrastructure and presence of locals of interest. The stations are positioned in order to form a condensed network, favouring the sharing system.

Besides mobility purposes, Tembici also attend delivery users. The growth of online orders, especially food and groceries, due to the Pandemic, increased the demand for couriers, also enlarging the concerns about sustainable and accessible delivery services. In partnership with iFood, the largest foodtech company of Latin America, it was created the iFood Pedal, a tailor made program to attend the specific demands of couriers, while also addressing environmental issues.

This project activity instance is expected to promote an average of 17,201,370 trips of bicycles and e-bikes per year when reaching its full potential. The annual average GHG emission reductions are estimated at 2,654 tons of CO2e and 26,536 tons of CO2e in the first 10 years of the crediting period. The amount of GHG emission reductions is expected to increase proportionally to the expansion of bike stations and availability of bikes and e-bikes in other cities in Latin America, as well as the expansion of users, trips and distance travelled in each city.

The continuation of the current transportation modes in the cities where the project is to be implemented, is the baseline scenario. The common scenario in these urban centres comprehends the majority of fossil fuel-based transportation. The introduction of cycles and e-cycles decrease the use of fossil fuels that would otherwise occur, reducing the amount of GHG emissions. Although the project has electricity consumption's emissions

related to e-bikes implementation, it is still lower than the average emissions of GHG by the usual transport models.

As a grouped project within the countries of South America, namely, Brazil, Colombia, Chile, Argentina, Uruguay, Paraguay, Bolivia, Ecuador, Venezuela and Peru, the expansion of a project activity after project validation is allowed and each project activity instance shall follow the program eligibility criteria for its inclusion as detailed in sections 1.3 and 1.4

1.2 Sectoral Scope and Project Type

"Cycling the Change" is designed as a grouped project.

The sectoral scope applicable to the project "Cycling the Change" is the 7: Transport, as established by the Clean Development Mechanism (CDM).

CDM approved Methodologies are applicable to the Verra Carbon Standard (VCS), in accordance the VCS criteria https://verra.org/methodologies-main/

1.3 Project Eligibility

The eligibility criteria for the inclusion of a new project activity instances are prescribed at the applied methodology AMS-III.BM and, detailed below following the guidance from the VCS Standard v4.3.

Grouped projects shall include one or more sets of eligibility criteria for the inclusion of new project activity instances. At least one set of eligibility criteria for the inclusion of new project activity instances shall be provided for each combination of project activity and geographic area specified in the project description. A set of eligibility criteria shall ensure that new project activity instances:

Meet the applicability conditions set out in the methodology applied to the project.

Each project activity instance included in the grouped project shall follow the detailed applicability conditions of the CDM methodology AMS-III.BM and the applied tools described in Section 3.2, as stated below:

1. *Use the technologies or measures specified in the project description.*
2. *Apply the technologies or measures in the same manner as specified in the project description. The technologies or measures, as described in section 1.1, are the implementation of new bicycle sharing program with sharing stations, the*

expansion of the existing parking areas, expansion of existing transportation and introduction of e-bikes and more bikes in determined countries of South America.

3. *Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area. Each project activity instance shall apply the baseline scenario described in section 3.4 and calculation of emission reductions defined in section 4.*
4. *Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For example, the new project activity instances have financial, technical and/or other parameters (such as the size/scale of the instances) consistent with the initial instances, or face the same investment, technological and/or other barriers as the initial instances.*
5. *Each project activity instance shall assess additionality as described in section 3.5.*

1.4 Project Design

This proposed Project was designed for the countries of Latin America and has been developed as a grouped project.

Eligibility Criteria

For the expansion of a project activity, after the validation, each activity instance of a grouped project shall follow the program eligibility criteria for its inclusion as detailed in item 1.3. All instances included in the Grouped Project must be located in cities within Latin America.

1.5 Project Proponent

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1.6 Other Entities Involved in the Project

Organization name	Green Domus
Role in the project	Project Developer
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Organization name	iFood
Role in the project	iFood Pedal Project Partner
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1.7 Ownership

The project is registered under a Public Concession, through the (decree/regulation/statute)[1], Tembici is responsible for the acquisition, maintenance, and operation of the program Cycling the Change. For each instance, Public authorities are responsible only for spot authorization, while Tembici is responsible for asset acquisition and system operation, making the proponent the sole owner of the carbon credits to be issued.

[1] Inserir link para o documento de evidência: Project ownership arising or granted under statute, regulation or decree by a competent authoritys

1.8 Project Start Date

According to the VCS Standard, version 4.3, the project start date of a non-AFOLU project is the date on which the project began generating GHG emission reductions or removals.

Therefore, the project start date is defined as the first bike sharing station started operations, either in the implementation of new systems or the expansion of the existing ones. The start date for each instance was set as follows:

Project instance 1 - Salvador (BR): Expansion schedule to September, 2023

Project instance 2 - Porto Alegre (BR) August, 19th 2022

Project instance 3 - Brasilia (BR): October 11th 2021

Project instance 4 - Pernambuco (BR): December 1st, 2021

Project instance 5 - Belo Horizonte (BR): Schedule to start on September 1st, 2023

Project instance 6 - Florianópolis (BR): Schedule to start on October 1st, 2023

Project instance 7 - Curitiba (BR): July 17th, 2023

Project instance 8 - Bogotá (COL): September, 30th 2022

1.9 Project Crediting Period

Indicate the project crediting period, specifying the day, month and year for the start and end dates and the total number of years.

The project will have a maximum of 10 years of crediting period, starting on October 11th 2021 and finishing on October 10th 2031, once renewable for another 10 years.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	x
Large project	

Year	SSA	POA	BSB	PE	BH	FLO	CUR	BOG	TOTAL
2021	0	0	38	9	0	0	0	0	47
2022	0	132	50	44	0	0	0	103	330
2023	90	142	53	48	31	6	40	108	517
2024	102	145	82	56	414	61	529	2,537	3,924
2025	100	142	80	54	405	59	519	2,475	3,834
2026	98	139	78	53	397	58	508	2,415	3,747
2027	96	136	77	52	389	57	498	2,355	3,660
2028	94	133	75	51	381	56	488	2,297	3,576
2029	92	131	74	50	373	55	478	2,239	3,492
2030	90	128	72	49	366	54	468	2,183	3,411
Total estimated ERs	**759**	**1,227**	**680**	**468**	**2,756**	**407**	**3,529**	**16,712**	**25,537**
Total number of crediting years	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Average annual ERs	**76**	**123**	**68**	**47**	**276**	**41**	**353**	**1,671**	**2,654**

1.11 Description of the Project Activity

Technologies and measures employed under the Project "Cycling the Change" are all types of projects that shift the mode of transport of urban passengers to mechanical bicycles, tricycles, e-bikes or e-tricycles eligible under methodology AMS-III.BM (see Table 1).

However, the primary objective of the project is to promote alternative mobility with the following technologies and/or measures:

Implementation of a new bicycle sharing program (through dockless bicycles or sharing stations).

Expansion of an existing bicycle sharing program (through increasing the number of dockless bicycles and/or through increasing the size or number of bicycle sharing stations).

Construction of new bicycle parking areas. These parking areas may be connected to public transport (subway stations, bus stops, light-rail train stations, etc.) or activity hubs (office towers, shopping centers, markets, venues, etc.)

- *Expansion of the existing bicycle parking areas.*
- *Introduction of e-bikes, and.*
- *Implementation of a new transportation service or expansion of an existing one based on tricycles.*

The Project "Cycling the Change" comprehends the installation, operation and maintenance of the bicycle sharing system, as mentioned above. All the bikes and e-bikes available in the system rely on international quality assured by Tembici's Canadian supplier PBSC, which is present in Toronto, Dubai, New York, São Paulo and many other cities around the world. The whole system, which also comprehends cities that are out of the Grouped Project, is now composed of 1886 stations and 16,524 bikes, 2,050 of which are electric.

The mechanical bikes have a user-friendly system allowing height adjustment of the saddle and pedal, basket for carrying up to 5kg, by QR Code unlocking system or through the app, security provided by anti-vandal system, localization controlled by GPS and LED lights that becomes up when the bicycle is being used, and protection offered by the front and rear fenders that allow safer driving and the cooper chain for greater protection when pedalling. The electric bikes count with the same system with power added when starting pedalling and the bike's motor for an extra energy dose.

The stations are integrated with solar panels, which provides energy to the entire station in a sustainable way, the computer system allows real-time monitoring of the status on stations and bicycles. All the system can be operated through an application, available both for Android and iOS, through this the registered customer can choose a plan and start using the bikes.

In the iFood Pedal program, besides electric bikes and special plans, which considers the specific needs of the delivery type of usage, the users have access to support hubs, areas designed to offer convenience to the couriers. The hubs are equipped with restrooms, meals place, drinking fountain, couches and charging outlets. Beyond the support hubs, iFood Pedal couriers have access to special training, in order train couriers in relation to road safety, bicycle use and socioeconomic content.

Outside the project boundary is included the bicycle lanes, its maintenance and expansion of the existing bicycle lanes. Although this structure has direct influence in the project operation, these facilities are municipalities' responsibility.

In the absence of the project the common modal transportation such as vehicles, buses, train and motorcycles, is the usual mobility offered to the population.

1.12 Project Location

Cycling the Change implementation occurs within the geographical area of the countries of South America: Brazil, Colombia, Chile, Argentina, Uruguay, Paraguay, Bolivia, Ecuador, Venezuela and Peru.

The project instances included in the grouped project so far occur in the metropolitan area of the cities of Salvador, Porto Alegre, Brasilia, Recife, Belo Horizonte, Florianópolis and Curitiba in Brazil and Bogotá, in Colombia.

The KML file with coordinates, will be provided individually for each project instance included in the grouped project.

All project activity instances will be implemented taking into consideration applicable national, regional and/or sectoral policies and regulations.

1.13 Conditions Prior to Project Initiation

The baseline scenario is the same as the conditions existing prior to the project initiation.

The details of the baseline scenario can be checked at the Section 3.4 (Baseline Scenario).

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The proposed project complies with all and relevant local, regional, or national laws, statutes and regulatory frameworks.

The project activities acquire the right to operate in each instance by participating into public tenders and biddings. The winner of these biddings must comply with all legal requirements as well as all conditions described in these requests.

Find below the public bidding for each instance. The documents can be assessed by the VVB if needed.

Instance	Resolution
Salvador (BR)	Termo de Permissão nº 001/2018 / Processo nº305/2017 /Concorrência Pública nº 002/2017
Brasilia (BR)	CONTRATO Nº 01/2021 | Processo SEI-GDF Nº 00090- 00004419/2020- 67.
Pernambuco (BR)	Termo de Cooperação Técnica nº 01/2020

Porto Alegre (BR)	Processo Administrativo nº 20.16.000045912-6
Florianópolis (BR)	Processo Administrativo nº 151/SMA/SUPLC/2022
Belo Horizonte (BR)	Processo Administrativo nº 01-072.068/21-15
Curitiba (BR)	Processo Administrativo nº. 01-054810/2021
Bogotá (COL)	Processo Administrativo 93597/2021

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

Not applicable. The proposed Project had not been registered in any other GHG program.

1.15.2 Projects Rejected by Other GHG Programs

Not applicable. The proposed Project did not request registration or participation in any other GHG program.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Not applicable. The possible GHG emission from the proposed Project are not included in any emission trading program or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

Not applicable. The proposed Project does not aim to obtain other forms of environmental credit.

Supply Chain (Scope 3) Emissions

Since Tembici's client is the final user of the system, Supply Chain (Scope 3) emissions is not applicable

1.1 Sustainable Development Contributions

The use of bicycles as a mode of transport has a positive socio-environmental impact both in urban areas, for users and, consequently, for the planet. Besides the decrease in consumption of fossil fuels and the consequent emission of Greenhouse Gases and pollutants, modal replacement also optimizes road organization. In Brazil, it is estimated that 75% of roads are occupied by cars, which are responsible for transporting only 20% of the population. With the growing population density in cities, road congestion is making the use of vehicles an increasingly less attractive option. The adoption of bikes thus manages to improve the scenario in the personal and social sphere: By pedaling, the users are able to reach the destination faster (a journey made by bike can guarantee up to 9 minutes of savings compared to cars, and 19 minutes in compared to public transport), and by leaving the car in the garage, it relieves congestion in large urban centers.

Another important social impact is related to inclusion and domestic economy. Most people in cities do not own a car and offering alternative modes expands access to the city for residents farther away from urban centers. Cycling is also cheaper: the adoption of bicycles on cycle paths can reduce travel costs between 5% and 14%.

As it is an active means of transport, the use of bikes also brings benefits to health, by allowing the body to move. Cycling helps people meet daily exercise recommendations, improves physical and mental health and reduces the chance of premature death. In addition, unlike the car, the use of bikes causes insignificant damage to other people, either through accidents or pollution. This makes bikes a healthier mode not just for the cyclist, but for everyone else as well. According to an article published by Agência Brasil in 2018, the use of a bike could also reduce SUS expenses in SP by more than R$34 million due to circulation problems and diabetes . The increase in cyclists numbers can also contribute to the reduction of accidents, which in Brazil generate an annual cost of R$40 billion, and which places us among the 5 largest countries in number of deaths in traffic.

Another positive impact observed with the rise of micromobility through bicycles is the increase in movement and occupation of the streets, reducing the feeling of insecurity. The more people on the streets, the more we observe the theory of "Street Eyes", in which the informal surveillance that people exercise, voluntarily or not, when they occupy the urban environment, increases the sense of security of a place.

Finally, the sharing business model of the project contributes to the efficient use of natural resources: once one bike can meet the displacement need of up to 10 people daily, the bike sharing system contribute to the less use of non-renewable raw materials and to the reduction of waste generation, in relation to the traditional ownership model.

Project Contribution	SDG	Indicator

CtC provides a clean mode of transport using bikes and e-bikes, thus replacing other modes of transport that use fossil fuels.	11.2	Proportion of users with access to sustainable transport (e-bikes).
CtC's sharing business model contributes to the sustainable management and efficient use of natural resources	12.5	Proportion of recyclable waste generated
Number of companies publishing sustainability reports	12.6	Release of Tembici's sustainability report every year
The continuous replacement of polluting modes by bikes and e-bikes reduces the emission of pollutants and Greenhouse Gases.	13.2	13.2.2 – Total greenhouse gas emissions avoided per year by CtC

With respect to nationally stated sustainable development priorities the project contributes to achieving nationally stated sustainable development priorities as follows:

In the first Brazilian NDC submission one reads, "Brazil intends to adopt further measures that are consistent with the 2°C temperature goal, in particular... vi) in the transportation sector, further promote efficiency measures, and improve infrastructure for transport and public transportation in urban areas."

In 2021 the Brazilian Ministry of Regional Development presented the Bicycle Brazil Seal, created to promote more sustainable urban mobility and recognize good practices encouraging the use of bicycles, and officially released a six-publication series on "Low Carbon Urban Mobility," co-authored by the Interamerican Development Bank and the National Secretary of Mobility and Regional Urban Development, including one specific on Bicycle Mobility.

1.17 Additional Information Relevant to the Project

Leakage Management

Not applicable. The proposed Project does not result in any leakage, neither during it installation nor operation.

Commercially Sensitive Information

The number of trips made and the total distance travelled are considered sensitive information and therefore must be excluded from the public version.

Further Information

Not applicable. There is no further information, everything that is relevant to the Project has been related in this document.

2 SAFEGUARDS

2.1 No Net Harm

The project activity does not have any negative impact on the environment or local communities.

2.2 Local Stakeholder Consultation

There are no national or municipal regulations that provide for stakeholder consultation prior to the implementation/expansion of the bikeshare system.

In addition, all implementation/expansion is carried out through bidding, where the government, through its notices, invites the private sector to install and operate the system. During the call phase, notices are made public and any doubt or comment can be forwarded to the public authorities for clarification. In some cases, according to Law 8666/93, public notices may undergo public consultations, where the interested public can also express their doubts and concerns before the publication of the notice.

The installation area is defined in public notice by the government and the specific location of the stations is defined together with the municipality, through the application for licenses and permissions, which are also provided by the government. In this sense, local stakeholders are taken into consideration since the stations are installed following the city urban planning.

It is worth mentioning that the more stations a system is consisted of, the more appealing it is for the public, since it increases shared bike usage convenience. Since the stations are spread across the city and its installations are made gradually, that is, not all at once, the local stakeholder engagement is a continuous work, which is done through the following mechanisms:

• The users of the Bike Sharing System have access to a chat, in the app used to unlock the bikes. The chat can be accessed through the website by any stakeholder. It is available every day from 5:00 am to 00:00. Telephone service is also available every day from 08:00 to 22:00 (3003-7302).

• The users from iFood Pedal count with a dedicated service team, accessed by the chat through iFood's and/or Tembici's app, as well as through the website. It is available every day from 5:00 am to 00:00.

• Any stakeholder can communicate and interact anytime through the helpdesk (URL: https://tembicihelp.zendesk.com/hc/pt-br) and the etic channel, accessible on the homepage (https://www.tembici.com.br/)

• Tembici regularly follows and responds to any complaints at the publicly available services (e.g., "Reclame Aqui" (https://www.reclameaqui.com.br/), Procon and social networks (instagram, Facebook and Twitter).

• Tembici is an IFC investee, which means it is under the Compliance Advisor Ombudsman (CAO), mechanism that addresses the environmental and social concerns of people and communities affected by IFC projects. The project was also made available for public comments from May 25th 2022 to June 30th 2022 on IFC website page and received no comments

• In the Support Hubs, the couriers from iFood pedal can also start new plans and solve any problems they may be facing.

• In April 2021, a survey was carried out with couriers in order to help the project iFood Pedal in its relationship with couriers and to improve the relationship and strategy of its purpose, considering their point of view. Almost 1500 couriers were heard about daily life, income and financial life, relationship with the project and dreams and perspectives.

• The company has a stakeholder engagement plan, which is applied in system installations and expansions, aiming to: establish a relationship harmonious with the community, reduce conflicts, foster the use of the systems and enable partnerships and opportunities.

The plan includes actions to promote bicycle culture within communities, which may be organised in partnership with the government or civil society entities, and the relationship channel, where communities can reach out to us and send their questions and requests before, during and after system installation.

• Finally, the company also organises quarterly meetings with cycle activists in order to share the main advances in the period as well as collect the perceptions of this public in relation to the system.

In Bogota, the mobility secretariat requested a specific engagement plan with local communities and general public, as detailed below:

Local Stakeholder Consultation and Involvement, in the Cycling the Change for Bogota's project instance took place through the Social Management Plan, divided in five steps: Step 1 – instruments for Information Collection; Step 2 – Collection of Information; Step 3 – Development of Divulgation, Socialization and Citizen Participation Plans; Step 4 –

Dissemination of Consultation Results; Step 5 – Communication with the Stakeholders. The Plan was conducted by the social communication and research centre named Despacio.

The main objective of the Social Management Plan is to keep the stakeholders involved and informed about the bikeshare project in Bogota, by developing communication strategies, create and maintain channels of access to the project information.

The First Step of the project was comprised of three key activities, each serving a specific purpose in the implementation of the project. The first activity, which took place on May 27, 2022, involved the virtual start-up meeting between the teams of Despacio, Tembici, and the District Mobility Secretariat. The objective of this meeting was to introduce the project and its work plan, which was presented in detail, outlining the various stages and scope of the project. During this meeting, the teams also had the opportunity to ask questions and discuss any concerns that they had.

The second activity focused on engaging with District entities and interest groups to gain their help and support for the project. A virtual presentation of the system and the Social Management Plan was proposed to these entities, which included representatives from local businesses, community organizations, and other stakeholders. To ensure maximum participation, the meetings were scheduled across four days, from June 14 to June 18, 2022, in four different hours. This provided sufficient time for the entities to participate and ask questions, provide feedback, and voice any concerns they had, which was crucial in ensuring their buy-in and support for the project.

During the third activity, a total of five actions were proposed to facilitate information collection, follow-up, monitoring, and socialization of the central aspects of the plan. These actions were carried out between June and July of 2022, which enabled the identification of work subzones and key actors that should be involved in the plan. As a result, the project team was able to map out the involvement of various stakeholders, including those from the community, private, public, and non-governmental sectors, to ensure the success of the project.

Overall, the First Step was a critical phase in the project's implementation, and the activities conducted during this phase were instrumental in laying the groundwork for the project's success. The virtual meetings and presentations helped to establish strong working relationships with key stakeholders, which will be essential in moving forward with the project.

The Second Step of the project comprised four pivotal activities aimed at establishing guidelines and methodological instruments to collect the necessary information for communicating the implementation of the Plan to the public. The objective was to identify potential risks and problems in the Plan's implementation and provide spaces for citizen participation.

The first activity in this phase focused on obtaining initial information through the results of focus groups and actor mapping. A diagnosis was conducted on the sub-zones where this Social Management Plan will be implemented to understand the social and mobility dynamics related to the System's implementation, guiding the actions that will be carried out in subsequent stages of the Plan.

The second activity involved developing monitoring indicators for the Social Management Plan to evaluate the quality of service of the Shared Bicycle System and to ensure its effective implementation. A series of qualitative and quantitative indicators were presented for this purpose, which will be used to track the system's performance and identify areas for improvement in its operation. The information provided by these indicators is crucial for monitoring the system's performance and identifying opportunities for improvement.

The third activity centered on the data collection process for monitoring the indicators of the Social Management Plan. The principles set forth by the Data Management Law 1581 of 2012 and Decree 1377 of 2013 were strictly followed in the process of collecting data for monitoring indicators. Various methodological tools were used, including surveys for the System's baseline and the construction of the indicator tracking matrix through socialization workshops. Meetings and socializations were carried out from July to October 2022.

Finally, the fourth activity focused on gathering information from the focus groups. The findings were used to create the Tembici Manager's Manual, which has been the basic tool used in face-to-face and virtual socializations with the Mobility Secretary, the Recreation and Sports Institute, the Local Mobility Centers, and the general public. It is estimated that in the first phase of socialization, prior to the launch of the system, the Manual has been presented to over 500 people.

The Third Step of the Social Management Plan involved mapping the main risks and issues encountered during project implementation. These issues were identified based on street experiences, media interactions, and social media, as well as applied to similar experiences. This stage was divided into two main phases.

The first part of this stage consisted of developing a communication and citizen participation plan for the shared bicycle system. Having a communication and dissemination plan is of utmost importance to clearly define the project and communicate it to all stakeholders involved and affected by the shared bicycle system. Therefore, this part of the third stage was carefully delineated and studied to encompass all effective communication strategies. Communication channels, target audiences, communication approaches, as well as content and advertising materials were defined. Additionally, messages capable of promoting active, safe, and inclusive mobility were formulated.

The second part involved the development of a sustainability plan aimed at promoting actions that fostered identification and ownership of the project by citizens, both users

and non-users of the shared bicycle system, in both public and institutional spaces. To achieve this, three main actions were undertaken: identification of systemic risks, identification of institutional offerings that promote active and sustainable mobility, and establishment of strategic alliances with key stakeholders.

2.3 Environmental Impact

The project activity is implemented through open announcements and public bidding in each of the cities where it has operations. The environmental and social impact requirements are usually set in theses process and winners must comply with them.

Additionally, the project activity voluntary commits with mitigating the environmental and social impact of its activity by applying the measures presented below:

Renewable electricity consumption: 85% of the project activity consumed electricity comes from renewable sources, being 34% provided by its own solar panels installed in the bike stations.

Recycling of operation's residues: the project activity has its own maintenance offices in order to improve the life cycle of the bicycle parts. Nevertheless, 96% of residues are sent for recycling.

Bike station's implementation process: all bike stations' localization points are approved with local authorities and are custom designed to have minimum impact in urban infra-structure.

The data presented above can be verified in Tembici's ESG report3.

2.4 Public Comments

The Project is available for public comments

2.5 AFOLU-Specific Safeguards

For non-AFOLU projects, this section is not required.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The methodology applied to this project is the CDM Small-scale methodology AMS-III.BM, "lightweight two and three-wheeled personal transportation", version 02.0.

The methodology also refers to the following tools:

- CDM TOOL05 -Methodological tool -Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0;
- CDM TOOL07 - Tool to calculate the emission factor for an electricity system - version 07.0;
- CDM TOOL11 -Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period, version 03.0.1;
- CDM TOOL18 -Methodological tool -Baseline emissions for modal shift measures in urban passenger transport, version 01.0;
- CDM TOOL19 -Methodological tool –Demonstration of additionality of microscale project activities, version 10.0;
- CDM TOOL21 -Demonstration of additionality of small-scale project activities, version 13.1;
- CDM TOOL23 – Additionality of first-of-its-kind project activities, version 03.0
- CDM TOOL27 – Investment Analysis, version 12.0.

The standard "Sampling and surveys for CDM project activities and programme of activities" (version 9.0) may also be used when applying option 1 of AMS-III.BM.

3.2 Applicability of Methodology

Each project activity instance included in the grouped project will have to follow the detailed applicability conditions of the CDM methodology AMS-III.BM and the applied tools. The table below presents the applicable type of projects according to the methodology conditions:

Table 1 - Applicable type of projects under methodology ASM-III.BM

Type of project	Description
Type 1	Construction of new bicycle lanes
Type 2	Extension of the existing bicycle lanes
Type 3	Implementation of new bicycle sharing program (through dockless bicycles or sharing stations)
Type 4	Expansion of an existing bicycle sharing program (through increasing the number of dockless bicycles and/or through increasing the size or number of bicycle sharing stations)
Type 5	Construction of new bicycle parking areas. These parking areas may be connected to public transport (subway stations, bus stops, light-rail train stations, etc.) or activity hubs (office towers, shopping centers, markets, venues, etc.)
Type 6	Expansion of the existing bicycle parking areas
Type 7	Introduction of e-bikes
Type 8	Implementation of a new transportation service or expansion of an existing one based on tricycles

The initial activity instances included in the grouped project are "AMS-III.BM, type 3" project, a new bicycle sharing program operated in the cities of Brasilia, Belo Horizonte, Curitiba, Florianópolis and Bogotá; and AMS-III.BM, type 4, expansion of an existing bicycle sharing program (through increasing the number of dockless bicycles and/or through increasing the size or number of bicycle sharing stations) in the cities of Salvador, Porto Alegre and Pernambuco.~

The following conditions are also required by ASM-III.BM:

- If one or more measures described in Table 1 above have already been implemented within the project boundary (e.g. within the same city as the proposed project activity), it shall be ensured that these measures are identified and taken into account when determining the baseline.
- Combination of measures described in Table 1 are also eligible. If multiple measures are implemented as part of the project activity, it shall be ensured that any interactive effects between the measures are identified and taken into account to avoid double-counting. The project proponent should make an analysis of the interactive effects and account for them following the provisions from the applicable version of the "Guidelines for the consideration of interactive effects for the application of multiple CDM methodologies for a program of activities", considering that interactive effects could occur, for example, in the following situations:

  (a) When there is an overlap in users between different measures of the project; or

(b) When several measures rely on the same information when estimating emission reductions; or

(c) When relying on default factors for setting the baseline.

- If the project activity involves the construction of on-road bicycle lanes, the width of any existing dedicated bus lane shall not be reduced in such a way that the traffic would be altered.
- The applicability conditions included in the tools referred to below also apply.
- Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.

In reference to the conditions presented above it should be emphasized that the initial activity instance project does not involve the construction of on-road bicycle lanes and its reduction emissions measures are below 60 kt CO2 equivalent annually. The latter will be also applied to the sum of emission reductions of all activity instances to be included in the grouped project.

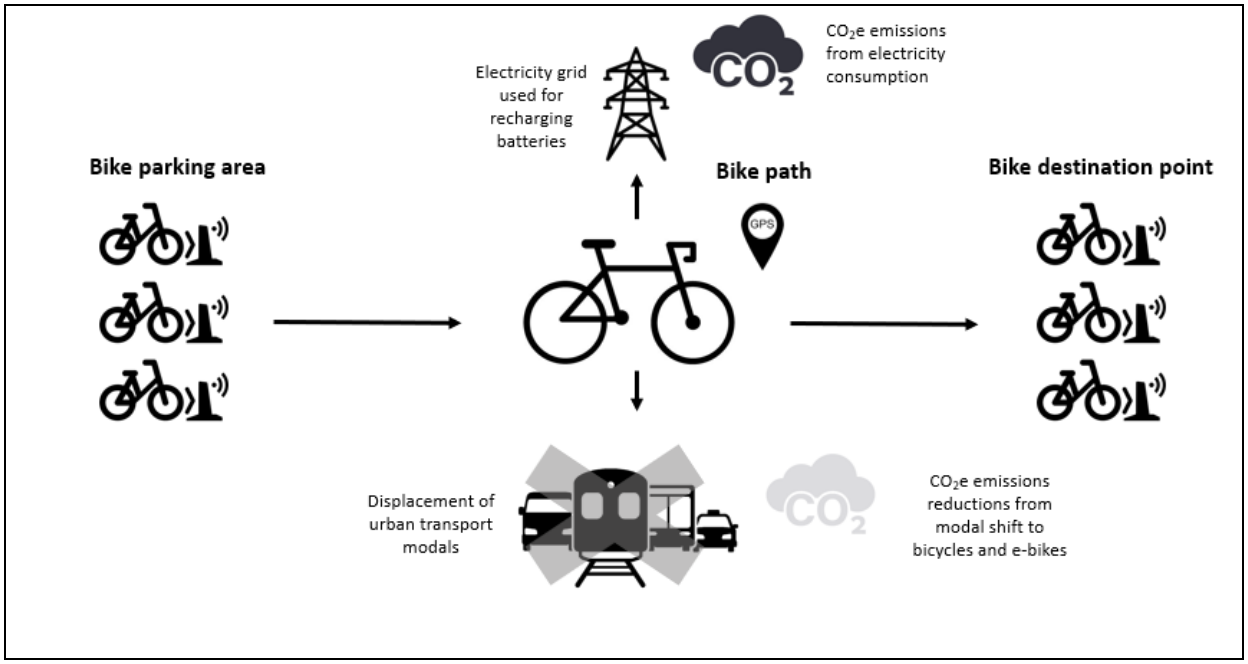
3.3 Project Boundary

As per methodology ASM-III.BM the project boundary encompasses:

- *The area in which the users of the infrastructure and/or of the promoted bicycles, tricycles, e-bikes or e-tricycles travel between origins and destinations;*
- *The electric grid and all physically connected power plants that supply electricity to the grid used to recharge the battery from e-bikes or e-tricycles, if the project involves the use of e-bikes or e-tricycles;*
- *CO2 emissions from different modes of transport that the users of the bicycles, e-bikes, tricycles and e-tricycles would have taken in the absence of the project activity. Project emissions include CO2 emissions from electricity consumption (e.g. to recharge the batteries). N2O and CH4 emissions are excluded from the project boundary as the amount of these emissions are considered not significant.*

The scheme presented below represents the project boundary:

Figure 1 – Project boundary scheme



Relevant GHG sources, sinks and reservoirs for the project and baseline scenarios are as follows:

Table 2 - Relevant GHG sources, sinks and reservoirs for the project

Source		Gas	Included?	Justification/Explanation
Baseline	Emission from road-based vehicles displaced by the project activity	CO_2	yes	Main emission source
		CH_4	no	Not significant
		N_2O	no	Not significant
		Other	no	Not significant
	Emission from electric-based vehicles displaced by the project activity	CO_2	yes	Main emission source
		CH_4	no	Not significant
		N_2O	no	Not significant
		Other	no	Not significant
Project	Emissions from electricity consumption of e-bikes	CO_2	yes	Main emission source
		CH_4	no	Not significant
		N_2O	no	Not significant
		Other	no	Not significant

3.4 Baseline Scenario

According to AMS-III.BM, the continuation of the use of existing modes of transport is the baseline scenario in the absence of the CDM project activity.

3.5 Additionality

As per methodology section 5.3.1 the following measures, referred in Table 1, alone or in combination, are considered as automatically additional:

(a) Type 1 and Type 2 (i.e. construction of new bicycle lanes and extension of the existing bicycle lanes);

(b) Type 3 and Type 4 (i.e. implementation of new or expansion of existing bicycle sharing programs), if the value paid when renting the bicycle is fully refundable upon return to the sharing station;

(c) Type 5 and Type 6 (i.e. construction of new or expansion of existing bicycle parking areas), if no charges are applied to park the bicycles.

The initial activity instances do not comply with any of the measures described above. As an alternative the methodology determines that the project activity can demonstrate its additionality by satisfying at least one of the following conditions:

(a) The project activity complies with the criteria for demonstrating additionality of microscale project activities; or

(b) The first-of-its-kind barrier is demonstrated as per TOOL23; or

(c) Activities that are type 7 (i.e. introduction of e-bikes) and the market penetration of e-bikes among bicycles in use in the city is below or equal to 1.5 per cent based on number of annual bicycle trips undertaken in the city or based on the stock of bicycles; or

(d) It is demonstrated, through the application of TOOL21, that at least one barrier would prevent the implementation of the project activity

Since the project activity instances do not satisfy conditions a, b, and c from paragraph 18, neither the additional conditions a, b and c from paragraph 19 of the "AMS-III.BM Lightweight two and three wheeled personal transportation" methodology, the TOOL 21 "Demonstration of additionality of small-scale project activities" may be applied. As per methodological TOOL 21, the project activity is considered additional if it can demonstrate that one of the following barriers would prevent its occurrence:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The additionality of each project instance using the TOOL 21 "Demonstration of additionality of small-scale project activities" is described below:

Curitiba

The proposed implementation of new bicycle sharing system in the metropolitan area of Curitiba complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (c), "barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions".

Since the methodological TOOL21 does not give an exact definition of how exactly to demonstrate the barrier, the project proponent use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 10 (Appendix, paragraph 1) use penetration rate of less than 2.5 per cent as condition to be considered automatically additional. As it can be seen in Table 3, bicycles are used as transport mode in 2,1% of the trips in Curitiba, demonstrating a barrier due to the prevailing practice.

Table 3 - Modal share in Curitiba

Means of transportation	Share
Bus	25,20%
Car	45,80%
Taxi	0,50%

Moto	2,70%
Walk	23,30%
Bike	2,10%
Outros	0,50%

It is worth mentioning that two other bike sharing system companies have tried to operate in Curitiba, with no success.

The 2022 bidding process was built in the accreditation format, where companies interested in offering bike sharing services can submit their proposals and all systems considered viable can be installed, with no guarantee of exclusivity. Until present days, Tembici is the only company that showed interest in installing and operating the bike sharing system, demonstrating an existence of an organizational capacity barrier to be considered, which is considered automatically additional as detailed in TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Salvador

The proposed expansion of an existing bicycle sharing system in the metropolitan area of Salvador complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (c), "barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions".

Since the methodological TOOL21 does not give an exact definition of how exactly to demonstrate the barrier, the project proponent use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 10 (Appendix, paragraph 1) use penetration rate of less than 2.5 per cent as condition to be considered automatically additional. As it can be seen in Table 4, bicycles are used as transport mode in 0.9% of the trips in Salvador, demonstrating a barrier due to the prevailing practice.

Table 4 - Modal share in Salvador

Means of transportation	Trips / day	Share
Bus	2,206,876	37.17%
Minibus	234,212	3.94%
Car	1,135,739	19.13%
Taxi	64,467	1.09%
Moto	130,387	2.20%
Walk	2,097,843	35.33%
Bike	54,124	0.91%
Outros	13,973	0.24%

Belo Horizonte

The proposed new bike sharing system in the metropolitan area of Belo Horizonte complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (c), "barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions".

Since the methodological TOOL21 does not give an exact definition of how exactly to demonstrate the barrier, the project proponent use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 10 (Appendix, paragraph 1) use penetration rate of less than 2.5 per cent as condition to be considered automatically additional. As it can be seen in Table 5, bicycles are used as transport mode in 0.98% of the trips in Belo Horizonte, demonstrating a barrier due to the prevailing practice.

Table 5 - Modal share in Belo Horizonte

Means of transportation	Trips / day	Share
Collective	4,100,807	31.40%
Individual	4,011,237	30.70%
Non-motorized - by foot	4,810,854.82	36.84%

Non-motorized - Bike	128,421.18	0.98%
Others	8,398.00	0.10%

Porto Alegre

The proposed new bike sharing system in the metropolitan area of Porto Alegre complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (c), "barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions".

Since the methodological TOOL21 does not give an exact definition of how exactly to demonstrate the barrier, the project proponent use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 10 (Appendix, paragraph 1) use penetration rate of less than 2.5 per cent as condition to be considered automatically additional. As it can be seen in Table 6, bicycles are used as transport mode in 0.55% of the trips, demonstrating a barrier due to the prevailing practice.

Table 6 - Modal share in Porto Alegre

Means of transportation	**Trips / day**	**Share**
Collective	1,017,072	36.74%
Individual	1.003.796	36.26%
Non-motorized - by foot	623.785	22.53%
Non-motorized - Bike	15.291	0.55%
Others	108.688	3.93%

Brasília

The proposed Implementation of new bicycle sharing program complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (d), " Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher."

The bidding process for Brasilia's system works as an accreditation, meaning that all companies interested in offering bike sharing services can submit their proposals and all systems considered viable can be installed, with no guarantee of exclusivity. During the bidding process, only Tembici was interested in installing the shared bike system, and it is the only company operating the system until present days, demonstrating an existence of an organizational capacity barrier to be considered.

Florianópolis

The proposed Implementation of new bicycle sharing program in Florianópolis complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (d), " Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher."

The bidding process for Florianópoli's system works as an accreditation, meaning that all companies interested in offering bike sharing services can submit their proposals and all systems considered viable can be installed, with no guarantee of exclusivity. During the bidding process, only Tembici was interested in installing the shared bike system, and it is the only company operating the system until present days, demonstrating an existence of an organizational capacity barrier to be considered.

Recife

The proposed expansion of an existing bicycle sharing system in the metropolitan area of Recife *complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (c), "barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions".*

Since the methodological TOOL21 does not give an exact definition of how exactly to demonstrate the barrier, the project proponent use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 10 (Appendix, paragraph 1) use penetration rate of less than 2.5 per cent as condition to be considered automatically additional. As it can be seen in Table 7, bicycles are used as transport mode in 2.2% of the trips in Recife, demonstrating a barrier due to the prevailing practice.

Table 7 - Modal share in Recife

Means of transportation	Share
Bus	35.59%
Car	11.23%
Taxi	0.27%
Moto	5.24%
Walk	37.83%
Bike	2,22%
Outros	7.61%

It is worth mentioning that the proposed expansion the bicycle sharing system in the metropolitan area of Recife also complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13.1, paragraph 10 (d), " Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher."

During the bidding process of Recife's system, only Tembici was interested in installing the shared bike system, and it is the only company operating the system until present days, demonstrating an existence of an organizational capacity barrier to be considered.

Bogotá

The implementation of bike sharing programs is not the most financially attractive option, since it competes with the prevailing practice of urban transportation infrastructure that is already in place and does not require any investment to maintain its current situation. Additionally, two other bike sharing were implemented in Bogotá before the project activity instance and both had to shut down their operations. Therefore, the investment barrier is the most suitable option to demonstrate the project activity additionality. As per methodology ASM-III.BM, when assessing investment barriers, the investment analysis should be undertaken from the perspective of the operator/investor of the bike parking areas or bicycle sharing stations, reflecting the costs and revenues from the perspective of the operator/investor – meaning that the

revenues from the parking fees and other sources (e.g. advertising) and the costs associated with the rent and maintenance of the parking area and/or the bicycle sharing station, security and personnel and the land cost and/or opportunity cost of land and/or fair value of the land shall be considered when conducting the investment analysis.

As the methodology does not specify any tool to assess the investment barrier, the Tool 27 Investment analysis version 12.0 will be used. This tool provides specific measures to assess investment barriers to the implementation of project activities. Since, the investment decision is a "go, don't go" type, the net present value (NPV) will be chosen as the performance indicator. The reason for this choice is that this indicator reflects the potential cash flow of the project activity on the date of investment decision taking into account the capital expenditures and a discount rate. Therefore, if the NPV is below zero, it demonstrates an investment barrier. The discount rate will be determined by applying the IRR benchmark provided in section 6 of methodological Tool 27 as recommended in paragraph 8 of the same.

The parameters for the NPV calculation are presented below and calculations, as well as information sources can be assessed in detail in the spreadsheet <input spreadsheet name>:

Table 8 – NPV Calculation Parameters

Parameter	Unit	Value
Quantity of bikes	units	3,000
Quantity of stations	units	300
Quantity of annual trips	thousands	10,751.2
Opex	thousands BRL	985
Capex	thousands BRL	68,579
Sponsorship revenue	thousands BRL/year	9,900
Advertising revenue	thousands BRL/year	5,775
User Revenue	thousands BRL/year	34,200
SG&A	% of net sales	9.80%
Depreciation	%	10%
User and advertising ramp-up	% discount in first year	73.80%
COGS ramp-up	% discount in first year	45%
Monthly ramp-up	% discount in first year	62.50%

Note: Opex = Operational expenditures, Capex = Capital expenditures, SG&A = Selling, General and Administrative expenses, COGS = Cost of Goods Sold.

The discount rate used for NPV was calculated using the default value of 11.91% that can be found in [2]of Tool 27 version 12.0. Since, the benchmark represents a real rate and NPV was calculated in nominal terms it was adjusted upon inflation target from Brazil's Central Bank[3] as demonstrated below:

$$Benchmark\,rate = (1 + 11,91\%)x(1 + 3\%) - 1 = 15,3\%$$

The NPV value calculated with the parameters above is presented below:

Parameter	Unit	Value
Net Present Value	thousands BRL	-3,017

The value is negative, which means that, for the capital expenditures needed for the project activity implementation, the potential cash flow was not enough to pay the discount rate, which is the benchmark rate. This represents an investment barrier, since the project depends on a decision of investment based on its fair value.

Other project activity instances shall be subjected to the same assessment provided in this section and some of them might demonstrate additionality by attesting barriers of prevailing practice or first-of-its-kind situations. For the first will be provided evidence that the project complies with the definition of CDM TOOL19, version 9 (Appendix, paragraph 1), "use penetration rate of less than five per cent as condition to be considered automatically additional", since no the methodology doesn't specify what is the measure of prevailing practice. For the latter will be provided evidence that the project is the first-of-its-kind by applying the latest version of CDM's tool 23 "Additionality of first-of-its-kind project activities.

3.6 Methodology Deviations

One possible deviation of methodology is the use of surveys of local authorities or data used for cities official mobility plans to determine values of parameter Si "Share of passengers who shifted from electricity-based or roadbased vehicle category i (%)". The reason for this deviation is that the data provided by this kind of research is already collected and, since the project has small scale, the avoidance of survey's costs is a

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[3] https://www.bcb.gov.br/controleinflacao/historicometas

significant source of efficiency to the project proponent. This kind of data doesn't comply with the methodology as per reasons presented below:

1. *It is not an ex-post survey;*
2. *It was not conducted with the users of the infrastructure; and*
3. *It does not follow exactly the standard "Sampling and surveys for CDM project activities and programme of activities"*

If any project instance decides to use this kind of research, an assessment of the survey's methodology will be provided to make sure that the requirements respected to methodology deviations found in the latest version of VCS Standard are attended.

4 Quantification of GHG Emission Reductions and Removals

4.1 Baseline Emissions

As per methodology AMS-III.BM version 2.0 baseline emissions are the emissions resulting from transportation of passengers in the absence of the project activity. It is differentiated per baseline modes of transport (relevant travel modes) that the project activity users would have used in the absence of the project activity. One of the options below shall be applied for baseline emissions:

Option 1: Ex-post survey of baseline travel modes

Option 2: Baseline emissions based on public transportation (excluding cars, taxis and motorcycles) as benchmark

Option 3: Based on a survey of users of e-bikes and users of bicycle sharing programs

Option 1 was chosen. This option is suitable for all types indicated in Table 2 in section 3.2.

Under this option, baseline emissions cover the emissions which would have been caused by the user of the infrastructure (bicycle lanes, bicycle sharing program, parking areas) and/or of the e-bikes, e-tricycles in absence of the project from origin (O) to destination (D), where the O and D points of the trip are assumed to be equal for both the baseline and the project scenarios. 23.

Baseline emissions are determined by applying Steps 1 to 4 from the latest approved version of TOOL18, using parameters estimated based on data collected during the

survey in the year 1 and optionally in the year 4 of the crediting period. The survey shall be conducted with the users of the infrastructure, bicycle sharing program or new tricycles, e-bikes or e-tricycles.

The vehicle categories index i indicated in Step 1 of TOOL18 shall be included, and "cycling" and "walking" should be considered as potential baseline "vehicle categories" with an emission factor of zero. If some vehicle categories are not explicitly identified or do not fit into the categories from the tool, they should be included in the survey as "others" and baseline emissions of this category are counted as zero. The survey shall be undertaken at locations of the project infrastructure and origin/destination of the cycling trip shall be substituted for "entry/exit station" in TOOL18. The survey may be conducted with a sample of users in the case of the bicycle sharing program or new tricycles, e-bikes or e-tricycles.

When applying Step 4 of TOOL18, the following provisions shall apply:

(a) Parameter Py (Number of passengers travelled by the project system in year y) should be considered as number of trips on the new infrastructure / service per year as measured by counting, if necessary, relying on sampling (sampling in accordance with the standard "Sampling and surveys for CDM project activities and programme of activities");

(b) Parameter Di (Average trip distance travelled by passengers) may be determined:

(i) from the survey with the users in the project;

(ii) as an average value for bicycle, tricycle, e-tricycle or e-bike trips (as relevant) from official data or studies at the city level; or

(iii) by applying the default conservative value of 2.5 km for bicycle or tricycle trips and 5 km for e-bike or e-tricycle trips[4].

The steps 1 to 4 from the latest approved version of TOOL18 are detailed in Appendix A.

4.2 Project Emissions

As per methodology AMS-III.BM version 2.0 project emissions are determined based on the amount of electricity consumed to recharge the batteries of e-bikes or e-tricycles (ECPJ,y) using Equation (1) from TOOL 05:

$$PE_{EC,y} = \Sigma EC_{PJ,j,y} \times EF_{EF,j,y} \times (1 + TDL_{j,y})$$

[4] According to the study "A Global High Shift Cycling Scenario", prepared by the Institute for Transportation and Development Policy (ITDP) and by the Institute of Transportation Services (ITS) from UC Davis, a typical cycling trip distance is of 3 – 5 km and can be covered in 20 minutes using a bicycle; e-bikes can cover 10 km in 20 minutes.

The electricity consumed to recharge the batteries ($EC_{PJ,y}$) may be determined:

(a) By directly measuring the electricity consumed by all e-bikes or e-tricycles included in the project; or

(b) Alternatively, assuming a default consumption of 0.015 kWh/km travelled. In this situation, the electricity consumed is determined according to the equation below:

$EC_{PJ,y} = 0.015 \times \Sigma DT_{u,y}$

Where:

$EC_{PJ,y}$ = Quantity of electricity consumed to recharge the batteries of e-bikes or e-tricycles in year y (kWh)

$DT_{u,y}$ = Total distance travelled by the individual user u of the bicycle sharing program and/or of the promoted e-bikes in year y (km)

As the project activity usually consumes energy from the grid the emission from electricity consumption $EF_{EF,j,y}$ will be calculated using the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the TOOL07 "Tool to calculate the emission factor for an electricity system" (EFEL,j/k/l,y = EFgrid,CM,y) as per option A1 from TOOL05 paragraph 19.

As per TOOL07 the combined margin emissions factor is calculated as follows:

$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (t CO2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (t CO2/MWh)

W_{OM} = Weighting of operating margin emissions factor (per cent)

W_{BM} = Weighting of build margin emissions factor (per cent)

The following default values should be used for W_{OM} and W_{BM}:

(a) Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM}= 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;

(b) All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM}= 0.75 for the second and third crediting period[5], unless otherwise specified in the approved methodology which refers to this tool.

Alternative weights can be proposed, as long as W_{OM} + W_{BM} = 1, for consideration by the Board, taking into account the guidance as described below. The values for W_{OM} + W_{BM} applied by project participants should be fixed for a crediting period and may be revised at the renewal of the crediting period.

It must be added that when applying this tool for a programme of activities (PoA) or grouped project, the steps defined above shall be applied to each component project activity (CPA) of the PoA for determining the CO2 emission factor for an electricity system

4.3 Leakage

As per methodology AS-III.BM version 2.0 leakage does not have to be taken into account

4.4 Net GHG Emission Reductions and Removals

As per methodology AS-III.BM version 2.0 emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y= Emission reductions in year y (tCO_2)

BE_y= Baseline emissions in year y(tCO_2)

PE_y= Project emissions in year y(tCO_2)

From now on the examples of baseline emission, project emission and emission reduction are based on the project activity instance of Bogotá.

As explained in section 4.1 the option 1 for calculation of baseline was chosen. An example of the steps 1 to 4 of TOOL18 are presented below for the city of Bogotá.

[5] Project participants can submit alternative proposal, for revision of tool or the methodology or deviation from its use, if the weightage does not reflect their situation with an explanation for the alternative weights.

All values and sources are presented in the spreadsheet "<Cycling the Change Emission Reduction Calculations>" submitted as annex.

Step 1: Determine relevant vehicle categories

The relevant vehicle categories of Bogotá are listed below according to the survey "Encuesta de movilidad"[6] which was taken in 2019 and it's the official government data.

a) Bus (Small, Medium and Large)

b) Passenger Cars

c) Taxis

d) Motorcycle

e) Pedestrians

f) Bicycles

A clarification on the method used to classify the bus sizes is needed. The city of Bogotá has a mass transport system which includes various types of buses, namely i) SITP Zonal, ii) SITP Provisional, iii) Transmilenio, iv) Intermunicipal, v) special and vi) Informal according to the survey "Encuesta de movilidad". Theses buses differ significantly in number of seats, as it can vary from 19 to 250 in terms of passengers capacity[7]. To classify the bus fleet into small, medium and large a two-step approach was held. First, the total number of buses were grouped into the category bus using data from "Encuesta de movilidad". Since, the categorization used in this research does not refer to the size of the buses – the SITP contemplates buses with 19 and 120 seats – it was used data from the Colombian energy balance report[8] which divides the buses into three categories: bus, buseta, and microbus, what was classified as large, medium and small, respectively. This data was not only convenient, since it is a much simpler categorization, but it also allows to identify the fuel type and number of trips per fuel type. As a result, one has the total number of buses according to the sum of the various types as identified in the survey "Encuesta de movilidad" and divided into three categories of size for each fuel type (gasoline, diesel and NGV) according to the Colombian energy balance report.

The vehicles and share of each category are presented below:

[6] https://observatorio.movilidadbogota.gov.co/encuestas_de_movilidad

[7] https://ciencia.lasalle.edu.co/cgi/viewcontent.cgi?article=1262&context=economia

[8] https://www1.upme.gov.co/DemandayEficiencia/Documents/Balance_energia_util/BEU-Transporte.pdf

Table 8 – Share of transportation modal in the city of Bogotá

Relevant vehicle categories	Share of passengers who shifted from electricity-based or roadbased vehicle category i (%)
Passengers' cars	14,90%
Taxi	4,90%
Motorcycle	5,50%
Pedestrian	23,90%
Bicycles	6,60%
Bus (Large Gasoline)	6,2%
Bus (Medium Gasoline)	0,9%
Bus (Small Gasoline)	1,9%
Bus (Large Diesel)	21,4%
Bus (Medium Diesel)	7,0%
Bus (Small Diesel)	4,3%
Bus (Large NGV)	0,7%
Bus (Medium NGV)	0,9%
Bus (Small NGV)	0,9%

Step 2: Determine the emission factor per kilometre for each relevant road-based vehicle category

The first task into applying the step 2 is to determine the fuel type for each vehicle. The fuel type is defined in the step below:

Table 9 – Relevant vehicles per fuel type

Relevant vehicle categories	Fuel type
Passengers' cars	Gasoline
Taxi	Gasoline
Motorcycle	Gasoline
Pedestrian	Not applicable
Bicycles	Not applicable
Bus (Large Gasoline)	Gasoline
Bus (Medium Gasoline)	Gasoline
Bus (Small Gasoline)	Gasoline
Bus (Large Diesel)	Diesel
Bus (Medium Diesel)	Diesel
Bus (Small Diesel)	Diesel
Bus (Large NGV)	NGV
Bus (Medium NGV)	NGV
Bus (Small NGV)	NGV

The second step is to apply the equation below:

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

Since there is no electricity-based vehicle listed the parameter $SEC_{i,x}$ is null. It should be noted that the vehicles which differ in terms of fuel type are already being treated separately, thus the parameter $N_{i,n,x}N_{i,x}$ equals to 1. As a conclusion the $EF_{KM,i,x}$ is obtained by the multiplication of the parameter below for each vehicle:

Table 10 – $EF_{KM,i,x}$ calculation table

	$SFC_{i,n,x}$	$NCV_{i,n}$	$EF_{CO2,n}$	$EF_{KM,i,x}$
Relevant vehicle categories	**Specific fuel consumption of vehicle category i using fuel type n in year x (L/km)**	**Net calorific value of fuel n used in vehicle category i (MJ/L)**	**Emission factor for fuel type n (g CO2/MJ**	**Emission factor per kilometre of vehicle category i in year x (g CO2/km)**
Passengers cars	0,06	31,54	67,50	127,72
Taxi	0,06	31,54	67,50	127,72
Motorcycle	0,02	31,54	67,50	42,57
Pedestrian	0,00	0,00	0,00	0,00
Bycicles	0,00	0,00	0,00	0,00
Bus (Large Gasoline)	0,47	31,54	67,50	1007,21
Bus (Medium Gasoline)	0,32	31,54	67,50	671,47
Bus (Small Gasoline)	0,76	31,54	67,50	1611,53
Bus (Large Diesel)	0,42	34,78	72,60	1061,91
Bus (Medium Diesel)	0,21	34,78	72,60	530,95
Bus (Small Diesel)	0,47	34,78	72,60	1194,65
Bus (Large NGV)	0,16	22,58	58,30	216,63
Bus (Medium NGV)	0,13	22,58	58,30	166,08
Bus (Small NGV)	0,42	22,58	58,30	553,61
Source	Default value of Tool 18 for passengers' cars, taxis and motorcycle and Colmbian Energy Balance report for buses	2006 IPCC Guidelines on National GHG Inventories	2006 IPCC Guidelines on National GHG Inventories	calculated

$EF_{PKM,i,x}$= 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), etc.)

X =Most recent calendar year for which data is available. Data not older than three years

Except for buses, the average occupancy rate of vehicle category was estimated for each vehicle using default values of TOOL 18 as presented in the table below:

Table 11 – $OC_{i,x}$ calculation table

parameter	$OC_{i,x}$	
Relevant vehicle categories	**Average occupancy rate of vehicle category i in year x**	**source**
Passengers cars	2	Tool 18 Baseline emissions for modal shiftmeasures in urban passenger transport
Taxi	1,1	Tool 18 Baseline emissions for modal shiftmeasures in urban passenger transport
Motorcycle	1,5	Tool 18 Baseline emissions for modal shiftmeasures in urban passenger transport
Pedestrian	1	Tool 18 Baseline emissions for modal shiftmeasures in urban passenger transport
Bycicles	1	Tool 18 Baseline emissions for modal shiftmeasures in urban passenger transport

For the bus category the assumptions used for calculation are presented below:

Table 12 – Bus type assumptions

Bus size	**Capacity**	**Average Occupancy Rate (% of total Capacity)**	**Occupancy rate**
Large	80	40%	32
Medium	40	40%	16
Small	19	40%	7,6
Source	Zapata and Castillo, 2017*	TOOL18	calculated

Note: * https://ciencia.lasalle.edu.co/cgi/viewcontent.cgi?article=1262&context=economia

Dividing the parameter $EF_{KM,i,x}$ by $OC_{i,x}$ for each vehicle category one has the result presented below:

Table 13 – $EF_{KM,i,x}$ calculation

parameter	$EF_{PKM,i,x}$
Relevant vehicle categories	**Emission factor per passenger-kilometre for electricity-based or road-based vehicle category i in year x (g CO2eq/PKM)**
Passengers cars	63,86
Taxi	116,11
Motorcycle	28,38
Pedestrian	-
Bycicles	-
Bus (Large Gasoline)	31,48
Bus (Medium Gasoline)	41,97
Bus (Small Gasoline)	212,04
Bus (Large Diesel)	33,18
Bus (Medium Diesel)	33,18
Bus (Small Diesel)	157,19
Bus (Large NGV)	6,77
Bus (Medium NGV)	10,38
Bus (Small NGV)	72,84

Step 4: Determine the baseline emission

For the determination of ex-ante baseline emissions, option 1 of TOOL18 is considered based on average distance trip (D_i), number of passengers (P_y) and share of passengers who shifted from electricity-based or road-base vehicle category (S_i) as presented in table 8.

For the technology improvement factor for fleet, default value of 0.99 is considered for all vehicles as required by TOOL18 in order to determine baseline emissions.

Number of passengers travelled with the system (P_y) and average distance (D_i) were based on the following assumptions presented below:

Table 14 –P_y and D_i assumptions

Type of project	**Type 3**
Bike stations	300
Quantity of bikes per station	10
% of e-bikes	50%
Average distance for e-bikes	5 km
Average distance for mechanical bikes	2,5 km
Number of Days	360

Number of slots per day for e-bikes	15
Number of slots per day for mechanical bikes	20
Number of passengers travelled per year e-bikes	10,180,800
Number of passengers travelled per year mechanical bikes	11,642,400

Baseline emissions were calculated using equation below and results for each vehicle category as well as the total baseline emission is presented in the table 15:

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

Table 15 –Baseline emissions per vehicle category for a full potential year

Relevant vehicle categories	Baseline emissions in full potential year (tCO2e)
Passengers cars	224
Taxi	134
Motorcycle	37
Pedestrian	-
Bycicles	-
Bus (Large Gasoline)	46
Bus (Medium Gasoline)	9
Bus (Small Gasoline)	93
Bus (Large Diesel)	167
Bus (Medium Diesel)	55
Bus (Small Diesel)	160
Bus (Large NGV)	1
Bus (Medium NGV)	2
Bus (Small NGV)	15
Total	945

Calculation the project emissions

Since the project activity instance of the city of Bogotá encompasses the use of e-bikes the calculation of project emissions will consider the distance travelled in this type of bike, the electricity consumption and the emission factor of the electricity grid what is represented in the equation below:

$$PE_{EC,y} = \Sigma EC_{PJ,j,y} \times EF_{EF,j,y} \times (1 + TDL_{j,y})$$

The electricity consumption $EC_{PJ,j,y}$ will be defined using alternative (b) assuming a default consumption of 0.015 kWh/km travelled as explained in section 4.2. The distance travelled is the

same used for the baseline emission calculation of e-bikes based on assumptions presented in table 9. As a result, one has the equation below:

$$EC_{PJ,y} = 0.015 \times \Sigma DT_{u,y}$$

$EC_{PJ,1}$ = 0.015 x 11,642,400 = 175.000 Kwh or 175 MWh

To calculate the project emission the total electricity consumption should be multiplied by the emission factor of the electricity grid, which is calculated used the combined margin based on the Colombian DNA official data for operating and building margins. As per section 4.2 the equations were applied for each parameter and the calculation was held as follows:

Table 16 - $EF_{grid,OM,y}$ **calculation**

Emission Factor of Operation Margin Efgrid, OM,y (tCO2e/Mwh)		
Year	$EF_{EL,DD,h}$	Source
2022	0,73	Colombian DNA https://www1.upme.gov.co/ServicioCiudadano/Documents/Proyectos_normativos/Documento_Tecnico_FE_2020.pdf#search=Documento%5FTecnico%5FFE%5F2020)
2023	0,73	
2024	0,73	
2025	0,73	
2026	0,73	
2027	0,73	
2028	0,73	
2029	0,73	
2030	0,73	
2031	0,73	

Table 17 - $EF_{grid,BM,y}$ **calculation**

Emission Factor of Build Margin Efgrid, BM,y (tCO2e/Mwh)		
Year	Average	Source
2022	0,46	Colombian DNA https://www1.upme.gov.co/ServicioCiudadano/Documents/Proyectos_normativos/Documento_Tecnico_FE_2020.pdf#search=Documento%5FTecnico%5FFE%5F2020)
2023	0,46	
2024	0,46	
2025	0,46	
2026	0,46	
2027	0,46	
2028	0,46	
2029	0,46	
2030	0,46	
2031	0,46	

Table 18 – Operating Margin and Building Margin weights

Weighting of operating and building margin emissions factor – Default			
Year	WOM	WBM	Source
2022	0,50	0,50	Colombian DNA https://www1.upme.gov.co/ServicioCiudadano/Documents/Proyectos_normativos/Documento_Tecnico_FE_2020.pdf#search=Documento%5FTecnico%5FFE%5F2020)
2023	0,75	0,25	
2024	0,75	0,25	
2025	0,75	0,25	
2026	0,75	0,25	
2027	0,75	0,25	
2028	0,75	0,25	
2029	0,75	0,25	
2030	0,75	0,25	
2031	0,75	0,25	

Table 19 – Combined margin calculation

EFgrid,CM,y – Combined margin CO2 emission factor in year y		
Year	Average	Source
2022	0,5943	Calculated as per "Tool to calculate the emission factor for na electricity system" V 7.0
2023	0,6618	
2024	0,6618	
2025	0,6618	
2026	0,6618	
2027	0,6618	
2028	0,6618	
2029	0,6618	
2030	0,6618	
2031	0,6618	

Once the combined margin was calculated the $PE_{EC,y}$ equation is applied resulting in the table below:

Table 20 – $PE_{EC,y}$ calculation

parameter	$EC_{PJ,j,y}$	$EF_{EF,j,y}$	$TDL_{j,y}$	$PE_{EC,y}$
year	Quantity of electricity consumed to recharge the batteries of e-bikes or e-tricycles in year y (MWh)	Emission factor for electricity generation for source j in year y (t CO2/MWh)	Average technical transmission and distribution losses for providing electricity to source j in year y	Project emissions from electricity consumption in year y (t CO2 / yr
2022	-	0,6618	20%	-
2023	-	0,6618	20%	-
2024	175	0,6618	20%	116
2025	175	0,6618	20%	116
2026	175	0,6618	20%	116
2027	175	0,6618	20%	116
2028	175	0,6618	20%	116
2029	175	0,6618	20%	116
2030	175	0,6618	20%	116
2031	175	0,6618	20%	116

By subtracting the project emissions from the baseline emission estimated net GHG emission reductions is calculated as presented in the table below:

Table 21 - Estimated net GHG emission reductions or removals

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2022	103	-		103
2023	108	-		108
2024	3,115	116		3,000
2025	3,053	116		2,938
2026	2,993	116		2,877
2027	2,933	116		2,817
2028	2,875	116		2,759
2029	2,817	116		2,702
2030	2,761	116		2,646
2031	2,706	116		2,591
Total	23,465	925		22,540

5 MONITORING

5.1 Data and Parameters Available at Validation

The tables below present the data and parameters in which values applied were available at validation.

Data /parameter table 1

Data / Parameter	$SFC_{i,n,x}$
Data unit	*Mass or volume units of fuel/km*
Description	*Specific fuel consumption of vehicle category i using fuel type n in year x*

Source of data	*In decreasing order of preference:* *1. Local measured data (studies, e.g. performed by universities, other institutions or ordered by project proponent);* *2. National or international data from studies;* *3. IPCC default values for the respective vehicle categories (latest IPCC report)* *4. Design data for relevant vehicle categories* *5. Globally applicable default values (see table 15)*
Value applied	*Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.*
Justification of choice of data or description of measurement methods and procedures applied	*The following alternatives are proposed to determine specific fuel consumption (in order of preference). In case one of the alternatives does not provide required values for all categories, the combination of these alternatives can be used and justification for the use of combination should be provided.* ***Alternative 1:*** *Measurement of fuel consumption data using total data (if available e.g. from bus or taxi companies) or a representative sample for the respective category and fuel type. Sampling per category and fuel should include, as core characteristics, vehicle age and motorization to ensure that the sample is as close as possible to the actual vehicle composition in the urban area(s) of the region for which the baseline is established. Vehicle age and technology (related often to emission standards such as Euro standards) are factors, which influence to a significant extent the fuel consumption. To be conservative, specific fuel consumptions based on samples shall be based on the lower limit of the uncertainty band at a 95 per cent confidence level.* ***Alternative 2:*** *Use of fixed values based on national or international literature. The literature data can either be based on measurements of similar vehicles in comparable surroundings (e.g. from comparable cities of other countries) or may include identifying the vehicle age and technology of average vehicles circulating in the urban area(s) of the region for which the baseline is established and then matching this with the most appropriate IPCC default values. The most important proxy to identify vehicle technologies is the average age of vehicles used in the*

	urban area(s) of the region for which the baseline is established, to determine whether either US, Japanese or European default factors apply, or local vehicle manufacturer information can be used (in the case of having a substantial domestic vehicle motor industry or source of origin of vehicle imports). ***Alternative 3:*** *latest IPCC default values reported matching the respective vehicle category, age, vehicle origin and technology.* ***Alternative 4.*** *Design data for relevant vehicle categories.* ***Alternative 5.*** *Globally applicable specific fuel consumption for vehicle category default values (see Table 15).*

Table 15 - Specific fuel consumption	Value	Unit
Gasoline car (personal and taxi)	*6*	L/100km
Diesel car (personal and taxi)	*5*	L/100km
Motorcycle	*2*	L/100km

Purpose of Data	Calculation of baseline emissions.
Comments	-

Data /parameter table 2

Data / Parameter	$SEC_{i,x}$
Data unit	kWh/km
Description	Specific electricity consumption of vehicle category i using electricity in year x
Source of data	*In decreasing order of preference:*

	1. Local measured data (studies, e.g. performed by universities, other institutions or ordered by project proponent); *2. National or international data from studies;* *3. IPCC default values for the respective vehicle categories (latest IPCC report)* *4. Design data for relevant vehicle categories* *5. Globally applicable default values (see table 14)*
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	The following alternatives are proposed to determine specific electricity consumption (in order of preference). In case one of the alternatives does not provide required value for all categories, the combination of these alternatives can be used and justification for the use of combination should be provided. **Alternative 1:** Measurement of electricity consumption data using total data (if available e.g. from bus or taxi companies) or a representative sample for the respective category. Sampling per category should include, as core characteristics, vehicle age and technology to ensure that the sample is as close as possible to the actual vehicle composition in the urban area(s) of the region for which the baseline is established. To be conservative, specific electricity consumptions based on samples shall be based on the lower limit of the uncertainty band at a 95 per cent confidence level. **Alternative 2:** Use of fixed values based on national or international literature. The literature data can either be based on measurements of similar vehicles in comparable surroundings (e.g. from comparable cities of other countries) or may include identifying the vehicle age and technology of average vehicles circulating in the urban area(s) of the region for which the baseline is established and then matching this with the most appropriate IPCC default values. The most important proxy to identify vehicle technologies is the average age of vehicles used in the urban area(s) of the region for which the baseline is established, to determine whether either of US, Japanese or European default factors apply, or local vehicle manufacturer information can be used (in the case of having

	a substantial domestic vehicle motor industry or source of origin of vehicle imports). **Alternative 3:** latest IPCC default values reported matching the respective vehicle category, age, vehicle origin and technology. **Alternative 4.** Design data for relevant vehicle categories. **Alternative 5.** Globally applicable default values. (Table 16)

Table 16 - Specific fuel consumption	Value	Unit
Electric vehicles	0.12	Kwh/Km

Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 3

Data / Parameter	$N_{i,n,x}$
Data unit	VKM or units
Description	Number of vehicle-kilometres vehicle category i using fuel type n driven in year x or number of vehicles in vehicle category i using fuel type n in year x
Source of data	Municipal transit authorities based on vehicle registration statistics from the respective city or data from vehicle control stations (technical and emission control stations). If no city/municipal data is available, regional data (canton, state) or, as a last option, national data can be used
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	Used for all vehicle categories identified as relevant vehicle categories. In the cases of buses and taxis, informal or illegal units may operate. While estimates on the number of informal units may be available, these are by their nature not trustworthy. For both categories it is thus recommended to only include formally registered units. For consistency, it is

	important that transported passengers are also based on the official records thus not including passenger trips of informal units. For electrical vehicles fuel type n represents electricity
Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 4

Data / Parameter	$N_{i,n,x}$ / $N_{i,x}$
Data unit	Percentage or share
Description	Percentage or share of vehicle-kilometres or vehicles in vehicle category i using fuel type n in year x
Source of data	National transport statistics based on vehicle registration statistics, company data (for buses) or surveys
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	For buses it should be based on urban units as urban buses often use a different fuel type than inter-urban units
Purpose of Data	Calculation of baseline emissions
Comments	Used for all relevant vehicle categories
Comments	-

Data /parameter table 5

Data / Parameter	$NCV_{i,n}$
Data unit	Energy/mass or volume units of fuel type n
Description	Net calorific value of fuel n used in vehicle category i
Source of data	Data sources in Table 17 may be used if the relevant conditions apply.

	Data sources	Conditions for using the data source
	(a) National default values	This source can be only used for liquid fuels and should be based on well documented reliable sources (such as national energy balances)
	(b) IPCC default values at the lower limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.2 of chapter 1 of volume 2 (energy) of the 2006 IPCC Guidelines on National GHG Inventories	
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.	
Justification of choice of data or description of measurement methods and procedures applied	Following provisions established in TOOL18.	
Purpose of Data	Calculation of baseline emissions	
Comments	Vehicle owners or operators can buy fuel from a variety of sources (fuel stations). Therefore, in practice it is considered to be simpler to determine the parameter using options (a) or (b).	

Data /parameter table 6

Data / Parameter	IR_i
Data unit	-
Description	Technology improvement factor for vehicle category i per year

Source of data	TOOL18
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	When the tool is used for estimating baseline emissions for individual CDM project activities or Programmes of Activities, the default technology improvement factor is 0.99 for all vehicle categories.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 7

Data / Parameter	$OC_{i,x}$ or $OC_{B,x}$ / $OC_{T,x}$ / $OC_{C,x}$ / $OC_{MR,x}$
Data unit	Passengers
Description	Average occupancy rate of vehicle category i in year x (e.g., buses (B), taxis (T), passenger cars (C), motorized rickshaws (MR)
Source of data	Option 1. Municipal transit authorities or specific studies. Vintage maximum three years. Option 2. The following default values can be applied:

Vehicle type	Average occupancy		Unit
	World	South Asia	
Car	2.0	2.0	Person (including driver)
Taxi	1.1	1.1	Person (including driver)
Motorcycle	1.5	1.5	Person (including driver)
Bus	40%	80%	Total capacity

Option 3. Survey of occupancy of individual motorized transport (motorcycles, personal cars, taxis) in the urban area for which the baseline is established. The obtained

	occupancy rates can be used as default values for these vehicle categories at a country level, as variation in occupancy rates of individual motorized transport used in the urban context is relatively low. Survey of occupancy rates of public transport (bus, light rail, tram, metro, BRTs, etc.) in the urban area for which the standardized baseline is established. If standardized baselines for multiple cities in a country are established, these cities need to be grouped in categories of similar cities (based on population size, population density, etc.) and surveys on occupancy rates of public transport of sample cities need to be conducted. If there is no big variation in occupancy rates of the same mode in the cities of the same category, then surveyed occupancy rates of public transport can be used as defaults for the rest of the cities in the same category
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	Based on visual occupation studies for all vehicle categories. For buses the occupation rate is based on boarding-alighting studies, electronic smart tickets or on visual occupation studies with expansion factors for routes served to determine the average occupation 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 by buses. For taxis (including motorized rickshaws), the driver should not be counted
Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 8

Data / Parameter	$EF_{CO2,n}$
Data unit	g CO_2/J
Description	Emission factor for fuel type n

Source of data	Data sources in Table 15 may be used if the relevant conditions apply. Note: In case biofuels or biofuel blends are used, the CO2 emission factor for the share of biofuels used as pure or in blends is equal to zero
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	Following provisions established in TOOL18.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 9

Data / Parameter	$EF_{CO2,x}$
Data unit	g CO_2/kWh
Description	Emission factor for electricity in year x (g CO_2/kWh)
Source of data	Official source of data
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	TOOL05 shall be applied.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 10

Data / Parameter	$EF_{KM,i,x}$

Data unit	g CO_2/km
Description	Emission factor per kilometre of vehicle category i in year x (g CO_2/km)
Source of data	Official source of data
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Justification of choice of data or description of measurement methods and procedures applied	Emission factor for new vehicles.
Purpose of Data	Calculation of baseline emissions
Comments	This option is available for taxis, personal cars and motorcycles. Depending on the regions from which the cars are purchased (the US, European Union, Japan, domestic car industry, etc.) respective emission factors for new cars manufactured in these regions shall be used.

Data /parameter table 11

Data / Parameter	$DE_{EL,i,x}$
Data unit	km
Description	Average trip distance travelled by passengers using electricity based vehicle category i in year x
Source of data	Official statistics or data obtained from the system operator.
Value applied	Not applicable here, since the project instance does not have electricity vehicles as baseline
Justification of choice of data or description of measurement methods and procedures applied	Data should be maximum three years old. Following provisions established in TOOL18.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 12

Data / Parameter	$P_{EL,i,x}$
Data unit	Passengers
Description	Total number of passengers transported per annum by electricitybased vehicle category i in year x
Source of data	Official statistics or data obtained from the system operator. Data not older than three years.
Value applied	Not applicable here, since the project instance does not have electricity vehicles as baseline
Justification of choice of data or description of measurement methods and procedures applied	Following provisions established in TOOL18.
Purpose of Data	Calculation of baseline emissions
Comments	-

5.2 Data and Parameters Monitored

The tables below present data and parameters which will be monitored across the crediting period.

Data /parameter table 13

Data / Parameter	$ADT_{u,y}$
Data unit	km
Description	Average distance travelled per trip by the user u of the infrastructure that would not have used the bicycle in the absence of the project in year y
Source of data	a) Estimated via survey of the users of the infrastructure; or (b) Directly measured via GPS; or (c) As a conservative approach, the average distance travelled can be assumed as 2.5 km for bicycles and 5 km for e-bikes

Description of measurement methods and procedures to be applied	The survey shall be conducted with a representative sample of users of the bicycle lanes or bicycles parking areas, following the standard "Sampling and surveys for CDM project activities and programme of activities"
Frequency of monitoring/recording	The survey shall be conducted in the year 1 and optionally in the year 4 of the crediting period
Value applied	It depends on the option used for the determination of the baselines emissions of the additional instance of the project activity.
Monitoring equipment	N/A
QA/QC procedures to be applied	Average distance travelled per trip by the user when determined through a survey shall be cross checked with values of travel modes and trip length reported in literature (e.g. published reports, studies pertaining to the project region). If local studies are not available, values reported in Appendix 5 of the "Manual for Calculating Greenhouse Gas Benefits of Global Environment Facility Transportation Projects" prepared by the ITDP and available at https://www.thegef.org/publications/manualcalculating-ghg-benefits-gef-transportation-projects may be used for crosschecking. If the mode shares and trip length determined through the survey is conservative or comparable to literature values no further action is required, otherwise project proponent shall demonstrate that the outcome of the survey is representative and reliable explaining the factors that lead to differences (e.g. based on sample based checks of evidences such as fuel receipts of cars or travel tickets for bus or metro).
Purpose of data	*Calculation of baseline emissions*
Calculation method	Parameter used when applying Option 2 of the methodology
Comments	-

Data /parameter table 14

Data / Parameter	$EC_{Pj,y}$
Data unit	km
Description	Quantity of electricity consumed to recharge the batteries of ebikes or e-tricycles in year y
Source of data	Continuous measurements
Description of measurement methods and procedures to be applied	As per the latest version of the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05). When applying the tool, requirements for EGPJ,grid,y and/or EGPJ,j,y specified in the tool should apply to electricity consumed form the grid and electricity consumed from the captive power plant, whichever applicable
Frequency of monitoring/recording	As per the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05)
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	N/A
QA/QC procedures to be applied	A unique identification number shall be assigned to each user at the time of registering with the e-bike or bicycle sharing program. The manager of the program shall implement measures to link the distance travelled by each of the users to its unique identification number. The records shall be made in a centralized database that allows the project proponent to have access to the information related to the users' travels.
Purpose of data	*Calculation of baseline emissions*
Calculation method	Parameter used when applying option 3 of the methodology.

Comments	Data shall be controlled for outliers, e.g. trips with travel distances longer than three standard deviations above the mean shall be excluded

Data /parameter table 15

Data / Parameter	D_i
Data unit	kilometres
Description	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category i
Source of data	The two options of TOOL18 may be used: ii. As an average value for bicycle, tricycle, e-tricycle or e-bike trips (as relevant) from official data or studies at the city level; or iii. By applying the default conservative value of 2.5 km for bicycle or tricycle trips and 5 km for e-bike or e-tricycle trips.
Description of measurement methods and procedures to be applied	In case of using the average value (option i above), the data will be collected for each trip by a GPS system and stored at the Tembici information system for extraction and calculation of the average value. In cases where the GPS information is not available the default value (option ii above) will be used.
Frequency of monitoring/recording	In case of average value, the parameter shall be measured while travelling. The values shall be aggregated monthly or annually and the average will be calculated.
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	GPS data is collected through equipment installed in each bicycle
QA/QC procedures to be applied	Data is collected and stored at the data center. Database is constantly sanitized to assure its quality.
Purpose of data	*Calculation of baseline emissions and project emission*

Calculation method	The sum of distance of each individual user is then divided by the total number of users with valid input for the selected period.
Comments	-

Data /parameter table 16

Data / Parameter	SD_i
Data unit	%
Description	Share of passengers who shifted from electricity-based or roadbased vehicle category i
Source of data	Survey
Description of measurement methods and procedures to be applied	Survey of the project passengers in year 1 and optionally in year 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).
Frequency of monitoring/recording	Continuous
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	N/A
QA/QC procedures to be applied	Official source of data or following provisions established in the standard "Sampling and surveys for CDM project activities and programme of activities" (appendix B) and TOOL18.
Purpose of data	Calculation of baseline emissions
Calculation method	Parameter used when applying Option 2 of TOOL18
Comments	-

Data /parameter table 17

Data / Parameter	P_y
Data unit	Passengers
Description	Number of passengers travelled by the project system in year y
Source of data	Project system operator. Electronic ticketing system or any other official records
Description of measurement methods and procedures to be applied	Each time a user unlock a bicycle at the point of origin and lock it in the destination point the system count it as a trip or a passenger travelled by the project system.
Frequency of monitoring/recording	Continuous
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	[descrever]
QA/QC procedures to be applied	Data is collected and stored at the data center. Database is constantly sanitized to assure its quality.
Purpose of data	Calculation of baseline emissions
Calculation method	Parameter used when applying Option 1 or 2 of TOOL18
Comments	-

Data /parameter table 18

Data / Parameter	PD_y
Data unit	PKM
Description	Number of passenger-kilometres travelled by the project system in year y

Source of data	Project system operator. Electronic ticketing system or any other official records.
Description of measurement methods and procedures to be applied	Estimated annually. Can be estimated by transport operators based on surveys, occupancy rates at different points in the network.
Frequency of monitoring/recording	Estimated annually
Value applied	Not applied for ex-ante calculation.
Monitoring equipment	N/A
QA/QC procedures to be applied	Following provisions established in the standard "Sampling and surveys for CDM project activities and programme of activities" and TOOL18.
Purpose of data	Calculation of baseline emissions
Calculation method	Parameter used when applying Option 2 of TOOL18.
Comments	-

Data /parameter table 19

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_{2e}/Mwh
Description	Combined margin emission factor
Source of data	Calculated as per TOOL07
Description of measurement methods and procedures to be applied	Calculated following provisions of TOOL07
Frequency of monitoring/recording	Annual

Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	N/A
QA/QC procedures to be applied	Following provisions of TOOL07
Purpose of data	Calculation of project emissions
Calculation method	Following provisions of TOOL07
Comments	-

Data /parameter table 20

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_{2e}/Mwh
Description	Operating margin emission factor
Source of data	The simple OM may be calculated by one of the following two options: (a) Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or (b) Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system. Option B can only be used if: (i) The necessary data for Option A is not available; and (ii) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and (iii) Off-grid power plants are not included in the calculation (i.e. if Option I has been chosen in Step 2 of TOOL07)

Description of measurement methods and procedures to be applied	Calculated following provisions of TOOL07
Frequency of monitoring/recording	Annual
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	N/A
QA/QC procedures to be applied	Following provisions of TOOL07
Purpose of data	Calculation of project emissions
Calculation method	Following provisions of TOOL07
Comments	-

Data /parameter table 21

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_{2e}/Mwh
Description	Building margin emission factor
Source of data	The simple OM may be calculated by one of the following two options: (a) Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or (b) Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system. Option B can only be used if: (i) The necessary data for Option A is not available; and (ii) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the

	quantity of electricity supplied to the grid by these sources is known; and (iii) Off-grid power plants are not included in the calculation (i.e. if Option I has been chosen in Step 2 of TOOL07)
Description of measurement methods and procedures to be applied	Calculated following provisions of TOOL07
Frequency of monitoring/recording	Annual
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	N/A
QA/QC procedures to be applied	Following provisions of TOOL07
Purpose of data	Calculation of project emissions
Calculation method	Following provisions of TOOL07
Comments	-

Data /parameter table 22

Data / Parameter	W_{BM}
Data unit	%
Description	Weight of building margin emission factor
Source of data	TOOL07
Description of measurement methods and procedures to be applied	Calculated following provisions of TOOL07
Frequency of monitoring/recording	Annual

Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	N/A
QA/QC procedures to be applied	Following provisions of TOOL07
Purpose of data	Calculation of project emissions
Calculation method	Following provisions of TOOL07
Comments	-

Data /parameter table 23

Data / Parameter	W_{OM}
Data unit	%
Description	Weight of operating margin emission factor
Source of data	TOOL07
Description of measurement methods and procedures to be applied	Calculated following provisions of TOOL07
Frequency of monitoring/recording	Annual
Value applied	Values applied with references/sources disclosed in the ER calculation spreadsheet, submitted as annex.
Monitoring equipment	N/A
QA/QC procedures to be applied	Following provisions of TOOL07
Purpose of data	Calculation of project emissions

Calculation method	Following provisions of TOOL07
Comments	-

5.3 Monitoring Plan

The parameters which require data collection from internal information systems or involve survey with users are the ones related to the distance and number of passengers travelled, electricity consumption and share of passengers who shifted from fossil-based or electricity-based vehicles. The latter is the only one that relies on external surveys, since for all other parameters data is available in the project proponent information system. The remaining parameters related to emissions of the electricity consumption from the grid are based on data published by local authorities and default values as per TOOL07.

The table below presents the analytical procedures for the parameters measured with data collected in the project proponent information system and surveys:

Table 22 –Internal data procedures

Parameter	Data collect	Record and Storage	Aggregation	Measure	Report
P_y and PD_y	Data is collected every time a user unlock the bike in an entry station and lock it in an exit station.	Data is uploaded and stored in Tembici's DataLake once a day	Data is compiled with user ID, time, date and localization specification of entry and exit of bike stations	Total numbers of travellers are continuously measured.	Data is reported in a predefined dashboard per monitoring cycle
$ADT_{u,y}$ and D_i	Data is obtained through a GPS equipment installed in each bicycle which measures distance from the point of origin to the point of destination for each user trip in kilometers.	Data is uploaded and stored in Tembici's DataLake once a day	Data is compiled with user ID, time, date and localization specification of entry and exit of bike stations	Annual average value for each instance and type of bike is calculated.	Data is reported in a predefined dashboard per monitoring cycle

$EC_{Pj,y}$	Data is obtained through measurement of kWh consumed by a test Jig.	Data is recorded and stored in Tembici's data center for the period of the test.	Data is compiled with period specification ID of the bike stations	Electricity consumption by the battery is measured by a test Jig.	Data is reported in a predefined dashboard per monitoring cycle
SD_i	When there is no public information about the project instance available, data is obtained through a survey launched in the Tembici's app	Data is uploaded and stored in Tembici's data center for each user response	Data is compiled with users' responses on which vehicle was shifted for this specific trip and distance of the trip	The sum of each vehicle is divided by the total numbers of responses and the percent is weighted based on distance of each response.	Data is reported in a predefined dashboard for the year 1 and optionally for the year four of the project.

The organizational structure responsible for the activities related to project monitoring is listed below with its roles, responsibilities and competences:

Table 23 –Internal data procedures

Role	Responsibilities	Competences
Head of Data Analytics	Is accountable for data processing management, data schedule management, personnel allocation, data quality and data infrastructure.	Data processing and analysis, data quality, information system management, data security and business intelligence.
Data Analyst	Is accountable for data sanitization, extraction, implementation of measurement codes and reporting data in pre-established standards. The data analyst is responsible for	Data processing and analysis, and data quality.

Head of Sustainability	Approval and communication of monitored data and parameters with top leadership and stakeholders.	Project management, leadership, sustainability and climate change combat initiatives.
Project Leader	Coordinate data compliance with methodological and monitoring procedures defined in the project design document. Alignment of monitoring schedule with internal data processing schedule and intermediate communication with Standard, VVB and internal personnel.	Project management, leadership, sustainability, Verra VCS knowledge of requirements and procedures, and climate change combat initiatives.

Policies for oversight and accountability of monitoring activities

All monitoring reports will be accessed by the project leader and head of sustainability and will be presented in board meetings for communication purposes and accountability of information reported.

Procedures for internal auditing and QA/QC

All monitoring reports will be audited by the internal compliance department to ensure data integrity and all inquiries and additional request made by VVB or Verra VCS will be answered by the project leader supported by the data team.

Data on distances per trip are treated for excluding missing information and erroneous data (e.g., unfinished trips, maintenance routes, GPS malfunction). As per methodology ASM –III.BM version 2.0 the data collected in the survey will be compared to the most recent survey held by local authorities on urban travel modals share and disparities will be assigned accordingly.

Sampling procedures

The only information that will require sampling procedures is the survey with users to calculate the SD_i which will follow provisions of "Standard for sampling and surveys for CDM project activities and programme of activities"

APPENDIX A:APPLICATION OF STEPS 1 TO 4 OF TOOL 18

The steps 1 to 4 of TOOL 18 are presented below.

Step 1. Determine relevant vehicle categories

Only vehicle categories that are relevant for urban transport shall be included. These may include but are not limited to the following vehicle categories:

(a) Buses, differentiating between large, medium and small buses if appropriate, as well as buses operating in conventional bus systems and buses operating on bus lanes or BRTs, which are in commercial operation at the time of determining baseline emissions. Emissions from a conventional bus system and BRT shall be determined separately;

(b) Passenger cars;

(c) Taxis;

(d) Motorcycles;

(e) Rail-based urban mass transit (metro, light rail transit, trams);

(f) Other vehicle categories such as para-transit.

Step 2. Determine the emission factor per kilometre for each relevant road-based vehicle category

Differentiate relevant fuel types for each of the relevant road-based vehicle categories identified in Step 1. Vehicles in a vehicle category using diesel, gasoline, biofuel, biofuel blend, electricity or gas (compressed natural gas (CNG) or liquefied petroleum gas (LPG)) should be listed separately.

Estimating emission factor per kilometre based on the fraction of vehicles using a specific fuel type, the consumption of each fuel type and CO2eq emissions per unit of fuel consumed:

$$EF_{KM,i,x}=[\Sigma[SFC_{i,n,x}\times NCV_{i,n}\times EF_{CO2,n}+SEC_{i,x}\times EF_{CO2,x}]_n\times N_{i,n,x}N_{i,x}] \text{ (Equation 1)}$$

Where:

$EF_{KM,i,x}$= Emission factor per kilometre of vehicle category i in year x(gCO2/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)

$EFCO_{2,n}$=Emission factor for fuel type n (g CO2/MJ)

$SEC_{i,x}$=Specific electricity consumption of vehicle category i using electricity in year x(kWh/km)

$EFCO_{2,x}$=Emission factor for electricity in year x (g CO2/kWh)

$N_{i,x}$=Number of vehicle-kilometres 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 n26driven in year x(VKM) or number of vehicles in vehicle category i using fuel type n26in year x(units)

N =Fuel types used by vehicle category i in year x

I =Road-based vehicle categories (such as passenger car (C), bus (B), motorcycle (M), etc.)

X =Most recent calendar year for which data is available. Data not older than three years

Note 1: for taxis, personal cars and motorcycles, instead of estimating the emission factor EFKM,i,x a default emission factor for new vehicles can be obtained from the source provided in the table in section "Data and Parameters not monitored".

Note 2: instead of the two parameters Ni,n,x and Ni,x, it is possible to use one parameter Ni,n,x/Ni,x which can be defined using the following options, which are described in the order of preference (see "Data and parameters" section for further guidance on data requirements):

(a) Approach 1. The share of vehicle-kilometers within vehicle category i that are driven by vehicles using fuel type n, if a reliable data source for this parameter exists (see "Data and parameters" section for further guidance on data requirements). This is the preferred option;

(b) Approach 2. In case data on vehicle-kilometres required in approach 1 is not available the share of vehicles within vehicle category i that use fuel type n should be used, if a reliable data source for this parameter exists.

Step 3. Determine the emission factor per passenger-kilometre

The emission factors per passenger kilometre (PKM) are determined for each vehicle category as follows:

(a) Electricity based transport system. The emission factor per PKM for electricity based transport systems (e.g. urban rail-based systems) is determined using the following equation:

$EF_{PKM,i,x}=TE_{EL,i,x}P_{EL,i,x}\times D_{EL,i,x}\times 10^{-6}$ (Equation 2)

Where:

$EF_{PKM,i,x}$= Emission factor per passenger-kilometre for electricity-based vehicle category i in year x (g CO_2/PKM)

$TE_{EL,i,x}$= Total emissions from electricity-based vehicle category iin year x(t CO_2)

$P_{EL,i,x}$= Total number of passengers transported per annum by electricity-based vehicle category i in year x (passengers)

$D_{EL,i,x}$= Average trip distance travelled by passengers using electricity-based vehicle category I in year x(km)

X = Most recent calendar year for which data is available. Data not older than three years

The total emissions $TE_{EL,i,x}$ from electricity-based vehicle category i should be calculated for each vehicle category i using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" where parameter $TE_{EL,i,x}$ corresponds to parameter $BE_{EC,y}$in the tool. When applying this tool, parameter $EC_{BL,k,y}$in the tool should be taken as the amount of electricity used by electricity-based vehicle category i in year x, which shall be consistent with the year for data on transportation of $P_{EL,i,x}$ passengers along the average distance $D_{EL,I,x27}$. Parameter $EF_{CO2,x}$ should be used instead of parameter $EF_{EL,k,y}$ in the above referred tool, that is monitored according to monitoring requirements stipulated in TOOL18.

(b) Fuel based transport system. Emission factors per PKM for fuel-based transport systems (e.g. road-based vehicles) should be calculated as follows:

$$EF_{PKM,i,x}=EF_{KM,i,x}OC_{i,x}$$

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), etc.)

X =Most recent calendar year for which data is available. Data not older than three years

Step 4 -Determine baseline emissions

Option 1. Determining baseline emissions based on the shares of passengers shifted from baseline vehicle categories i to the project urban public system(s) and an average trip distance on each relevant vehicle category. Baseline emissions are estimated as follows:

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

Where:

BE_y= Baseline emissions in year y(tCO_2eq)

IR_i= Technology improvement factor[28]for vehicle category i per year (ratio)

T = Time difference (in years) between the year for which data is available for vehicle category iand 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), rail-based urban transit (R), etc.)

Y = Crediting year when emissions reductions are estimated

The share of passengers Si (%) out of total number of passengers using the project system who have shifted from electricity-based or road-based vehicle categories i to the urban public system(s) established as CDM project activities as well as an average trip distance on each relevant vehicle category Di,y are determined from a survey of the project system by the project developers (note: in case of the development of a standardized baseline this parameter remains project specific and, therefore, project proponents, not DNAs, should collect these data).

Surveys conducted in year 1 and year 4 of the first crediting period shall be used to determine: (i) the entry and exit stations for each surveyed passenger to determine the average trip distance on each relevant vehicle category Di,y (ii) the vehicle category from which each surveyed passenger had shifted to determine the share of passengers Si (%) out of total number of passengers using the project system who have shifted from each relevant vehicle category.

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.

The total number of passengers shall be monitored annually, which when multiplied by the shares of passengers S_i(%) who have shifted from electricity-based or road-based vehicle categories, respective trip distances on these vehicle categories $D_{i,y}$ and emission factors per passenger-kilometre $EF_{PKM,i,x}$ are used in Equation 8 to calculate baseline emissions.

Option 2.Determining baseline emissions based on the share of passenger-kilometres shifted from baseline vehicle categories i.

Baseline emissions are determined based on the share of passenger-kilometres shifted from vehicle categories i and the passenger-kilometres travelled on the project system. Baseline emissions are estimated as follows:

$$BE_y=[\Sigma[(IR_i)_{t+y-1}\times EF_{PKM,i,x}\times SD_i]_i]\times PD_y\times 10^{-6}$$

Where:

BE_y= Baseline emissions in year y(tCO_2eq)

IR_i= Technology improvement factor[28]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)

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), rail-based urban transit (R), etc.)

Y = Crediting year when emissions reductions are estimated

The share of passenger-kilometres SDi (%) out of total number of passengers using the project system who have shifted from electricity-based or road-based vehicle categories i to the urban public system(s) established as CDM project activities is determined from a survey of the project system by the project developers (note: in case of the development of a standardized baseline this parameter remains project specific and, therefore, project proponents, not DNAs, should collect these data).

Surveys conducted in year 1 and year 4 of the first crediting period shall be used to determine: (i) the entry and exit stations for each surveyed passenger to determine the average trip distance for this passenger; (ii) the vehicle category from which each surveyed passenger had shifted, to determine the share of passenger-kilometres SDi (%) out of total number of passengers using the project system who have shifted from each relevant vehicle category.

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.

The total number of passenger-kilometres shall be monitored annually, which when multiplied by the shares of passengers SDi (%) who have shifted from electricity-based or road-based vehicle categories, and emission factors per passenger-kilometre EFPKM,i,x are used in Equation 9 to calculate baseline emissions.