Bikes for the Planet Brazil

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The primary objective of "*Bikes for the Planet Brazil*" project (the Project or "Bikes4PlanetBR") is to promote alternative mobility with the following technologies and/or measures:

> construction of new and/or expansion of existing bicycle lanes, bicycle sharing programs (through dockless bicycles or sharing stations), bicycle parking areas; introduction of e-bikes or tricycles; and/or implementation of new and/or expansion of existing passenger transportation services based on tricycles in different locations throughout Brazil.

Urban centres face many problems related to transport and traffic. Enhance low-carbon two- and three-wheeled mobility while reducing congestion and pollution has the potential to be a key solution for a cleaner and healthier urban life. In Brazil, the greenhouse gas (GHG) emissions from transportation represent 46% of emissions from the energy sector[1]. In this context, the strategic plan for Brazil's Nationally Determined Contribution (NDC) establishes 4.9 $MtCO_2e$ reduction target for transportation[2] in line with Paris Agreement approved on September 21st, 2016 by the government. Brazil has committed to reduce emissions by 1.3 $GtCO_2e$ in 2025 and 1.2 $GtCO_2e$ by 2030, corresponding to 37% and 43% reduction based on 2005 levels[3].

The project emerges as a contribution for pursuing the goals proposed by the government. The program is developed as a grouped project within the Brazilian boundaries. Thus, the expansion of a project activity subsequent to 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.

In the absence of the program, the baseline scenario is the continuation use of the existing transportation modes.

The program implementation results in avoided negative environmental impacts and may contribute to better mobility and, consequently, in better quality of life as it:

- Reduces demand on fossil fuel-based vehicles;
- Reduces traffic in rush hour and increases the offer on non-motorized options;
- Reduces GHG emissions (GHG emission free) and improves air quality.

[1] WRI Brasil (2017). *A estratégia do Brasil na área de transportes para colocar em prática o Acordo de Paris.* Retrieved from http://bit.ly/2Dugqf7 (access on 23/Jan/2019).

[2] "... in the transportation sector, further promote efficiency measures, and improve infrastructure for transport and public transportation in urban areas" (source: Federative Republic of Brazil Intended Nationally Determined Contributions Towards Achieving the Objective of the United Nations Framework Convention on Climate Change).

[3] UNFCCC's INDCs as communicated by Parties; Brazilian INDC submitted on 28/Sep/2015; retrieved from http://bit.ly/2DuU6C0 (access on 23/Jan/2019).

Although the Program does not have alone a major impact in the Host Country in terms of GHG emission reductions given its mobility restrictions (few or non-existent cycle routes connected to public transportation, climate, physical conditioning, etc.), it is part of a greater idea. The program contributes to sustainable development since it reduces fossil fuel consumption, traffic congestion, GHG emissions and other air pollutants as well as increases well-being. Therefore, it meets the needs of the present without compromising the ability of future generations to meet their own needs, as defined by the Brundtland Commission (1987).

An estimate of annual average and total GHG emission reductions and removals depends on the number of instances added to the grouped project. The initial activity instance included in the grouped project is a new bicycle sharing program operated in the metropolitan region of the city of Sao Paulo and, when fully operational, results in estimated annual 3,650,000 km ridden and emissions reductions of 167 tCO_2e (see section 4, Estimated GHG Emission Reductions and Removals, for details of the calculation).

1.2 Sectoral Scope and Project Type

"*Bikes for the Planet Brazil*" (or Bikes4PlanetBR) is a grouped project.

Sectoral scope 7: Transport as established by the Clean Development Mechanism (CDM).

Methodologies approved under CDM are applicable under the Voluntary Carbon Standard (VCS) as stated at http://verra.org/methodologies/.

1.3 Project Eligibility

The eligibility criteria for the inclusion of a new project activity instances are the ones prescribed in AMS-III.BM, detailed below following the guidance from the VCS Standard (version 4, paragraph 3.5.15):

1) Meet the applicability conditions set out in the methodology applied to the project

Each project activity instance shall follow methodology and applicable tools described in section 3.2.	✓

2) Use the technologies or measures specified in the project description

Each project activity instance shall apply one of the project types described in section 3.2.	✓

3) Apply the technologies or measures in the same manner as specified in the project description

Technologies or measures (as described in item 1.1) are related to the construction of new and/or expansion of existing bicycle lanes, bicycle sharing programs (through dockless bicycles or sharing stations), bicycle parking areas; introduction of e-bikes or tricycles; and/or implementation of new	✓

and/or expansion of existing passenger transportation services based on tricycles in different locations throughout Brazil.	

4) 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.	✓

5) 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

Each project activity instance shall assess additionality as described in section 3.5.	✓

1.4 Project Design

The project has been designed as a grouped project.

Additional information relevant to the design of the grouped project -more specifically the eligibility criteria for the inclusion of new project activity instances, are described in item 1.3.

1.5 Project Proponent

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1.6 Other Entities Involved in the Project

Not applicable.

1.7 Ownership

Prior consideration of the project activity ("Bikes for the Planet Brazil") were submitted by ZSCORE on 18 July 2018 to the UNFCCC (the information is publicly available at https://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html, site accessed on 9-Nov-2019), and to the Brazilian Designated National Authority (evidences submitted to the validation/verification body during the joint validation and verification process).

An agreement/contract will be signed between each individual project activity instance operator and ZSCORE for each addition of a project activity instance (evidences submitted to the validation/verification body during the joint validation and verification process).

1.8 Project Start Date

According to the Program Definitions: VCS Standard, version 4, 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 starting date is 30-Jan-2018, when the first official[4] bike sharing stations where made available to the public and started operation under the first project activity instance (first official registered bike rental on 30-Jan-2018 at 7h13min).

1.9 Project Crediting Period

The Project will have a maximum of 10 years of crediting period as follows:

- Crediting period start, 30-Jan-2018
- Crediting period end, 29-Jan-2028

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Indicate the scale of the project (project or large project) and the estimated annual GHG emission reductions or removals for the project crediting period.

Project Scale	
Project	✓
Large project	

[4] Field operations started on 27 January 2018 and run in test mode for three days, up to 29-January-2018. Official operation started in 30 January 2018, which is the project start date.

Year[5]	Estimated GHG emission reductions or removals (tCO_2e)
Year 1 – 2018	175
Year 2 – 2019	173
Year 3 – 2020	171
Year 4 – 2021	169
Year 5 – 2022	168
Year 6 – 2023	166
Year 7 – 2024	164
Year 8 – 2025	163
Year 9 – 2026	161
Year 10 – 2027	160
Total estimated ERs	**1,670**
Total number of crediting years	**10**
Average annual ERs	**167**

1.11 Description of the Project Activity

Applicable technologies and measures 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 2). The primary objective of Bikes4PlanetBR is, therefore, to promote alternative mobility with the following technologies and/or measures:

> construction of new and/or expansion of existing bicycle lanes, bicycle sharing programs (through dockless bicycles or sharing stations), bicycle parking areas; introduction of e-bikes or tricycles; and/or implementation of new and/or expansion of existing passenger transportation services based on tricycles in different locations throughout Brazil.

Since the program will be implemented in the context of a Grouped Project, if one or more measures described in Table 2 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.

[5] Chronologically "year 1" will run from 30-Jan-2018 to 29-Jan-2019.

If multiple measures are implemented as part of the project activity instance, 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 programme 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.

1.12 Project Location

Bikes4PlanetBR implementation occurs within the geographical area of Brazil (KML file supplied during the validation and request for registration processes).

The first two project instances included in the grouped project occur in the metropolitan area of the city of Sao Paulo (KML file valid for both project instances supplied during the validation and request for registration processes).

Geodetic coordinates will be provided individually for each additional 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.

For details on the determination of the baseline scenario, please refer to section 3.4

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The proposed Project complies with all laws and regulations, otherwise, permissions and licenses will not be issued.

Relevant local law and regulations are presented in Table 1.

Each project activity instance shall follow all local/municipal regulations regarding bicycle lanes, parking areas and sharing programs.

Table 1 – National applicable legislation

Date	Regulation	Regulator	Description

19/06/2018	Law #13,683	Federal	It changes Law 13,089/2015 and Law 12,587/2012
12/01/2015	Law #13,089	Federal	It establishes the City Statute for planning, management and execution of public functions of common interest in metropolitan regions and in urban agglomerations instituted by the State
03/01/2012	Law #12,587	Federal	It establishes guidelines for the National Policy on Urban Mobility
08/05/2009	Resolution #315	National Traffic Council (CONTRAN)	It regulates the necessary requirements from cycle-electric to mopeds vehicles for driving in public roads open to circulation
22/04/2004	Resolution #160	CONTRAN	It approves Annex II of the National Traffic Code, which includes signaling on bicycle lanes
29/05/2003	Decree #4,711	Federal	It establishes the National Traffic System coordination
23/09/1997	Law #9,503	Federal	It establishes the National Traffic Code

1.15 Participation under Other GHG Programs

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

The project submitted on 18-Jul-2018 a "prior consideration" of the Clean Development Mechanism (CDM)[6], but by November 2019 has not been registered, or is seeking registration under the CDM or any GHG programs other than the VCS.

1.15.2 Projects Rejected by Other GHG Programs

Not applicable, as the proposed Project did not request registration/participation in any other GHG program.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

[6] See https://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html (access on 4-Nov-2019).

Not applicable as 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

The Project did not and is not seeking or receiving another form of GHG-related environmental credits.

1.17 Additional Information Relevant to the Project

Leakage Management

Not applicable.

Commercially Sensitive Information

All information related to the operation of the individual project activity instances is considered sensitive. Sensitive information is highlighted in the joint PD&VR document (background in red and text in yellow) used for validation, but will have to be covered in the public version. The same is applicable to the individual project activity instances operation results sheets in emission reduction calculation spreadsheet (but not to the individual emission reduction calculation sheets).

Sustainable Development

The program contributes to sustainable development since it reduces fossil fuel consumption, traffic congestion, GHG emissions and other air pollutants as well as increases healthier habits and well-being.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

Not applicable.

2.2 Local Stakeholder Consultation

There are no national or regional requirements for local stakeholder consultation due to the implementation of measure types identified in section 2.2. For that reason, the global public comments carried out in the at the VCS pipeline projects database in April 2019 is also considered as the local stakeholder consultation. This project was up for public comment from 12 April - 12 May, 2019 and no comments were received.

Additionally, any new activity or public infrastructure requires license and permits, including the construction or expansion of bicycle lanes and parking areas, which is under municipality management.

2.3 Environmental Impact

There is no national requirement for the preparation of environmental impact assessment due to the implementation of measure types identified in section 2.2. However, any new activity or public infrastructure requires licenses and permits, including the construction or expansion of bicycle lanes and parking areas, which is under municipality management.

Compliance with the requirements established in licenses and environmental impact assessments, if required, shall be evaluated for each project activity instance based on local legislation.

The Municipal Assembly of Sao Paulo recently approved Law number 16,885 on 16-April-2018, for the creation of the Sao Paulo Cycling System[7] ("SICLO") aiming the promotion of bicycle use. It also established the necessity of public hearings and technical and environmental studies for new bicycle lanes implementation.

In spite of this new regulation, there is no municipal requirement for measure type 3.

2.4 Public Comments

The project submitted documents for public comments at the VCS pipeline projects database in April 2019. This project was up for public comment from 12 April - 12 May, 2019 and no comments were received.

2.5 AFOLU-Specific Safeguards

Not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

CDM Small-scale methodology AMS-III.BM, "lightweight two and three-wheeled personal transportation", version 01.0.

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;

[7] Available at http://documentacao.camara.sp.gov.br/iah/fulltext/leis/L16885.pdf.

- 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 08.0;
- CDM TOOL21 - Demonstration of additionality of small-scale project activities, version 13.0;
- CDM TOOL23 - Additionality of first-of-its-kind project activities, version 03.0.

The standard "Sampling and surveys for CDM project activities and programme of activities" (version 7.0) 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.

Table 2 below illustrates which types of project activities are eligible under AMS-III.BM.

Table 2 – Types of projects eligible under this methodology

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 instance included in the grouped project is an "AMS-III.BM, type 3" project, a new bicycle sharing program operated in the metropolitan region of the city of Sao Paulo.

According to the applicability section of the methodology (AMS-III.BM, version 01.0, Small-scale methodology: Lightweight two and three wheeled personal transportation):

- item 2.1 (scope), paragraph 2, the "methodology applies to project activities the shift the mode of transport of urban passengers to mechanical bikes, tricycles, e-bikes or e-tricycles, by implementing related infrastructure in an urban area such as bicycle lanes, bicycle sharing programs.. and bicycle parking areas". Therefore, the methodology is applicable to the planned new bicycle sharing program in the metropolitan area of Sao Paulo.
- Item 2.2 (applicability), paragraph 3, "implementation of new bicycle sharing program (through dockless bicycles of sharing stations)" is one of the eligible types of project activities (type 3, see Table 2), with applicable baseline calculation "option 1" (ex-post survey of baseline travel modes) or "option 3" (based on a survey of users of e-bikes and users of bicycle sharing programs). Therefore, the methodology is applicable to new bicycle sharing programs in the metropolitan area of Sao Paulo. With respect to the baseline determination, "option 1" will be applied (see details in item 3.6).
- Item 2.2 (applicability), paragraph 4, all lightweight two and three wheeled personal transportation measures implemented in project boundary are taken into account when determining the baseline. The determination of the baseline is made using a survey carried out in Metropolitan area of São Paulo (see sections 3.4 and 3.6 for details), which considered all existing infrastructure and available transportation modes, confirming that all measures lightweight two and three wheeled personal transportation measures implemented in the city of São Paulo are taken into account. Therefore, the methodology is applicable to new bicycle sharing programs in the metropolitan area of Sao Paulo.
- Item 2.2 (applicability), paragraph 5, "combination of measures… are also eligible. If multiple measures are implemented, it shall be ensured that any interactive effects between the measures are identified and taken into account to avoid double-counting." The planned project instances to be included in the grouped project are all "Type 3" measures. Therefore, the methodology is applicable to the new bicycle sharing program in the metropolitan area of Sao Paulo.
- Item 2.2 (applicability), paragraph 6, "if the project activity involves the construction of on-road bicycle lanes…". The planned project instances to be included in the grouped project are all "type 3" measures (no project activity instance involving construction of on-road bicycle lanes forecasted). Therefore, the methodology is applicable to the new bicycle sharing program in the metropolitan area of Sao Paulo.

- Item 2.2 (applicability), paragraph 7, applicability conditions included in the tools mentioned in AMS-III.BM… also apply".
    - TOOL5 – not used (no emissions are calculated for electricity).
    - TOOL11 – there is no condition for the applicability of the tool.
    - TOOL18 – applicable to project activities in urban passenger transport that implement a measure or a group of measures aimed at a modal shift to urban public transit. The project activity instance aims at a modal shift to bicycle use, and, therefore, it is applicable to the new bicycle sharing program in the metropolitan area of Sao Paulo.
    - TOOL19 – not used as TOOL21 will be used to demonstrate additionality.
    - TOOL21 - Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually. Estimated annual net GHG emissions are of roughly 170 tCO_2e and, therefore, it is applicable to the new bicycle sharing program in the metropolitan area of Sao Paulo.
    - TOOL23 – not used as the planned measures are not "first-of-its-kind".
    - Standard "Sampling and surveys…" – not used as Metro's survey is used.
- Item 2.2 (applicability), paragraph 8, "measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually. Estimated annual net GHG emissions are of roughly 170 tCO_2e. Therefore, the methodology is applicable to the new bicycle sharing program in the metropolitan area of Sao Paulo.

Therefore, the methodology is applicable to the planned instances to be included in the grouped project, two new bicycle sharing programs in the metropolitan area of Sao Paulo.

3.3 Project Boundary

In accordance with AMS-III.BM, the project boundary is the area in which the users of the infrastructure and/or the promoted bicycles, tricycles, e-bikes or e-tricycles travel between origins and destinations.

If the project involves the use of e-bikes or e-tricycles, the project boundary also includes 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.

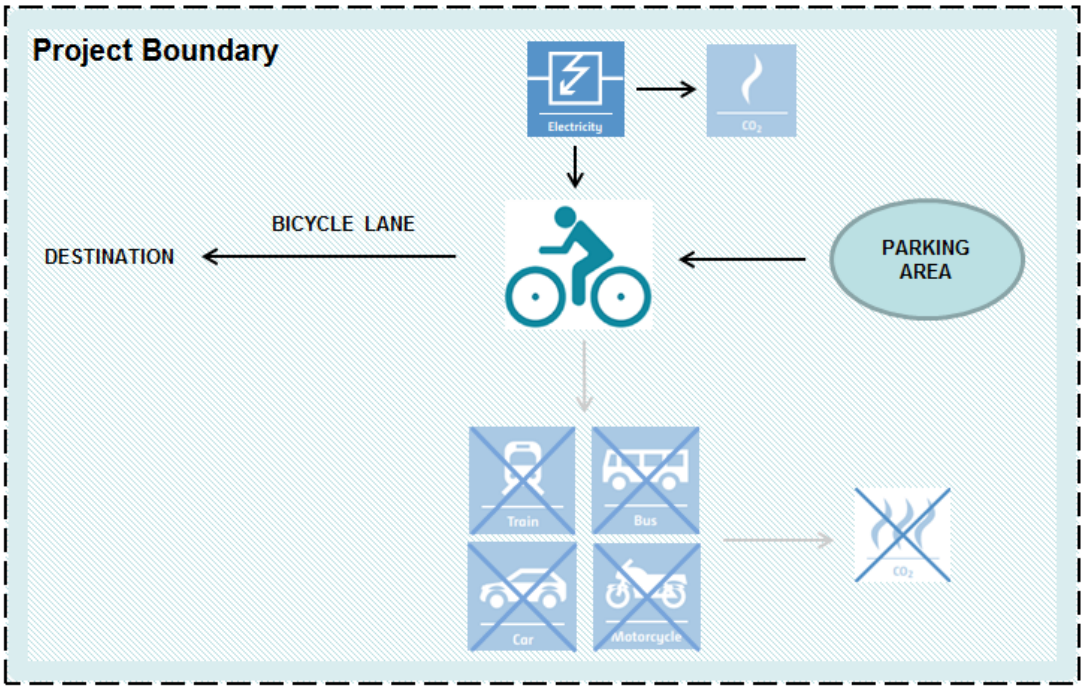

Figure 1 – Flow diagram of the project boundary

Relevant GHG sources included in the baseline and program scenario are as follows.

Source		Gas	Included?	Justification/Explanation
Baseline	Source 1	CO_2	Yes	Main emission source
		CH_4	No	These emissions are not significant
		N_2O	No	These emissions are not significant
Project	Source 1	CO_2	Yes	Main emission source
		CH_4	No	These emissions are not significant
		N_2O	No	These emissions are 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

The initial activity instance included in the grouped project is an "AMS-III.BM, type 3" project, a new bicycle sharing program operated in the metropolitan region of the city of Sao Paulo.

According to the additionality section of the methodology (AMS-III.BM, version 01.0, Small-scale methodology: Lightweight two and three wheeled personal transportation):

- Item 5.3.1 (activities that are automatically additional), paragraph 18.
  a) None of the conditions is applicable to the new bicycle sharing program in the metropolitan area of Sao Paulo.
- Item 5.3.2 (other activities), paragraph 19, "other activities that do not satisfy the conditions under paragraph 18 above are considered additional if:
  a) Compliance with the criteria of demonstrating additionality of microscale project activities
  b) First-of-its-kind barrier demonstrated
  c) Activities type 7 with share of penetration below 5%
  d) Demonstration through the application of the methodological tool "demonstration of additionality of small-scale project activities"

From the above item 5.3.2 options the project proponents apply option (d), use of the methodological tool "demonstration of additionality of small-scale project activities" (TOOL21). The proposed new bicycle sharing program in the metropolitan area of Sao Paulo complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13, and demonstrate additionality as follows:

- According to paragraph 10 (c), barrier due to prevailing practice. Because there is no exact definition of how exactly to demonstrate the barrier, the project proponents use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 9 (Appendix, paragraph 1) use penetration rate of less than five per cent as condition to be considered automatically additional. (2) TOOL32, version 2 use throughout the document a share of less than two per cent to be defined as automatically additional. As it can be seen in Table 3, bicycles are used as transport mode in less than 1% of the trips in Sao Paulo, 0.9% to be more precise, demonstrating a barrier due to the prevailing practice.
- Additionally, according the appendix (TOOL21, page 5, also seen in "Appendix C" below), as GHG emission reductions (i) are lower than 600 tCO2e/year, and, (ii) end users of the measure are households and communities[8], it is automatically additional.

Therefore, the planned activity instances to be included in the grouped project (two new bicycle sharing programs in the metropolitan area of Sao Paulo) are additional.

3.6 Methodology Deviations

[8] End users of the subsystems are the independent individuals riding the bikes, which can be reasonably considered equivalent/similar to households/communities.

At least one deviation[9] is anticipated at the moment of the project description and it will be applied in the example calculation described in item 4 ("Estimated GHG Emission Reductions and Removals") below

Deviation 1. Option 1 (ex-post survey of baseline travel modes) of AMS-III.BM for the determination baseline emission. Nevertheless, data from the origin-destination survey carried out by Metrô on transport modes used in the Metropolitan Region of Sao Paulo (RMSP from the Portuguese "Região Metropolitana de São Paulo") will be used.

Project Proponents are aware that the use of the survey carried out by Metrô is a deviation of the methodology because of three reasons:

1. it is not an ex-post survey (it was carried from 2017 to 2018),
2. It was not conducted with the users of the infrastructure (it was conducted with all inhabitants of the Sao Paulo metropolitan area), and
3. It does not follow exactly the standard "Sampling and surveys for CDM project activities and programme of activities".

With respect to methodology deviations, according the VCS Standard, version 4.0, item 3.17:

> *Projects may deviate from the procedures set out in methodologies in certain cases, where alternative methods may be more efficient for project-specific circumstances, and where the deviation will achieve the same level of accuracy or is more conservative than what is set out in the methodology.*
>
> *Requirements*
>
> *3.17.1 - Deviations from the applied methodology are permitted where they represent a deviation from the criteria and procedures relating to monitoring or measurement set out in the methodology (i.e., deviations are permitted where they relate to data and parameters available at validation, data and parameters monitored, or the monitoring plan).*
>
> *3.17.2 - Methodology deviations shall not negatively impact the conservativeness of the quantification of GHG emission reductions or removals, except where they result in increased accuracy of such quantification. Deviations relating to any other part of the methodology shall not be permitted.*
>
> *3.17.3 - Methodology deviations shall be permitted at validation or verification and their consequences shall be reported in the validation or verification report, as applicable, and all subsequent verification reports. Methodology deviations are not considered to be precedent setting.*

[9] The need of other deviations might arise while including a new project activity instance. Therefore, additional methodology deviations, if necessary, will be described and justified at the level of project activity instance.

In the project proponent's opinion, the proposed deviation is more efficient for the project-specific circumstances and will not only achieve at least the same level of accuracy set out in the methodology, but will be likely more conservative because of the following reasons:

1. Metrô carried out the survey (nicknamed OD2017, from the Portuguese "Origem-Destino 2017") from July 2017 to October 2018, published preliminary results in December 2018 and detailed analysis and data in July 2019. Therefore, considering the project activity instances start date in January (Tembici) and August (Grow) 2018, the project proponents consider the vintage reasonably applicable, because it does not negatively affect the conservativeness of the quantification of GHG emission reductions.

2. The survey OD2017 was conducted with all inhabitants of the RMSP, but the project activity instances concentrate their operation in the city of São Paulo (Center Region of the Metropolitan Area in the survey), in areas with better transportation infrastructure. The results of the survey show that the users of the bicycle-sharing infrastructure - located in the city of São Paulo, will use less zero-emission modes (see Table 3, with the share of trips by mode "walking", "bicycles" and "others" are all below the RMSP average). For that reason, using the population of the RMSP is clearly more conservative than using only the users of the bicycle-share infrastructure and, therefore, the deviation does not negatively affect the conservativeness of the quantification of GHG emission reductions.

Table 3 – Daily trips by mode (source: Metrô, 2019[10])

Region of origin	subway	railway	bus 1	bus 2	minibus	car	taxi	motorcycle	bicycle	walk	other	TOTAL	(%) of the total
Southwest	65	4	246	9	102	356	3	79	15	510	4	1,393	3.3%
	4.67%	0.29%	17.66%	0.65%	7.32%	25.56%	0.22%	5.67%	1.08%	36.61%	0.29%	100.0%	
West	91	178	645	37	227	1,164	22	153	15	1,196	10	3,738	8.9%
	2.43%	4.76%	17.26%	0.99%	6.07%	31.14%	0.59%	4.09%	0.40%	32.00%	0.27%	100.0%	
North	27	51	111	4	82	185	2	15	9	329	2	817	1.9%
	3.30%	6.24%	13.59%	0.49%	10.04%	22.64%	0.24%	1.84%	1.10%	40.27%	0.24%	100.0%	
Northeast	61	21	579	23	170	786	28	62	34	979	14	2,757	6.6%
	2.21%	0.76%	21.00%	0.83%	6.17%	28.51%	1.02%	2.25%	1.23%	35.51%	0.51%	100.0%	
East	74	121	346	32	118	645	19	52	55	996	6	2,464	5.9%
	3.00%	4.91%	14.04%	1.30%	4.79%	26.18%	0.77%	2.11%	2.23%	40.42%	0.24%	100.0%	
Southeast	127	148	875	81	257	1,652	48	156	37	1,606	10	4,997	11.9%
	2.54%	2.96%	17.51%	1.62%	5.14%	33.06%	0.96%	3.12%	0.74%	32.14%	0.20%	100.0%	
Center	2,955	722	5,502	66	1,138	6,553	346	547	212	7,734	66	25,841	61.5%
(City of São Paulo)	11.44%	2.79%	21.29%	0.26%	4.40%	25.36%	1.34%	2.12%	**0.82%**	**29.93%**	**0.26%**	100.0%	
TOTAL	3,400	1,245	8,304	252	2,094	11,341	468	1,064	377	13,350	112	42,007	100.0%
TOTAL (%)	8.09%	2.96%	19.77%	0.60%	4.98%	27.00%	1.11%	2.53%	**0.90%**	**31.78%**	**0.27%**	100.0%	

3. The sampling did not follow exactly the prescription of the standard "Sampling and surveys for CDM project activities and programme of activities". But there is no doubt about the seriousness, quality and accuracy of the surveys regularly carried out by Metrô[11] since 1967[12] and used the governments of the City and State of Sao Paulo to plan and develop transport sector policies in the RMSP. The most recent edition of the survey, financed by the World Bank, compiled over 150,000 samples and is the most

[10] Prepared using data from table 48 of Metrô (2019).

[11] Relevant to mention that Metrô as a public company owned by the State of São Paulo.

[12] Surveys carried out in 1967, 1977, 1987, 1997, 2002, 2007, 2012 and the most recent one initiated in 2017 and published in 2019.

complete diagnosis of transport modes use in a metropolitan area in Brazil. For that reason, the project proponents are confident to state that the deviation does not negatively affect the conservativeness of the quantification of GHG emission reductions.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

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:

Option I: Ex-post survey of baseline travels models

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

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

Table 4 – Types of projects eligible under this methodology

Type of project	Description	Baseline options applicable (as per AMS-III.BM, section 5.4)		
		Option 1	Option 2	Option 3
Type 1	Construction of new bicycle lanes	✓	✓	
Type 2	Extension of the existing bicycle lanes	✓	✓	
Type 3	Implementation of new bicycle sharing program	✓		✓
Type 4	Expansion of an existing bicycle sharing program	✓		✓
Type 5	Construction of new bicycle parking areas. These parking areas may be connected to public transport	✓	✓	
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	✓		

While applying Option 1, steps from 1 to 4 of TOOL18 shall be applied; while applying Option 2, steps from 1 to 3 of TOOL18. Appendix A presents steps according to TOOL18 for the calculation of baseline emissions.

Option 1: Ex post survey of baseline travel modes

Under this option, baseline emissions cover the emissions, which would have been caused by the user of the bicycle-sharing program in absence of the project from origin (O) to destination (D), where the O and D points of the trip are assumed equal for both the baseline and the project scenarios.

Baseline emissions are determined by applying Steps 1 to 4 from the latest approved version of the methodological tool "Baseline emissions for modal shift measures in urban passenger transport" (TOOL18) as presented in Appendix A, using parameters estimated based on data collected during the survey[13] in the year 1 and optionally in the year 4 of the crediting period:

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 the 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 P_y (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;

(b) Parameter D_i (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.

Sampling and surveys may be used following "Sampling and surveys for CDM project activities and programme of activities" (appendix B).

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

This option is suitable for Type 1 and Type 2 (i.e. construction of new or extension of existing bicycle lanes) and Type 5 and Type 6 (i.e. construction of new or expansion of existing bicycle

[13] The survey shall be conducted with the users of the infrastructure, bicycle sharing program.

parking areas).

Under this option, the modal shares of the public transportation in the city (excluding travels using passenger cars, motorcycles and taxis) and the corresponding CO_2 emissions are determined before the implementation of the project, using statistics from the transport authority or other credible studies. Steps 1 to 3 of the methodological tool "Baseline emissions for modal shift measures in urban passenger transport" (TOOL18) may be applied to complement existing data, if necessary (appendix A). Also, the number of cycling trips prior to installation of the new infrastructure ($N_{bicycles,BL}$) shall be determined ex ante.

The baseline emissions are calculated considering the number of cycling trips after installation of the new infrastructure and the distance travelled by the users of the infrastructure.

$$BE_y = 0.9 \times \left(N_{bicycles,y-}N_{bicycles,BL}\right) \times ADT_{u,y} \times EF_{BL,benchmark} \quad \textbf{Equation 1}$$

Where:

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

0.9 = Net-to-gross adjustment factor to account for 'walking' in the baseline

$N_{bycicles,y}$ = Number of bicycles trips travelling through the bicycle infrastructure in year y

$N_{bycicles,BL}$ = Number of bicycle trips travelling through the location of the new bicycle infrastructure prior to implementation of the project activity

$ADT_{u,y}$ = Average distance travelled per trip by the user u of the infrastructure in year y (km)

$EF_{BL,benhcmark}$ = Weighted average CO_2 emission factor per passenger-kilometre corresponding to public transportation-mix in the city (excluding travels by using passenger cars, motorcycles and taxis) (tCO_2/pkm), before the implementation of the project, using statistics from the transport authority or credible studies

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

Under this option, the baseline emission factor is determined through a survey of users of e-bike promotion programs or bicycle sharing programs ($EF_{BL,CO2,survey}$) and the distance travelled will be monitored for each user of the programs ($DT_{u,y}$).

Baseline emissions are determined through the equation below:

$$BE_y = EF_{BL,CO2,survey} \times \sum_u DT_{u,y} \quad \textbf{Equation 2}$$

Where:

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

$EF_{BL,CO2,survey}$ = Average CO_2 emission factor per passenger-kilometre based on survey conducted with users of e-bike promotion programs or bicycle sharing programs (tCO_2/pkm)

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

While applying Option 1 and 2 above, steps of TOOL18 shall be considered for the calculation of baseline emissions as presented in appendix A.

4.2 Project Emissions

Project emissions are determined based on the amount of electricity consumed to recharge the batteries of e-bikes or e-tricycles ($EC_{PJ,y}$) using Equation (1) from the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05).

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[14]. In this situation, the electricity consumed is determined according to the equation below:

$$EC_{PJ,y} = 0.015 \times \sum_{u} DT_{u,y} \qquad \textbf{Equation 3}$$

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)

4.3 Leakage

In accordance with AMS-III.BM, leakage does not have to be considered.

[14] This parameter depends on a number of factors, such as terrain, level of assistance from batteries to offset pedaling set by the cyclist, weight of the cyclist, weight of the bicycle, outside temperature, direction and speed of the wind, type of battery, efficiency of the motor. Typically, a standard 36V and 10Ah e-bike consumes between 7.5 – 15 Wh/km.

4.4 Estimated Net GHG Emission Reductions and Removals

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \qquad \textbf{Equation 4}$$

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)

Estimated GHG emission reductions are based on assumptions considered for the Bikes4PlanetBR (see Table 11).

In the example calculation below "option 1: ex-post survey of baseline travel modes" is selected to determine the baseline emissions, using data from the origin-destination survey carried out by Metrô[15] on transport modes used in the Metropolitan Region of Sao Paulo (nicknamed OD2017). Metrô published preliminary results of the survey[16] in December 2018 and synthesis report[17] plus detailed data made available in July 2019 (available at http://www.metro.sp.gov.br/pesquisa-od/, accessed on 8-November-2019).

The following steps from TOOL18 were applied for the calculation of estimated net baseline emissions:

Step 1: Determine relevant vehicle categories

The following vehicle categories are considered relevant for urban transport:

(a) Bus ("ônibus + fretado");

(b) Minibus ("escolar + lotação"[18]);

(c) Car (private and taxis);

(d) Motorcycle;

(e) Metrô (rail-based urban mass transit, mainly subway/underground railway, operated by "Metrô - Companhia do Metropolitano de São Paulo");

[15] The City of São Paulo Subway System (Metrô) is operated by the "Companhia do Metropolitano de São Paulo", one of the urban railways that serves the city of São Paulo, alongside with the "Companhia Paulista de Trens Metropolitanos" (CPTM), forming the largest metropolitan rail transport network of Latin America.

[16] Metrô (2018). *Balanço da realização e os primeiros resultados da Pesquisa Origem e Destino 2017.* Companhia do Metropolitano de São Paulo.

[17] Metrô (2019). A Mobilidade Urbana da Região Metropolitana de São Paulo em Detalhes. Companhia do Metropolitano de São Paulo.

[18] "Lotação" is a mode of transport which falls between taxicabs and buses. These vehicles for hire are typically smaller than buses ("transporters") and usually take passengers on a fixed or semi-fixed route without timetables. They may stop anywhere to pick up or drop off passengers.

(f) CPTM (rail-based urban mass transit, mainly surface railway, operated by "CPTM - Companhia Paulista de Trens Metropolitanos");

(g) Bicycle;

(h) Walking.

Table 5 – Share of transport means categories (source: METRÔ, 2019)[19]

Vehicle categories	Transportation share use
Bus	20.4%
Minibus	5.0%
Subway	8.1%
Railway	3.0%
Car	28.1%
Motorcycle	2.5%
Bicycle	0.9%
Walking	32.0%

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.

Relevant fuel types for each relevant vehicle category are as follows:

Table 6 – Fuel type per transport means categories (source: CETESB, 2018)[20]

Vehicle categories	Fuel type
Bus	Diesel oil
Minibus (lotação)	Diesel oil
Metrô (subway)	Electricity

[19] Metrô (2019). *Pesquisa Origem Destino 2017 - 50 anos - A mobilidade urbana da região metropolitana de São Paulo em detalhes.* Companhia do Metropolitano de São Paulo (preliminary results published in December 2018; Summary report and published data in July 2019). Available at http://www.metro.sp.gov.br/pesquisa-od/ (access on October 20, 2019).

[20] CETESB (2019). *Emissão veicular 2018.* Companhia Ambiental do Estado de São Paulo. Available at: https://cetesb.sp.gov.br/veicular/relatorios-e-publicacoes/ (access on October 20, 2019).

CPTM (railway)	Electricity
Bicycle	Not applicable
Walking	Not applicable

Estimated emission factor per kilometre based on the fraction of vehicles using a specific fuel type was calculated according to equation 6 as follows:

Table 7 – Emission factor per kilometre for fossil fuel motorized vehicle categories

Vehicle Categories	Fuel Type		Density (kg/l)	Fuel/Electric consumption (un./km or kWh)	Net calorific value (kcal/kg)	Emission Factor (kgCO2/TJ)	Emission Factor (kgCO2/km)
Parameter	**N**	**unit**	**d**	**SFCi,n,x / SECi,x**	**NCVi,n**	$EF_{CO2,n/x}$	$EF_{KM,i,x}$
Bus	Diesel oil	liters	0.840	0.471	10,100	74,067	1.24
Minibus	Diesel oil	liters	0.840	0.303	10,100	74,067	0.80
Car (private+taxi)	Gasoline	liters	0.742	0.070	10,400	69,300	0.16
	Ethanol	liters	0.809	0.102	6,300	70,767	0.00
Motorcycle	Gasoline	liters	0.742	0.017	10,400	69,300	0.04
	Ethanol	liters	0.809	0.028	6,300	70,767	0.00
Source		-	BEN (2018)	Cetesb (2018)	BEN (2018)	IPCC (2006)	Calculated
Level	City	-	National	State	National	Default	TOOL18

The emission factor per kilometre of vehicle category ($EF_{km,i,x}$) is calculated in order to determine the emission factor per passenger-kilometre ($EF_{PKM,i,x}$).

As prescribed in TOOL18. instead of the two parameters $N_{i,n,x}$ and $N_{i,x}$, it is possible to use one parameter $N_{i,n,x}/N_{i,x}$ 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-kilometres within vehicle category i that are driven by vehicles using fuel type n, if a reliable data source for this parameter exists (see TOOL18, "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.

As data on vehicle kilometres required in approach 1 is not available, "approach 2 (share of vehicles within category i that used fuel type n) is used for the determination of $N_{i,n,x}/N_{i,x}$. The data was derived from the OD2017 survey and is presented in table 4.

In the case of subway and railway, $EF_{PKM,i,x}$ is already provided by the public state transport companies (METRÔ and CPTM)[21] and, therefore, there is no need to calculate $EF_{km,i,x}$ parameter above for these categories.

Step 3: Determine the emission factor passenger-kilometre

The emission factor passenger-kilometre for electricity-based transport system is calculated by the public state transport companies (METRÔ and CPTM) and is 6.00 gCO_2/pkm for both

[21] Metrô (2019b). *Relatório Integrado 2018.* Companhia do Metropolitano de São Paulo.

means of transport. Considering the share applied to each of the transport system ($N_{i,n,x}/N_{i,x}$, table 4), results are as follows:

Table 8 – Emission factor per passenger-kilometre for electricity-based transport (gCO_2/pkm)

$EF_{PKM,subway,2018}$ =	6.00
$EF_{PKM,railway,2018}$ =	6.00

For the determination of the emission factor passenger-kilometre for fuel-based transport system, equation 8 was considered and results are as follows:

Table 9 – Emission factor per passenger-kilometer for fuel-based transport (gCO_2/pkm)

Vehicle	$EF_{KM,i,x}$ ($kgCO_2$/km)	$OC_{i,x}$ (passengers)	$EF_{PKM,I,x}$ (gCO_2/pkm)
Bus	1.24	40% x 40 seats = 16.0	77.42
Minibus	0.80	40% x 10 seats = 4.0	199.31
Car	0.16	2.0[22]	78.84
Motorcycle	0.04	1.5	25.52
Source of data	Calculated table 6	Default TOOL18	Calculated TOOL18

In summary, emission factors are as follows:

Table 10 – Emission factor per passenger-kilometer (gCO_2/pkm)

$EF_{PKM,bus,2018}$ =	77.42
$EF_{PKM,minibus,2018}$ =	199.31
$EF_{PKM,subway,2018}$ =	6.00
$EF_{PKM,railway,2018}$ =	6.00
$EF_{PKM,car,2018}$ =	78.84[23]
$EF_{PKM,\ motorcycle,2018}$ =	25.52[23]
$EF_{PKM,bicycle,2018}$ =	0.00

[22] Taxis and private cars are grouped in the category "cars". Tool18 recommended occupancy rate for taxis is "1.1", but for simplicity and conservative reasons (the higher the occupancy rate, the smaller is the emission factor per passenger-kilometer) the same figure applied for cars ("2.0") is used.

[23] Using the total fuel consumption of 2017 (source: Cetesb, 2018) in the State of São Paulo: 52.1% gasoline, 13.3% anhydrous bioethanol and 34.6% hydrated bioethanol (shares in energy terms). For biofuels emission factor is assumed to be zero.

$EF_{PKM,walking,2018}$ =	0.00

Step 4: Determine baseline emissions

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) following equation 9 (appendix A).

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.

Estimated net GHG emissions were based on the following assumptions to Bikes4PlanetBR:

Table 11 – Assumptions for net baseline emissions under Bikes for the Planet Grouped Project

Parameter	Data
Type of project	Type 3
Quantity of stations	250
Quantity of bikes/station	10
Quantity of trips/bike/day	2
Days in year	365
Average trip distance (km)	2

Neither project emissions nor leakage were considered for the determination of emission reductions and, therefore, they are zero.

Considering assumptions above and the share of passengers of each transport category based on table 4, baseline emissions are as follows:

Table 12 – Assumptions for net GHG emission reductions under Bikes for the Planet Program

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)
Year 1 - 2018	175	0	0	175
Year 2 – 2019	173	0	0	173
Year 3 – 2020	171	0	0	171
Year 4 – 2021	169	0	0	169

Year 5 – 2022	168	0	0	168
Year 6 – 2023	166	0	0	166
Year 7 – 2024	164	0	0	164
Year 8 – 2025	163	0	0	163
Year 9 – 2026	161	0	0	161
Year 10 - 2027	160	0	0	160
Total	**1,670**	**0**	**0**	**1,670**

5 MONITORING

According to AMS-III.BM, the monitoring methodology will require the monitoring of different parameters depending on the approach selected to calculate the baseline emissions:

(a) If the project participants decide to calculate baseline emissions based on section 5.4.1, the relevant parameters indicated in the methodological tool "Baseline emissions for modal shift measures in urban passenger transport" (TOOL18) shall be measured for years 1 and optionally on year 4 of the crediting period. In doing so, the guideline "Sampling and surveys for CDM project activities and programmes of activities" shall be followed;

(b) For the other options, the monitored parameters are indicated in the tables from AMS-III.BM.

In addition to the parameters listed in AMS-III.BM, provisions on data and parameters monitored in the tools referred to in the methodology also apply.

5.1 Data and Parameters Available at Validation

From AMS-III.BM - lightweight two and three-wheeled personal transportation

Data /parameter table 1

Data / Parameter	$EF_{BL,benchmark}$
Data unit	tCO_2/pkm
Description	Average CO_2 emission factor per passenger-kilometre corresponding to public transportation-mix in the city (excluding travels using passenger cars, motorcycles and taxis)
Source of data	Official statistics from the transport authority or published studies conducted by a third party

Value applied:	It depends on the option used for the determination of the baselines emissions of the additional instance of the project activity. The parameter will be used when applying option 2 of the methodology for the determination of the baseline emissions. Not applicable here as the example project will apply option 1.
Justification of choice of data or description of measurement methods and procedures applied	Steps 1 to 3 of the methodological tool "Baseline emissions for modal shift measures in urban passenger transport" (TOOL18) may be applied to complement existing data. If the data from the statistics or from the studies only allow the determination of the activity levels in terms of pkm (passenger-kilometre), a conservative default value of 50 gCO_2/pkm for buses and 0.1 kWh/pkm for metro can be used (both values based on the performance analysis benchmarks from ACM0016). If the average CO_2 emission factor per passenger-kilometre determined is significantly higher than 50 gCO2/pkm for buses and 0.1 kWh/pkm for metro, these values shall be further justified in accordance with the guidance in section 4.7 "Data and parameters" of the "General guidelines for SSC CDM methodologies"
Purpose of Data	Calculation of baseline emissions
Comments	Parameter used when applying option 2 of the methodology.

Data /parameter table 2

Data / Parameter	$N_{bicycles,BL}$
Data unit	Number of bicycle trips
Description	Number of bicycle trips travelling through the location of the new bicycle infrastructure (Type 1 or Type 2) or parked in the area of influence e.g. surroundings of new bicycle parking area the (Type 5 or Type 6) prior to implementation of the project activity in a year
Source of data	Measured directly and/or based on a sample basis
Value applied:	It depends on the option used for the determination of the baselines emissions of the additional instance of the project activity. The parameter will be used when applying option 2 of the methodology for the determination of the baseline emissions. Not applicable here as the example project will apply option 1.
Justification of choice of data or description of	In direct measurement method, this parameter is determined through sensors installed in the location that counts the number of

measurement methods and procedures applied	bicycles riding in the lane or the number of bicycles parked in the parking area. In a sampling-based method, visual counting methods or camera-based methods may also be applied. Any sampling-based methods shall be in accordance with the standard "Sampling and surveys for CDM project activities and programme of activities" (appendix B).
Purpose of Data	Calculation of baseline emissions
Comments	Parameter used when applying Option 2 of the methodology.

Data /parameter table 3

Data / Parameter	$EF_{BL,CO2,survey}$
Data unit	tCO_2/pkm
Description	Average CO_2 emission factor per passenger-kilometre in the baseline
Source of data	Survey with users of e-bike promotion programs and bicycle sharing programs
Value applied:	It depends on the option used for the determination of the baselines emissions of the additional instance of the project activity. The parameter will be used when applying option 3 of the methodology for the determination of the baseline emissions. Not applicable here as the example project will apply option 1.
Justification of choice of data or description of measurement methods and procedures applied	The survey's questionnaire shall be designed to determine the users travel modes and trip length prior to the project activity in terms of average emissions per passenger-kilometre (gCO_2/pkm). Sampling shall be in accordance with the standard "Sampling and surveys for CDM project activities and programme of activities" (appendix B). The survey shall be conducted in the year 1 and optionally in the year 4 of the crediting period
Purpose of Data	Calculation of baseline emissions
Comments	Parameter used when applying Option 3 of the methodology. The emission factor is determined by applying Steps 1 to 3 from the latest approved version of the methodological tool "Baseline emissions for modal shift measures in urban passenger transport",

	using parameters estimated based on data collected during the survey. See description of the procedure in paragraph I.5 (Establishment and description of baseline scenario). Average CO_2 emission factor per passenger-kilometre in the baseline determined through the survey as above shall be cross checked with values of typical share 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/manual-calculating-ghg-benefits-gef-transportation-projects> may be used for cross-checking. 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 outcomes 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).

From TOOL18 - Methodological tool - Baseline emissions for modal shift measures in urban passenger transport.

Data /parameter table 4

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
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 (Table 13).

Table 13 - Specific fuel consumption	Value	Unit
Gasoline car (personal and taxi)	6	l/100 km

	Diesel car (personal and taxi)	5	l/100 km	
	Motorcycle	2	l/100 km	
Purpose of Data	Calculation of baseline emissions.			
Comments	-			

Data /parameter table 5

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 14).

Table 14 - Specific electricity consumption	Value	Unit
Electric vehicles	0.12	kWh/km

Purpose of Data	Calculation of baseline emissions
Comments	-

Data /parameter table 6

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 7

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

Data /parameter table 8

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 15 may be used if the relevant conditions apply. **Table 15 – Data sources and conditions for their usage** Data sources: (a) National default values — Conditions for using the data source: This source can be only used for liquid fuels and should be based on well documented reliable sources (such as national energy balances) Data sources: (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 — Conditions for using the data source:
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 9

Data / Parameter	IR_i
Data unit	-

Description	Technology improvement factor for vehicle category *i* per year
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	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 10

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: **Table 16 – Average occupancy as per vehicle type** Vehicle type | Average occupancy (World | South Asia) | Unit Car | 2.0 | 2.0 | Person (including driver) Taxi | 1.1 | 1.1 | Person (excluding 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 11

Data / Parameter	$EF_{CO2,n}$
Data unit	g CO2/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 12

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 13

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	Emission factor for new vehicles.

measurement methods and procedures applied	
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 14

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 as the example project will be type 3, i.e., no e-bikes or e-tricycles.
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 15

Data / Parameter	$P_{EL,i,x}$
Data unit	Passengers
Description	Total number of passengers transported per annum by electricity-based 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 as the example project will be type 3, i.e., no e-bikes or e-tricycles.

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

From AMS-III.BM - lightweight two and three-wheeled personal transportation

Data /parameter table 16

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 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" (appendix B).
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 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/manual-calculating-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 17

Data / Parameter	$N_{bicycles,y}$
Data unit	Number of bicycles trips
Description	Number of bicycles trips travelling through the bicycle infrastructure in year y or parked in the bicycle parking area
Source of data	Measured directly and/or based on a sample basis
Description of measurement methods and procedures applied	In direct measurement method, this parameter is determined through sensors installed in the location that counts the number of bicycles riding in the lane or the number of bicycles parked in the parking area. In a sampling-based method, visual counting methods or camera-based methods may also be applied. Any sampling-based methods shall be in accordance with the standard "Sampling and surveys for CDM project activities and programme of activities" (appendix B).
Frequency of monitoring/recording	Measured continuously and consolidated daily if direct measurement methods are used
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 applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	Parameter used when applying option 2 of the methodology.
Comments	-

Data /parameter table 18

Data / Parameter	$DT_{u,y}$
Data unit	km
Description	Total distance travelled by the individual user u of the e-bike promotion program or bicycle sharing program in year y
Source of data	(a) For programs that promoted e-bikes, data shall be sourced from mobile apps that record the distance travelled based on GPS; (b) For bicycle sharing programs, data shall be sourced from mobile apps that record the distance travelled based on GPS or from sensors installed in bicycles. (c) For bicycle sharing programs using docking spaces, if the data for (b) are not available, then trip distance may be conservatively assumed as the straight distance between the check-out and check-in docking spaces of the trip
Description of measurement methods and procedures applied	(a) When using mobile apps, the user shall turn on the app when starting the travel and turn off when the travel finishes; (b) When using sensors, the distance travelled shall be continuously measured
Frequency of monitoring/recording	The parameter shall be measured while travelling. The values shall be aggregated monthly for each individual user u
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 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 19

Data / Parameter	$ECP_{j,y}$
Data unit	kWh
Description	Quantity of electricity consumed to recharge the batteries of e-bikes or e-tricycles in year y
Source of data	Continuous measurements
Description of measurement methods and procedures 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 $EG_{PJ,grid,y}$ and/or $EG_{PJ,j,y}$ 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:	Not applicable here as the example project will be type 3, i.e., no e-bikes or e-tricycles.
Monitoring equipment	As per the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05)

QA/QC procedures applied	As per the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05)
Purpose of data	Calculation of project emissions
Calculation method	As per the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05)
Comments	If this parameter is determined through paragraph 33(b) of the methodology, only the parameter "Total distance travelled by the individual user u of the infrastructure and/or of the promoted e-bikes in year y" ($DT_{u,y}$) needs to be monitored.

From TOOL18 - Methodological tool - Baseline emissions for modal shift measures in urban passenger transport

Data /parameter table 20

Data / Parameter	*Di*
Data unit	kilometres
Description	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category i
Source of data	Survey
Description of measurement methods and procedures applied	Survey of the project passengers in year 1 and optionally in year 4 of the first crediting period asking about the entry and exit stations in the project system and noting electricity-based or road-based vehicle category i each surveyed passenger used prior to shifting to the project system (Si).
Frequency of monitoring/recording	At the survey in year 1 and optionally in the year 4 when applying option 1 or continuous when applying option 3.
Value applied:	For the ex-ante calculation, 2km/trip for each vehicle category.
Monitoring equipment	N/A
QA/QC procedures 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 1 of TOOL18

Comments	-

Data /parameter table 21

Data / Parameter	S_i
Data unit	%
Description	Share of passengers who shifted from electricity-based or road-based vehicle category *i*
Source of data	Survey
Description of measurement methods and procedures 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	At the survey in year 1 and optionally in the year 4 when applying option 1 or continuous when applying option 3.
Value applied:	The following values were considered for ex-ante calculation:

Vehicle category	Share of passengers
Bus	20.4%
Minibus (lotação)	5.0%
Metrô (subway)	8.1%
CPTM (railway)	3.0%
Car	28.1%
Motorcycle	2.5%
Bicycle	0.9%
Walking	32.0%

Monitoring equipment	N/A
QA/QC procedures 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 1 of TOOL18.
Comments	-

Data /parameter table 22

Data / Parameter	SD_i
Data unit	%
Description	Share of passenger-kilometres who shifted from electricity-based or road-based vehicle category *i* (%)
Source of data	Survey
Description of measurement methods and procedures 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 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.
Frequency of monitoring/recording	At the survey in year 1 and optionally in the year 4 when applying option 1 or continuous when applying option 3.
Value applied:	Not applied for ex-ante calculation.
Monitoring equipment	N/A
QA/QC procedures applied	Official source of data or 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 23

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 applied	-
Frequency of monitoring/recording	Monitored annually
Value applied:	1,825,000 passengers/year were considered for ex-ante calculation.
Monitoring equipment	N/A
QA/QC procedures 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 1 or 2 of TOOL18
Comments	-

Data /parameter table 24

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 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 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	-

5.3 Monitoring Plan

The majority of the data and parameters used in the emissions reduction calculations are not monitored and will be sourced from local measured data (published national or international studies by governmental, academic or private institutions or, if necessary, commissioned by the project participants).

Monitored data and parameters will depend on the baseline emissions option used for the calculation but are all related to the use of the two and three-wheeled personal transportation and will all be determined in surveys.

Surveys will be detailed at the project activity instance level and in accordance with procedures from the Standard for Sampling and Surveys for CDM project activities and programme of Activities (version 7.0, May 2017), summarized in appendix B.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

The following description of achieved GHG emission reductions is related to project activity instance 1 and project activity instance 2 under the grouped project for the monitoring period from 30-Jan-2018 to 17-Dec-2018. Both project activity instances located in the city of Sao Paulo, state of Sao Paulo, Brazil and apply type 3 of AMS-III.BM, i.e. expansion of an existing bicycle sharing program through dockless bicycles and sharing stations.

PROJECT ACTIVITY INSTANCE 1 - TEMBICI

"Tembici Participações S.A." (Tembici) is a company focused on shared bicycles and e-bicycles with sharing stations in the whole country. However, no e-bicycles were included in this monitoring period.

In Sao Paulo, Tembici implements the Program "Bike Sampa" aiming to incentive the modal switch under public spaces. It also has activities under private spaces (figure 2).

Figure 2 – Sharing station of Tembici in Sao Paulo in public (left) and private spaces (right) (source: https://tembici.com.br/)

According to the PD, project activity instances must follow the eligibility criteria for its inclusion in Bikes4PlanetBR.

The compliance assessment for the inclusion of the proposed project activity instance 1 is as follows:

1) Meet the applicability conditions set out in the methodology applied to the project

The proposed project activity instance follows all applicable requirements described in section 3.2: • The measure is the implementation of new bicycle sharing program (through dockless bicycles or sharing stations) • The measure will result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually. • The measure applies the applicability conditions set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13 (see applicability condition 5 below)	✓

2) Use the technologies or measures specified in the project description

The proposed project activity instance applies type 3 of as described in sections 1.1, 1.11 and 3.2. (Construction of new bicycle share program through dockless bicycles or docking stations).	✓

3) Apply the technologies or measures in the same manner as specified in the project description

The proposed project activity instance applies type 3 of as described in sections 1.1, 1.11 and 3.2. (Construction of new bicycle share program through dockless bicycles or docking stations).	✓

4) Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area

The baseline scenario of the proposed project activity instance is the ones presented in section 3.4, i.e. the continuation of the use of the exiting modes of transport.	✓

5) Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.

The proposed project activity instance complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13: • According to paragraph 10 (c), barrier due to prevailing practice. Because there is no exact definition of how exactly to demonstrate the barrier, the project proponents use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 9 (Appendix, paragraph 1) use penetration rate of less than five per cent as condition to be considered automatically additional. (2) TOOL32, version 2 use throughout the document a share of less than two per cent to be defined as automatically additional. As it can be seen in Table 3, bicycles are used as transport mode in less than 1% of the trips in Sao Paulo, 0.9% to be more precise, demonstrating a barrier due to the prevailing practice. • Additionally, according the appendix (TOOL21, page 5, also seen in "Appendix C" below), as GHG emission reductions (i) are lower than 600 tCO2e/year, and, (ii) end users of the measure are households and communities, it is automatically additional.	✓

PROJECT ACTIVITY INSTANCE 2 - GROW

GROW is a joint venture between "*Grin Mobilidade Ltda.*" and "*Yellow Soluções de Mobilidade Ltda.*" The purpose of the company is to provide alternative means of transport by providing bicycles and electric scooters in urban centers in Brazil.

Figure 3 – Bicycles and scooters from Grow in urban centers of Brazil (source: https://www.mobilize.org.br, http://www.revistaurbanova.com.br)[24]

According to the PD, project activity instances must follow the eligibility criteria for its inclusion in Bikes4PlanetBR.

The compliance assessment for the inclusion of the proposed project activity instance 2 is as follows:

1) Meet the applicability conditions set out in the methodology applied to the project

The proposed project activity instance follows all applicable requirements described in section 3.2: • The measure is the implementation of new bicycle sharing program (through dockless bicycles or sharing stations) • The measure will result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually. • The measure applies the applicability conditions set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13 (see applicability condition 5 below)	✓

2) Use the technologies or measures specified in the project description

The proposed project activity instance applies type 3 of as described in sections 1.1, 1.11 and 3.2. (Construction of new bicycle share program through dockless bicycles or docking stations).	✓

3) Apply the technologies or measures in the same manner as specified in the project description

The proposed project activity instance applies type 3 of as described in sections 1.1, 1.11 and 3.2. (Construction of new bicycle share program through dockless bicycles or docking stations).	✓

4) Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area

The baseline scenario of the proposed project activity instance is the ones presented in section 3.4, i.e. the continuation of the use of the exiting modes of transport.	✓

5) Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.

[24] Sources: http://www.revistaurbanova.com.br/novidade-grin-traz-a-sao-jose-200-patinetes-eletricos-compartilhados/ and https://www.mobilize.org.br/blogs/brasilia-para-pessoas/sem-categoria/as-amarelinhas-chegaram-a-brasilia/.

The proposed project activity instance complies with the criteria set in the methodological TOOL21 "demonstration of additionality of small-scale project activities", version 13: • According to paragraph 10 (c), barrier due to prevailing practice. Because there is no exact definition of how exactly to demonstrate the barrier, the project proponents use definitions of two approved CDM tools to demonstrate it; (1) TOOL19, version 9 (Appendix, paragraph 1) use penetration rate of less than five per cent as condition to be considered automatically additional. (2) TOOL32, version 2 use throughout the document a share of less than two per cent to be defined as automatically additional. As it can be seen in Table 3, bicycles are used as transport mode in less than 1% of the trips in Sao Paulo, 0.9% to be more precise, demonstrating a barrier due to the prevailing practice. • Additionally, according the appendix (TOOL21, page 5, also seen in "Appendix C" below), as GHG emission reductions (i) are lower than 600 tCO2e/year, and, (ii) end users of the measure are households and communities, it is automatically additional.	✓

6.1 Data and Parameters Monitored

From TOOL18 - Methodological tool - Baseline emissions for modal shift measures in urban passenger transport

Data / Parameter	D_i
Data unit	kilometers
Description	Average trip distance travelled by passengers who shifted from electricity-based or road-based vehicle category i
Value applied:	Data from the project system operator:

Project instance	2018
1 – Tembici	Commercially sensitive information
2 – Grow	Commercially sensitive information

Comments	Parameter applicable when using Option 1 of TOOL18

Data / Parameter	S_i
Data unit	%
Description	Share of passengers who shifted from electricity-based or road-based vehicle category *i*

Value applied:	The following values were considered based on survey applied in year 1 (official source):

Vehicle category	Share of passengers
Bus	20.4%
Minibus (lotação)	5.0%
Metrô (subway)	8.1%
CPTM (railway)	3.0%
Car	28.1%
Motorcycle	2.5%
Bicycle	0.9%
Walking	32.0%

Comments	Parameter applicable when using Option 1 of TOOL18.

Data / Parameter	P_y
Data unit	Passengers
Description	Number of passengers travelled by the project system in year *y*
Value applied:	Data from the project system operator: Data from the project system operator:

Project instance	2018
1 – Tembici	Commercially sensitive information
2 – Grow	Commercially sensitive information

Comments	Parameter applicable when using Option 1 or 2 of TOOL18.

6.2 Baseline Emissions

Both proposed activity instances apply option 1 (ex-post survey of baseline travel modes) of AMS-III.BM for the determination baseline emission calculation using data from the origin-destination survey carried out by Metrô on transport modes used in the RMSP.

Project Proponents are aware that the use of the survey carried out by Metrô is a deviation of the methodology. The use of the Metrô survey is explained and justified in item 3.6 of the project description document.

The following national and municipal transit authorities' studies are used to determine the weighted average CO_2 emission factor per passenger-kilometre corresponding to public transportation-mix in the city:

- Metrô (2018). *Relatório de Sustentabilidade do Metrô de São Paulo.* Companhia do Metropolitano de São Paulo.
- Metrô (2019). Pesquisa Origem Destino 2017 - Balanço da realização e os primeiros resultados da Pesquisa Origem e Destino 2017. Companhia do Metropolitano de São Paulo.
- MMA (2014). *Primeiro inventário nacional de emissões atmosféricas por veículos automotores rodoviários – relatório final.* Ministério do Meio Ambiente.
- Cetesb (2018). *Emissões veiculares no estado de São Paulo 2017.* Companhia Ambiental do Estado de São Paulo.
- EPE (2018). *Brazilian Energy Balance 2018: Base Year 2017.* Empresa de Pesquisa Energética.

For full references and calculations, see the emission reduction spreadsheet, submitted as annex.

Following the methodology, steps 1 to 4 from TOOL18 were applied (see details in section 4.4 of the Project Description Document above) as follows.

Step 1: Determine relevant vehicle categories

Relevant vehicle categories are the ones presented in Table 5 (source: Metrô, 2019). Information related to fuel applicable to vehicle categories and average consumption can be seen in Table 6 (source: Cetesb, 2018). Fuel-related information – density and net calorific value – is collected from EPE (2018), option a) of TOOL18. The CO_2 emission factors for the applicable fuel are the ones form the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

All parameters considered for the calculation of baseline emissions are presented in Table 7.

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

The emission factor per kilometre for road-based categories was determined based on parameters presented in Table 7 and equation 5.

The emission factor per kilometre for electricity-based categories ($EF_{KM,i,x}$) were not calculated as this parameter is required to calculate the emission factor per passenger-kilometre ($EF_{PKM,i,x}$) only, which is already given by the public state transport companies (METRÔ and CPTM).

Step 3: Determine the emission factor passenger-kilometre

Data considered for the determination of the emission factor passenger-kilometre including source is presented as follows:

Table 17 – Data considered for the calculation of emission factor passenger-kilometre

Vehicle categories	Fuel type	Fuel density (kg/l)	$NCV_{i,n}$ (kcal/kg)	$EF_{CO2,n}$ ($kgCO_2/TJ$)	$SFC_{i,n,x}$ (L or kWh/km)	$EF_{km,i,x}$ ($kgCO_2/km$)	$N_{i,n,x}/N_{i,x}$ (%)	$OC_{i,x}$ (qty)	IR_i (%)
Bus	Diesel oil	0.840	10,100	72,600	0.471	1.24	20.4	16	0.99
Minibus	Diesel oil	0.840	10,100	72,600	0.303	0.80	5.0	4	0.99
Car	Gasoline	0.742	10,400	67,500	0.070	0.16	28.1	2	0.99
	bioethanol	0.809	6,300	0	0.102	0			
Motorcycle	Gasoline	0.742	10,400	67,500	0.070	0.16	2.5	1.5	0.99
	bioethanol	0.809	6,300	0	0.102	0			
Metrô (subway)	Electricity	n/a	n/a	n/a	n/a	n/a	8.1	200	0.99
CPTM (railway)	Electricity	n/a	n/a	n/a	n/a	n/a	3.0	200	0.99
Bicycle	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Walking	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Source	CETESB, 2018	BEN, 2018	BEN, 2018	IPCC, 2006	CETESB, 2018	Calculated TOOL18	METRÔ, 2018	Default TOOL18	Default TOOL18

The emission factor passenger-kilometre for each vehicle categories is presented in table 9.

Step 4: Determine baseline emissions

For the determination of baseline emissions, the technology improvement factor considered was the default value provided by TOOL18, i.e. 0.99. The following monitored data was considered for each project activity instances:

Table 18 – Data monitored & baseline emissions, project activity instance 1 – Tembici

Parameter		2018
Time Diff. (years)	T_i	$t_{2018} - t_{2017} = 1$
Avg. Dist. (km)	D_i	Commercially sensitive information
Passengers	P_y	Commercially sensitive information
Baseline emissions	BE_y	120

Table 19 – Data monitored & baseline emissions, project activity instance 2 – Grow

Parameter	2018

Time Diff. (years)	T_i	$t_{2018} - t_{2017} = 1$
Avg. Dist. (km)	D_i	Commercially sensitive information
Passengers	P_y	Commercially sensitive information
Baseline emissions	BE_y	120

Parameter "D_i" (average trip distance travelled by passengers) is individually and directly measured for each project instance as follows:

- For project activity instance 1 (Tembici), measurement is made using the shortest road path between the station where the bicycle is taken and the station where it is returned. For conservative reasons, if the stations where the bicycle is taken and returned are the same, a zero km distance trip is assumed. Yearly chronological averages is used in the determination of D_i.
- For project activity instance 2 (Grow), all trips are directly measured and the average trip distance for the country[25] is used.

Parameter P_y (number of passengers travelled by the project system in year y) is directly determined by each project instance for each chronological year.

6.3 Project Emissions

Both project activity instances do not include e-bikes or e-tricycles and, therefore, according to the approved methodology project AMS-III.BM emissions are 0 (zero).

6.4 Leakage

In accordance with AMS-III.BM, no leakage is considered.

6.5 Net GHG Emission Reductions and Removals

Table 20 – Net GHG emission reductions and removals, project activity instance 1 - Tembici

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 1 - 2018 (30-Jan-2018 to 17-Dec-2018)	120	0	0	120
Total	**120**	**0**	**0**	**120**

[25] Grow (2019). *Micromobilidade: um panorama Latino-americano.* Grow Mobility Blog, 12-Ago-2019 (URL: https://blog.grow.mobi/micromobilidade-panorama-latino-americano/, access on 17-Oct-2019).

Table 21 – Net GHG emission reductions and removals, project activity instance 2 - Grow

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 1 - 2018 (02-Aug-2018 to 17-Dec-2018)	120	0	0	120
Total	**120**	**0**	**0**	**120**

Table 22 – Total net GHG emission reductions and removals achieved, grouped project

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 1 - 2018 (30-Jan-2018 to 17-Dec-2018)	240	0	0	240
Total	**240**	**0**	**0**	**240**

APPENDIX A: APPLICATION OF TOOL18 FOR BASELINE EMISSION CALCULATION

In order to apply Option 1 or 2 for the calculation of baseline emissions, the following steps of TOOL18 shall be followed according to AMS-III.BM:

Step 1 - Determine the 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:

$$EF_{KM,i,x} = \left[\sum_{n}\left[SFC_{i,n,x} \times NCV_{i,n} \times EF_{CO2,n} + SEC_{i,x} \times EF_{CO2,x}\right] \times \frac{N_{i,n,x}}{N_{i,x}}\right] \qquad \textbf{Equation 5}$$

Where:

$EF_{KM,i,x}$ = Emission factor per kilometre of vehicle category *i* in year *x* (gCO_2/km)

$SFC_{i,n,x}$ = Specific fuel consumption of vehicle category *i* using fuel type *n* in year *x* (mass or volume units of fuel/km)

$NCV_{i,n}$ = Net calorific value of fuel *n* used in vehicle category *i* (MJ/mass or volume units of fuel)

$EF_{CO2,n}$ = Emission factor for fuel type *n* (g CO_2/MJ)

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

$EF_{CO2,x}$ = Emission factor for electricity in year *x* (g CO_2/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 *n*[26] driven in year *x* (VKM) or number of vehicles in vehicle category *i* using fuel type *n*[26] in 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 $EF_{KM,i,x}$ a default emission factor for new vehicles can be obtained from the source provided in TOOL18, table in section "Data and Parameters not monitored".

Note 2: instead of the two parameters $N_{i,n,x}$ and $N_{i,x}$, it is possible to use one parameter $N_{i,n,x}/N_{i,x}$ 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):

(c) Approach 1. The share of vehicle-kilometres within vehicle category i that are driven by vehicles using fuel type n, if a reliable data source for this parameter exists (see TOOL18, "Data and parameters" section for further guidance on data requirements). This is the preferred option;

(d) 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

[26] For electrical vehicles fuel type *n* represents electricity only for variable $N_{i,n,x}$.

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:

$$EF_{PKM,i,x} = \frac{TE_{EL,i,x}}{P_{EL,i,x} \times D_{EL,i,x}} \times 10^6 \quad \textbf{Equation 6}$$

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 *i* in 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 $D_{EL,I,x}$[27]. 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:

$$EF_{PKM,i,x} = \frac{EF_{KM,i,x}}{OC_{i,x}} \quad \textbf{Equation 7}$$

Where:

[27] The trip distance is only determined prior to estimating baseline emissions. The electricity consumed, and the passengers transported should be updated annually to track technological improvements in the rail-based system leading to changes in the emission factor per passenger transported.

$EF_{PKM,i,x}$ = 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:

$$BE_y = \left[\sum_i \left[(IR_i)^{t+y-1} \times EF_{PKM,i,x} \times D_i \times S_i\right]\right] \times P_y \times 10^{-6} \qquad \textbf{Equation 8}$$

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)

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*

[28] Since, according to current requirements, data for standardized baselines need to be updated every three years, after such an update, technology improvement factor can be calculated based on country specific data and used in calculations instead of the default value. Relevant provisions in the recent approved "Procedure for development, revision, clarification and update of standardized baselines" shall be applied when this parameter is calculated for establishing standardized baselines.

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:

$$BE_y = \left[\sum_i \left[(IR_i)^{t+y-1} \times EF_{PKM,i,x} \times SD_i\right]\right] \times PD_y \times 10^{-6} \qquad \textbf{Equation 9}$$

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 $EF_{PKM,i,x}$ are used in Equation 9 to calculate baseline emissions.

APPENDIX B: APPLICATION OF SAMPLING AND SURVEYS

In order to apply Option 1 of AMS-III.BM, the standard "Sampling and surveys for CDM project activities and programme of activities" may be applied.

The purpose of sampling is to obtain: (a) unbiased and (b) reliable estimates of the mean value of parameters used in the calculations of GHG emission reductions.

Where there is no specific guidance in the applied methodology, the project participants or the coordinating/managing entity shall use 90/10 confidence/precision as the criteria for the reliability of sampling efforts for small-scale CDM project activities. Where two or more project activities, CPAs or PoAs are grouped for undertaking a common survey it shall be ensured that a confidence/precision of 95/10 is achieved for each of the project activity, CPA or PoA that is included in the group for the survey. This reliability specification shall be applied to determine the sampling requirements for each individual parameter value determined through a sampling effort.

Precision of 10 per cent, that is, ± 10 per cent shall be interpreted:

(a) As a relative unit when the parameter of interest is a proportion (or a percentage). For instance, ± 10 per cent in relative units means that the interval around a proportion value of 70 per cent is 63 per cent to 77 per cent. A proportion can describe either of the two possible scenarios of the success rate (p) or the failure rate (1−p), for example (i) cookstove still operational or (ii) cookstove no longer operational. The project participants or the coordinating/managing entity may use the larger of the two proportions in the sample size calculation, that is p or (1−p), in any of the monitoring periods during the crediting period without having to revise the monitoring plan.

(b) As a relative term when the parameter of interest is a mean. For example, ± 10 per cent in relative terms means that the interval around a mean value of 4 is 3.6 to 4.4. If the estimates from the actual samples fail to achieve the target minimum levels of precision from paragraph above (90/10 or 95/10), the project participants or the coordinating/managing entity shall either:

1. Perform additional data collection that is a supplemental or new sample to reach the required precision level; or
2. Apply a correction to the estimates using one of the two options below:
    i. Discounting the emission reduction estimates by either:
        1. Taking the lower or the upper bound, whatever is the more conservative, of the 90 or 95 per cent confidence interval, depending on the type of methodologies applied; or
        2. Discounting by no less than three times (x3) the percentage precision points missed (e.g. if the required precision is 90/10 and the attained precision is

90/11 then the GHG emission reduction estimates are discounted by 3 per cent);

ii. Using a conservative default value included in the applied methodologies (e.g. 3.5 hours for lighting usage for AMS-II.J, default failure rates provided in equation 3 of AMS-II.J);

3. The option in subparagraph (b) above is only eligible for the application to the survey undertaken during the first two years of the crediting period of the CDM project activity or component project activities (CPAs) (if sampling is undertaken at the PoA level, the two-year limit applies from the start date of crediting to the PoA), and when the attained confidence/precision from the actual samples is equal to or better than 90/15 for a small-scale CDM project activity and 95/15 for a large-scale CDM project activity.

When developing a sampling plan, the project participants or the coordinating/managing entity shall calculate the sample size required to achieve a required level of reliability. The sample size should be determined manually or using appropriate statistical software. The calculation is dependent on all of the following as well as the target level of confidence and the precision (e.g. 90/10 or 95/10):

(a) The type of parameter of interest, that is, mean value or proportion value;

(b) The target value, that is, the expected value of the parameter, which should be determined using the project participants' or the coordinating/managing entity's knowledge and experience;

(c) Expected variance (or standard deviation) for that measure in the sample, based on the results from similar studies including other similar CDM project activities or previous monitoring periods, pilot studies or from the project planner's own knowledge of the data.

If the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 shall be chosen when the parameter of interest is a proportion. If the parameter of interest is a numeric mean value (i.e. not a proportion or percentage) the Student's t distribution shall be used if the resulting sample size is less than 30.

APPENDIX C: TOOL 21, VERSION 13, APPENDIX

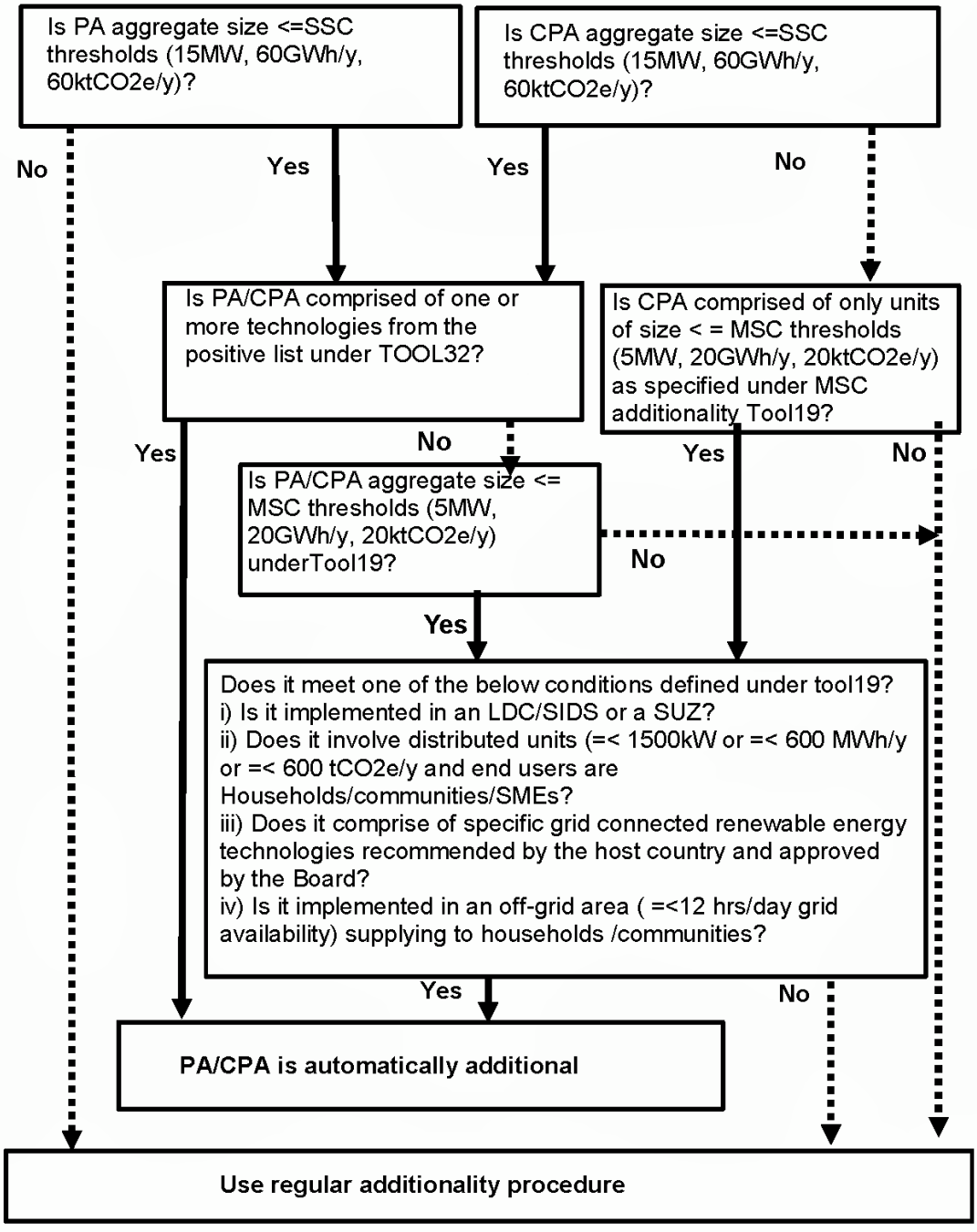

Figure 4 – Provisions of small-scale and microscale tools for automatic adittionality