Establishing Standardized UGI and ISWM baseline and MRV Mechanism for Calculating Emission Reductions

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MRV Mechanism – Final Report

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1 INTRODUCTION

This MRV system provides **procedures to measure, report and verify GHG emissions** and sustainable benefits from

1. compost production using the organic fraction of landfill waste
2. substitution of fertilizers for compost or urban greenery
3. urban and peri-urban reforestation of degraded land (implicitly also covering the displacement of non-renewable fuel wood with renewable biomass generated by managed forests)

which are mitigation actions of the GEF-funded project **Creating Opportunities for Municipalities to Produce and Operationalise Solid Waste Transformation** (COMPOST)

By applying internationally accepted methodologies and approaches (Intergovernmental Panel on Climate Change (IPCC), and Clean Development Mechanism (CDM)) the MRV mechanism can be used for a national voluntary carbon offsetting scheme or for international reporting purposes.

2 MRV – COMPOST PRODUCTION USING THE ORGANIC FRACTION OF LANDFILL WASTE

2.1 DEFINITIONS

Composting - a process of biodegradation of waste under aerobic (oxygen-rich) conditions. Waste that can be composted must contain solid biodegradable organic material. Composting converts biodegradable organic carbon to mostly carbon dioxide (CO2) and a residue (compost) that can be used as a fertilizer. Other outputs from composting can include, inter alia, methane (CH4) and nitrous oxide (N2O);

Managed SWDS - a SWDS that has controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste. In this tool, a SWDS that does not meet this definition is considered an unmanaged SWDS;

Municipal solid waste (MSW) - a heterogeneous mix of different solid waste types, usually collected by municipalities or other local authorities. MSW includes household waste, garden/park waste and commercial/institutional waste;

Solid waste disposal site (SWDS) - designated areas intended as the final storage place for solid waste.

Windrow - a composting installation where waste is composted in a long, low ridge. This shape is designed to passively aerate the waste by making use of wind and natural drafts caused by the increased temperatures of the biodegradation process.

2.2 MEASURING

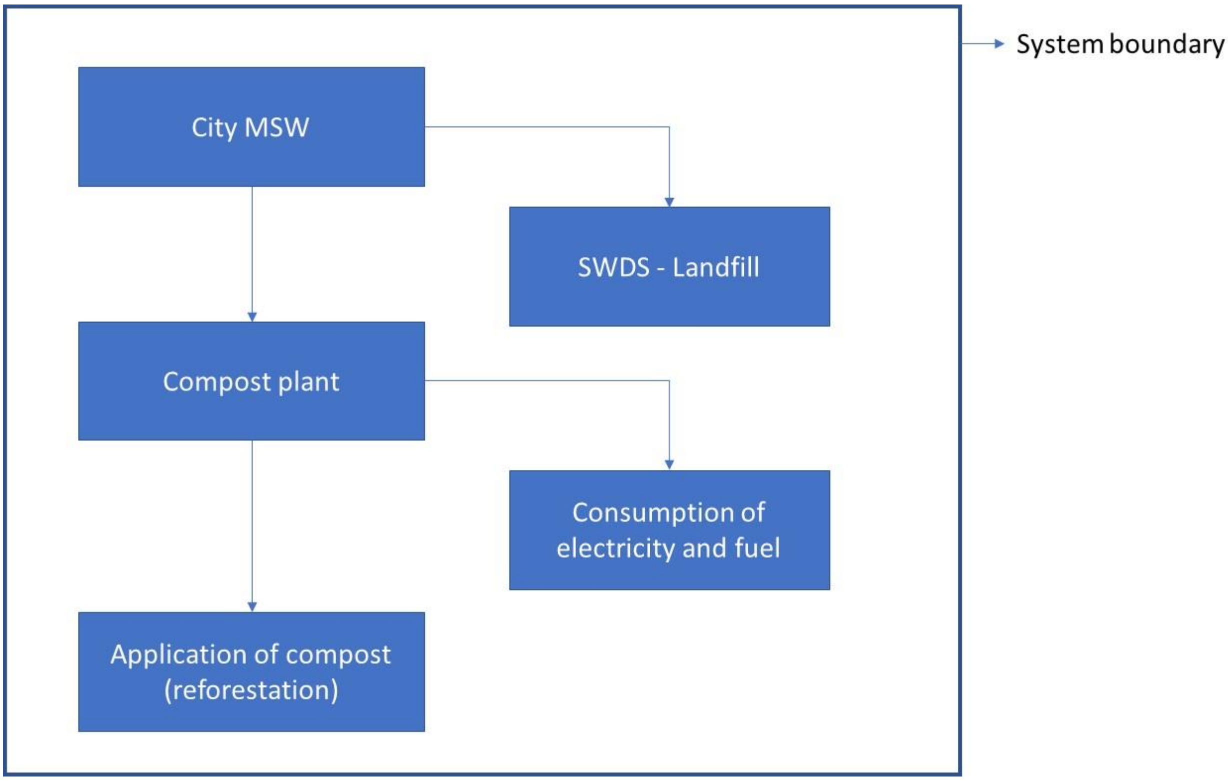
2.2.1 GHG EMISSIONS

2.2.1.1 METHODOLOGY

For the calculation of GHG emissions from composting, the MRV mechanism refers to

- CDM Small-scale methodology AMS-III.F. Avoidance of methane emissions through composting, version 12.0
- CDM methodological tool 03 - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, version 03.0
- CDM methodological tool 04 – Emissions from solid waste disposal sites, version 08.0
- CDM methodological tool 05, Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0
- CDM methodological tool 13 – Project and leakage emissions from composting, version 02.0

The system boundary of the mitigation action consists of the compost plant, the landfill (or solid waste disposal site where the MSW would have been disposed) and the areas where the compost will be utilized. Possible GHG emissions resulting from fuel combustion and electricity consumption in the operation of the mitigation action will be accounted for as well. A graphical representation of the mitigation action is shown in diagram below:



2.2.1.2 CALCULATIONS

Please see attached Excel file ETH-RFP-2017-15-MRV-Mechanism-CompostCalculationV3.xls which serves as **calculation tool** for the subsequent formulas. GHG emissions (baseline emissions BE_y, mitigation action emissions PE_y and leakage emissions LE_y if applicable) and if applicable achieved emission reductions shall be calculated as follows

$$ER_y = BE_y - (PE_y + LE_y) \quad (1)$$

Where:

ER_y	=	Emission reduction in the year y (tCO_2e)
BE_y	=	Baseline emissions in the year y (tCO2e)
PE_y	=	Mitigation action emissions in the year y (tCO_2e)
LE_y	=	Leakage emissions in year y (tCO_2e)

Baseline emissions

$$BE_{CH4,SWDS,y} = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{x=1}^{y} Default_x \times W_y \quad (2)$$

where

φ_y	=	Model correction factor to account for model uncertainties for year y
f_y	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	=	Global warming potential of methane
$Default_x$	=	The value of $Default_x$ depends on the year x since the disposal of the waste. The default values have been derived by an analysis of registered CDM projects with verified waste compositions, and the default values are selected to ensure conservativeness of the resulting baseline emissions (using 95% confidence and 10% precision) tCH4/ t
W_y	=	Total amount of waste disposed in the baseline in the year y, i.e. in the absence of the mitigation action (composting plant)

$$W_y = \sum_{t=1}^{n} CT_{t,y} \qquad 3$$

where:

$CT_{t,y}$	=	Carrying capacity of truck t used in year y to deliver waste to the composting installation
t	=	Waste deliveries in trucks to the composting installation in year y

Mitigation action emissions

$$PE_{Comp,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{N2O,y} \qquad 4$$

where:

$PE_{Comp,y}$	=	Mitigation action emissions associated with composting in year y (tCO2e)
$PE_{EC,y}$	=	Mitigation action emissions from electricity consumption associated with composting in year y (tC2Oe)
$PE_{FC,y}$	=	Mitigation action emissions from fossil fuel consumption associated with composting in year y (tCO2e)
$PE_{CH4,y}$	=	Mitigation action emissions of methane from composting process in year (tCO2e)
$PE_{N2O,y}$	=	Mitigation action emissions of nitrous oxide from the composting process in year y (tCO2e)

<u>Mitigation action emissions from electricity consumption</u>

$$PE_{EC,y} = EC_{PJ,comp,y} \times EF_{PJ,default} \qquad 5$$

where:

$PE_{EC,y}$	=	Mitigation action emissions from electricity consumption associated with composting in year y (tC2Oe)
$EC_{PJ,comp,y}$	=	Electricity consumption associated with composting in year y (MWh)
$EF_{PJ,default}$		Emission factor of electricity consumption associated with composting in year y (tCO2e/ MWh)

In case the mitigation action (composting plant) is associated with no electricity consumption $EC_{PJ,comp,y} = 0$; otherwise:

$$EC_{PJ,comp,y} = W_y \times SEC_{comp,default} \quad 6$$

where:

$EC_{PJ,comp,y}$	=	Electricity consumption associated with composting in year y (MWh)
W_y	=	Quantity of waste composted in year y (t)
$SEC_{comp\ default}$	=	Default value for the specific quantity of electricity consumed per tonne of waste composted (MWh/t)

Mitigation action emissions from fossil fuel consumption

In case the mitigation action (composting plant) is associated with no fossil fuel consumption $PE_{FC,y} = 0$; otherwise:

$$PE_{FC,y} = W_y \times EF_{FC,default} \quad 7$$

where:

$PE_{FC,y}$	=	Mitigation action emissions from fossil fuel consumption associated with composting in year y (tCO2e)
W_y	=	Quantity of waste composted in year y (t)
$EF_{FC,default}$	=	Default emission factor for fossil fuels consumed by the composting action per tonne of waste (tCO2e/t)

Mitigation action emissions of methane

$$PE_{CH4,y} = W_y \times EF_{CH4,y,default} \times GWP_{CH4} \quad 8$$

where:

$PE_{CH4,y}$	=	Mitigation action emissions of methane from the composting process in year y (tCO2e)
W_y	=	Quantity of waste composted in year y (t)
$EF_{CH4,y,default}$		Default emission factor of methane per ton of waste composted valid for year y (tCH4/ t)
GWP_{CH4}	=	Global Warming Potential of CH4 (tCO2e/ tCH4)

Mitigation action of nitrous oxide

$$PE_{N2O,y} = W_y \times EF_{N2O,y,default} \times GWP_{N2O} \quad 9$$

where:

$PE_{N2O,y}$	=	Mitigation action emissions of nitrous oxide from the composting process in year y (tCO2e)
W_y	=	Quantity of waste composted in year y (t)

$EF_{N2O,y,default}$		Default emission factor of nitrous oxide per tonne of waste composted valid for year y (tN2O/ t)
GWP_{N2O}	=	Global Warming Potential of N2O (tCO2e/ tN2O)

Leakage emissions
Leakage emissions from composting should be accounted for only if compost is subjected to anaerobic storage or disposed of in a SWDS. For this mitigation action it is assumed to be 0.

2.2.2 SUSTAINABLE BENEFITS

2.2.2.1 METHODOLOGY

For the calculation of sustainable benefits from composting, the MRV mechanism refers to the proposed methodology, *"Valuing the sustainable development co-benefits of climate change mitigation actions: The case of the waste sector and recommendations for the design of nationally appropriate mitigation actions"* (NAMAs), published by United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) (2014) and the UN Sustainable Goals (SDGS) framework.

The study states…."*in implementing such decentralized, pro-poor and community-based waste-to-resource projects [experience] has shown that they can generate a broad number of co-benefits, such as green job creation, improved health, improved waste collection, cost savings from reduced need for landfilling, and improved crop yields through the use of compost, among others*." (p 24)
http://www.unescap.org/sites/default/files/Valuing%20the%20Sustainable%20Dev%20Co-Benefits%20(Final).pdf

Based on the listed sustainable benefits in the study, this MRV mechanism applies two quantifiable sustainable benefits directly related to the amount of MSW disposed/ composted

1. Creation of jobs due to composting (composting provides better and more stable income and safer working conditions to waste pickers)

2. Saved landfill space due to composting (land for landfill sites is becoming scarce in most developing countries due to increases in land prices and opposition to landfills)

SDG	Description	Benefits examples
SDG 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	• Creation of jobs due to the composting activities
SDG 11	Sustainable cities and communities. Make cities and human settlements inclusive, safe, resilient and sustainable	• Saving landfill space

Each City can extend the table above to address additional Sustainable Development Goals, depending on the identified sustainable benefits and available data evidence.

More information about the UN SDG goals are available at:

http://www.un.org/sustainabledevelopment/

2.2.2.2 CALCULATIONS

Saved landfill space due to composting

$$SL_y = W_y \times FSL_{default}$$

where:

SL_y	=	Saved space of land due to avoidance of landfilling via composting per year(m³)
W_y	=	Quantity of MSW disposed/ composted (t)
$FSL_{default}$	=	Default value for saved space of land due to avoidance of landfilling

Created jobs due to composting

$$CJ_y = W_y \times FCJ_{default}$$

where:

CJ_y	=	Created jobs due to composting
W_y	=	Quantity of MSW disposed/ composted (t)
$FCJ_{default}$	=	Default value for creation of jobs due to composting.

2.3 REPORTING

Each city will prepare a periodic report (annually) describing the baseline, mitigation action and leakage emissions and associated emission reductions.

The reporting template to be used is described in detail in Annex I of the MRV mechanism.

The reporting structure and processes is explained in detail in Section 2.5, Institutional Framework.

Data and parameters fixed ex ante

Data/Parameter	$\varphi_{default}$
Unit	--
Description	Default value for the model correction factor to account for model uncertainties
Source of data	CDM methodological tool 04 “Emissions from solid waste disposal sites” version 08.0
Value(s) applied	For baseline emissions = 0.75

Data/Parameter	$Default_x$
Unit	--
Description	Default value for the gas potential of the specific SWDS
Source of data	CDM methodological tool 04 “Emissions from solid waste disposal sites” version 08.0 The default values have been derived by an analysis of registered CDM projects with verified waste compositions, and the default values are selected to ensure conservativeness of the resulting baseline emissions (using 95% confidence and 10% precision).
Value(s) applied	<u>Tropical dry:</u> MAT – mean annual temperature > 20°C MAP -Mean annual precipitation <1000mm **X** / **Tropical dry** 1: 0.002715 2: 0.002516 3: 0.002330 4: 0.002156 5: 0.001995 6: 0.001845 7: 0.001706 8: 0.001577 9: 0.001458 10: 0.001347 <u>Tropical wet:</u> MAT – mean annual temperature > 20°C MAP -Mean annual precipitation >1000mm **X** / **Tropical wet** 1: 0.008263 2: 0.006066 3: 0.004527 4: 0.003324 5: 0.002348 6: 0.001657 7: 0.001185 8: 0.000862 9: 0.000641 10: 0.000489

Data/Parameter	$SEC_{comp,default}$
Unit	MWh/ t
Description	Default value for the specific quantity of electricity consumed per tonne MSW disposed/ composted (wet basis)
Source of data	Based on a review of fossil fuel consumption per tonne of waste composted in relevant validation reports of CDM projects and using a conservative default emission factor for diesel (from 2006 IPCC guidelines)
Value(s) applied	0.01

Data/Parameter	$EF_{PJ,default}$
Unit	tCO2e/ MWh
Description	Default emission factor for the specific quantity of electricity consumed per tonne MSW disposed/ composted (wet basis)
Source of data	Based on the CDM tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0
Value(s) applied	1.3

Data/Parameter	$EF_{FC,default}$
Unit	tCO2e/ t
Description	Default emission factor for fossil fuel consumed by the composting activity per tonne MSW disposed/ composted (wet basis)
Source of data	Based on a review of fossil fuel consumption per tonne of waste composted in relevant validation reports of CDM projects and using a conservative default emission factor for diesel (from 2006 IPCC guidelines)
Value(s) applied	0.0207

Data/Parameter	$EF_{CH4,y,default}$
Unit	tCH4/ t
Description	Default emission factor of methane per tonne MSW disposed/ composted (wet basis)
Source of data	The emission factor was selected based on studying published results of emission measurements from composting facilities, literature reviews and published emission factors. Data from recent, high-quality sources was analysed and a value conservatively selected from the higher end of the range in results
Value(s) applied	0.002

Data/Parameter	$EF_{N2O,y,default}$
Unit	tN2O/ t
Description	Default emission factor of nitrous oxide per tonne MSW disposed/ composted (wet basis)
Source of data	The emission factor was selected based on studying published results of emission measurements from composting facilities, literature reviews and published emission factors. Data from recent, high-quality sources was analysed and a value conservatively selected from the higher end of the range in results
Value(s) applied	0.0002

Data/Parameter	GWP_{CH4}
Unit	tCO2e/ tCH4
Description	Global Warming Potential of CH4
Source of data	Standard for application of the global warming potentials to CDM project activities and programmes of activities for the second commitment period
Value(s) applied	25 shall be updated for future commitment periods according to any future COP/ MOP decisions

Data/Parameter	GWP_{N2O}
Unit	tCO2e/ tN2O
Description	Global Warming Potential of N2O
Source of data	Standard for application of the global warming potentials to CDM project activities and programmes of activities for the second commitment period
Value(s) applied	298 Shall be updated for future commitment periods according to any future COP/ MOP decisions

Data/Parameter	$FSL_{default}$
Unit	--
Description	Default value for saved space of land due to composting
Source of data	Valuing the sustainable development co-benefits of climate change mitigation actions- Table 3 https://www.uncclearn.org/sites/default/files/inventory/escap07092015.pdf
Value(s) applied	For baseline emissions = 0 For mitigation action = 1.1

Data/Parameter	$FJC_{default}$
Unit	--
Description	Default value for creation of jobs due to composting
Source of data	Valuing the sustainable development co-benefits of climate change mitigation actions- Table 3 https://www.uncclearn.org/sites/default/files/inventory/escap07092015.pdf
Value(s) applied	For baseline emissions = 0 For mitigation action = 2

Data and parameters monitored

Data/Parameter	f_y
Unit	--
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y*
Measured/calculated/ Default	Default
Source of data	No contractual or regulation requirements to collect and destroy methane emissions from landfills in Ethiopia
Measuring/reading/recording frequency	Once at the start of the mitigation action
QA/QC procedures	--
Additional comments	--

Data/Parameter	$CT_{t,y}$
Unit	T
Description	Carrying capacity of each truck delivering waste to the composting installation in year y
Measured/calculated/ Default	The maximum carrying capacity as stated on the truck´s nameplate is registered by personnel at the entrance gate of the composting installation
Source of data	
Measuring/reading/recording frequency	Register maximum carrying capacity of every truck delivery for the year y
Calculation method (if applicable)	
QA/QC procedures	--
Additional comments	--

2.4 VERIFICATION

Verification plays a vital role to confirm that the mitigation action is implemented, measured and reported in accordance with the requirements of the underlying methodology/tools, relevant decisions, and guidance.

The Verification should be based on documentary evidence and physical evidence and be undertaken periodically by an independent individual or entity (third party).

Verification is not supposed to control cities but, rather, to install a **process of learning** and to foster continuous improvement processes.

Verification may be done by a national (e.g. universities) or international third party and should at least

- assess the implemented mitigation action via on-site visit
- assess the implemented processes according to the defined requirements
- examine the reporting approaches/ templates and collected data/ information
- assess the applied values used in the calculations of GHG emissions
- assess the values used in the calculations of sustainable benefits
- assess the appropriateness of the institutional framework

The assessed mitigation action and associated data and processes shall be verified in a transparent manner via report and include recommendations as well.

2.5 INSTITUTIONAL FRAMEWORK

Management structure and responsibility

City level

Overall responsibility for daily operating and reporting lies with each City. A staff member will be specified within each City, and provided with training, to carry out the reporting work (data recording and archiving, quality assurance and quality control of the data, equipment calibration, scheduled and unscheduled maintenance, and adoption of corrective actions if needed). The City will carry out the calculations.

The manager of the proposed mitigation action will assume overall responsibility for the monitoring process, including the follow-up of daily operations, definition of personnel involved with the monitoring work, review of the monitored results/data, and quality assurance of measurements and the process of training new staff.

Responsibility of the personnel directly involved

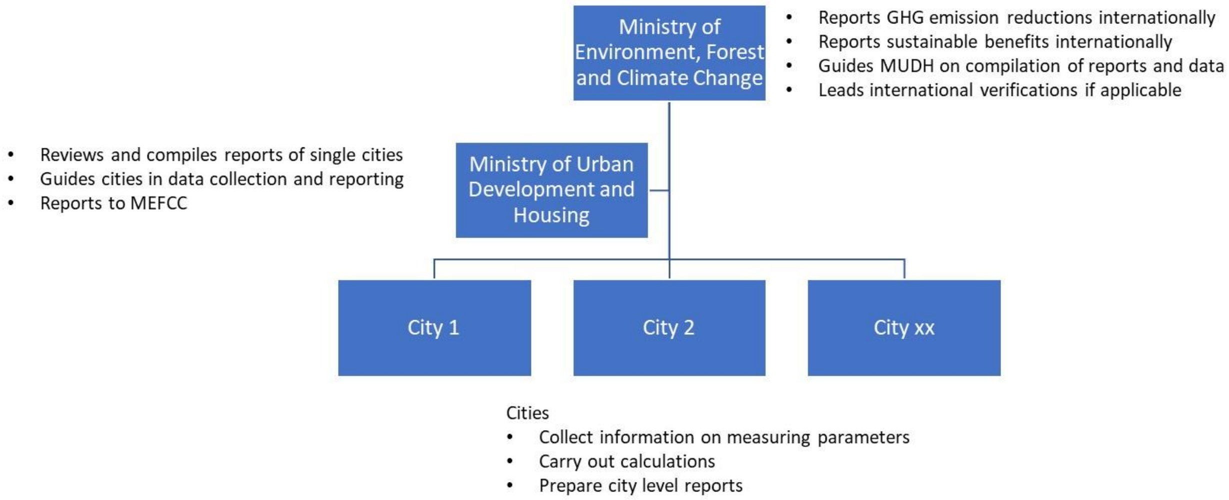
The personnel involved with monitoring will be given appropriate training. They will be responsible for carrying out the following tasks:

- the staff will coordinate internally to ensure and verify adequate measuring and recording of data and
- will be responsible for storing all monitoring data and making it available to the verifier for the verification of emission reductions.

<u>Ministry of Urban Development and Housing</u>
Each City will forward an annual report to the Ministry of Urban Development and Housing (MUDH). MUDH is responsible for compiling the reports of each City, to guide Cities in data collection and reporting, and reporting to the Ministry of Environment, Forest and Climate Change (MEFCC).

<u>The Ministry of Environment, Forest and Climate Change is responsible for</u>
- reporting internationally GHG emission reductions
- reporting internationally sustainable benefits
- guiding MUDH on compilation of reports and data
- leading any international verification of the MRV and its reporting if applicable

This management structure is illustrated in the diagram below.



Monitoring equipment and installation:
All equipment will be in compliance with national standards.

Data monitoring management and recording
All monitoring data and records will be archived at least as paper print-outs and if possible electronically. If the City intends to receive any form of carbon credits for its mitigation activities it shall keep recorded data for at least two years after the end of the crediting period or issuance of carbon credits, whichever occurs later.

Quality control and Quality assurance
All required data types, their compilation and documentation requirements are defined in Section **Fehler! Verweisquelle konnte nicht gefunden werden.** and in this section. A standardized

procedure to collect, consolidate and maintain data is determined. The MRV mechanism involves 3 levels of plausibility checks (City, MUDH and MEFCC)

Emergency procedures

In case of emergencies (conditions under which the City has not been able to monitor due to an unexpected accident), the City will not claim emission reductions due to the mitigation action for the duration of the emergency. The City will follow the below procedure for declaring the emergency period to be over:

- The City will ensure that all requirements for monitoring of emission reductions have been re-established.
- The monitoring staff and the manager of the mitigation action will both sign a statement declaring the emergency situation to have ended and normal operations to have resumed.

3 MRV - SUBSTITUTION OF FERTILIZERS FOR URBAN GREENERY OR REFORESTATION

The substitution of chemical fertilizer by compost is usually referred to as a sustainable co-benefit of composting activities (see *"Valuing the sustainable development co-benefits of climate change mitigation actions: The case of the waste sector and recommendations for the design of nationally appropriate mitigation actions"* (NAMAs), published by United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) (2014))

This MRV mechanism addresses the reduction of GHG emissions by the substitution of chemical fertilizer using compost. The reporting, verification and institutional framework will correspond with the MRV system for compost production using the organic fraction of landfill waste.

3.1 DEFINITIONS

N.A.

3.2 MEASURING

3.2.1 GHG EMISSIONS

3.2.1.1 METHODOLOGY

For the calculation of GHG emissions from the substitution of chemical fertilizer by compost, the MRV mechanism refers to

ICLEI 2013: **Recycling and Composting Emissions Protocol** *For Estimating Greenhouse Gas Emissions and Emissions Reductions Associated with Community-Level Recycling and Composting*

3.2.1.2 CALCULATION

Please see attached Excel file ETH-RFP-2017-15-MRV-Mechanism-CompostCalculationV3.xls which serves as **calculation tool** for the subsequent formulas. GHG emissions (baseline emissions BE_y, mitigation action emissions PE_y and leakage emissions LE_y if applicable) and if applicable achieved emission reductions shall be calculated as follows

$$ER_y = BE_y - (PE_y + LE_y) \quad (1)$$

ER_y	=	Emission reduction in the year y (tCO_2e)
BE_y	=	Baseline emissions in the year y (tCO2e)
PE_y	=	Mitigation action emissions in the year y (tCO_2e)
LE_y	=	Leakage emissions in year y (tCO_2e)

Baseline emissions

$$BE_y = W_y \times FE_y \quad (2)$$

where:

W_y	=	Total amount of waste disposed in the baseline in the year y (t)
FE_y	=	Default value representing the emission reduction associated with the substitution of chemical fertilizer (tCO2/ t)

$$W_y = \sum CT_{t,y} \quad (3)$$

where

$CT_{t,y}$	=	Carrying capacity of truck t used in year y to deliver waste to the composting installation
t	=	Waste deliveries in trucks to the composting installation in year y

Mitigation action emissions
Are accounted for under MRV for "Compost production using the organic fraction of landfill waste".

Leakage emissions
Are accounted for under MRV for "Compost production using the organic fraction of landfill waste".

3.2.2 SUSTAINABLE BENEFITS

N.A.

3.3 REPORTING

Reporting structure and process please see 2.3

Data and parameters fixed ex ante

Data/Parameter	$\boldsymbol{FE_y}$
Unit	tCO2/t
Description	Default value representing the emission reduction associated with the substitution of chemical fertilizer
Source of data	ICLEI 2013: **Recycling and Composting Emissions Protocol** *For Estimating Greenhouse Gas Emissions and Emissions Reductions Associated with Community Level Recycling and Composting*
Value(s) applied	0.03 tCO2/t composted waste

Data and parameters monitored

Data/Parameter	**$CT_{t,y}$**
Unit	t
Description	Carrying capacity of each truck delivering waste to the composting installation in year y
Measured/calculated/ Default	The maximum carrying capacity as stated on the truck´s nameplate is registered by personnel at the entrance gate of the composting installation
Source of data	
Measuring/reading/recording frequency	Register maximum carrying capacity of every truck delivery for the year y
Calculation method (if applicable)	
QA/QC procedures	--
Additional comments	--

3.4 VERIFICATION

See 2.4

3.5 INSTITUTIONAL FRAMEWORK

See 2.5

4 MRV - URBAN AND PERI-URBAN REFORESTATION OF DEGRADED LAND

4.1 DEFINITIONS

Crop land - includes cropped land, including rice fields, and agro-forestry systems where the vegetation structure falls below the thresholds used for the Forest Land category (IPCC 2006).

Forest land -

- *IPCC Definition:* forest includes all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach the threshold values used by a country to define the Forest Land category (IPCC 2006). http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_03_Ch3_Representation.pdf
- *National Definition:* Land spanning at least 0.5 ha covered by trees and bamboo), attaining a height of at least 2m and a canopy cover of at least 20% or trees with the potential to reach these thresholds in situ in due course (Minutes of Forest Sector Management, MEFCC, Feb. 2015) http://redd.unfccc.int/files/2016_submission_frel_ethiopia.pdf

Grassland: grass - includes rangelands and pasture land that are not considered as cropland. It also includes systems with woody vegetation and other non-grass vegetation such as herbs and brushes that fall below the threshold values used in the Forest Land category. The category also includes all grassland from wild lands to recreational areas as well as agricultural and silvi-pastural systems, consistent with national definitions (IPCC 2006).

Land degradation - means the temporary or permanent reduction or loss of the biological or economic productivity and complexity of land ecosystems resulting from land uses or from a combination of processes arising from human activities and habitation patterns (IPCC 2006).

Other Land - includes bare soil, rock, ice, and all land areas that do not fall into any of the other five categories (crop land, forest, grass land, settlements, wetland). It allows the total of identified land areas to match the national area, where data are available. If data are available, countries are encouraged to classify unmanaged lands by the above land-use categories (e.g., into unmanaged Forest Land, Unmanaged Grassland, and Unmanaged Wetlands). This will improve transparency and enhance the ability to track land-use conversions from specific types of unmanaged lands into the categories (IPCC 2006).

Settlements - includes all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories. This should be consistent with national definitions (IPCC 2006).

Soil disturbance - is any kind of activity that that results in a decrease in soil organic carbon (SOC), for example ploughing, ripping, scarification, digging of pits and trenches, stump removal, etc (UNFCCC)

Wetland - includes areas of peat extraction and land that is covered or saturated by water for all or part of the year (e.g., peatlands) and that does not fall into the Forest Land, Cropland, Grassland or Settlements categories. It includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions (IPCC 2006).

4.2 MEASURING

4.2.1 GHG EMISSIONS

4.2.1.1 METHODOLODY

BACKGROUND

The following methodologies and tools have been identified to determine the emission reductions related to land use change from degraded land to forest (reforestation).

IPCC:

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use
  http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html
- 2003 IPCC: Good Practice Guidance for Land Use, Land-Use Change and Forestry
  http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html
- 2003 IPCC: Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types
  http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/degradation.html

UNFCCC CDM methodology

- Large-scale methodology:
  AR-ACM0003 Afforestation and reforestation of lands except wetlands: Version 02.0
  http://cdm.unfccc.int/methodologies/DB/C9QS5G3CS8FW04MYYXDFOQDPXWM4OE

UNFCCC tools

- A/R Methodological Tool: Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity

  http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v4.0.0.pdf
- A/R Methodological Tool: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities

  http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v3.1.pdf
- AR-Tool 14 A/R Methodological Tool: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities
  http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v4.2.pdf
- AR-Tool 15 A/R Methodological Tool: Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity

http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf

- A/R Methodological Tool: Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities (Version 01.1.0) http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-16-v1.1.0.pdf
- A/R methodological Tool: "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities" - Version 01 https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-13-v1.pdf

Calculation tool

- FAO Ex-Ante Carbon-balance Tool (EX-ACT): http://www.fao.org/tc/exact/carbon-balance-tool-ex-act/en/

UNDERLYING METHODOLOGY

The underlying methodology, to measure and calculate the emission reductions, i.e. the anthropogenic GHG removals by forest as sinks, due to urban and peri-urban reforestation of degraded land, is based on the UNFCCC CDM afforestation and reforestation large-scale UNFCCC/CDM methodology AR-ACM0003 *Afforestation and reforestation of lands except wetlands: Version 02.0* and associated tools, which are based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

The methodology is applicable under the following criteria:

- The designated degraded land for reforestation is not classified as wetland
- The land spans at least 0.5 ha. (refer to the national forest definition)
- Soil disturbance 10% threshold:
  Where the land use "degraded land" (baseline situation) has soil organic carbon (SOC) content that is expected to be higher than that under the land-use of "forestry" (planned mitigation action), the extent of soil disturbance is limited be no more than 10 per cent.
  Example: Digging pits of size 0.50 m × 0.50 m (length × width) at a spacing of 3 m × 3 m is equal to a coverage of 2.78 per cent; continuous ploughing of land is equal to a coverage of 100 per cent.

The principle of the methodology is based on an accounting of carbon pool stock changes expressed in equivalent tonnes of CO2 per year. The difference represents the potential impact of the mitigation activities, i.e. change from degraded land to forest under the Compost NAMA, indicating the net amount of carbon sequestered (sinks) or emitted greenhouse gases (emission source). Additional emissions attributable to the displacement of agricultural activities due to implementation of a reforestation activity are considered as leakage.

Overview of Carbon pools according to the methodology.

Carbon pool	shall be considered	Calculation approach refers to
Living biomass: Trees and shrubs	Yes - mandatory	AR-Tool 14 A/R Methodological Tool: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities
Non-living biomass: Dead wood and litter	No - Optional	A/R Methodological Tool: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.
Soil organic carbon	No - Optional	A/R Methodological Tool: Estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities.

The city may choose to exclude or include dead wood, litter, and soil organic carbon to calculate emission reduction due to reforestation of degraded land. It is recommended to follow the national forestry inventory approach, which excludes litter and soil organic carbon pools at the moment. (refer to: Ethiopia's forest reference level submission to the UNFCCC 2016). Please note that currently the values for dead wood are under review, especially the results for Acacia-Commiphora biome.
http://redd.unfccc.int/files/2016_submission_frel_ethiopia.pdf #
Therefore, it is recommended to decide to include the deadwood pool only after the final clarification.

Overview of GHG Emission sources according to the to the methodology.

Emission source	Shall be considered	Calculation approach refers to
Burning of woody biomass for site preparation, or as part of forest management.	Yes - mandatory	A/R Methodological Tool: Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v4.0.0.pdf

Overview of Leakage sources according to the to the methodology.

Emission source	Shall be considered	Calculation approach refers to
Agriculture activities; refers to crop cultivation activities and grazing activities occurring on land;	Yes - mandatory	AR-Tool 15 A/R Methodological Tool: Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v4.0.0.pdf

Leakage emission attributable to the displacement of agricultural activities due to implementation of a reforestation activity is estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity.

Note: Leakage emissions are not expected, because the identified dedicated degraded land for conversion to forest land by the cities has no agricultural activity history.

DEFINE SYSTEM BOUNDARY

The system boundary is defined for the purposes of ensuring the project's net GHG emission reduction performance. The system boundary encompasses the urban and peri-urban boundary of the city. The mitigation action shall be within the system boundary. Use maps or satellite images, including GIS data, so that the system boundary can be verified by external parties.

DEFINE AREA – ACTIVITY DATA

- Clearly define the boundary of each degraded land area, within the system boundary, which will be dedicated for reforestation as mitigation action. Use maps or satellite images, including GIS data, that each degraded land area can be verified by external parties.
- Assign a unique identification code or name for each degraded land area to avoid confusion.
- Calculate the plot size for each degraded land area. Exclude the degraded land areas which are less than 0.5 ha. Areas less than 0.5 ha are not qualified as “forest” according to the national definition.

DEMONSTRATE THAT THE LAND IS DEGRADED

Provide documented evidence that the area has been classified as “degraded” according to the UNFCCC A/R methodological Tool *“Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities”*. The approach used by this tool relies on a progression of requirements of documented evidence of degradation, from the simplest case consisting of using existing documented local, regional, national or international land degradation classification, to the situation where visual observation of selected degradation indicators and/or participatory rural appraisal to demonstrate that the land is degraded, are required.

Stage 1: This stage involves an initial screening of lands to determine whether the area has been classified as "degraded" under any verifiable local, regional, national or international land classification system

International classification systems are for example.:

- ISRIC World soil information: Global Assessment of Human-induced Soil Degradation (GLASOD)
  - http://www.isric.org/projects/global-assessment-human-induced-soil-degradation-glasod
  - http://data.isric.org/geonetwork/srv/eng/catalog.search#/metadata/9e84c15e-cb46-45e2-9126-1ca38bd5cd22

- FAO-UNEP (2008) Land Degradation Assessment in Drylands (LADA):
  - http://www.fao.org/land-water/land/land-governance/land-resources-planning-toolbox/category/details/en/c/1036360/
  - http://www.fao.org/nr/lada/gladis/gladis_db/

or credible study produced **within the last ten years**.

If the documented evidence of degradation **is older than ten years,** then provide evidence that the natural or anthropogenic degradation drivers and pressures that led to the land becoming "degraded" are still present and/or that there are no insufficient land management interventions to reverse degradation.

Stage 2: This stage involves lands for which there is no documented verifiable local, regional, national or international land classification designating them as "degraded" and/or "degrading" and for which evidence must be provided to demonstrate that the area is "degraded" and/or "degrading". The demonstration of degradation is carried out by either:

- By direct visual field evidence of selected indicators of land degradation and/or the results of a verifiable participatory rural appraisal (PRA); or
- A comparison of candidate lands to degraded lands under similar ecological conditions and socio-economic and land use drivers.

DETERMINE INITIAL LAND USE - if available
according to regional/land categories and/or according to IPCC categories

Regional/land categories

In case that that you use national or regional land classification systems, give the initial land use according to your classification system for each degraded land area, which will be reforested under the NAMA COMPOST project.

IPCC categories

Determine the initial land use according to IPCC categories for each degraded land area which will be reforested under the NAMA COMPOST project.

Land use change	**Initial land use**	**Project NAMA classification**
Case 1	Forest land	Forest land
Case 2	Cropland	Forest land
Case 3	Grazing land	Forest land
Case 4	Settlements	Forest land
Case 5	Other land	Forest land

Note: The IPCC divides land use into 6 categories: Forest land, Cropland, Grazing land, wetland, Settlements and Other land. The category wetland is not considered here, because no wetland areas have been detected within the system boundaries of the six cities: Adama, Bahir Dar, Bishoftu, Dire Dawa, Hawassa, Mekele.

DETERMINE CLIMATE ZONE

Determine the climate zone within the city boundary

- ☐ Boreal or
- ☐ cool temperate or
- ☐ warm temperate or
- ☐ tropical mountain

DETERMINE MOISTURE REGIME

Determine the moisture regime within the city boundary

- ☐ dry or
- ☐ moist or
- ☐ wet

DETERMINE DOMINANT REGIONAL SOIL TYPE

Determine the dominated regional soil type within the system boundary or the dedicated area for reforestation.

- ☐ HAC soil
- ☐ LAC soil
- ☐ sandy soil
- ☐ spodic soil
- ☐ volcanic soil

DETERMINE THE TYPE OF VEGETATION

Define the type of plant species for each degraded area.

Dedicated area for reforestation (ID)	Type of vegetation that will be planted

FIRE USE

Select if fire is used for land conversion to burn dead biomass

- ☐ YES
- ☐ NO

4.2.1.2 CALCULATION

CALCULATING NET ANTHROPOGENIC GHG REMOVALS BY SINKS

The net anthropogenic GHG removals by sinks shall be calculated as follows

$$\Delta C_{AR,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t$$

Where:

$\Delta C_{AR,t}$	=	Net anthropogenic GHG removals by sinks, in year *t*; t CO_2-e
$\Delta C_{ACTUAL,t}$	=	Actual net GHG removals by sinks, in year *t*; t CO_2-e
$\Delta C_{BSL,t}$	=	Baseline net GHG removals by sinks, in year *t*; t CO_2-e
LK_t	=	GHG emissions due to leakage, in year *t*; t CO_2-e

Note: GHG emissions resulting from removal of herbaceous vegetation, combustion of fossil fuel, fertilizer application, use of wood, decomposition of litter and fine roots of N-fixing trees, construction of access roads within the system boundary, and transportation attributable to the mitigation action shall be considered insignificant and therefore accounted as zero.

CALCULATING BASELINE NET GHG REMOVALS BY SINKS

The baseline net GHG removals by sinks shall be calculated as follows:

$$\Delta C_{BSL,t} = \Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,t} + \Delta C_{DW\_BSL,t} + \Delta C_{LI\_BSL,t}$$

Where

$\Delta C_{BSL,t}$	=	Baseline net GHG removals by sinks in year *t*; t CO_2-e

$\Delta C_{TREE\_BSL,t}$	=	Change in carbon stock in baseline tree biomass within the project boundary in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e
$\Delta C_{SHRUB\_BSL,t}$	=	Change in carbon stock in baseline shrub biomass within the project boundary, in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e
$\Delta C_{DW\_BSL,t}$	=	Change in carbon stock in baseline dead wood biomass within the project boundary, in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e - OPTIONAL
$\Delta C_{LI\_BSL,t}$	=	Change in carbon stock in baseline litter biomass within the project boundary, in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e - OPTIONAL

CALCULATING LEAKAGE EMISSIONS

Leakage emissions shall be calculated as follows:

$$LK_t = LK_{AGRIC,t}$$

Where:

LK_t	=	GHG emissions due to leakage, in year *t*; t CO_2-e
$LK_{AGRIC,t}$	=	Leakage due to the displacement of agricultural activities in year *t*, as estimated in the tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity"; t CO_2-e

CALCULATING NET GHG REMOVALS BY SINKS

The actual net GHG removals by sinks shall be calculated as follows

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t}$$

Where

$\Delta C_{ACTUAL,t}$	=	Actual net GHG removals by sinks, in year *t*; t CO_2-e
$\Delta C_{P,t}$	=	Change in the carbon stocks in project, occurring in the selected carbon pools, in year *t*; t CO_2-e

$GHG_{E,t}$	=	Increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year *t*, as estimated in the tool "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity"; t CO_2-e

CALCULATING CHANGE IN THE CARBON STOCKS IN PROJECT

Change in the carbon stocks in project, occurring in the selected carbon pools in year t shall be calculated as follows:

$$\Delta C_{P,t} = \Delta C_{TREE\_PROJ,t} + \Delta C_{SHRUB\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta C_{LI\_PROJ,t} + \Delta SOC_{AL,t}$$

Where:

$\Delta C_{P,t}$	=	Change in the carbon stocks in project, occurring in the selected carbon pools, in year *t*; t CO_2-e
$\Delta C_{TREE\_PROJ,t}$	=	Change in carbon stock in tree biomass in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e
$\Delta C_{SHRUB\_PROJ,t}$	=	Change in carbon stock in shrub biomass in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e
$\Delta C_{DW\_PROJ,t}$	=	Change in carbon stock in dead wood in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e – OPTIONAL
$\Delta C_{LI\_PROJ,t}$	=	Change in carbon stock in litter in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e – OPTIONAL
$\Delta SOC_{AL,t}$	=	Change in carbon stock in SOC in project, in year *t*, in areas of land meeting the applicability conditions of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities", as estimated in the same tool; t CO_2-e

CALCULATION TOOL

The city should apply the FAO Ex-Ante Carbon-balance Tool (EX-ACT) to calculate the associated emission reduction due to the land use change from degraded land to forest land. The formulas described above are integrated into the EX-ACT tool to calculate greenhouse gas removals by reforested areas.

The Ex-Ante Carbon-balance Tool (EX-ACT) is an appraisal system developed by FAO that provides estimates of the impact of forestry and agriculture development projects, programmes and policies on the carbon-balance. EX-ACT has been developed based on the Guidelines for 2006 IPCC National Greenhouse Gas Inventories, which underlies the UNFCCC CDM methodology.

The tool is free of charge and can be downloaded under the following link:
http://www.fao.org/tc/exact/carbon-balance-tool-ex-act/en/
including user guidance:
http://www.fao.org/tc/exact/user-guidelines/en/

Apply the following steps:

1.) Insert under the "Description":
- Project name
- Continent
- Climate
- Moisture regime
- Dominant regional soil type
- Duration of the project

2.) Select under "Land use change":
2.2. Afforestation and Reforestation and insert:
- Type of vegetation that will be planted
- Fires use
- Previous land use
- Area that will be reforested

3.) Select under "Detailed result":
    - Select GWP for calculation: Official (2nd period 2013-2020)

4.2.2 SUSTAINABLE BENEFITS

4.2.2.1 METHODOLOGY

The UN Sustainable Development Goals (SDG) framework will be applied to classify the sustainable benefits due to land use change from degraded land to forest land within the city system boundary.

Reforested areas can offer a wide range of sustainable benefits beyond GHG emission reductions, due to carbon sequestration, and will contribute to several UN SDGs to ensure the promotion of an economically, socially and environmentally sustainable future.

Reforested areas within the city system boundary contribute at least to the following SDGs:

SDG	Description	Benefits examples
SDG 11	Sustainable cities and communities. Make cities and human settlements inclusive, safe, resilient and sustainable	• supporting and enhancing biodiversity; • providing opportunities for open-access outdoor recreation • enhancing the visual quality of the landscape
SDG13	Climate action: Make urgent action to combat climate change and its impact	• improving air quality • strengthening climate resilience

The cities can extend the table above to address additional sustainable development goals, depending on the identified sustainable benefits and available data evidences.

More information about the UN SDGs: http://www.un.org/sustainabledevelopment/

For the calculation of sustainable benefits from reforestation, the MRV mechanism refers to the proposed "*Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development*" published by the UN Department of Economic and Social Affairs https://unstats.un.org/sdgs/ .

4.2.2.2 CALCULATION

Sustainable cities and communities
Increasing green area due to reforestation of degraded land (SDG 11)

$$A_{,y} = l_{Ai} \times w_{Ai}$$

where:

Ai_y	=	Reforested area, former degraded land that is going under transition to a forest land [m²] or [ha]
$l_{Ai}, w_{Ai},$	=	Length Dimension of the reforested area [m]

Climate action and Sustainable cities and communities
Improving the city climate due to increased green areas (SDG 11 and 13)

$$A_i = L_{Ai} \times W_{Ai}$$

where:

Ai_y	=	Reforested area, former degraded land that is going under transition to a forest land [m²] or [ha]
l_{Ai}, w_{Ai},	=	Length Dimensions of the reforested area [m]

4.3 REPORTING

Each City will prepare a periodic report (annually) describing the baseline, mitigation action and leakage emissions and associated emission reductions.

The reporting template to be used is described in detail in Annex I of the MRV mechanism.

The reporting structure and processes is explained in detail in Section 2.5, Institutional framework.

Data and parameters monitored

Data/Parameter	**Ai**
Unit	Ha
Description	Reforested area, former degraded land that is going under transition to a forest land.
Source of data	Field measurement and satellite data/ national forest inventory
Measurement procedures (if any):	Standard operating procedures (SOPs) prescribed under national forest inventory is applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Monitoring frequency	Once for the crediting period
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied

Data/Parameter	**CCTree,i**
Unit	-
Description	Crown cover of trees in tree biomass stratum i of the reforested area
Source of data	Field measurement and satellite data/ national forest inventory
Measurement procedures (if any):	Considering that the biomass in trees in the baseline is smaller compared to the biomass in trees in the project, a simplified method of measurement may be used for estimating tree crown cover. Ocular estimation of tree crown cover may be carried out or any other method such as the line transect method or the relascope method may be applied.
Monitoring frequency	Once for the crediting period
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied

Data/Parameter	CCSHRUB,i
Unit	-
Description	Crown cover of shrubs in shrub biomass stratum I of the reforested area
Source of data	Field measurement and satellite data/ national forest inventory
Measurement procedures (if any):	Considering that the biomass in shrubs is smaller than the biomass in trees, a simplified method of measurement may be used for estimating shrub crown cover. Ocular estimation of crown cover may be carried out or any other method such as the line transect method or the relascope method may be applied
Monitoring frequency	Once for the crediting period
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied

In case of considering deadwood/litter or soil, apply the calculation approach and values provided by the national forest inventory.

4.4 VERIFICATION

Verification plays a vital role to confirm that the mitigation action is implemented, measured and reported in accordance with the requirements of the underlying methodology/tools, relevant decisions and guidance.

The Verification should be based on documentary evidence and physical evidence and be undertaken periodically by an independent individual or entity (third party).

Verification is not supposed to control cities but rather to install a **process of learning** and to foster continuous improvement processes.

Verification may be done by a national (e.g. universities) or international third party and should at least

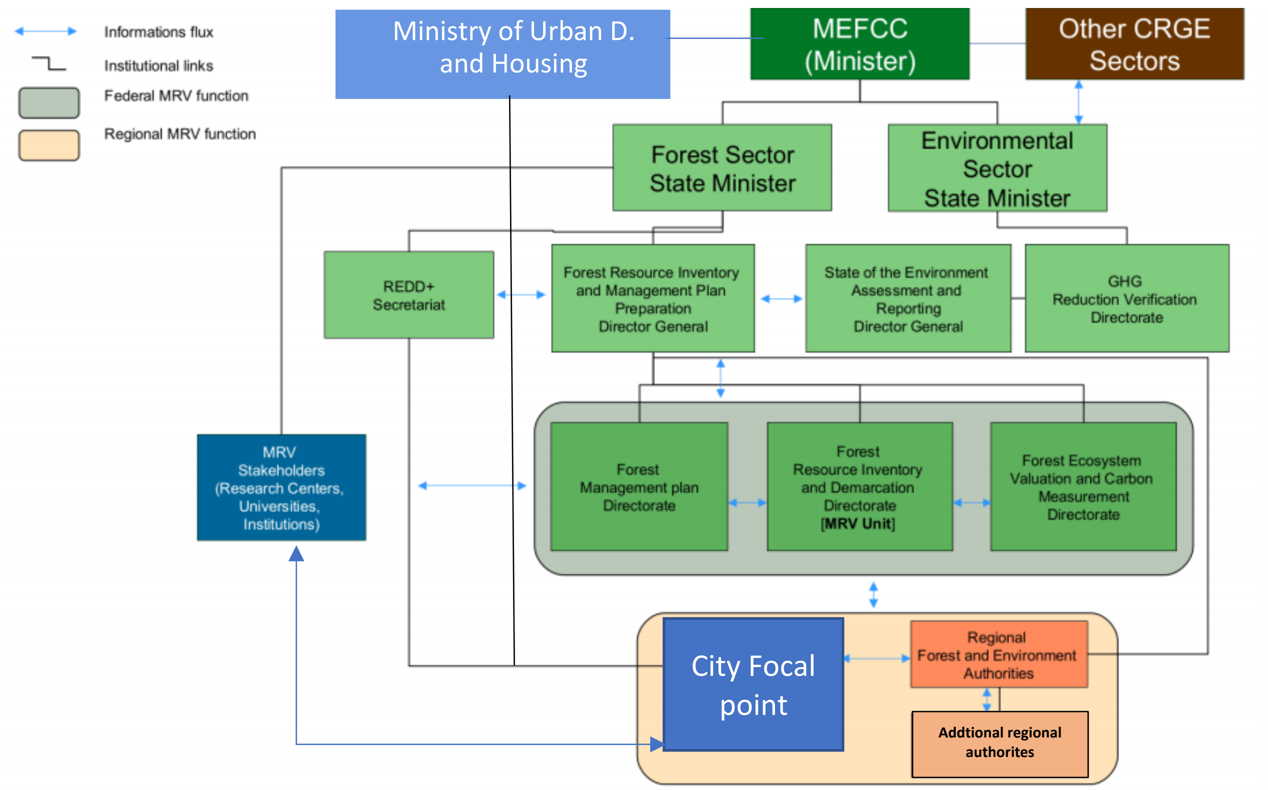
- Assess the implemented mitigation action via on-site visit
- assess the implemented processes according to the defined requirements
- examine the reporting approaches/ templates and collected data/ information
- assess the applied values used in the calculations of GHG emissions
- assess the values used in the calculations of sustainable benefits
- assess the appropriateness of the institutional framework

The assessed mitigation action and associated data and processes shall be verified in a transparent manner via report and include recommendations as well.

4.5 INSTITUTIONAL FRAMEWORK

The institutional framework of the MRV mechanism for urban and peri-urban reforestation of degraded land will be aligned *with Ethiopia's Institutional Framework for the MRV under the REDD+ Program* as illustrated below.

The Cities' focal points and MUDH will coordinate with the MEFCC and its regional office to generate the information as required (see page 8 of *Ethiopia's Institutional Framework for the MRV under the REDD+ Program).*



Annex I – Reporting Template

GHG Measuring Report	
Title of mitigation action	
Version number of this measuring report	
Completion date of this measuring report	
Duration of this measuring period	
Owners of the mitigation action	
Applied measurement methodologies	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved in this measuring period	

1. **SECTION 1 DESCRIPTION OF MITIGATION ACTION**
    a. GENERAL DESCRIPTION OF MITIGATION ACTION
    b. LOCATION OF MITIGATION ACTION
    c. REFERENCE TO APPLIED METHODOLOGIES
    d. CREDITING PERIOD
2. **SECTION 2: IMPLEMENTATION OF MITIGATION ACTION**
    a. DESCRIPTION OF IMPLEMENTED MITIGATION ACTION
        b. CHANGES TO THE MITIGATION ACTION SINCE THE PREVIOUS MEASURING PERIOD
            - Temporary deviations
            - Corrections
            - Permanent changes to the implemented mitigation action
            - Changes in the design of the mitigation action
3. SECTION 3: DESCRIPTION OF MEASURING SYSTEM

4. SECTION 4: DATA AND PARAMETERS

Data and parameters fixed ex ante

Data/Parameter	
Unit	
Description	
Source of data	
Value(s) applied	
Choice of data or measurement methods and procedures	
Purpose of data/parameter	
Additional comments	

Data and parameters monitored

Data/Parameter	
Unit	
Description	
Measured/calculated/ default	
Source of data	
Value(s) of monitored parameter	
Monitoring equipment	
Measuring/reading/recording frequency	
Calculation method (if applicable)	
QA/QC procedures	
Purpose of data/parameter	
Additional comments	