



**Monitoring report form for CDM programme of activities
(Version 03.0)**

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

MONITORING REPORT

Title of the PoA	Tanzania Renewable Energy Programme	
UNFCCC reference number of the PoA	9904	
Version numbers of the PoA-DD applicable to this monitoring report	Version 8 dated 23/04/2014	
Version number of this monitoring report	03	
Completion date of this monitoring report	06/05/2020	
Monitoring period number	Third monitoring period	
Duration of this monitoring period	From 01/01/2018 to 31/12/2018 (first and last days included)	
Monitoring report number for this monitoring period	02 (only Mbinga CPA is covered in this monitoring report)	
Coordinating/managing entity	Rural Energy Agency (REA)	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	United Republic of Tanzania	Yes
Applied methodologies and standardized baselines	<ul style="list-style-type: none"> AMS I.D. Grid connected renewable electricity generation, Version 17, EB 61. AMS I.F. Renewable electricity generation for captive use and mini-grid, Version 02, EB 61. 	
Sectoral scopes	01 – Energy Industries (renewable/non-renewable sources)	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 tCO _{2e}	1,922 tCO _{2e}
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report	2,707 tCO _{2e}	

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

Tanzania has, over the years, strived to create an appropriate policy environment to attract private investments to the renewable energy generation sector. The National Energy Policy 2003 sets national energy objectives to ensure the availability of reliable and affordable energy supplies and to promote energy efficiency in order to support national development goals. The policy recognizes that, the main thrust should be private initiatives and investments for exploring the local energy sources. The policy sets an entirely new approach to modern energy in the rural areas of Tanzania and the government has committed itself to develop and implement the new strategy to address modern energy needs of over 85% of Tanzanians living in the rural areas.

For these reasons, the Rural Energy Board (REB), the Rural Energy Agency (REA) and the Rural Energy Fund (REF) were established and entrusted with the role of promoting, stimulating and facilitating improved access to modern energy services in the rural areas through empowering both public and private sector initiatives in the rural energy.

The main objective of this programme of activities (PoA) is to increase the access to modern energy services in Tanzania by promoting both off-grid (isolated mini-grid) and national grid renewable energy projects in the country using photovoltaic, wind, hydro and biomass technologies for electricity generation. The generated electricity from these renewable energy sources under the component project activities (CPAs) will replace equivalent electricity, which would be otherwise generated using fossil fuels either in the national grid and/or in the isolated mini-grid, resulting in the emission reductions. The program also aims for further assisting the project developers to invest and implement renewable energy projects. It provides a platform for overcoming the institutional, financial and structural hurdles for the development of small scale renewable energy projects in Tanzania.

REA, under the Ministry of Energy and Minerals (MEM) of the United Republic of Tanzania, is the nodal agency to promote rural electrification projects in Tanzania. REA is responsible for implementing the PoA and acts as the coordinating and managing entity (CME).

REA, with the assistance from the World Bank, is supporting small rural and renewable energy initiatives through (i) an enabling policy and regulatory framework including standardized power purchase agreements (SPPA) and simplified regulatory rules, which reduce some of the transaction costs for the small renewable power projects, (ii) a subsidy scheme for new connections in rural areas (performance grants) and technical assistance/pre-investment support (matching grants) for the project developers and (iii) a line of credit (LOC) to the Tanzanian financial institutions for long-term lending to the small renewable energy projects.

As the CME for the registered small-scale PoA, REA performs the following main activities: (i) coordinating the implementation of the PoA, (ii) screening and accepting the CPAs under the program, (iii) supporting the effective commercialization of Certified Emission Reductions (CERs), (iv) liaising with the project developers for maintaining the required database for verification and (v) following up any other functions that need to be performed as per the PoA rules.

The CPAs are implemented by the project developers. Building on the existing relationship with the individual project developers, REA entered into a contractual agreement with each of the individual power projects (CPAs). The signed contracts give REA the legal rights to deal with the carbon credits that are generated from these projects, monitor the project implementation and all necessary parameters that are required for calculating the emission reductions from each CPA.

This is the third monitoring period of the PoA from 01/01/2018 to 31/12/2018 (first and last days included). The cumulative net electricity exported to the grid and mini-grids by Mbinga Hydro

power project covered in this report during the monitoring period is 2,559 MWh. The CERs generated during this monitoring period is 1,922 tCO₂e.

A.1.1. Corresponding generic component project activities (CPAs)

Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Sectoral scopes	Applied methodologies and standardized baselines
Renewable energy technology (hydro, wind, biomass or PV) connected to the national utility main grid avoiding generation from mix of fuels. Ref no: CPA category 01	Version 08 dated 23/04/2014	01 - Energy Industries (Renewable / Non-renewable sources)	AMS I.D. Grid connected renewable electricity generation, Version 17 ¹ .
Renewable energy technology (hydro, wind, biomass or PV) connected to the existing or new isolated mini-grids replacing existing dedicated diesel based power generation Ref no: CPA category 02			AMS I.F. Renewable electricity generation for captive use and mini-grid, Version 02 ² .
Renewable energy technology (hydro, wind, biomass or PV) supplies electricity to both the national grid and the existing or new isolated mini-grids. Ref no: CPA category 03			AMS I.D. Grid connected renewable electricity generation, Version 17. AND AMS I.F. Renewable electricity generation for captive use and mini-grid, Version 02.

A.1.2. CPAs included in the PoA

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Mapembasi hydro power project, Njombe district, 9904-P1-0001-CP1	Version 08 dated 23/04/2014	Renewable energy technology (hydro, wind, biomass or PV) supplies electricity to both national grid and existing or new	Renewable crediting type, 01/01/2015-31/12/2021	No ³

¹ <https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK>

² <https://cdm.unfccc.int/methodologies/DB/9KJWQ1G0WEG6LKHX21MLPS8BQR7242>

³ Project is delayed.

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
		isolated mini-grids. Ref no: CPA category 03		
NextGen solar project, Kigoma region, 9904-P1-0002-CP1		Renewable energy technology (hydro, wind, biomass or PV) connected to existing or new isolated mini-grids replacing existing dedicated diesel based power generation Ref no: CPA category 02	Renewable crediting type, 04/06/2014 - 03/06/2021	No ⁴
Mbinga hydroelectric project, 9904-P1-0003-CP1		Renewable energy technology (hydro, wind, biomass or PV) supplies electricity to both national grid and existing or new isolated mini-grids Ref no: CPA category 03	Renewable crediting type, 01/12/2015 - 30/11/2022	Yes
Yovi small hydro power project, 9904-P1-0004-CP1		Renewable energy technology (hydro, wind, biomass or PV) supplies electricity to both national grid and existing or new isolated mini-grids. Ref no: CPA category 03	Renewable crediting type, 01/12/2015 - 30/11/2022	No ⁵
Tulila hydro-electric plant, 9904-P1-0005-CP1		Renewable energy technology (hydro, wind, biomass or PV) supplies electricity to both national grid and existing or new	Renewable crediting type, 01/12/2015 - 30/11/2022	No ⁶

⁴ Project is delayed

⁵ Covered in Monitoring Report 01

⁶ Covered in Monitoring Report 01

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
		isolated mini-grids. Ref no: CPA category 03		
Maguta small hydro power project, 9904-P1-0006-CP1		Renewable energy technology (hydro, wind, biomass or PV) supplies electricity to both national grid and existing or new isolated mini-grids. Ref no: CPA category 03	Renewable crediting type, 01/11/2016 - 31/10/2023	No ⁷
Ngombeni biomass power plant project, 9904-P1-0007-CP1		Renewable energy technology (hydro, wind, biomass or PV) connected to existing or new isolated mini-grids replacing existing dedicated diesel based power generation Ref no: CPA category 02	Renewable crediting type, 01/09/2016 - 31/08/2023	No ⁸
Ikondo micro hydro power plant, 9904-P1-0008-CP1		Renewable energy technology (hydro, wind, biomass or PV) supplies electricity to both national grid and existing or new isolated mini-grids. Ref no: CPA category 03	Renewable crediting type, 14/10/2016 - 13/10/2023	No ⁹
Darakuta mini hydro project, 9904-P1-0009-CP1		Renewable energy technology (hydro, wind, biomass or PV) connected to	Renewable crediting type, 12/12/2017-	No ¹⁰

⁷ Covered in Monitoring Report 01

⁸ Covered in Monitoring Report 01

⁹ Covered in Monitoring Report 01

¹⁰ Covered in Monitoring Report 01

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
		the national utility main grid avoiding generation from mix of fuels. Ref no: CPA category 01	11/12/2024	
Mpanda Solar Photovoltaic Power Plant 9904-P1-0010-CP1		Renewable energy technology (hydro, wind, biomass or PV) connected to existing or new isolated mini-grids replacing existing dedicated diesel based power generation Ref no: CPA category 02	Renewable crediting type, 01/06/2020- 31/05/2027	Not applicable

A.2. Coordinating/managing entity

The coordinating/managing entity (CME) of the PoA is the “Rural Energy Agency (REA)”.

SECTION B. Implementation of PoA

B.1. Description of implemented PoA

Management system

The management system was developed in accordance with the “Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities”, Version 3, EB74.

REA is the PoA managing entity. The operational and management arrangements established by the REA for the implementation of the PoA are described below.

The operational and management structure provided information and data flow channel between the CME and the CPA implementer. At the CPA level, REA ensured the actual involvement of field personnel (power plant operators/technicians) in the monitoring, data collection and record keeping activities. REA requested each CPA to designate a CPA manager at the project developer head office and an engineer in-charge of the power plant operation. Figure 1 gives the implementation structure of the program.

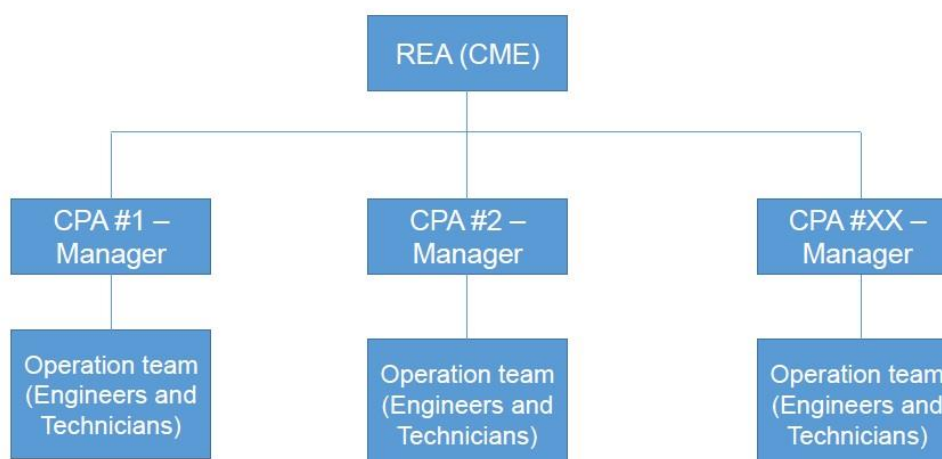


Figure 1. Operational and management structure

Operation and management plan

The operation and management plan is described below.

i) A record keeping system for each CPA under the PoA

A record keeping system was established by REA, which contained the following details providing the unique identity for each SSC-CPA. The details include, but not limited to:

- Name of the CPA.
- CPA number.
- Name of the CPA implementer.
- Contact details of the implementing entity (Address/Contact person/Phone/e-mail/fax).
- Location of the CPA (e.g., GPS coordinates of the power house and the water intake for a hydro power plant).
- Type of renewable energy source.
- Installed capacity of the CPA.
- The record on technical specification of each renewable energy plant participating in the PoA.
- Type and name of the grid (national grid, TANESCO mini-grid, existing isolated grid, new isolated grid) fed by the project.
- Gross electricity generation.
- Net electricity generation and electricity sales.
- Meter calibration.
- Commissioning date.

Two databases were developed by REA for record keeping – one at the CPA level and the other at the PoA level.

At the CPA level, the CPA implementer was responsible for managing the records and the data associated with each SSC-CPA. They maintained a proper electronic database for these records. A hard copy backup of all these records was also made available. In case of failure in the electronic data transfer system, manually recorded project details at the site were collected and compiled, which was sent to REA. The record keeping was carried out using the field instruments, hardware and software installed in every project site and/or manual data recording in the log book. The recorded data was submitted to REA, which was responsible to archive the data as per the individual CPA.

At the PoA level, REA managed and maintained a record of complete database on all CPAs and the entire PoA. REA cross-checked the data from all the CPAs to ensure completeness, accuracy

and consistency. The PoA level database was obtained from the CPA level database after REA's own review work.

Paper and electronic records will be kept during the entire crediting period for each CPA and for additional two years after the crediting period.

ii) Records of arrangements for training and capacity development for personnel

REA was responsible for keeping the record on training and capacity development activities provided to the relevant personnel. The record includes:

- Date, time and venue of each training and capacity development event
- Participants record for each event
- Agenda for each training and capacity development event
- Manuals and training materials for each training and capacity development event

All relevant project staff were trained in various aspects of the CPA operation and management. Operators also pursued on-site training.

iii) Measures for continuous improvements of the PoA management system

The Project Manager of the PoA organized a meeting with all his/her staff and CPA personnel to review the performance of the PoA management system to identify issues to be addressed and to obtain continuous improvements of the PoA management system.

B.2. Post-registration changes to PoA

B.2.1. Corrections

Not applicable

B.2.2. Inclusion of monitoring plan

Not applicable

B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Not applicable

B.2.4. Changes to programme design

Not applicable

B.2.5. Changes specific to afforestation or reforestation activities

Not applicable

PART II Monitoring of CPAs

This report is prepared as monitoring report number 02 for one CPA (Mbinga hydropower project) under the PoA. The CPA was in operation during this monitoring period from 01/01/2018 to 31/12/2018 (first and last days included).

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

Currently the PoA has included ten CPAs, out of which four CPAs are not yet implemented. Table 1 provides the details of CPA that is considered in this monitoring report number 02 (and rest are covered in monitoring report number 01).

Table 1. CPA of the PoA covered in this monitoring period

CPA reference no.	CPA name ¹¹	Registered / Included ¹²	Total capacity (MW)	Project implementer
9904-P1-0003-CP1	Mbinga hydroelectric project	06/11/2015	1.148	Andoya Hydroelectric Power Company Limited

Table 2 provides the major milestones during the project implementation of Mbinga CPA.

Table 2. Milestone for Mbinga CPA

Description	Date
CPA start date	22/10/2012
CPA inclusion date	06/11/2015
Start date of the first crediting period	01/12/2015
Commissioning date	19/03/2015 ¹³

Technical description of the CPA

This CPA is a run-of-the-river hydroelectric power plant with a capacity of 1.060 MW (560 kW + 500 kW) installed in two phases. The plant design consists of a weir, intake, desilting bay, canal, forebay, penstock pipe, power house, electromechanical machines, controls, step up transformer and transmission line to Mbinga township being the main line. A medium voltage line to Mbangamao, Lifakara and Kilimani village branches from the main line. The plant design also includes improvement of 12 km and 2 km new stretch. Both phases are commissioned and in operation now, phase 1 (560 kW) of power plant was commissioned on 19/03/2015 and the phase 2 (500 kW) was commissioned in November 2018.

The CPA is designed to supply electricity to both, mini-grid and national grid (Category 03). The CPA was connected to TANESCO national grid extension from Njombe region to Ruvuma region and started supplying power to the national grid from 18/09/2018. The change of TANESCO mini-grid to the national grid is out of control of the CPA implementer.

¹¹ For simplicity, in this monitoring report, this CPA is shortly referred to as Mbinga.

¹² https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/DEI4JOVUTN7A0936CP1WLMSGYB58ZF/viewCPAs

¹³ Andoya commission report dated 29/04/2015

Table 3 and 4 provides the technical specifications of phase 1 installation.

Table 3. Specification of installed power plant for phase 1

Turbine	Type	Horizontal Francis Turbine
	Rated speed	750 rpm
	Rated capacity	550 kW
Generator	Frequency	50 HZ
	Rated voltage	400 V
	Rated Capacity	700 kVA (560 kW)
	Power factor	0.8 PF

Table 4. Generation power loss

Generation Losses	Value
Turbine speed	50 rpm
Generator Efficiency	98%
Net electric power generated	495 kW at power station
Transformer efficiency	97%
Line efficiency	98%
Available power at user end	470 kW
Installed output capacity	4,117 MWh
Delivered output estimates	3,293 MWh
Losses in the distribution	5.43% = 179 MWh
Net saleable electricity	3,114 MWh/y

Table 5 provides the technical specifications of phase 2 installation.

Table 5. Specification of installed power plant for phase 2

Turbine	Type	Hydraulic Turbine
	Rated speed	100 rpm
	Rated capacity	525 kW
Generator	Frequency	50 Hz
	Rated voltage	400 V
	Rated Capacity	588.2 kVA
	Power factor	0.85

Net GHG emission reduction:

Table 6 gives the net emission reduction achieved with Mbinga CPA during this monitoring period.

Table 6. Net emission reduction of Mbinga CPA

No.	CPA	Actual net emission reduction achieved (tCO ₂ e)
1	Mbinga	1,922
	Total	1,922

It is also confirmed here that the power plant electricity export readings for each month are metered and the meter values are supported by monthly invoices for the CPA. Hence, the double counting of power generation and emission reduction is avoided.

C.2. Location of CPAs

Detail	Mbinga
Host party	United Republic of Tanzania
Region / State / Province, etc.	Ruvuma
City / Town / Community, etc.	Mbinga district
Geographical reference of project site	
Latitude (°S)	11.2708
Longitude (°E)	35.5875

Figure 2 provides the location map of the CPA.

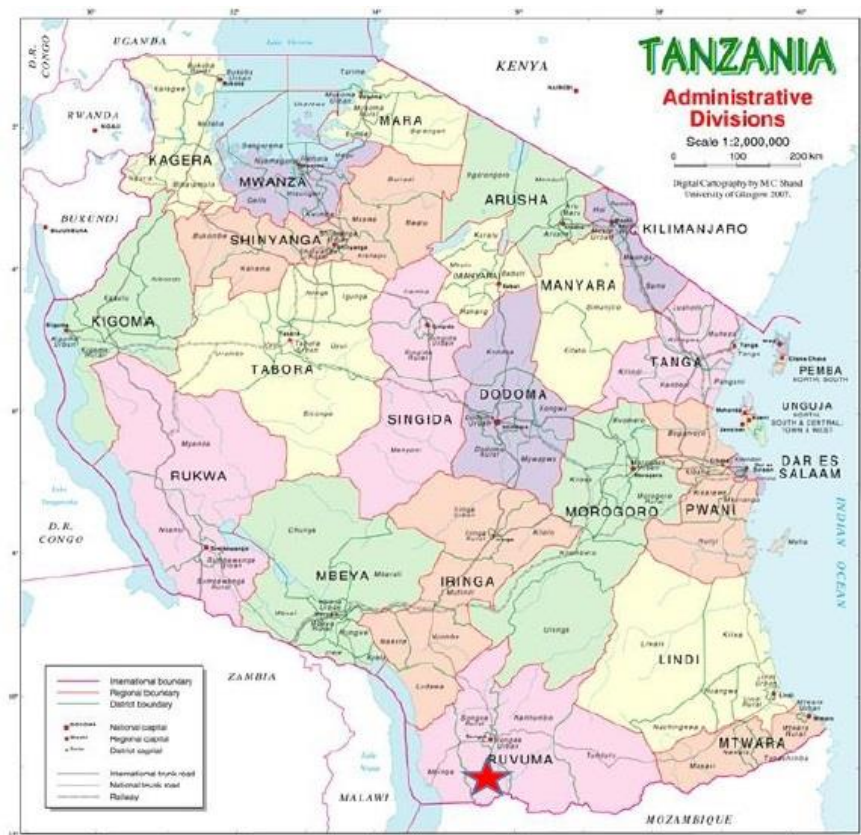


Figure 2. Location map of the reported CPA

C.3. Post-registration changes to CPAs**C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies, standardized baselines or other methodological regulatory documents**

Not applicable

C.3.2. Corrections

Not applicable

C.3.3. Changes to the start date of the crediting period

Not applicable

C.3.4. Inclusion of monitoring plan

Not applicable

C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

The Mbinga CPA had started supplying the power to the TANESCO national grid from 18/09/2018 after the completion of the Makambako – Songea 132 kV transmission line. Hence there was a change in project design (refer section C.3.6 of this MR) of CPA. Due to the change in project design of the CPA, the monitoring plan of the CPA was also revised to be in line with category 03 from the existing category 02. The monitoring plan of category 03 includes the monitoring requirement of AMS I.D version 17 and AMS I.F version 02 (refer section D of this MR for more details). As per the revised monitoring plan, the quantity of net electricity supplied to the national grid ($EG_{actual,y}/EG_{BL,y(Category\ 1)}$) will be monitored in addition to the quantity of net electricity displaced from the mini-grid ($EG_{BL,y}$). The grid emission factor was also estimated and applied in the revised monitoring plan for the CPA as per the monitoring requirement of category 03. A PRC request was made to the CDM Executive Board (EB) through verifying DOE.

The change in project design was approved by the CDM EB on 27/04/2020¹⁴ with PRC reference number 9904-004.

C.3.6. The change comes under option 2 (b) “Corrections that have been notified to the secretariat as applicable from this monitoring period” as provided in the guidelines in updating the MR.Changes to project design

Mbinga CPA was designed to supply power to the mini-grid alone as per the registered CPA DD (category 02). However, after the completion of Makambako – Songea 132 kV transmission line on 18/09/2018, the CPA started supplying the power to the national grid. A PRC request for the change of category 02 to category 03 has been made. A new grid emission factor for the TANESCO grid is estimated using the latest data. A revised CPA DD was submitted for this

¹⁴ <https://cdm.unfccc.int/CPAPostRegChanges/DB/prcp512979669/view>

purpose through the verifying DOE to the CDM Executive Board. The revised CPA DD (version 04 dated 23/12/2019) was approved on 27/04/2020¹⁵ with PRC reference number 9904-004.

The change comes under option 2 (b) "Corrections that have been notified to the secretariat as applicable from this monitoring period" as provided in the guidelines in updating the MR.

C.3.7. Changes specific to afforestation or reforestation CPA

Not applicable

SECTION D. Description of monitoring system of CPAs

The monitoring plan of the PoA is consistent with the methodology AMS-I.D (version 17) and AMS-I.F (Version 02). The monitoring structure and plan for a SSC-CPA is an integrated part of the management and monitoring plan of the PoA as described in section C and section B.7.2 (Part II) of the PoA.

The management system is developed in accordance with the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities".

Various parameters with respect to the project category were monitored in the power plants. Various data used for the estimation of emission reduction were also monitored. The data are archived electronically and will be stored for additional 2 years after the end of the crediting period of the CPA. REA as the CME, has supervised the implementation of the monitoring plan. REA also ensured that all the relevant staff of the CPAs as well as their own personnel are trained adequately in this task.

To ensure that the data is reliable and transparent, the CME also established quality assurance and quality control (QA & QC) measures to effectively control and manage the data reading, recording, auditing as well as archiving data and all relevant documents.

Project Category

Category 1 - Power projects connected to grid

Category 2 - Power projects connected to mini-grid

Category 3 - Power projects connected to both grid and mini-grid

Monitored parameters

Table 7 provides the parameters to be monitored by the CPA.

Table 7. Parameters to be monitored for the CPA

CPA	Parameter
Mbinga Hydroelectric power plant	Net electricity generation supplied to the national grid
	Net electricity supplied to the mini-grids

The above parameters were monitored by the plant operators at the project site and were entered in the data sheets.

¹⁵ <https://cdm.unfccc.int/CPAPostRegChanges/DB/prcp512979669/view>

Monitoring procedure

The gross electricity generation, if possible and the quantity of net electricity supplied to the grid were continuously measured using the energy meters with a maximum rated error of 0.5% as mandated by Energy and Water Utilities Regulatory Authority (EWURA).

Cumulative measurements were entered into an electronic database at the end of each month. Any problems observed in the monitoring equipment were also captured. The CPA implementer produced the reports containing the monthly monitoring data files and details of any equipment faults and/or loss of data. The reports were submitted to the CME and project participants for review and acceptance. All records will be retained for at least two years after the end of the crediting period.

The following measures were taken relating to the monitoring equipment owned by the CPA implementer, its installation and operation.

- All meters are designed and manufactured to the accepted standards (Regulatory standards shall be followed for each electricity meter). Each CPA shall provide all information regarding the metering devices including accuracy class and calibration frequency required, at least annually.
- All monitoring equipment should be located in secure locations free from the possibility of accidental damage.
- Routine maintenance and calibration of all monitoring equipment will be performed in accordance with the utility standards, regular standards or the manufacturer's specification, whenever applicable, to ensure that the data remains accurate.

When all the generated electricity was delivered to the national grid, then the emission reductions (ER) were calculated based on the amount of electricity measured by the buyer. The project records were used primarily for cross-checking and secondarily for ER calculation in case the buyer could not measure the purchased electricity. In all the cases, the agreed amount of electricity used for billing purpose were the main base for ER calculation.

The Mbinga power plant supplied energy to the TANESCO mini-grid and isolated mini-grid until 17/09/2018. However, due to the establishment of TANESCO national grid, the existing TANESCO mini grid was connected with the national grid. Hence, the Mbinga power plant supplies power to TANESCO national grid from 18/09/2018 at the same metering point where TANESCO minigrid is connected. Table 8 provides the technical specifications of energy meters installed at Mbinga power plant.

Table 8. Technical details of the power meters installed at the export point in Mbinga

Parameter	Main meter	Check meter
Model	EDMI Mk10E	EDMI Mk10E
Type	Bi-directional	Bi-directional
Accuracy	0.5s	0.5s

Parameter	Main meter	Check meter
Serial No.	211108423	211108415
First calibration date	19/03/2015	19/03/2015
Second calibration date	03/03/2017	03/03/2017
Third calibration date	28/02/2018	28/02/2018

Figure 3 gives the metering points of the Mbinga CPA for the TANESCO grid and the isolated mini-grid.

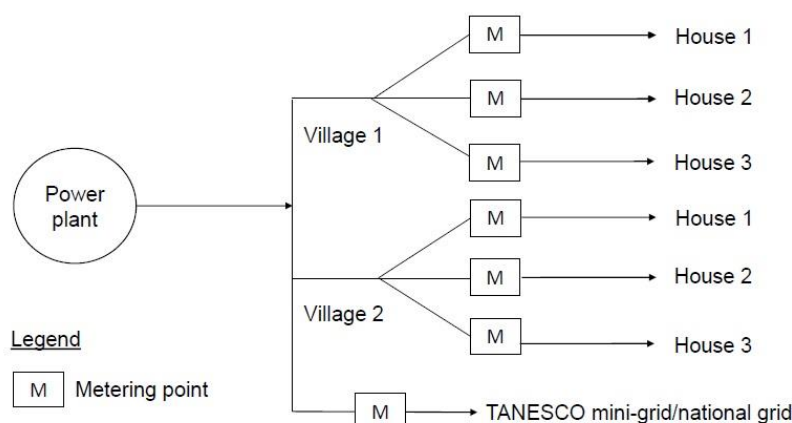


Figure 3. Metering points for Mbinga CPA supplying to mini-grid and national grid

Quality assurance (QA) and quality control (QC)

QA & QC procedures for recording, maintaining and archiving data were implemented as a part of this CDM project activity. The CPA owner implemented QA & QC measures to calibrate and guarantee the accuracy of metering (for meters under his responsibility) and safety of the project operation.

Data collection, reporting, archiving and preparation for periodic verification

Data was recorded daily by the plant operator and any data outages were recorded in an operational log and reported to the plant engineer. The plant engineer at each project site has prepared a report consisting of the above parameters in electronic format. The soft copy of data as well as the electronic report, were forwarded to the CPA Manager, who manages the database for CPAs in line with the CDM requirements under the supervision of REA.

After the quality control, the CPA manager has sent the consolidated data collected to the REA. Being the CME, REA is responsible for the management of records and data associated with each SSC-CPA. REA maintains the overall programme database for these records. The Project Manager of the PoA is responsible for the overall programme database and maintains the records of all the CPAs under this program. Figure 4 gives the operation and management structure for the monitoring of the PoA.

To ensure the quality of the recorded data, all the personnel were trained in accordance with this monitoring plan.

If applicable, the net electricity supplied to a grid was cross checked as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical

losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

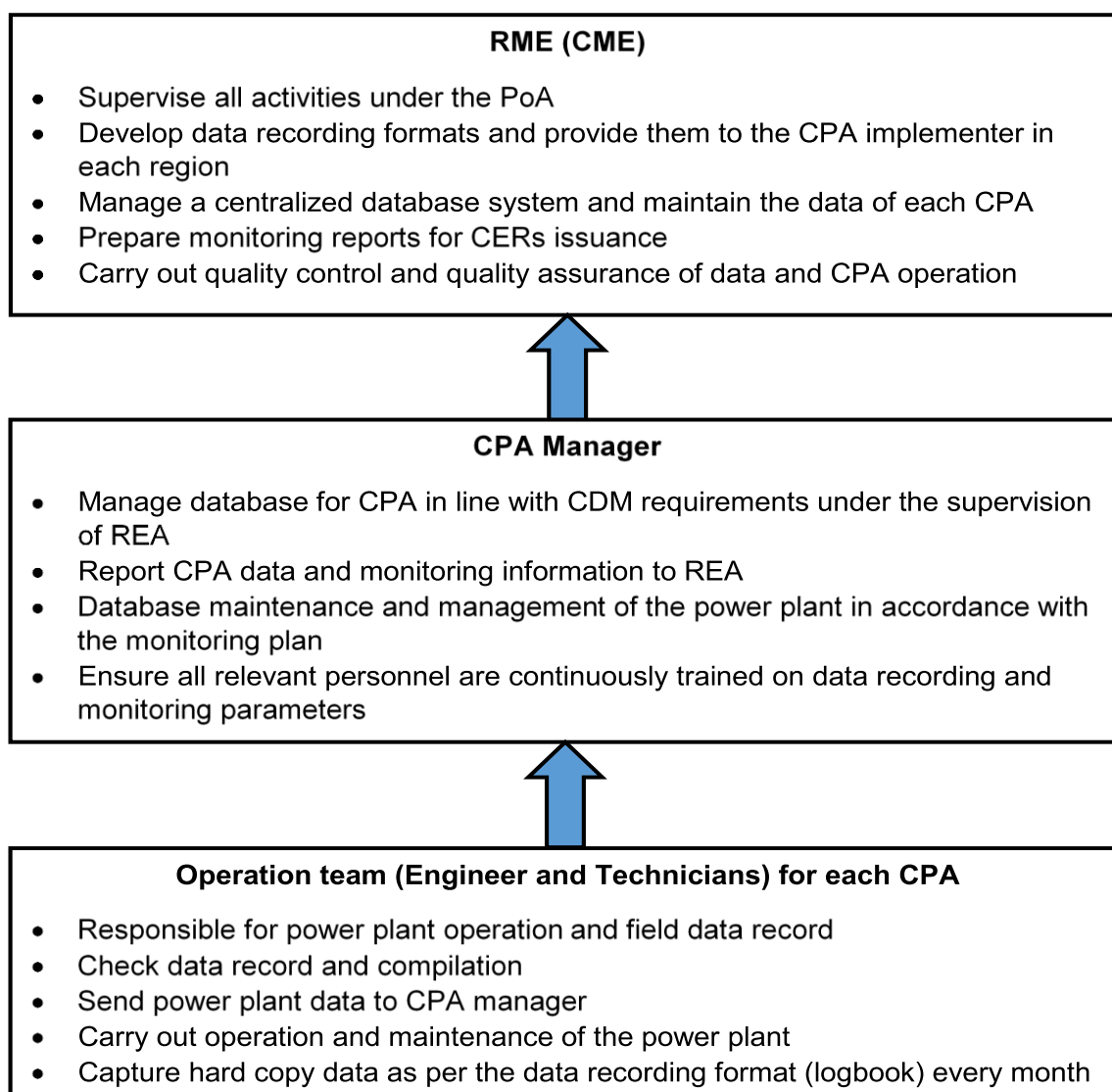


Figure 4: Operational and management structure for monitoring

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

CPA Category 1: CPAs supplying to the national grid (AMS I.D. Grid connected renewable electricity generation).

(Copy this table for each data or parameter.)

Data/Parameter	EF_{CO₂,grid,y}
Unit	tCO ₂ e/MWh.
Description	CO ₂ emission factor of the grid in year y
Source of data	Calculated as described in part II section B.6.3 of PoA DD. Details of Tanzania national grid obtained from TANESCO.
Value(s) applied	0.479

Choice of data or measurement methods and procedures	The grid emission factor is calculated using the latest version of the "Tool to calculate the emission factor for an electricity system". The power generation data of Tanzania national grid for years 2015-17 is used.
Purpose of data/parameter	Calculation of baseline emission
Additional comments	The value is fixed ex-ante for the first crediting period.

Data/Parameter	EF_{CO₂,m,i,y.}
Unit	tCO ₂ /GJ.
Description	CO ₂ emission factor of fossil fuel type i used in power unit m in year y.
Source of data	IPCC ¹⁶ default values at the lower limit of uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG inventories.
Value(s) applied	Gas Oil/Diesel Oil - 0.0726 tCO ₂ /GJ. Natural Gas - 0.0543 tCO ₂ /GJ.
Choice of data or measurement methods and procedures	No data for the fuels used in Tanzania is available. Hence IPCC defaults are used. For the calculation of the Simple Adjusted Operating Margin (OM), these figures shall be updated once, at the start of each crediting period in accordance with the applicable IPCC data at that time. For the build margin (BM), these figures shall be updated once, at the start of each crediting period with the applicable IPCC data at the time.
Purpose of data/parameter	Calculation of baseline emission.
Additional comments	Not applicable.

Data/Parameter	EF_{EL,m,y.}																																		
Unit	tCO ₂ /MWh																																		
Description	CO ₂ emission factor of power unit m considered in grid emission factor calculation in year.																																		
Source of data	TANESCO																																		
Value(s) applied	<table border="1"> <thead> <tr> <th>Plants</th><th>Emission Factor EF_(EL,m,y) (tCO₂/MWh)</th></tr> </thead> <tbody> <tr><td>Zuzu</td><td>1.14</td></tr> <tr><td>Tegeta Gas Plant (TGP)</td><td>0.49</td></tr> <tr><td>Ubungu Gas Plant (UGP)</td><td>0.49</td></tr> <tr><td>SONGAS UGT1&2</td><td>0.49</td></tr> <tr><td>SONGAS UGT3,4,5&6</td><td>0.49</td></tr> <tr><td>IPTL</td><td>0.69</td></tr> <tr><td>NYAKATO</td><td>0.66</td></tr> <tr><td>AGR(TG)</td><td>0.66</td></tr> <tr><td>AGR(UB)</td><td>0.66</td></tr> <tr><td>UGP 2</td><td>0.59</td></tr> <tr><td>SYMB UB GP</td><td>0.49</td></tr> <tr><td>SYMB UB JET A</td><td>0.66</td></tr> <tr><td>SYMB (AR)</td><td>0.66</td></tr> <tr><td>SYMB (DD)</td><td>0.66</td></tr> <tr><td>Kinyerezi I</td><td>0.32</td></tr> <tr><td>Kinyerezi II</td><td>0.32</td></tr> </tbody> </table>	Plants	Emission Factor EF _(EL,m,y) (tCO ₂ /MWh)	Zuzu	1.14	Tegeta Gas Plant (TGP)	0.49	Ubungu Gas Plant (UGP)	0.49	SONGAS UGT1&2	0.49	SONGAS UGT3,4,5&6	0.49	IPTL	0.69	NYAKATO	0.66	AGR(TG)	0.66	AGR(UB)	0.66	UGP 2	0.59	SYMB UB GP	0.49	SYMB UB JET A	0.66	SYMB (AR)	0.66	SYMB (DD)	0.66	Kinyerezi I	0.32	Kinyerezi II	0.32
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Kinyerezi II	0.32																																		

¹⁶ Intergovernmental Panel on Climate Change

Choice of data or measurement methods and procedures	Calculated based on the approach provided under Option A of the OM method, using annual electricity generation, fuel type and efficiency of each power unit, m.
Purpose of data/parameter	Calculation of baseline emission.
Additional comments	This data will be used if available from TANESCO. Otherwise, it should be calculated.

Data/Parameter	$\eta_{m,y}$			
Unit	%			
Description	Average net energy conversion efficiency of power unit m in year y.			
Source of data	TANESCO and default values as per Appendix 1 of “Tool to calculate the emission factor for an electricity system”, version 04.0.0			
Value(s) applied				
	Plants	Type of fuels	Technology Used	Efficiency (%)
	Zuzu	Diesel & Industrial Oil	Open Cycle	22.85%
	Tegeta Gas Plant (TGP)	Natural Gas	Open Cycle	39.50%
	Ubungo Gas Plant (UGP)	Natural Gas	Open Cycle	39.50%
	SONGAS UGT1&2	Natural Gas	Open Cycle	39.50%
	SONGAS UGT3,4,5&6	Natural Gas	Open Cycle	39.50%
	IPTL	HFO	Open Cycle	39.50%
	NYAKATO	Diesel & Industrial Oil	Open Cycle	39.50%
	AGR(TG)	Diesel & Industrial Oil	Open Cycle	39.50%
	AGR(UB)	Diesel & Industrial Oil	Open Cycle	39.50%
	UGP 2	Natural Gas	Open Cycle	33.00%
	SYMB UB GP	Natural Gas	Open Cycle	39.50%
	SYMB UB JET A	Diesel & Industrial Oil	Open Cycle	39.50%
	SYMB (AR)	Diesel & Industrial Oil	Open Cycle	39.50%
	SYMB (DD)	Diesel & Industrial Oil	Open Cycle	39.50%
	Kinyerezi I	Natural Gas	Combined cycle	62.00%
	Kinyerezi II	Natural Gas	Combined cycle	62.00%
	Efficiency factor of AGR and SYMB plants are taken from Appendix 1 of the “Tool to calculate the emission factor for an electricity system” for plant built after 2000.			
Choice of data or measurement methods and procedures	Data from the Tanzanian grid company are used as available. Default values are used for the plants, where data are not available.			
Purpose of data/parameter	Calculation of baseline emission			
Additional comments	Not applicable.			

Data/Parameter	$EG_{m,y}$
Unit	MWh.
Description	Net quantity of electricity generated and delivered to the grid by power unit m in year y.
Source of data	TANESCO.

Value(s) applied	See grid emission factor calculation spreadsheet
Choice of data or measurement methods and procedures	As per "Tool to calculate the emission factor for an electricity system" method for simple OM.
Purpose of data/parameter	Calculation of baseline emission.
Additional comments	Not applicable.

Data/Parameter	EG_{k,y}
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit k in year y (by low cost/must run power plants).
Source of data	TANESCO.
Value(s) applied	See grid emission factor calculation spreadsheet
Choice of data or measurement methods and procedures	As per "Tool to calculate the emission factor for an electricity system" method for simple OM.
Purpose of data/parameter	Calculation of baseline emission.
Additional comments	Not applicable

CPA Category 2: CPAs supplying to a mini-grid (AMS I.F. Renewable electricity generation for captive use and mini-grid).

Data/Parameter	EF_{CO₂,y}
Unit	tCO ₂ e/MWh.
Description	CO ₂ emission factor for displacement of electricity in the minigrid and /or the captive power plant in year y.
Source of data	Table I.F.1. of AMS – I.F
Value(s) applied	0.8
Choice of data or measurement methods and procedures	<p>The portion of electricity supplied to mini-grids replaces electricity production through diesel generators, that would have been used in the absence of the project activity. As per AMS-I.F, for a mini-grid system where all the generators use exclusively fuel oil and/or diesel fuel, an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1 can be used.</p> <p>The installed capacity is larger than 200 kW. Thus, the value of 0.8 tCO₂e/MWh is used. This is the emission factor for a modern diesel generating unit of capacity larger than 200 kW.</p>
Purpose of data/parameter	Calculation of baseline emission.
Additional comments	Not applicable.

CPA category 3: CPAs using both AMS I.D and AMS I.F

All parameters mentioned above for the category 1 and 2 are also applicable for the category 3.

E.2. Data and parameters monitored

(Copy this table for each data or parameter.)

CPA Category 3: CPAs supplying to both the national grid and the mini grid (TANESCO/Isolated).

Data/Parameter	EG_{actual,y}/EG_{BL,y}(Category 1)
Unit	MWh/Year

Description	Quantity of net electricity supplied to the national grid in year y.				
Measured/calculated/Default	Measured				
Source of data	Energy meter records				
Value(s) of monitored parameter	<p><u>To the TANESCO national grid (18/09/2018 to 31/12/2018)</u></p> <table border="1"> <tr> <th>CPA</th><th>Power supplied to the grid (MWh/year)</th></tr> <tr> <td>Mbinga¹⁷</td><td>387.172</td></tr> </table>	CPA	Power supplied to the grid (MWh/year)	Mbinga ¹⁷	387.172
CPA	Power supplied to the grid (MWh/year)				
Mbinga ¹⁷	387.172				
Monitoring equipment	Bidirectional energy meters.				
Measuring/reading/recording frequency	Continuous monitoring & daily measurement was done for the electricity generated at the plant and monthly recording was also done for electricity supplied to TANESCO national grid. The data will be held in reserve for the two years after the verification.				
Calculation method (if applicable)	<p>Measurements are taken using energy meters. Bidirectional meters are installed so that the electricity supplied by the grid to the project or to the communities is not included in the calculation of ERs.</p> <p>Measurement results are cross checked with records for sold/purchased electricity (e.g., invoices/receipts).</p> <p>The net electricity export/supplied to a grid is the difference between the measured quantities of the grid electricity export and the import. Cross check is done on net electricity supplied to a grid as the gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and the electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.</p>				
QA/QC procedures	<p>The device was calibrated and/or tested as per the instructions (schedules, procedures) for QA of the technology provider and EWURA's standard.</p> <p>There was strict compliance with the maintenance schedule recommended by the technology provider and EWURA. The quality control was ensured by EWURA's SSPA that mandates monthly readings, with rated error no greater than 0.5%.</p> <p>Quality control and assurance was achieved through a monthly check of the monitoring log sheet, which was signed by plant staff to acknowledge that the parameters are correct.</p>				
Purpose of data/parameter	Calculation of baseline emission.				
Additional comments	The data will be kept in reserve for two years after the crediting period.				

Data/Parameter	EG _{BL,y} .
Unit	MWh/Year
Description	Quantity of net electricity displaced in year y.
Measured/calculated/Default	Measured
Source of data	Energy meter records

¹⁷The Mbinga CPA was connected to the national grid after the establishment of Makambako – Songea 132KV transmission line. From 18/09/2018, the Mbinga CPA started to supply power to the grid.

Value(s) of monitored parameter	<u>To the TANESCO mini-grid (01/01/2018 – 17/09/2018)</u>	
	CPA	Power supplied to TANESCO mini-grid (MWh/year)
	Mbinga ¹⁸	2,080.799
	<u>To the isolated mini-grid (01/01/2018 – 31/12/2018)</u>	
	CPA	Power supplied to isolated mini-grid (MWh/year)
	Mbinga ¹⁹	94.666
Monitoring equipment	Unidirectional and bidirectional energy meters.	
Measuring/reading/recording frequency	Continuous monitoring & daily measurement was done for the electricity generated at the plant and monthly recording was also done for power supplied to TANESCO mini-grid and communities. The data will be held in reserve for the two years after the verification.	
Calculation method (if applicable)	For electricity supplied to the communities, the data were measured by the energy meters. For the electricity supplied to TANESCO mini-grid, the data were measured and then calculated by subtracting the auxiliary/station electricity consumption, technical losses and the electricity import from the TANESCO mini-grid to the project power plant measured at the TANESCO mini-grid interface/connection used for billing purposes.	
QA/QC procedures	<p>The device was calibrated and/or tested as per the instructions (schedules, procedures) for QA of the technology provider and EWURA's standard.</p> <p>There was strict compliance with the maintenance schedule recommended by the technology provider and EWURA. The quality control was ensured by EWURA's SSPA that mandates monthly readings, with rated error no greater than 0.5%.</p> <p>Quality control and assurance was achieved through a monthly check of the monitoring log sheet, which was signed by plant staff to acknowledge that the parameters are correct.</p>	
Purpose of data/parameter	Calculation of baseline emission.	
Additional comments	The data will be kept in reserve for two years after the crediting period.	

E.3. Implementation of sampling plan

Not applicable

SECTION F. Calculation of emission reductions or net anthropogenic removals

F.1. Calculation of baseline emissions or baseline net removals

CPA Category 3: For CPAs supplying to both the national grid and the mini-grid (AMS-I.D. and AMS-I.F.)

All the procedures for baseline estimations of Category 1 and 2 (Greenfield projects) are also applicable to Category 3.

¹⁸ From 01/01/2018 to 17/09/2018, Mbinga CPA supplied power to the TANESCO mini-grid. The CPA was connected to the national grid and started supplying power to the national grid from 18/09/2018 to 31/12/2018.

¹⁹ Only TANESCO mini-grid is connected with the national grid. Therefore, Mbinga CPA still supplies power to the isolated mini-grid.

Mbinga CPA is a greenfield power plant and supplies power to both TANESCO national grid and isolated mini grid (villages).

a) For power supplied to TANESCO grid (category 1):

$$BE_{y(Category\ 1)} = EG_{BL,y,(Category\ 1)} \times EF_{CO_2,grid,y}$$

Where,

$BE_{y(Category\ 1)}$ = Emission reductions in year y (tCO₂/y) resulting from part of electricity fed to the national grid

$EG_{BL,y,(Category\ 1)}$ = Quantity of net electricity supplied to the national grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{CO_2,grid,y}$ = CO₂ emission factor of the grid in year y (tCO₂/MWh)

b) For power supplied to mini grid (category 2):

$$BE_{y(Category\ 2)} = EG_{BL,y,(Category\ 2)} \times EF_{CO_2,y}$$

Where:

$BE_{y(Category\ 2)}$ = Emission reductions in year y (tCO₂/y) resulting from part of electricity fed to the mini-grid

$EG_{BL,y,(Category\ 2)}$ = Quantity of net electricity supplied to the mini-grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{CO_2,y}$ = CO₂ emission factor in year y (tCO₂/MWh)

Table 9 and 10 provides the details of net power supplied and imported from TANESCO mini-grid and national grid.

Table 9. Net electricity exported to and imported from the mini-grid by Mbinga CPA

Time period		Electricity supplied to TANESCO mini-grid	Electricity supplied to isolated mini-grid	Electricity imported from TANESCO mini-grid	Net electricity supplied $EG_{facility,y}$
From	To	(MWh)	(MWh)	(MWh)	(MWh)
		A	B	C	D=A+B-C
01/01/2018	31/01/2018	235.225	7.334	0.282	242.277
01/02/2018	28/02/2018	233.329	5.465	0.287	238.507
01/03/2018	31/03/2018	253.500	5.708	0.582	258.626
01/04/2018	30/04/2018	251.523	7.821	0.188	259.156
01/05/2018	31/05/2018	259.433	7.319	0.057	266.695
01/06/2018	30/06/2018	239.355	7.345	0.381	246.319
01/07/2018	31/07/2018	246.492	9.278	0.428	255.342

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Time period		Electricity supplied to TANESO mini-grid	Electricity supplied to isolated mini-grid	Electricity imported from TANESCO mini-grid	Net electricity supplied $EG_{\text{facility},y}$
From	To	(MWh)	(MWh)	(MWh)	(MWh)
		A	B	C	D=A+B-C
01/08/2018	31/08/2018	246.677	9.733	0.295	256.115
01/09/2018 ²⁰	30/09/2018	115.265	7.713	0.604	122.374
01/10/2018	31/10/2018	0.00	6.574	0.00	6.574
01/11/2018	30/11/2018	0.00	9.166	0.00	9.166
01/12/2018	31/12/2018	0.00	11.211	0.00	11.211
Total		2,080.799	94.666	3.104	2,172.362

The sample calculations for the baseline emissions under the CPA category 2

$$\begin{aligned}
 BE_{y(\text{Category}2)} &= EG_{BL,y(\text{Category}2)} \times EF_{CO_2,y} \\
 &= 2,172 \text{ MWh} \times 0.8 \text{ tCO}_2/\text{MWh} \\
 &= 1,737 \text{ tCO}_2
 \end{aligned}$$

Table 10. Net electricity exported to and imported from the grid by Mbinga CPA (18/09/2018 to 31/12/2018)

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied ($EG_{\text{facility},y}$)
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/01/2018	31/01/2018	0.000	0.000	0.000
01/02/2018	28/02/2018	0.000	0.000	0.000
01/03/2018	31/03/2018	0.000	0.000	0.000
01/04/2018	30/04/2018	0.000	0.000	0.000
01/05/2018	31/05/2018	0.000	0.000	0.000
01/06/2018	30/06/2018	0.000	0.000	0.000
01/07/2018	31/07/2018	0.000	0.000	0.000
01/08/2018	31/08/2018	0.000	0.000	0.000
01/09/2018 ²¹	30/09/2018	55.352	0.160	55.192

²⁰ From 01/01/2018 to 17/09/2018, the Mbinga CPA supplied energy to the TANESCO mini-grid and isolated mini-grid.

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied ($EG_{\text{facility},y}$)
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/10/2018	31/10/2018	157.809	1.665	156.144
01/11/2018	30/11/2018	51.971	1.432	50.539
01/12/2018	31/12/2018	131.635	6.338	125.297
Total		396.767	9.595	387.172

$$\begin{aligned}
 BE_{y(\text{Category } 1)} &= EG_{BL,y,(\text{Category } 1)} \times EF_{CO_2, \text{grid}, y} \\
 &= (387 \text{ MWh} \times 0.479 \text{ tCO}_2/\text{MWh}) \\
 &= 185 \text{ tCO}_2\text{e}
 \end{aligned}$$

Table 11 gives the baseline emissions for each of the CPA based on the power supply to the grid or mini-grid.

Table 11. Baseline emissions from Mbinga CPA

Grid type	Net electricity generation $EG_{\text{facility},y}$	Grid emission factor	Baseline emission BE_y
	(MWh)	(tCO_2/MWh)	(tCO_2)
	C	D	E = C*D
Minigrid	2,172	0.8	1,737
National grid ²²	387	0.479	185
Total			1,922

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

The CPA is generating power from run-of-the-river type hydro power project. Hence, the project emission is considered as zero.

$$PE_{y(\text{Category } 1)} = 0$$

F.3. Calculation of leakage emissions

As per AMS-I.D and AMS-I.F, leakage has to be considered, if there is any energy generating equipment transfer from another activity. The CPA (Mbinga) under this PoA were not involved

²¹ On 18/09/2018, the Mbinga CPA was connected to the national grid. Hence from 18/09/2018 to 31/12/2018, the CPA started supplying energy to the national grid and isolated mini-grid.

²² Mbinga hydro power plant started supplying electricity to the TANESCO grid from 18/09/2018.

any transfer of equipment from another activity. All systems having comprised only newly procured equipment. Hence, the leakage emission due to equipment transfer was not considered for the CPAs under this PoA.

$$LE_{y(\text{Category3})} = 0$$

F.4. Calculation of emission reductions or net anthropogenic removals

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
9904-P1-0003-CP1	1,922	0	0	0	1,922	1,922
Total	1,922	0	0	0	1,922	1,922

F.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the included CPA-DDs

CPA UNFCCC reference number	Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the CPA-DD (t CO ₂ e)
9904-P1-0003-CP1	1,922	2,707
Total	1,922	2,707

F.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the CPA-DD”

The ex-ante emission reduction is the estimated ex-ante CERs as per latest CPA DD for the period 01/01/2018 to 31/12/2018. Refer the monitoring ER sheet for more details.

F.6. Remarks on increase in achieved emission reductions

The overall CER generated from the CPA during the reported monitoring period is 29% less than the overall estimated CERs from the registered CPA DD.

F.7. Remarks on scale of small-scale CPAs

The installed capacity of project activity is 1.148 MW which is less than the threshold limit of 15 MW for Type I projects.

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN); • Add a section on remarks on the observance of the scale limit of small-scale CPAs during the crediting periods; • Add "changes specific to afforestation or reforestation activities/CPA" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R PoAs between two commitment periods; • Make structural and editorial improvements.
02.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for programmes of activities (CDM-EB93-A07-STAN); • Make editorial improvements.
01.0	1 April 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report, programme of activities		