



**Monitoring report form for CDM programme of activities
(Version 04.0)**

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 08 dated 23/04/2014		
Version number of this monitoring report	02		
Completion date of this monitoring report	03/05/2021		
Monitoring period number	Fourth monitoring period		
Duration of this monitoring period	From 01/01/2019 to 31/12/2020 (first and last days included).		
Monitoring report number for this monitoring period	01 (for six CPAs in the PoA)		
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 until 31 December 2020	Amount achieved from 1 January 2021
	0 tCO _{2e}	40,647 tCO _{2e}	0 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	102,529 tCO _{2e}		

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

Over the years, Tanzania has 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.

As a result, the government established and entrusted the Rural Energy Board (REB), the Rural Energy Agency (REA) and the Rural Energy Fund (REF) 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. Based 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, power generation and export data, meter calibration and all necessary parameters that are required for calculating the emission reductions from each CPA.

This is the fourth monitoring period of the PoA from 01/01/2019 to 31/12/2020 (first and last days included). The cumulative net electricity exported to the national grid and mini-grids (Isolated/TANESCO) by six CPAs covered in this report during the monitoring period is 76,159 MWh. The CERs generated during this monitoring period is 40,647 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 isolated mini-grids.	Renewable crediting type, 01/01/2015 - 31/12/2020	No ³

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

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

³ Project is delayed.

		Ref no: CPA category 03	1	
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	Yes
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 isolated mini-grids. Ref no: CPA category 03	Renewable crediting type, 01/12/2015 - 30/11/2022	Yes
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 ⁵
Ngombeni biomass		Renewable energy	Renewable	Yes ⁶

⁴ Project is delayed

⁵ Project is delayed

⁶ Power plant is not in operation due to technical issues. So no CER is claimed from this CPA in this monitoring period.

power plant project, 9904-P1-0007-CP1		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	e crediting type, 01/09/2016 - 31/08/2023	
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	Yes
Darakuta mini hydro project, 9904 P1-0009-CP1		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	Renewable crediting type, 12/12/2017 - 11/12/2024	Yes
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	No ⁷

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.

⁷ Project is delayed

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.

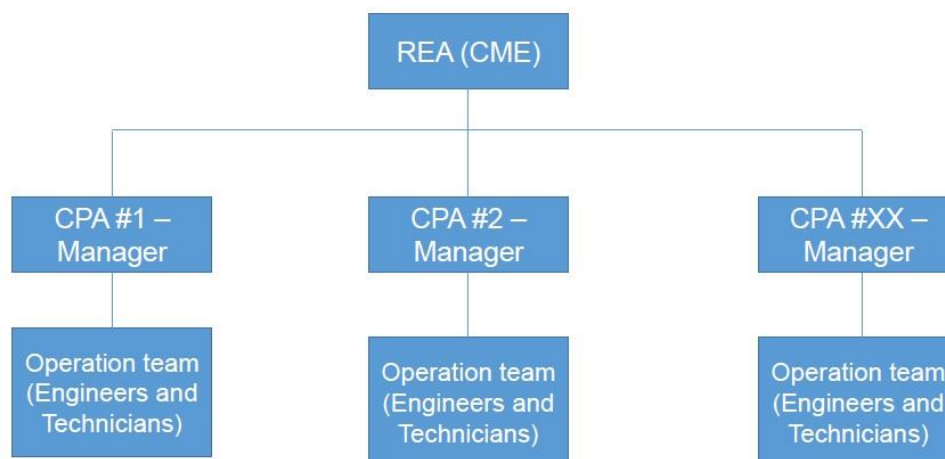


Figure 1. Operational and management structure

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

Though the CPAs are categorized as 01, 02 and 03 based on the type of power export (grid or mini-grid or both), there is not much difference in their operation, monitoring and reporting of estimated CERs. So all the CPAs reported in this MR are clubbed under one group and reported in Part II of this MR.

This monitoring report includes all six commissioned CPAs (Mbinga, Yovi, Tulila, Ngombeni, Ikondo and Darakuta) under the PoA. Out of these, only five CPAs (Yovi, Tulila, Mbinga, Ikondo and Darakuta) were in operation during this monitoring period from 01/01/2019 to 31/12/2020 (first and last days included). Due to technical issues, the Ngombeni biomass power plant CPA was not in operation during this entire monitoring period.

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 the six CPAs considered in this report. Out these, one CPA (Ngombeni biomass power plant project) could not generate any power during the monitoring period due to technical issues and hence no CER is claimed from that CPA.

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

CPA reference no.	CPA name ⁸	Registered / Included ⁹	Total capacity (MW)	Project implementer
9904-P1-0003-CP1	Mbinga Hydroelectric Project	06/11/2015	1.15	Andoya Hydroelectric Power Company Limited
9904-P1-0004-CP1	Yovi small hydro power project	06/11/2015	2.3	Yovi Hydro Power Company Limited
9904-P1-0005-CP1	Tulila hydroelectric plant	06/11/2015	7.5	Tulila Hydroelectric Plant Company Limited
9904-P1-0007-CP1	Ngombeni biomass power plant project	11/08/2016	2.5	Ngombeni Power Limited
9904-P1-0008-CP1	Ikondo micro hydro power plant	14/10/2016	0.430	Matembwe Village Company Limited
9904-P1-0009-CP1	Darakuta mini hydro project	12/12/2017	1.075	Darakuta Hydropower Development Company Limited

Table 2 provides the major milestones during the project implementation of six CPAs.

⁸ For simplicity, in this monitoring report, these CPAs are shortly referred to as Mbinga, Yovi, Tulila, Ngombeni, Ikondo and Darakuta respectively.

⁹https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/DEI4JOVUTN7A0936CP1WLMSGYB58ZF/viewCPAs

Table 2. Milestone for the CPAs

Description	Mbinga	Yovi	Tulila	Ngombeni	Ikondo	Darakuta
CPA start date	22/10/2012	19/07/2012	11/10/2013	31/01/2012	19/12/2013	04/03/2015
CPA inclusion date	06/11/2015	06/11/2015	06/11/2015	11/08/2016	14/10/2016	12/12/2017
Start date of the first crediting period	01/12/2015	01/12/2015	01/12/2015	01/09/2016	14/10/2016	12/12/2017
Commissioning date	19/03/2015 ¹⁰	06/11/2015 ¹¹	12/09/2015 ¹²	27/01/2014 ¹³	26/01/2016 ¹⁴	19/04/2016 ¹⁵

Technical description of the CPA

Mbinga:

Mbinga 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 locate along Mtandasi river at Mbangamao water fall site. Both phases are already installed supplying power to TANESCO grid and the isolated mini-grid and comes under CPA category 03.

The CPA involves installation 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 villages will branch from the main line. Both phases are commissioned and in operation now, phase 1 (560 kW) of power plant was commissioned in March 2015 and the phase 2 (500 kW) was commissioned in November 2018.

Table 3 and 4 provides the technical specifications of phase 1 installation and table 5 provides technical specifications for phase 2 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

¹⁰ Andoya commission report dated 29/04/2015

¹¹ Yovi-TANESCO interconnection report dated 26/11/2015

¹² Date as per TANESCO interconnection certificate

¹³ Ngombeni-TANESCO interconnection report dated 04/02/2014

¹⁴ Provisional acceptance certificate

¹⁵ Date as per TANESCO interconnection certificate

	Rated capacity	700 kVA (560 kW)
	Power factor	0.8 PF

Table 4: Generation power loss

Generation losses	Value
Turbine speed	750 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
Operating days/year	80%
Losses in the distribution	0.543% = 179 MWh
Net saleable electricity	3,114 MWh/year

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 (500 kW)
	Power factor	0.85

The annual estimated net production capacity is 3,114 MWh during phase 1 and 3,114 MWh during phase 2 implementation. Since phase 1 and 2 are already implemented, the total annual net production is estimated to be around 6,228 MWh.

Yovi:

This CPA supplies power to the TANESCO grid and the isolated mini-grid and comes under CPA category 03.

Yovi CPA is a run-of-the-river hydroelectric power plant with a capacity of 2.3 MW (1 MW + 1.3 MW) installed in two phases. In first phase, a 1 MW Pelton turbine was installed and 33 kV transmission line was constructed to supply electricity to the national grid. In the second phase, additional 1.3 MW Pelton turbine will be installed to complete the planned capacity of 2.3 MW. It is during this second phase where an isolated mini-grid network will be developed.

The hydropower plant utilizes a natural head in the Yovi river. The powerhouse is constructed in a flat area at an elevation of 867 m height above mean sea level (AMSL) near the right bank of the river and is a one floor building with a pitched roof, that lodge the Pelton turbines and all the related electrical and mechanical equipment. Table 6 provides the main features of the 2.3 MW hydro power plant.

Table 6. Specification of 2.3 MW hydro power plant

Parameter	Value
Water level at the diversion weir (minimum)	1,225.01m above mean sea level (AMSL)
Water level in the fore bay	1,224.30 m AMSL
Powerhouse elevation	867.00 m AMSL
Tail water level	864.48 m AMSL
Head	357.30 m
Plant flow	360 l/s – 520 l/s
Mean flow	360 l/s – 520 l/s
Installed capacity	2.3 MW
Penstock diameter	600 mm
Penstock length	1,725 m
Expected generation	15.1GWh/y

Table 7 provides the technical specification of installed 1 MW hydro power plant (first phase).

Table 7. Specification of installed power plant for phase 1

Turbine	Type	Horizontal Pelton Turbine
	Rated speed	1,000 rpm
	Rated capacity	995 kW
Generator	Frequency	50 Hz
	Rated voltage	3,000 V
	Rated capacity	1,800 kVA
	Power factor	0.8 PF

Tulila:

This CPA supplies power to the national grid and the isolated mini-grid and comes under CPA category 03.

The CPA is a run-of-the-river hydroelectric power plant with an installed capacity of 7.5 MW (5 MW + 2.5 MW) in two phases. The power plant uses the natural base slope of the Ruvuma river at Tulila. It is constructed as a run-of-the-river hydroelectric power plant with earth fill dam and a weir system to divert the water to the power plant and utilize the naturally available high head. The surface area of the reservoir created by permanent impoundment is about 74,000 m². Water depth at the intake is 7.5 m which results in a total gross head of around 22.5 m.

The plant design consists of headworks including weirs, dams and intake, the tailworks, electromechanical machines and the powerhouse equipped with governors, transformers, medium voltage switchgear, indoor crane, drainage and dewatering system, control, monitoring and communication systems and an emergency power unit.

The whole weir system including dam and intake structure is constructed. The powerhouse will be equipped with three equisized turbines and is located at about 190 m downstream of the intake structure. It is connected to the intake structure by three separate penstocks in staggered diameters 2.3 / 2.5 m each. Due to the short distance, a surge shaft is not necessary. The water after passing through the turbines is diverted back to the Ruvuma river by a 100 m long tailrace channel.

In phase 1, two turbine-generator units (2 x 2.5 MW) and two penstocks were installed. From 01/01/2018 to 17/09/2018, the power plant supplied power to the Songea mini-grid network. On 18/09/2018, the Songea mini-grid was connected to TANESCO national grid through the interconnection of Makambako – Songea 132 kV transmission line. Thereafter, from 18/09/2018, the power plant has been supplying the power to TANESCO national grid.

In phase 2, third identical turbine-generator unit and a penstock will be installed and will be connected to the national grid as well through the same interconnection of Makambako – Songea 132 kV transmission line. Table 8 provides the main features of the Tulila power plant.

Table 8. Technical specification of power plant.

Parameter	Value
Turbine specifications	
Turbine type	Kaplan, axial flow with vertical axis
Rated output	2,581 kW (3 units: 2 in phase 1 and 1 in phase2)
Rated speed	375 rpm
Rated efficiency	92%
Generator specifications	
Generator type	Synchronous
Generator capacity	3.044 MVA (3 units; 2 in phase 1 and 1 in phase 2)
Power factor	0.8

Parameter	Value
Generation voltage	6.6 kV
Efficiency	96%

Ngombeni:

This CPA supplies power to the TANESCO mini-grid and comes under CPA category 02. The plant was not in operation during the reported monitoring period due to technical issues with the power plant boiler.

Ngombeni CPA is a 2.5 MW biomass power project, which covers an area of about 7,000 acres of land in Mafia Island. The area is comprised of sawmill, log yard, workshop, one office building and two staff houses nearby. The project is designed to use various biomass such as coconut palm tree wastes, different species of trees, bushes, etc., which are readily available as the main feed stock for electricity generation. The feed stock in general is derived from the discarded section of the coconut palm, trees, bushes, off-cuts, etc.

The feed stock from the chipper machine passes through the fire box in the boiler, which is burnt to generate heat. The heat generated boils the water in the boiler to produce steam at a pressure of 27–30 bar and at 280-300 °C. The produced steam is then introduced into the turbine and is converted into mechanical energy through expansion in steam turbine. The mechanical energy rotates the generator, which in turn produces desired electric power. Table 9 provides the main features of the Ngombeni power plant.

Table 9. Technical specification of power plant

Parameter	Value
Boiler capacity	10 ton/hr
Turbine capacity	2,500 kW
Generator capacity	3,125 kVA
Plant load factor	0.8
Expected electricity generation	15,023 MWh/y

Ikondo:

This CPA supplies power to both the national grid and the isolated mini-grid and comes under the CPA category 03.

Ikondo CPA is a run-of-the-river hydroelectric power plant with an installed capacity of 430 kW (80 kW + 350 kW), where water is diverted from Kyepa River and channeled through a 300 m long concrete lined canal into the head tank which has been located at the hill which enables the water to move downwards to the 22 m penstock effortlessly. The total amount of power generated in the hydroelectric power plant depends on the height of head tank and the amount of water flowing through the penstock. The flow from the penstock is forced into the turbine and the electricity is produced in the generator. At the end of the process, the utilized water from the power plant is normally released through a tailrace channel back into the Kyepa River.

The generated electricity is supplied to the national grid and to the isolated mini-grid. The generated power is directed into the step-up transformer and fed into the distribution grid of Medium Voltage (MV) Lines.

Only the 350 kW unit is considered for CDM purpose. It is a capacity addition to the existing 80 kW unit. As per registered CPA DD, it was assumed that 350 and 80 kW units will be connected to single energy meter before power off-take. The two units i.e 350 kW and 80 kW are connected to the same export point. So electricity export recorded is from both 350 kW unit and 80 kW unit. It is assumed that 71.5% will be exported to minigrid and the remaining 28.50% will be exported to the National grid. The same is used for CER estimations. Table 10 provides the main technical features of the Ikondo power plant.

Table 10. Technical specification of power plant

Parameter	Value
Penstock material	Steel
Penstock diameter	32 inches
Turbine type	Francis
Shaft orientation	Vertical
Speed	500 rpm
Net head	17 m
Maximum flow rate	2.3 m ³ /s
Mechanical power	350 kW
Minimum global efficiency at 80% of the flow rate	92%
Nominal electrical power	450 kVA
Power factor	0.85
Excitation	Brushless

Darakuta:

This CPA supplies power to the national grid and comes under the CPA category 01.

The CPA consists of a run-of-the-river power plant with installed capacity of 1 MW (320 kW + 680 kW) installed in two phases and supplies power to the national grid. The CPA implementer has been operating an existing 75 kW micro hydro power plant (not a CDM project and not covered under this PoA) which continues to supply power primarily for internal consumption of the ranch and the remaining power is exported to TANESCO national grid. A separate energy meter is installed on the existing 75 kW power plant to monitor its power generation and deduct it from the total power exported to the grid from the project site. During the whole reported monitoring period (01/01/2019 to 31/12/2020), the existing 75 kW unit was used for internal consumption of the ranch and the excess power was exported to TANESCO national grid.

The water flow from the Kou river down the rift valley had scope for generating additional power. Hence, the CPA implementer planned to construct an additional 1 MW hydro power plant in two phases for supplying electricity to the TANESCO national grid. The phase 1 of 320 kW (160 kW +160 kW) was installed in April 2016 and is currently in operation. The remaining 680 kW is planned in phase 2, which is yet to be installed. These additional power plants have been planned as the CDM project units under this CPA. It is to be noted that 320 kW hydro power plant (phase 1) and the existing 75 kW hydro power plant are located within the same power house. The 680 kW unit will be housed in a different location. Table 11 provides the main technical features of the Darakuta power plant.

Table 11. Technical specification of power plant.

No.	Parameter	Value
Turbine specification		
1	Number of units	2
2	Make	KSB
3	Type	Pump turbine
4	Rated capacity (kW)	160
5	Rated speed (RPM)	1,500
Generator specification		
1	Number of units	2
2	Make	Siemens
3	Frequency (Hz)	50
4	Rated voltage (V)	400
5	Rated capacity (kVA)	184
6	Power factor (P.F)	0.87
7	Rated capacity (kW)	160

Net GHG emission reduction:

Out of six CPAs included in this monitoring report, five CPAs operated normally during the monitoring period without any special events or situations which may impact the applicability of the methodology. One CPA (CPA 07) was not in operation at all due to technical issues.

Table 12 gives the net emission reduction achieved in each CPA during this monitoring period.

Table 12. Net emission reduction of each CPA

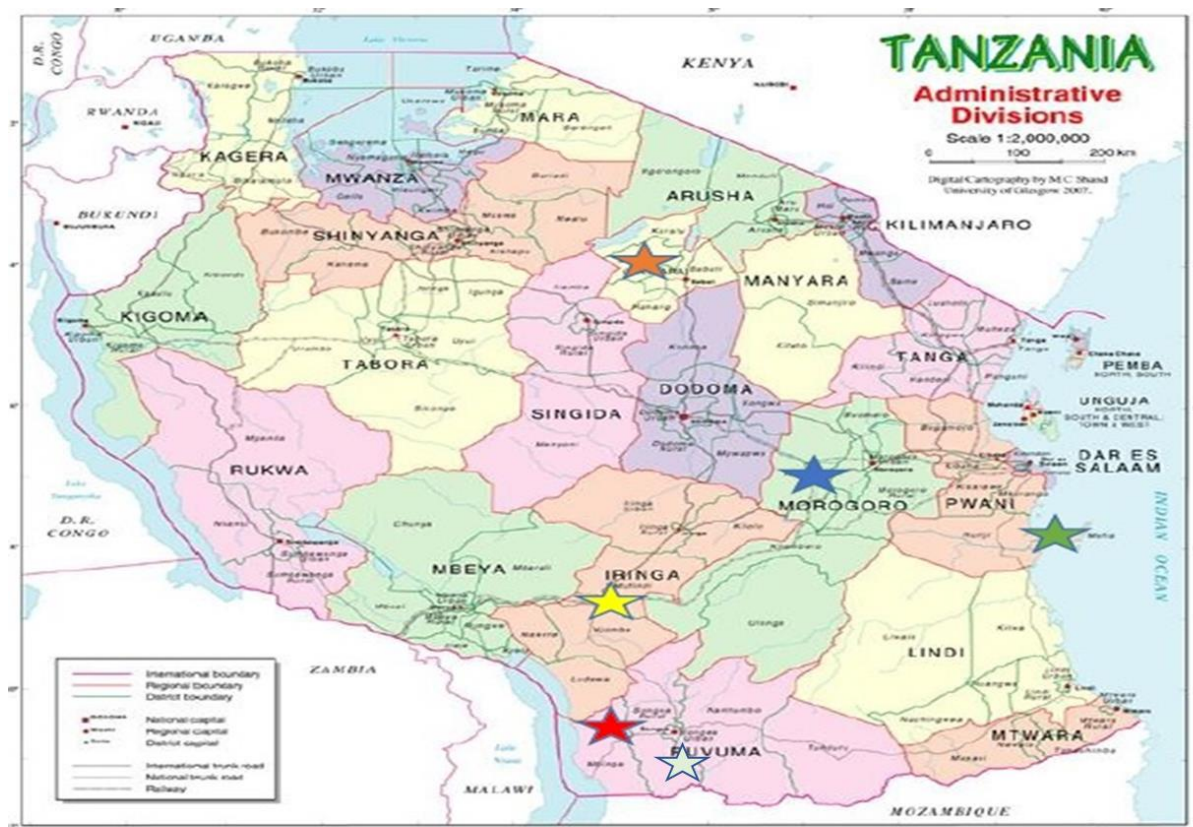
No.	CPA	Actual net emission reduction achieved (tCO ₂ e)
1	Mbinga	3,476
2	Yovi	4,201
3	Tulila	30,095
4	Ngombeni	0
5	Ikondo	914
6	Darakuta	1,961
	Total	40,647

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 each CPA. Hence, the double counting of power generation and emission reduction is avoided.

C.2. Location of CPAs

Detail	Mbinga	Yovi	Tulila	Ngombeni	Ikondo	Darakuta
Host party	United Republic of Tanzania					
Region / State / Province, etc.	Ruvuma	Morogoro	Ruvuma	Pwani	Njombe	Manyara
City / Town / Community, etc.	Mbangamao village, Mbinga district	Msolwa village, Kilosa district	Mpepai – Tulila village, Mbinga / Songea district	Ngombeni, Dundani, Minaki, Chunguruma, RasMbisi Estates Village, Mafia district	Ikondo village, Njombe district	Darakuta ranch, Babati district
Geographical reference of project site						
Latitude (°S)	11.2708	7.1934	11.0947	7.6555	9.0754	3.9675
Longitude (°E)	35.5875	36.7141	35.2769	39.6608	35.2330	35.6292

Figure 2 provides the location map of the respective CPAs.



- ★ Yovi small hydropower project
- ★ Darakuta mini hydro project
- ★ Tulila hydroelectric plant
- ★ Ngombeni biomass power plant project
- ★ Mbinga hydroelectric
- ★ Ikondo micro hydro power plant

Figure 2. Location map of the reported CPAs

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

Ngombeni CPA:

As per included CPA DD, the parameter “Moisture content (MC_{biomass})” was fixed ex-ante. It is now made as the monitoring parameter under “section B.5.1.Data and parameters to be monitored” of the CPA. Values of different biomass fuels were provided. In cases where a lab test of sampling is not possible (due to several project barriers) for any biomass type, provision is added to use the value from standard international sources for that particular biomass type.

Similarly, the net calorific value (NCV) for different types of biomass used in the plant is provided for the parameter “ NCV_{Biomass} ” in “section B.5.1.Data and parameters to be monitored” of the CPA. In cases where a lab test of sampling is not possible (due to several project barriers) for any

biomass type, provision is added to use the value from standard international sources for that particular biomass type.

The change comes under option 2 (a) “Corrections that have been notified to the secretariat as applicable from the period prior to this monitoring period” as provided in the guidelines in updating the MR. The revised CPA DD, version 06 dated 14/07/2018 was approved by EB on 21/08/2018.

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 27/04/2020¹⁶ 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.3.6. Changes to project design

Mbinga CPA:

Mbinga CPA was registered under category 02 – power supply to TANESCO mini-grid. However, 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. Currently the CPA is supplying electricity to both, mini-grid and national grid (Category 03). The change of TANESCO mini-grid to the national grid is out of control of the CPA implementer.

A post registration change (PRC) request was submitted for this aspect as part of verification process. The revised Mbinga CPA DD version 04 dated 23/12/2019 was approved by the EB on 27/04/2020 with PRC reference number 9904-004.

¹⁶ <https://cdm.unfccc.int/CPAPostRegChanges/DB/prcp512979669/view>

The change comes under option 2 (a) “Changes that have been notified to the secretariat as applicable from the period prior to this monitoring period” as provided in the guidelines in updating the MR.

Yovi CPA:

Yovi CPA was registered under category 02 – power supply to TANESCO mini-grid. However, during actual implementation, the power is supplied to TANESCO national grid and isolated mini-grid. A post registration change (PRC) request was submitted for this aspect as part of verification process. The revised Yovi CPA DD version 05 dated 31/01/2018 was approved by the EB on 31/01/2019.

The change comes under option 2 (a) “Changes that have been notified to the secretariat as applicable from the period prior to 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 13 provides the parameters to be monitored by each CPA.

Table 13. Parameters to be monitored for each CPA

Parameter	Mbinga	Yovi	Tulila	Ngombeni	Ikondo	Darakuta
Net electricity generation supplied to the national grid	√	√	√		√	√
Net electricity supplied to the mini-grids	√	√	√	√	√	
Quantity of biomass consumed in a year				√		
Net calorific value of the biomass				√		
Moisture content of the biomass				√		

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

Monitoring procedure

The gross electricity generation, if possible (for CPA that energy meters are installed just after generation) 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 implementers 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.

Table 14 provides the technical details of the power meters installed at Mbinga power plant.

Table 14. 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
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
Fourth calibration	03/12/2020	03/12/2020

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

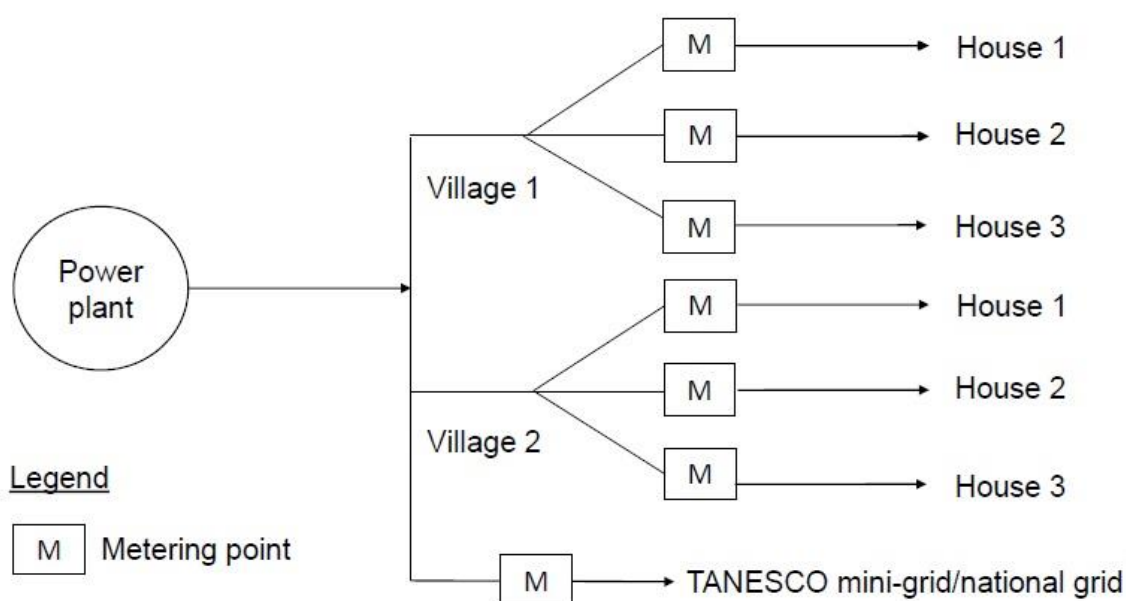
**Figure 3. Metering points for Mbinga CPA supplying to mini-grid and national grid**

Table 15 provides the technical details of the power meters installed at Yovi power plant.

Table 15. Technical details of the power meters installed at the grid export point in Yovi

Parameter	Main meter	Check meter
Model	EDMI Mk 6N	EDMI Mk 6N
Type	Bi-directional	Bi-directional
Accuracy	0.5s	0.5s

Parameter	Main meter	Check meter
Serial No.	208304008	208302546
First calibration date	06/11/2015	06/11/2015
Second calibration date	03/03/2017	03/03/2017
Third calibration	24/02/2018	24/02/2018
Fourth calibration	27/11/2020	27/11/2020

Figure 4 depicts the metering point of Yovi CPA.

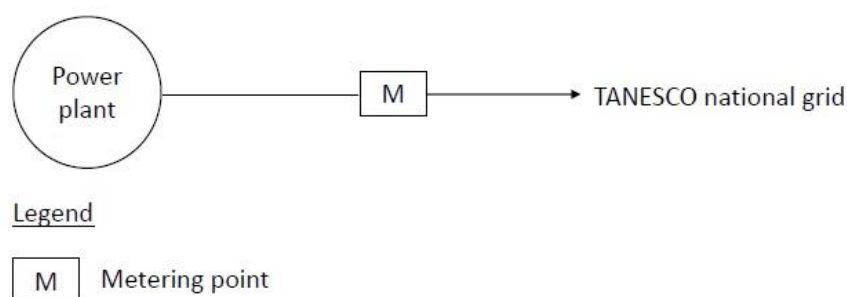


Figure 4: Metering points for Yovi CPA

Tulila CPA supplies power to TANESCO national grid. Table 16 gives the technical details of power meters installed in the Tulila power plant.

Table 16. Technical details of the power meters installed at the export point in Tulila

Parameter	Main meter	Check meter
Model	EDMI Mk10E	EDMI Mk 10E
Type	Bi-directional	Bi-directional
Accuracy	0.5s	0.5s
Serial No.	211112553	211112571
First calibration date	12/09/2015	12/09/2015
Second calibration date	03/03/2017	03/03/2017
Third calibration date	28/02/2018	28/02/2018
Fourth calibration date	01/12/2020	01/12/2020

Figure 5 depicts the metering points of the Tulila CPA supplying power to national grid.

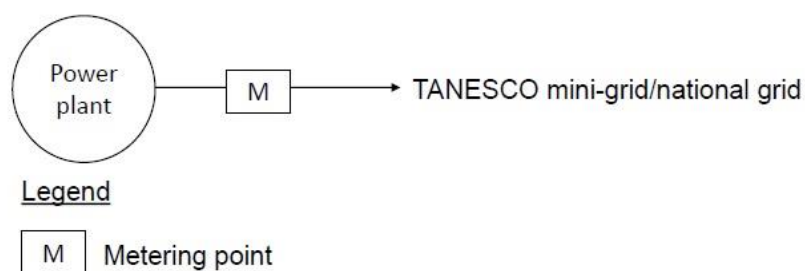


Figure 5: Metering points for Tulila CPA

Table 17 provides the technical details of the installed power meter at Ngombeni power plant.

Table 17. Technical details of the power meters installed at the mini-grid export point in Ngombeni

Parameter	Main meter	Check meter
Model	EDMI Mk 10E	EDMI Mk 10E
Type	Bi-directional	Bi-directional
Accuracy	0.5s	0.5s
Serial number	211108280	211108294
First calibration date	27/01/2014	27/01/2014
Second calibration date	03/03/2017	03/03/2017
Next calibration date	Plant not in operation	

Figure 6 depicts the metering points of the Ngombeni power plant

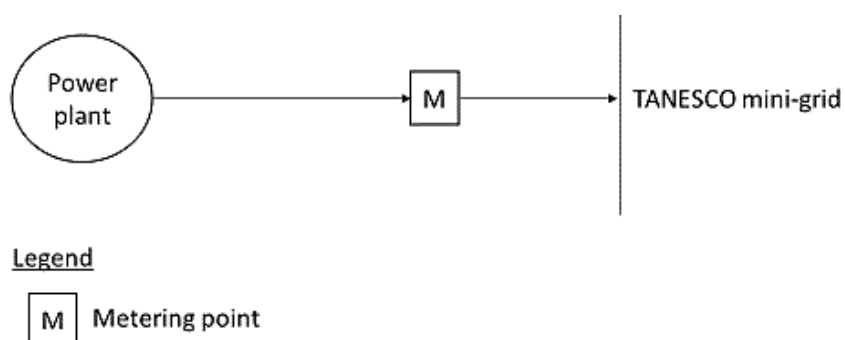


Figure 6. Metering points for Ngombeni CPA

Table 18 provides the technical details of the Ikondo power meters connected to the national grid.

Table 18. Technical details of the power meters installed at the grid export point in Ikondo

Parameter	Main meter	Check meter
Model	EDMI Mk 10E	EDMI Mk 10E
Type	Bi-directional	Bi-directional

Parameter	Main meter	Check meter
Accuracy	0.5s	0.5s
Serial No.	212556509	212556508
First calibration date	11/11/2016	11/11/2016
Second calibration date	03/03/2017	03/03/2017
Third calibration date	18/03/2018	18/03/2018

Table 19 provides the technical details of the Ikondo power meters connected to the distribution points of the minigrid.

Table 19. Technical details of the power meters installed at the distribution point of the minigrid in Ikondo

Location name	Serial No.	First calibration date	Second calibration date
Igumbilo	07-010631	12/01/2017	28/11/2020
Matembwe HQ	2015-0513598	12/01/2017	29/11/2020
Lung'angali	800153	12/01/2017	29/11/2020
Matembwe mission	800175	12/01/2017	29/11/2020
CEFA HQ Ikondo	2015-051356A	12/01/2017	28/11/2020
Ikondo ofisini	800235	12/01/2017	28/11/2020
Ukalawa	800199	12/01/2017	28/11/2020
Nyave	25094292	12/01/2017	28/11/2020
Isoliwaya	800200	12/01/2017	29/11/2020
Kanikelele (Igoga)	800041	12/01/2017	29/11/2020
Kanikelele (ofisini)	27349792	12/01/2017	29/11/2020
Uheni	900064	12/01/2017	28/11/2020
Mulunga	800182	12/01/2017	28/11/2020
Mkondoa	750085	12/01/2017	28/11/2020
Manyunyu	800198	12/01/2017	04/12/2020

Figure 7 depicts the metering point for Ikondo CPA.

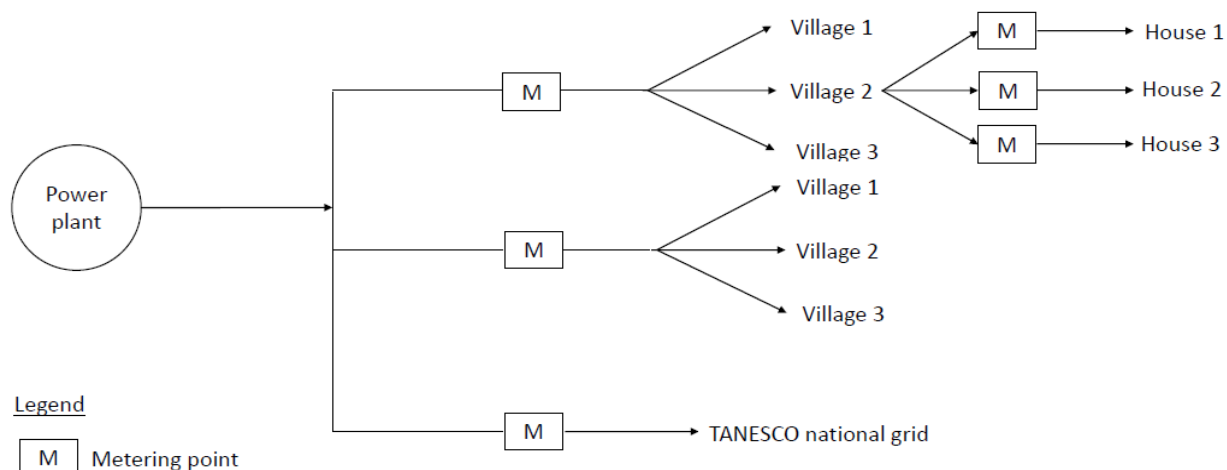


Figure 7. Metering points for Ikondo CPA

Table 20 provides the technical details of the power meters installed at Darakuta power plant.

Table 20. Technical details of the power meters installed at the grid export point in Darakuta

Parameter	Main meter	Check meter
Model	EDMI Mk 10E	EDMI Mk 10E
Type	Bi-directional	Bi-directional
Accuracy	0.5s	0.5s
Serial No.	215281802	215281805
First calibration date	03/03/2017	03/03/2017
Second calibration date	28/02/2018	28/02/2018
Third calibration date	05/12/2020	05/12/2020

Figure 8 depicts the metering points of Darakuta CPA.

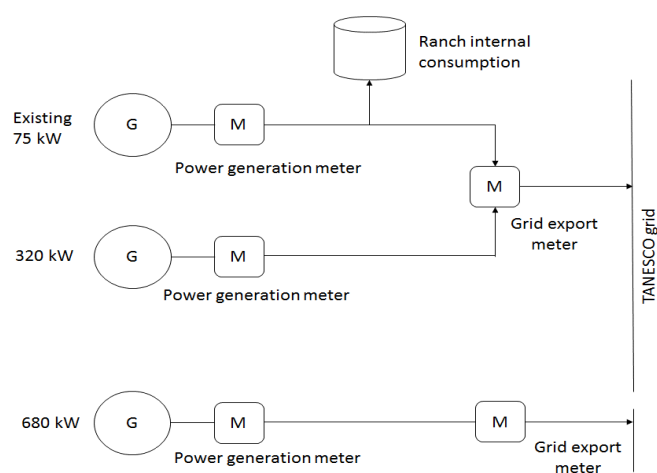


Figure 8. Metering points for Darakuta CPA

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.

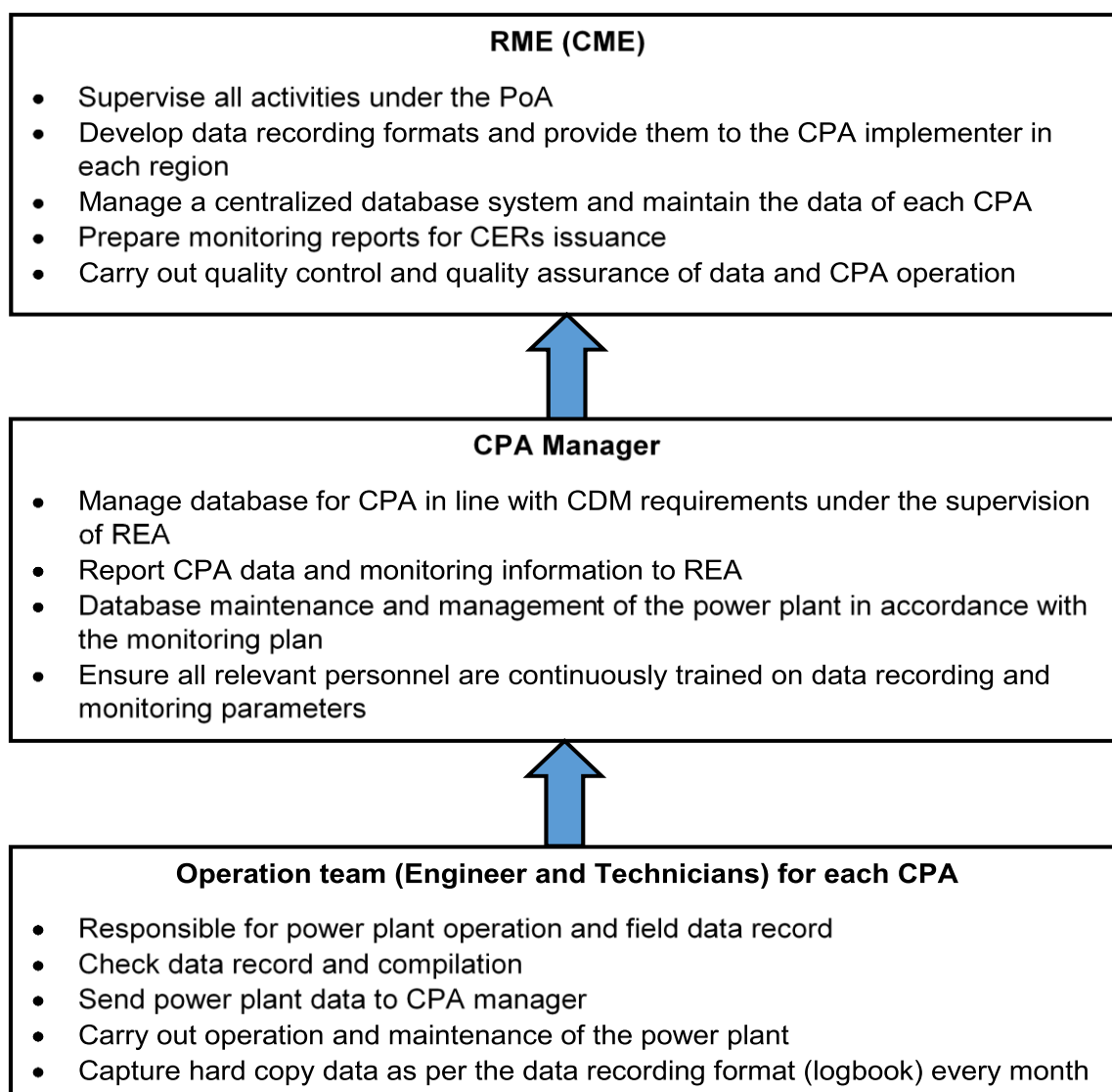


Figure 9: Operational and management structure for monitoring

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 9 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.

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

(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	0.530
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 2012-14 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 ¹⁷ 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

¹⁷ Intergovernmental Panel on Climate Change

Value(s) applied	<table><tr><th>Plants</th><th>Emission Factor EF_(EL,m,y) (tCO₂/MWh)</th></tr><tr><td>Zuzu</td><td>0.69</td></tr><tr><td>Tegeta Gas Plant (TGP)</td><td>0.46</td></tr><tr><td>Ubungo Gas Plant (UGP)</td><td>0.45</td></tr><tr><td>SONGAS UGT1&2</td><td>0.57</td></tr><tr><td>SONGAS UGT3,4,5&6</td><td>0.54</td></tr><tr><td>IPTL</td><td>0.70</td></tr><tr><td>NYAKATO</td><td>0.69</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>0.53</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></table>	Plants	Emission Factor EF _(EL,m,y) (tCO ₂ /MWh)	Zuzu	0.69	Tegeta Gas Plant (TGP)	0.46	Ubungo Gas Plant (UGP)	0.45	SONGAS UGT1&2	0.57	SONGAS UGT3,4,5&6	0.54	IPTL	0.70	NYAKATO	0.69	AGR (TG)	0.66	AGR (UB)	0.66	UGP 2	0.53	SYMB UB GP	0.49	SYMB UB JET A	0.66	SYMB (AR)	0.66	SYMB (DD)	0.66
	Plants	Emission Factor EF _(EL,m,y) (tCO ₂ /MWh)																													
	Zuzu	0.69																													
	Tegeta Gas Plant (TGP)	0.46																													
	Ubungo Gas Plant (UGP)	0.45																													
	SONGAS UGT1&2	0.57																													
	SONGAS UGT3,4,5&6	0.54																													
	IPTL	0.70																													
	NYAKATO	0.69																													
	AGR (TG)	0.66																													
	AGR (UB)	0.66																													
	UGP 2	0.53																													
	SYMB UB GP	0.49																													
	SYMB UB JET A	0.66																													
SYMB (AR)	0.66																														
SYMB (DD)	0.66																														
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	37.8%
	Tegeta Gas Plant(TGP)	Natural Gas	Open Cycle	42.4%
	Ubungo Gas Plant(UGP)	Natural Gas	Open Cycle	43.0%
	SONGAS UGT1&2	Natural Gas	Open Cycle	34.1%
	SONGAS UGT3,4,5&6	Natural Gas	Open Cycle	36.4%
	IPTL	HFO	Open Cycle	39.0%
	NYAKATO	Diesel & Industrial Oil	Open Cycle	38.00%
	AGR(TG)	Diesel & Industrial Oil	Open Cycle	39.50%
	AGR(UB)	Diesel & Industrial Oil	Open Cycle	39.50%
	UGP 2	Natural Gas	Open Cycle	37.00%
	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%
	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. In addition to the parameters of category 3, the following parameters are applicable to Ikondo CPA.

Data/Parameter	EG_{BL,existing,y,grid}
Unit	MWh.
Description	Estimated net electrical energy that would have been produced and supplied to grid by the existing units.
Source of data	Ikondo 80 kW power plant records for years 2010- 2015.
Value(s) applied	69
Choice of data or measurement methods and procedures	The annual average actual power produced from 80 kW unit was calculated from the historic data from 2010-2015. Similarly, the estimated electricity generation from the 80 kW unit was calculated using standard operating hours and plant load factor. The design factor (that only 28.5% of electricity generated would be exported to grid) is applied. As per methodology, the maximum of the two values, i.e., EG _{estimated,y} is considered for EG _{BL,existing,y,grid} .
Purpose of data/parameter	Calculation of baseline emission.
Additional comments	Not applicable.

Data/Parameter	EG_{BL,existing,y,MG}
Unit	MWh.
Description	Estimated net electrical energy that would have been produced and supplied to mini - grid by existing units.
Source of data	Ikondo 80 kW power plant records for years 2010- 2015.
Value(s) applied	175
Choice of data or measurement methods and procedures	The annual average actual power produced from 80 kW unit was calculated from the historic data from 2010 – 2015. Similarly, the estimated electricity generation from the 80 kW unit was calculated using standard operating hour and plant load factor. The design factor that only 71.5% of electricity generated would be exported to mini - grid is applied. As per methodology, the maximum of the two values, i.e. EG _{estimated,y} is considered for EG _{BL,existing,y,grid} .
Purpose of data/parameter	Calculation of baseline emission.
Additional comments	Not applicable.

E.2. Data and parameters monitored

(Copy this table for each data or parameter.)

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	EG_{PJ,add,y,grid}
Unit	MWh/Year
Description	Total net electrical energy supplied to a grid in year y by all units, existing and new project units

Measured/calculated/ Default	The data were measured and then calculated to obtain net electricity by subtracting 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.										
Source of data	Measured by energy meters										
Value(s) of monitored parameter	<table><tr><th rowspan="2">CPA</th><th colspan="2">Power supplied to the grid (MWh) from all existing and new sources</th></tr><tr><th>01/01/2019 – 31/12/2019</th><th>01/01/2020 – 31/12/2020</th></tr><tr><td>Darakuta</td><td>2,177.02</td><td>2,141.79</td></tr></table>			CPA	Power supplied to the grid (MWh) from all existing and new sources		01/01/2019 – 31/12/2019	01/01/2020 – 31/12/2020	Darakuta	2,177.02	2,141.79
CPA	Power supplied to the grid (MWh) from all existing and new sources										
	01/01/2019 – 31/12/2019	01/01/2020 – 31/12/2020									
Darakuta	2,177.02	2,141.79									
Monitoring equipment	Bidirectional energy meters.										
Measuring/reading/ recording frequency	Continuous monitoring, hourly measurement and at least monthly recording. The data will be archived for two years after the crediting period.										
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 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 SPPA 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 verification.										

Data/Parameter	$EG_{actual,y}$
Unit	MWh/Year
Description	Quantity of net electricity supplied to the national grid by the existing units in year y.
Measured/calculated/ Default	Energy meter installed to measure the power output to the national grid from the existing 75 kW unit.
Source of data	Calculation

Value(s) of monitored parameter	<table><tr><td rowspan="2">CPA</td><td colspan="2">Power supplied to the grid (MWh) from existing 75 kW unit</td></tr><tr><td>01/01/2019 – 31/12/2019</td><td>01/01/2020 – 31/12/2020</td></tr><tr><td>Darakuta</td><td>188.48</td><td>206.53</td></tr></table>			CPA	Power supplied to the grid (MWh) from existing 75 kW unit		01/01/2019 – 31/12/2019	01/01/2020 – 31/12/2020	Darakuta	188.48	206.53
CPA	Power supplied to the grid (MWh) from existing 75 kW unit										
	01/01/2019 – 31/12/2019	01/01/2020 – 31/12/2020									
Darakuta	188.48	206.53									
Monitoring equipment	Measured by bi-directional energy meter										
Measuring/reading/recording frequency	Continuous monitoring, hourly measurement and at least monthly recording. The data will be archived for two years after the crediting period.										
Calculation method (if applicable)	The 320 kW units and 75 kW are connected and export power through single energy meter only. The power generation meters is installed next to old unit (75 kW) to monitor the power generated from the old unit for easy deduction during emission estimation. The conservative estimation approach as described in the registered CPA DD is used in CER estimation during this monitoring period.										
QA/QC procedures	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.										
Purpose of data/parameter	Calculation of baseline emission.										
Additional comments	The data will be kept in reserve for two years after verification.										

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

Data/Parameter	EG _{BL,y}				
Unit	MWh/Year				
Description	Quantity of net electricity displaced in year y.				
Measured/calculated/Default	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.				
Source of data	Measured by energy meters				
Value(s) of monitored parameter	<p><u>To TANESCO mini-grid:</u></p> <table> <tr> <th>CPA</th><th>Power supplied to the mini-grid (MWh/year)</th></tr> <tr> <td>Ngombeni</td><td>0</td></tr> </table>	CPA	Power supplied to the mini-grid (MWh/year)	Ngombeni	0
CPA	Power supplied to the mini-grid (MWh/year)				
Ngombeni	0				
Monitoring equipment	Unidirectional and bidirectional energy meters.				
Measuring/reading/recording frequency	Continuous monitoring, daily measurement done for the electricity generated at the plant and monthly recording 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)	<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 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.

For Ngombeni CPA:

Data/parameter	Biomass Consumption
Unit	Tonnes/year
Description	Quantity of biomass consumed in year y
Measured/calculated/default	Measured
Source of data	The fuel consumed by the power plant will be measured at the fuel delivery system or taken from the plant records and log books.
Value(s) of monitored parameter	0
Monitoring equipment	Weigh bridge
Measuring/reading/recording frequency	The quantity of biomass was measured in batches.
Calculation method (if applicable)	Use mass or volume based measurements. If more than one type of biomass fuel was consumed, each was monitored separately. During the monitoring period, only single type of biomass, i.e., the biomass residue from coconut plantations was used in the CPA.
QA/QC procedures	Quality control and assurance was achieved through a daily check of the monitoring log sheet, which was signed by plant staff to acknowledge that the parameters are correct.
Purpose of data	<p>Cross-check of the measurements with an annual energy balance was done based on purchased quantities (e.g., with sales/receipts) and stock changes. The consistency of measurements ex post was checked with annual data on energy generation, biomass used and the efficiency of energy generation as determined ex ante. Here the amount of biomass brought into the power plant area is considered to be consumed for the power generation.</p> <p>The cross check showed that energy generated was not more than energy made available from biomass consumption reported during same period.</p>

Additional comments	Parameter listed as per methodology and PoA DD. This parameter is not used in the emission calculation.
---------------------	---

Data/parameter	NCV _{Biomass}
Unit	MJ/kg
Description	Net calorific value of biomass type k
Measured/calculated/default	Calculated
Source of data	Lab reports or standard sources such as IPCC
Value(s) of monitored parameter	0
Monitoring equipment	Measurement in the laboratories according to relevant national/international standards. NCV was measured based on wet biomass basis
Measuring/reading/recording frequency	Determined once in the first year or when a new biomass type is used and the value can be used for the rest of the crediting period.
Calculation method (if applicable)	Not applicable. NCV value is lab tested or referred from relevant national/international standards.
QA/QC procedures	Consistency of the measurements were checked by comparing the measurement results with relevant data sources (e.g., values in the literature, values used in the national GHG inventory, etc.) and default values by the IPCC.
Purpose of data	Parameter listed as per methodology and PoA DD. This parameter is not used in the emission calculations
Additional comments	The data will be archived for two years after the crediting period.

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	Measured by energy meters.																				
Value(s) of monitored parameter	<table><tr><th>CPA</th><th colspan="2">Power supplied to the grid (MWh/year)</th></tr><tr><th></th><th>01/01/2019 – 31/12/2019</th><th>01/01/2020 – 31/12/2020</th></tr><tr><td>Mbinga</td><td>2,636.00</td><td>3,668.83</td></tr><tr><td>Yovi</td><td>5,521.89</td><td>2,405.62</td></tr><tr><td>Tulila</td><td>24,181.27</td><td>32,600.92</td></tr><tr><td>Ikondo</td><td>29.51</td><td>365.72</td></tr></table>			CPA	Power supplied to the grid (MWh/year)			01/01/2019 – 31/12/2019	01/01/2020 – 31/12/2020	Mbinga	2,636.00	3,668.83	Yovi	5,521.89	2,405.62	Tulila	24,181.27	32,600.92	Ikondo	29.51	365.72
CPA	Power supplied to the grid (MWh/year)																				
	01/01/2019 – 31/12/2019	01/01/2020 – 31/12/2020																			
Mbinga	2,636.00	3,668.83																			
Yovi	5,521.89	2,405.62																			
Tulila	24,181.27	32,600.92																			
Ikondo	29.51	365.72																			
Monitoring equipment	Bidirectional energy meters.																				
Measuring/reading/recording frequency	Continuous monitoring, daily measurement done for the electricity generated at the plant and monthly recording 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</p>																				

	<p>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> <p><u>For Ikondo:</u></p> <p>The 350 kW unit and 80 kW are connected and export power through single energy meter only. The power generation meters installed next to both the generators are instantaneous meters only and the power generation from individual unit is not available. Because of this, the conservative estimation approach as described in the registered CPA DD is used in CER estimation during this monitoring period.</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	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.		
Source of data	Measured by energy meters		
Value(s) of monitored parameter	<div><div><div><div><div><div>CPA</div></div></div><div><div><div>Power supplied to isolated mini-grid (MWh/year)</div></div></div></div><div><div><div>01/01/2019 – 31/12/2019</div><div>01/01/2020 – 31/12/2020</div></div></div><div><div>Mbinga</div><div>90.74</div><div>78.21</div></div><div><div>Ikondo</div><div>443.70</div><div>438.49</div></div></div></div>		
Monitoring equipment	Unidirectional and bidirectional energy meters.		
Measuring/reading/recording frequency	Continuous monitoring, daily measurement done for the electricity generated at the plant and monthly recording 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)	Measurements are taken using energy meters. Bidirectional meters are installed so that the electricity supplied by TANESCO mini-grid to the project		

	<p>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> <p><u>For Ikondo:</u></p> <p>The 350 kW unit and 80 kW are connected and export power through single energy meter only. The power generation meters installed next to both the generators are instantaneous meters only and the power generation from individual unit is not available. Because of this, the conservative estimation approach as described in the registered CPA DD is used in CER estimation during this monitoring period.</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.

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 1: For electricity supplied to the national grid (AMS I.D. Grid connected renewable electricity generation).

For the part of electricity generated that was fed to the national grid, the CPA uses the AMS-I.D. (Version 17) and relevant equations.

Darakuta:

Darakuta hydro power plant is a capacity addition project to the existing 75 kW micro hydro power plant and supplies power to the national grid.

As the CPA is a renewable energy based capacity addition to an existing renewable energy power plant, the baseline emissions are calculated as per "*For capacity addition with renewable energy*

units other than photovoltaic, wind plants" approach provided in the registered PoA DD, version 08 page 42.

The baseline emissions from the electricity supply to the grid are calculated as,

$$BE_{Add,CO2,y,grid} = (EG_{PJ,add,y,grid} - EG_{BL,existing,y,grid}) \times EF_{CO2,grid,y}$$

Where,

$EG_{PJ,add,y,grid}$ = The total net electrical energy supplied to a grid in year y by all units, existing and new project units; (MWh)

$EG_{BL,existing,y,grid}$ = The estimated net electrical energy that would have been produced and supplied to a grid by existing units (installed before the project activity) in year y in the absence of the project activity; (MWh)

Where,

$$EG_{BL,existing,y,grid} = MAX (EG_{actual,y} \text{ or } EG_{estimated,y}) \text{ until } DATE_{baseline\ capacity\ addition}$$

and

$EG_{BL,existing,y,grid}$ is 0 on/after $DATE_{baseline\ capacity\ addition}$

Where,

$EG_{actual,y}$ = The actual, measured net electrical energy produced and supplied to the grid by the existing units in year y (MWh).

$EG_{estimated,y}$ = The estimated net electrical energy produced and supplied to the grid by the existing units in year y (MWh).

Table 21 provides the details of net power supplied to the national grid.

Table 21. Net electricity exported to grid from all existing and new units in Darakuta

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied ($EG_{PJ,add,y,grid}$)
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/01/2019	31/01/2019	180.66	0.00	180.66
01/02/2019	28/02/2019	143.36	0.00	143.36
01/03/2019	31/03/2019	178.46	0.00	178.46
01/04/2019	30/04/2019	192.60	0.00	192.60
01/05/2019	31/05/2019	202.80	0.00	202.80
01/06/2019	30/06/2019	202.16	0.00	202.16

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied ($EG_{PJ,add,y,grid}$)
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/07/2019	31/07/2019	171.69	0.00	171.69
01/08/2019	31/08/2019	205.69	0.00	205.69
01/09/2019	30/09/2019	163.09	0.02	163.07
01/10/2019	31/10/2019	186.25	0.00	186.25
01/11/2019	30/11/2019	182.74	0.00	182.74
01/12/2019	31/12/2019	167.54	0.00	167.54
Subtotal		2,177.04	0.00	2,177.02
01/01/2020	31/01/2020	194.90	0.00	194.90
01/02/2020	29/02/2020	181.48	0.00	181.48
01/03/2020	31/03/2020	171.27	0.00	171.27
01/04/2020	30/04/2020	150.00	0.00	150.00
01/05/2020	31/05/2020	157.57	0.00	157.57
01/06/2020	30/06/2020	166.59	0.00	166.59
01/07/2020	31/07/2020	164.20	0.00	164.20
01/08/2020	31/08/2020	193.82	0.00	193.82
01/09/2020	30/09/2020	193.93	0.00	193.93
01/10/2020	31/10/2020	198.28	0.00	198.28
01/11/2020	30/11/2020	179.77	0.00	179.77
01/12/2020	31/12/2020	189.98	0.00	189.98
Subtotal		2,141.79	0.00	2,141.79
Grand total		4,318.83	0.02	4,318.81

Table 22 provides the net electricity supplied to the grid from Darakuta hydro power plant. .

The normal lifetime of hydro power plants is 20 years. The date of baseline capacity additions is 2035. Therefore, this CPA will not claim any CERs after 31/12/2034.

Table 22. Net electricity supplied by Darakuta project to the grid

Time period		Total electricity supply to grid from all existing units ($EG_{PJ,add,y,grid}$)	Electricity supplied from 75 kW unit (Estimated) ($EG_{estimated,y}$)	Actual electricity supply from 75 kW unit $EG_{Actual,y}$	Conservative electricity supply from 75 kW unit $EG_{BL,Existing,y,grid}$	Net electricity supplied
From	To	(MWh)	(MWh)	(MWh)	(MWh)	(MWh)
		C	D	E	F	G=C-F
01/01/2019	31/01/2019	180.66	24.67	0.00	24.67	155.99
01/02/2019	28/02/2019	143.36	24.67	0.00	24.67	118.69
01/03/2019	31/03/2019	178.46	24.67	0.00	24.67	153.79
01/04/2019	30/04/2019	192.60	24.67	0.00	24.67	167.93
01/05/2019	31/05/2019	202.80	24.67	28.23	28.23	174.57
01/06/2019	30/06/2019	202.16	24.67	27.98	27.98	174.19
01/07/2019	31/07/2019	171.69	24.67	25.13	25.13	146.56
01/08/2019	31/08/2019	205.69	24.67	29.76	29.76	175.93
01/09/2019	30/09/2019	163.07	24.67	3.81	24.67	138.40
01/10/2019	31/10/2019	186.25	24.67	26.57	26.57	159.69
01/11/2019	30/11/2019	182.74	24.67	22.43	24.67	158.07
01/12/2019	31/12/2019	167.54	24.67	24.59	24.67	142.87
Subtotal		2,177.02	296.04	188.5	310.36	1,866.68
01/01/2020	31/01/2020	194.90	24.67	28.42	28.42	166.48
01/02/2020	29/02/2020	181.48	24.67	26.07	26.07	155.41
01/03/2020	31/03/2020	171.27	24.67	26.75	26.75	144.52
01/04/2020	30/04/2020	150.00	24.67	-	24.67	125.33
01/05/2020	31/05/2020	157.57	24.67	-	24.67	132.90
01/06/2020	30/06/2020	166.59	24.67	-	24.67	141.92
01/07/2020	31/07/2020	164.20	24.67	-	24.67	139.53
01/08/2020	31/08/2020	194.82	24.67	24.60	24.67	169.15
01/09/2020	30/09/2020	193.93	24.67	25.46	25.46	168.47
01/10/2020	31/10/2020	198.28	24.67	25.59	25.59	172.69
01/11/2020	30/11/2020	179.77	24.67	26.55	26.55	153.22
01/12/2020	31/12/2020	189.98	24.67	23.09	24.67	165.31
Subtotal		2,141.79	296.00	206.53	306.84	1,834.95
Grand total		4,318.81	592.08	395.01	617.17	3,701

The sample calculations for the baseline emissions under the CPA category 1 for the year 2019 (i.e., Jan to Dec 2019)

$$\text{Net electricity generation } (EG_{facility,y}) = (EG_{PJ,add,y,grid} - EG_{BL,existing,y,grid})$$

$$= 2,177.02 - 310.33 = 1,866.69 \text{ MWh}$$

Baseline emissions,

$$\begin{aligned} BE_{Add,CO_2,y,grid} &= (EG_{PJ,add,y,grid} - EG_{BL,exiting,y,grid}) \times EF_{CO_2,grid,y} \\ &= (1,866.69 \text{ MWh}) \times 0.530 \text{ tCO}_2/\text{MWh} \\ &= 989.37 \text{ tCO}_2 \end{aligned}$$

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

For the electricity fed into the isolated/TANESCO mini-grids, the CPA should use the methodology, AMS-I.F. (Version 02) and the relevant equations.

Baseline emissions

For new power plants at the site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant):

$$BE_{y(Category2)} = EG_{BL,y(Category2)} \times EF_{CO_2,y}$$

Where:

$BE_{y(Category2)}$ = Baseline emissions in year y (tCO₂) for mini-grids

$EG_{BL,y(Category2)}$ = 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 (tCO₂/MWh)

For the mini-grids, the emission factor is as of a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1. of AMS-I.F.

Ngombeni:

There was no power generation from this CPA during this monitoring period.

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/capacity addition projects) are also applicable to Category 3.

Yovi:

Yovi small power plant is a green field project and supplies power to national grid and it is expected to develop an isolated minigrid in the future.

Baseline emissions

As the Yovi CPA is a new power plant at the site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant), the baseline emissions are calculated as follows:

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

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

$BE_{y(Category\ 1)}$ = 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 23 provides the details of net electricity exported to the national grid.

Table 23. Net electricity exported to grid from Yovi

Time period		Electricity exported to grid	Electricity imported from grid	Net electricity exported $EG_{facility,y}$
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/01/2019	31/01/2019	513.691	0.000	513.691
01/02/2019	28/02/2019	394.258	0.000	394.258
01/03/2019	31/03/2019	545.071	0.001	545.070
01/04/2019	30/04/2019	534.960	0.000	534.960
01/05/2019	31/05/2019	48.394	0.000	48.394
01/06/2019	30/06/2019	449.802	0.006	449.796
01/07/2019	31/07/2019	579.176	0.000	579.176
01/08/2019	31/08/2019	535.454	0.000	535.454
01/09/2019	30/09/2019	632.121	0.000	632.121

Time period		Electricity exported to grid	Electricity imported from grid	Net electricity exported $EG_{\text{facility},y}$
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/10/2019	31/10/2019	461.410	0.000	461.410
01/11/2019	30/11/2019	463.300	0.000	463.300
01/12/2019	31/12/2019	364.260	0.001	364.259
Subtotal		5,521.897	0.008	5,521.889
01/01/2020	31/01/2020	398.190	0.000	398.190
01/02/2020	29/02/2020	326.660	0.000	326.660
01/03/2020	31/03/2020	302.760	0.000	302.760
01/04/2020	30/04/2020	145.520	0.000	145.520
01/05/2020	31/05/2020	89.340	0.000	89.340
01/06/2020	30/06/2020	0.000	0.000	0.000
01/07/2020	31/07/2020	0.000	0.000	0.000
01/08/2020	31/08/2020	0.000	0.000	0.000
01/09/2020	30/09/2020	0.000	0.000	0.000
01/10/2020	31/10/2020	249.470	0.000	249.470
01/11/2020	30/11/2020	440.480	0.000	440.480
01/12/2020	31/12/2020	453.200	0.000	453.200
Subtotal		2,405.62	0	2,405.62
Grand total		7,927.52	0.01	7,927.51

The sample calculations for the baseline emissions under the CPA category 3 for the year 2019 (i.e., Jan to Dec 2019)

a) For power supplied to TANESCO grid:

$$\begin{aligned}
 BE_{y(\text{Category1})} &= EG_{BL,y,(\text{Category1})} \times EF_{CO_2,grid,y} \\
 &= 5,521.89 \text{ MWh} \times 0.530 \text{ tCO}_2/\text{MWh} \\
 &= 2,926.66 \text{ tCO}_{2e}
 \end{aligned}$$

b) For power supplied to mini grid:

$$BE_{y(Catogory2)} = EG_{BL,y,(Catogory2)} \times EF_{CO2,y}$$

= 0 (since the mini-grid is not yet established under Yovi CPA)

Tulila:

Tulila hydroelectric power plant is a green field project and supplies power to the national grid as well as to the mini-grid. Currently, Tulila power plant is supplying power to the mini-grid as well as national grid, the CPA started to supply to the national grid in September 2018 after extension of the national grid to Ruvuma region.

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

$$BE_{y(Category 1)} = EG_{BL,y,(Catogory1)} \times EF_{CO2,grid,y}$$

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

$EG_{BL,y,(Catogory1)}$ = Quantity of net electricity supplied to the national grid as a result of the implementation of the CDM project activity in year y (MWh)

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

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

$$BE_{y(Category 2)} = EG_{BL,y,(Catogory2)} \times EF_{CO2,y}$$

Where:

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

$EG_{BL,y,(Catogory2)}$ = Quantity of net electricity supplied to the mini-grid as a result of the implementation of the CDM project activity in year y (MWh)

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

Table 24 provides the details of the net electricity supplied to TANESCO national grid.

Table 24. Net electricity exported to and imported from the grid by Tulila (from 01/01/2019 to 31/12/2020)

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied (EG _{facility,y})
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/01/2019	31/01/2019	2,693.55	0.01	2,693.54
01/02/2019	28/02/2019	2,306.46	0.00	2,306.46

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied (EG _{facility,y})
From	To	(MWh)	(MWh)	(MWh)
		A	B	C=A-B
01/03/2019	31/03/2019	2,795.56	0.00	2,795.56
01/04/2019	30/04/2019	2,745.58	0.00	2,745.58
01/05/2019	31/05/2019	2,983.71	0.01	2,983.70
01/06/2019	30/06/2019	2,216.34	0.00	2,216.34
01/07/2019	31/07/2019	1,940.86	0.00	1,940.86
01/08/2019	31/08/2019	1,512.22	0.00	1,512.22
01/09/2019	30/09/2019	1,103.02	0.00	1,103.02
01/10/2019	31/10/2019	853.62	0.00	853.62
01/11/2019	30/11/2019	634.21	0.01	634.20
01/12/2019	31/12/2019	2,396.17	0.00	2,396.17
Subtotal		24,181.3	0.03	24,181.27
01/01/2020	31/01/2020	2,707.80	0.01	2,707.79
01/02/2020	29/02/2020	2,853.84	0.00	2,853.84
01/03/2020	31/03/2020	3,044.34	0.00	3,044.34
01/04/2020	30/04/2020	3,230.02	0.00	3,230.02
01/05/2020	31/05/2020	3,524.84	0.00	3,524.84
01/06/2020	30/06/2020	3,474.60	0.00	3,474.60
01/07/2020	31/07/2020	3,353.18	0.00	3,353.18
01/08/2020	31/08/2020	3133.57	0.00	3,133.57
01/09/2020	30/09/2020	2311.61	0.00	2,311.61
01/10/2020	31/10/2020	1911.22	0.00	1,911.22
01/11/2020	30/11/2020	1354.08	0.01	1,354.07
01/12/2020	31/12/2020	1,701.84	0.00	1,701.84
Subtotal		32,600.94	0.02	32,600.92
Grand total		56,782.24	0.05	56,782.19

Baseline emissions,

$$\begin{aligned}
 BE_{y(Catogory1)} &= EG_{BL,y,(Catogory1)} \times EF_{CO2,grid,y} \\
 &= 24,181.27 \text{ MWh} \times 0.530 \text{ tCO}_2/\text{MWh} \\
 &= 12,816.31 \text{ tCO}_{2e}
 \end{aligned}$$

Ikondo:

Ikondo micro hydro power plant is a capacity addition project to the existing 80 kW micro hydro power plant and supplies power to the national grid as well as to the isolated mini-grid.

As the CPA is a renewable energy based capacity addition to an existing renewable energy power plant, the baseline emissions are calculated as per “*For capacity addition with renewable energy units other than photovoltaic, wind plants*” approach provided in the registered PoA DD, version 08 page 42.

a) For power supplied to TANESCO grid:

The baseline emissions from the electricity supply to the grid are calculated as,

$$BE_{Add,co2,y,grid} = (EG_{PJ,add,y,grid} - EG_{BL,existing,y,grid}) \times EF_{co2,grid,y}$$

Where,

$EG_{PJ,add,y,grid}$ = The total net electrical energy supplied to a grid in year y by all units, existing and new project units; (MWh)

$EG_{BL,existing,y,grid}$ = The estimated net electrical energy that would have been produced and supplied to a grid by existing units (installed before the project activity) in year y in the absence of the project activity; (MWh)

Where,

$$EG_{BL,existing,y,grid} = MAX (EG_{actual,y} \text{ or } EG_{estimated,y}) \text{ until } DATE_{baselinecapacityaddition}$$

and

$$EG_{BL,existing,y,grid} \text{ is } 0 \text{ on/after } DATE_{baselinecapacityaddition}$$

Where,

$EG_{actual,y}$ = The actual, measured net electrical energy produced and supplied to the grid by the existing units in year y (MWh).

$EG_{estimated,y}$ = The estimated net electrical energy produced and supplied to the grid by the existing units in year y (MWh).

The annual average actual power produced from the 80 kW unit was calculated using the historic data from 2010-2015. Similarly, the estimated electricity generation from the 80 kW unit was calculated using the standard operating hours and the plant load factor. Table 25 provides the values of power supply considering the grid export.

Table 25. The value of power supply considering export to the grid

Parameter	Total estimated (MWh)	Percentage supply to grid	Value to be considered (MWh)
$EG_{actual,y}$	79	28.5	22
$EG_{estimated,y}$	245		69

As per methodology, the maximum of the two values, i.e., $EG_{estimated,y}$ is considered for $EG_{BL,existing,y,grid} = 69$ MWh.

The existing 80 kW unit was installed in 2005. Considering the standard operating life of 25 years for hydro power plants, the $DATE_{baselinecapacityaddition}$ for existing 80 kW plant is 31/12/2024.

During the monitoring period, a separate energy meter was not installed to measure the power generation from the 80 kW unit. So as a conservative measure, the estimated power supply from 80 kW unit to the grid, i.e., 69 MWh as per CPA-DD is considered. Table 26 provides the net electricity export to grid from Ikondo power plant.

Table 26. Net electricity exported to grid from Ikondo

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied to the TANESCO grid	Electricity contribution from the 80 kW unit (MWh) ¹⁸	Net electricity supplied ($EG_{facility,y}$)
From	To	(MWh)	(MWh)	(MWh)	(MWh)	(MWh)
		A	B	C=A-B	D	E=C-D
01/01/2019	31/01/2019	0.00	0	0.00	0.00	0.00
01/02/2019	28/02/2019	0.00	0	0.00	0.00	0.00
01/03/2019	31/03/2019	0.00	0	0.00	0.00	0.00
01/04/2019	30/04/2019	0.00	0	0.00	0.00	0.00
01/05/2019	31/05/2019	0.00	0	0.00	0.00	0.00
01/06/2019	30/06/2019	0.00	0	0.00	0.00	0.00
01/07/2019	31/07/2019	0.00	0	0.00	0.00	0.00
01/08/2019	31/08/2019	0.00	0	0.00	0.00	0.00
01/09/2019	30/09/2019	31.17	1.11	30.06	5.75	24.31
01/10/2019	31/10/2019	12.86	1.91	10.95	5.75	5.20

¹⁸ 69 MWh for 12 months. For one month = $69/12 = 5.75$ MWh

Time period		Electricity supplied to TANESCO grid	Electricity imported from TANESCO grid	Net electricity supplied to the TANESCO grid	Electricity contribution from the 80 kW unit (MWh) ¹⁸	Net electricity supplied ($EG_{facility,y}$)
From	To	(MWh)	(MWh)	(MWh)	(MWh)	(MWh)
		A	B	C=A-B	D	E=C-D
01/11/2019	30/11/2019	3.36	1.6	1.76	1.76	0.00
01/12/2019	31/12/2019	0.00	0	0.00	0.00	0.00
Subtotal		47.39	4.62	42.77	13.26	29.51
01/01/2020	31/01/2020	0.00	0	0.00	0.00	0.00
01/02/2020	29/02/2020	17.69	0.63	17.06	5.75	11.31
01/03/2020	31/03/2020	15.50	0.52	14.98	5.75	9.23
01/04/2020	30/04/2020	14.92	0.41	14.51	5.75	8.76
01/05/2020	31/05/2020	92.23	0.62	91.61	5.75	85.86
01/06/2020	30/06/2020	36.76	0.74	36.02	5.75	30.27
01/07/2020	31/07/2020	82.46	0.08	82.38	5.75	76.63
01/08/2020	31/08/2020	69.37	0.25	69.12	5.75	63.37
01/09/2020	30/09/2020	38.18	0.12	38.06	5.75	32.31
01/10/2020	31/10/2020	44.48	0.6	43.88	5.75	38.13
01/11/2020	30/11/2020	9.58	0.26	9.32	5.75	3.57
01/12/2020	31/12/2020	12.10	0.07	12.03	5.75	6.28
Subtotal		433.27	4.3	428.97	63.25	365.72
Total		480.66	8.92	471.74	76.51	395.23

The sample calculations for the baseline emissions under the CPA category 3 for the year 2019 (i.e., Jan to Dec 2019)

$$\text{Net electricity generation } (EG_{facility,y}) = (EG_{PJ,add,y,grid} - EG_{BL,exiting,y,grid})$$

$$= 42.77 - 13.26 = 29.51 \text{ MWh}$$

Baseline emissions,

$$BE_{Add,co2,y,grid} = (EG_{PJ,add,y,grid} - EG_{BL,exiting,y,grid}) \times EF_{co2,grid,y}$$

$$= 29.51 \text{ MWh} \times 0.530 \text{ tCO}_2/\text{MWh}$$

$$= 15.64 \text{ tCO}_2$$

b) For power supplied to the mini-grid

The baseline emissions from the electricity supplied to mini-grid are calculated as,

$$BE_{Add,co2,y,MG} = (EG_{PJ,add,y,MG} - EG_{BL,existing,y,MG}) \times EF_{co2,grid,y}$$

Where,

$EG_{PJ,add,y,MG}$ = The total net electrical energy supplied to a mini-grid in year y by all units, existing and new project units; (MWh)

$EG_{BL,existing,y,MG}$ = The estimated net electrical energy that would have been produced and supplied to a mini-grid by existing units (installed before the project activity) in year y in the absence of the project activity; (MWh)

Where,

$$EG_{BL,existing,y,MG} = \text{MAX} (EG_{actual,y} \text{ or } EG_{estimated,y}) \text{ until } DATE_{baselinecapacityaddition}$$

and

$EG_{BL,existing,y,MG}$ is 0 on/after $DATE_{baselinecapacityaddition}$

Where,

$EG_{actual,y}$ = The actual, measured net electrical energy produced and supplied to the mini-grid by the existing units in year y (MWh)

$EG_{estimated,y}$ = The estimated net electrical energy produced and supplied to the mini-grid by the existing units in year y (MWh)

The annual average actual power produced from 80 kW unit was calculated from the historic data from 2010-2015. Similarly, the estimated electricity generation from the 80 kW unit was calculated using standard operating hours and plant load factor. The values of power supply considering mini-grid export are given in the table 27.

Table 27. The value of power supply considering export to the mini-grid

Parameter	Total estimated (MWh)	Percentage supply to mini-grid	Value to be considered (MWh)
$EG_{actual,y}$	79	71.50	57
$EG_{estimated,y}$	245		175

As per methodology, the maximum of the two values, i.e., $EG_{estimated,y}$ is considered for $EG_{BL,existing,y,MG} = 175$ MWh.

During the monitoring period, a separate energy meter was not installed to measure the power generation from the 80 kW unit. So as a conservative measure, the estimated power supply from 80 kW unit to mini-grid i.e., 175 MWh as per CPA DD is considered.

Table 28 provides the details of net electricity exported to the mini-grid.

Table 28. Net electricity exported to mini-grid from Ikondo

Time period		Electricity exported to mini- grid	Electricity contribution from 80 kW unit	Net electricity generation (EG _{facility,y})
From	To	(MWh)	(MWh)	(MWh)
01/01/2019	31/01/2019	62.99	14.58	48.40
01/02/2019	28/02/2019	37.33	14.58	22.75
01/03/2019	31/03/2019	42.30	14.58	27.71
01/04/2019	30/04/2019	56.01	14.58	41.42
01/05/2019	31/05/2019	49.30	14.58	34.72
01/06/2019	30/06/2019	46.81	14.58	32.22
01/07/2019	31/07/2019	57.10	14.58	42.51
01/08/2019	31/08/2019	62.57	14.58	47.98
01/09/2019	30/09/2019	55.82	14.58	41.24
01/10/2019	31/10/2019	54.36	14.58	39.77
01/11/2019	30/11/2019	45.72	14.58	31.13
01/12/2019	31/12/2019	48.41	14.58	33.83
Subtotal		618.72	174.96	443.68
01/01/2020	31/01/2020	49.46	14.58	34.88
01/02/2020	29/02/2020	41.61	14.58	27.02
01/03/2020	31/03/2020	46.49	14.58	31.90
01/04/2020	30/04/2020	40.99	14.58	26.40
01/05/2020	31/05/2020	42.07	14.58	27.49
01/06/2020	30/06/2020	49.13	14.58	34.55
01/07/2020	31/07/2020	51.70	14.58	37.12
01/08/2020	31/08/2020	52.83	14.58	38.24
01/09/2020	30/09/2020	56.05	14.58	41.47
01/10/2020	31/10/2020	53.60	14.58	39.02
01/11/2020	30/11/2020	49.00	14.58	34.41

Time period		Electricity exported to mini- grid	Electricity contribution from 80 kW unit	Net electricity generation ($EG_{\text{facility},y}$)
From	To	(MWh)	(MWh)	(MWh)
01/12/2020	31/12/2020	80.58	14.58	65.99
Subtotal		613.50	175.00	438.50
Total		1,232.23	349.92	882.17

The sample calculations for the baseline emissions under the CPA category 3 for the year 2019 (i.e., Jan to Dec 2019)

$$\begin{aligned} \text{Net electricity generation } (EG_{\text{facility},y}) &= (EG_{PJ,add,y,grid} - EG_{BL,exiting,y,grid}) \\ &= 618.72 - 174.96 = 443.68 \text{ MWh} \end{aligned}$$

Baseline emissions,

$$\begin{aligned} BE_{Add,co2,y,MG} &= (EG_{PJ,add,y,MG} - EG_{BL,exiting,y,MG}) \times EF_{co2,grid,y} \\ &= 443.68 \text{ MWh} \times 0.8 \text{ tCO}_2/\text{MWh} \\ &= 354.96 \text{ tCO}_2 \end{aligned}$$

Table 29 gives the baseline emissions for each of the CPA based on the power supply to the grid or mini-grid.

Table 29. Baseline emissions from the CPAs

Time period		Type of grid export	Net electricity generation $EG_{\text{facility},y}$	Emission factor	Baseline emission BE_y
From	To		(MWh)	(tCO ₂ /MWh)	(tCO ₂)
			C	D	E =C*D
Mbinga					
01/01/2019	31/12/2020	Mini-grid	168	0.8	135
01/01/2019	31/12/2020	National grid	6,304	0.53	3,341
Yovi					
01/01/2019	31/12/2020	National grid	7,927	0.53	4,201
Tulila					
01/01/2019	31/12/2020	National grid	56,782	0.53	30,095
Ngombeni					
01/01/2019	31/12/2020	Mini-grid	0	0	0

Time period		Type of grid export	Net electricity generation $EG_{\text{facility},y}$	Emission factor	Baseline emission BE_y
From	To		(MWh)	(tCO ₂ /MWh)	(tCO ₂)
			C	D	E =C*D
Ikondo					
01/01/2019	31/12/2020	Mini-grid	882	0.8	705
01/01/2019	31/12/2020	National grid	395	0.53	209
Darakuta					
01/01/2019	31/12/2020	National grid	3,701	0.53	1,961
Total baseline emissions					40,647

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

All the CPAs generating power from hydro sources are run-of-the-river type power projects. Hence, the project emission is considered as zero.

$$PE_{y(\text{Category1})} = 0$$

F.3. Calculation of leakage emissions

As per the AMS I.D and AMS I.F, the leakage has to be considered, if there is any energy generating equipment transfer from another activity. The CPAs (Mbinga, Tulila, Yovi, Ngombeni, Ikondo and Darakuta) under this PoA were not involved 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 until 31/12/2020	From 01/01/2021	Total amount
9904-P1-0003-CP1	3,476	0	0	0	3,476	0	3,476
9904-P1-0004-CP1	4,201	0	0	0	4,201	0	4,201

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 until 31/12/2020	From 01/01/2021	Total amount
9904-P1-0005-CP1	30,095	0	0	0	30,095	0	30,095
9904-P1-0007-CP1	0	0	0	0	0	0	0
9904-P1-0008-CP1	914	0	0	0	914	0	914
9904-P1-0009-CP1	1,961	0	0	0	1,961	0	1,961
Total	40,647	0	0	0	40,647	0	40,647

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	3,476	6,481
9904-P1-0004-CP1	4,201	18,045
9904-P1-0005-CP1	30,095	47,170
9904-P1-0007-CP1	0	24,038
9904-P1-0008-CP1	914	2,832
9904-P1-0009-CP1	1,961	3,963
Total	40,647	102,529

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

The ex-ante for this monitoring is calculated from 01/01/2019 to 31/12/2020. Refer monitoring ER sheet for the ex-ante emission reduction values.

F.6. Remarks on increase in achieved emission reductions

The overall CER generated from five CPAs during the reported monitoring period is 60% less than the overall estimated CERs from the respective registered CPA DDs.

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

All the CPAs covered in this monitoring report are small scale Type I projects whose installed capacity is less than the renewable energy project activities with a maximum output capacity of 15 MW. Table 30 provides the installed capacity of all the CPAs covered in this monitoring report.

Table 30. Installed capacity of the CPAs covered in this monitoring report

No.	CPA reference no.	Installed capacity (MW)	Remarks
1	9904-P1-0003-CP1	1.060	It is evident that the installed capacity of the CPAs covered in this monitoring report are less than the small scale threshold limit of 15 MW.
2	9904-P1-0004-CP1	1	
3	9904-P1-0005-CP1	5	
4	9904-P1-0007-CP1	2.5	
5	9904-P1-0008-CP1	0.430	
6	9904-P1-0009-CP1	0.395	

- - - - -

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	6 April 2021	Revision to: <ul style="list-style-type: none"> • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
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		