COMPONENT PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE COMPONENT PROJECT ACTIVITIES (F-CDM-SSC-CPA-DD) Version 02.0

COMPONENT PROJECT ACTIVITIES DESIGN DOCUMENT (CPA-DD)

SECTION A. General description of CPA

A.1. Title of the proposed or registered PoA

Promotion of Small Hydro Power in Solomon Islands

A.2. Title of the CPA

Auki Hydropower Project, Malaita, Solomon Islands, Unique identification code: SI- HP-CPA-01.
Version: 1
Dale of Completion: 10/11/2012

A.3. Description of the CPA

Auki Hydropower project (hereafter referred as 'Project') is a 1.16 MW run-of-river hydropower project to be built on the Fiu River which passes behind Auki town on its lower part. The project will involve relatively long canal of 3000m and a penstock of 755m. The powerhouse will be located at 86m elevation. The CPA's estimated annual gross power generation is 2.974 GWh[1].

Malaita is one of the six main islands, which make up the Solomon Islands. Auki is the largest town in Malaita Province. Malaita is the country's most populated island with a population of around 170,000 i.e. more than a third of national population and growth of around 3.3% per annum. Currently approximately only 4% of the population in the Malaita province has access to electricity. The electricity is generated by Solomon Islands Electricity Authority (SIEA) power station using diesel-based generation -sets at a power plant located at the outskirts of Auki. Although the installed capacity is 1.16 MW, the currently available capacity is 0.680MW[2]. The proposed project activity will provide an economical, reliable and cleaner energy source to the un-served population as well as the growing power demand of the region and will reduce the GHG intensity of Malaita mini grid by avoiding new diesel plants.

The project's contributions to the sustainable development of the local area as well as the host country are as follows:

Social:

- Ø Un-served communities in and around provincial centres will gain a much desired electricity supply.
- Ø Already connected customers will gain a more reliable and cheaper power supply.
- Ø Improved living standard with access to electricity, specially for women who are responsible for household chores, child and aged care
- Ø Electricity supply will improve conditions at schools, health clinics and community facilities especially in areas of new connection

[1] The generation is expected to thereafter increase 4% per annum with increase in electricity requirement.
[2] One of the engines faced catastrophic failure in March 2010

- For remote communities in particular, access roads that will be built to service the hydropower plants will significantly improve access to health services and schools.

Environment:

- The project activity is a run-of-river hydroelectric power plant. It is a well established technology which utilizes water for energy generation without depleting it or impacting the natural environment.
- Since the project activity generates electricity from renewable source, it avoids SOx, NOx and other particulates matter emission associated fossil fuel fired plants.

Economy:

- Jobs, training and income generation during construction and operation through direct employment.
- Income generation opportunities as a result of increased human activity in the area.
- Potential for improved working conditions. Possible activities include better marketing of fish (through fish freezing, ice production), increase in trading activities, etc.
- Increased working hours in remote areas with currently no access to electricity.

Technology:

- Numerous studies and investigations on hydropower carried out in Solomon Islands have concluded that the country is well endowed with hydropower resources. Successful implementation of the project activity will lead to replication of similar activity.

A.4. Entity/individual responsible for CPA

CPA implementer will be an Independent Power Producer (IPP). Decision is yet to be taken.

A.5. Technical description of the CPA

The Auki hydro project will develop a 1.16MW hydropower run-of-river project on the Fiu River. The Fiu River passes behind Auki town on its lower part. The project will involve relatively long canal of 3000m and a penstock of 755m.The powerhouse will be located at 86m elevation. The project is expected to generate 2,974 MWh of electricity per year from 2014. The electricity generated will be supplied to Malaita mini grid. Currently the grid is fed by diesel fired power plants.

The powerhouse will be equipped with a single jet Turgo turbine which is considered optimal based on the head and flow variability. As per the Feasibility Study Report, the plant's load factor is 0.586[3] and average lifetime is 25 years[4]. The expected power output from the project activity is 0.68 MW.

The powerhouse would be remote controlled through a SCADA system. The power extraction would require an 11kV power line of 9.6km to the SIEA diesel power plant where it will be connected to the 11kV bus bar supplying Auki's two feeders. The electricity generated by the CPA will be metered through the multifunction electricity meter(s) (the main meter M1 and the backup meter M2) at the point of generation before evacuation of the power to the transmission line.

[3] Based on Feasibility Study Report
[4] Industry Standards

. Key information related to the project is provided in the Table below.

Table 1: Key project information

Basic Project Location	Fiu River, Malaita
Dam Height, m	No dam
Estimated number of people to be displaced	Nil
Rated Power Output	1,160 kW
Turbine type	Single jet Turgo turbine
Water Storage Type	Run of River
River Diversion Scheme	In-stream flow regulation
Type of power demand to address	Base Load

A.6. Party(ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) CPA implementer(s) (as applicable)	Indicate if the Party involved wishes to be considered as CPA implementer (Yes/No)
Solomon Islands	Public entity –Solomon Islands Electricity Authority (SIEA)[5]	No

A.7. Geographic reference or other means of identification

>>

The CPA is located on Fiu River in Malaita province of Solomon Islands. The project coordinates are 8°50' 36.76" S and 160° 42' 43.47" E (see figure below).

[5] Government of SI will borrow money for implementation of the project from multi-lateral agencies such as AD or World Bank.

Figure 1: Project Location

A.8. Duration of the CPA
A.8.1. Start date of the CPA

01/11/2013 (Expected date for award of EPC contract)

A.8.2. Expected operational lifetime of the CPA
The expected operational lifetime of the CPA is 25 years and 0 months.

A.9. Choice of the crediting period and related information
Renewable crediting period

A.9.1. Start date of the crediting period
01/06/2017 or date of commissioning of the plant, whichever is later

A.9.2. Length of the crediting period
7 years x 3= 21 years
It may be noted that at no point the crediting period of the CPA will exceed life of PoA, i.e. the maximum crediting period of the CPA will be limited up to last date of 28 years length of PoA.

A.10. Estimated amount of GHG emission reductions

Emission reductions during the crediting period	
Years	**Annual GHG emission reductions (in tonnes of CO_2e) for each year**
Year 1	2,189
Year 2	2,277
Year 3	2,368
Year 4	2,462
Year 5	2,561
Year 6	2,663
Year 7	2,770
Total number of crediting years	**7**
Annual average GHG emission reductions over the crediting period	**2,470**
Total estimated reductions (tonnes of CO_2e)	**17,289**

A.11. Public funding of the CPA

The Project does not receive any public funding and do not have any diversion of ODA.

A.12. Debundling of small-scale component project activities

As described in section C of the PoA-DD, the de-bundling check for the CPA has been carried out according to the Guidelines on Assessment of De-bundling for SSC Project Activities, Version 3, Annex 13, EB 54, section II - Guidance for Determining the Occurrence of De-bundling under a Programme of Activities (PoA).

According to the guidelines, for the purposes of registration of a Programme of Activities (PoA), a proposed small-scale CPA of a PoA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity, which satisfies both conditions (a) and (b) below:

(a) Has the same activity implementer as the proposed small scale CPA or has a coordinating or managing entity, which also manages a large scale PoA of the same technology/measure, and;
(b) The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

In case of the Auki Hydropower project, both the above conditions are not applicable. Therefore, the project is not a de-bundled component.

A.13. Confirmation for CPA

By using the precise geographical coordinates of the Auki Hydropower project provided in section A.7 and comparing it with the electronic database as described in section C of the PoA-DD, it has been established there is no other registered CPA of a PoA, an application to register another small-scale CPA of a PoA or another registered CDM project activity.

Moreover, the coordinating entity does not manage another PoA of the same sectoral scope within Solomon Islands.

Further the CPA implementer has provided a statement to the CME confirming the following:

- The type of CPA entity involved in the CPA.

- The CPA is a voluntary action, and not mandated by the national law or regulatory.
- The CPA activity is not registered, and has not submitted for registration, neither as an individual CDM project activity, nor as part of another registered PoA.
- The CPA does not receive public funding and does not result in ODA.[6]

SECTION B. Environmental analysis
B.1. Analysis of the environmental impacts

The proposed project is consistent with environmental strategy and priorities of the host country. The Environment Act (1998) and associated Regulations determine the environmental impact assessment and approvals process in the Solomon Islands.

In order to comply with the EIA process a Screening Report and a Scoping Report must be submitted to the MECDM Environment and Conservation Division (ECD) as the consent authority. As per the screening report, a detailed EIA for the project activity will be carried out in accordance with the national regulations.

Different effects on the environment could occur during construction and operation phases of the project. Construction related effects are primarily erosion, and sediment and other contaminant-laden discharges to the water ways, affecting water quality. The environmental impacts of a typical project related to construction activities may include: water pollution; air and noise pollution. There may be some impacts on the local populations during construction stage.

Appropriate mitigation measures is planned to be developed through the EIA and the Construction Environmental Management Plan (CEMP). During operation project activity may have some impact on river habitat, sediment transport, water quality and riparian groundwater levels. These effects will be studied in the EIA to be carried out for this project but no serious negative impacts are envisaged in the project activity.

SECTION C. Local stakeholder comments
C.1. Solicitation of comments from local stakeholders

The stakeholder consultation has been carried out at the PoA level.
C.2. Summary of comments received

As above

C.3. Report on consideration of comments received

As above

SECTION D. Eligibility of CPA and Estimation of emissions reductions
D.1. Title and reference of the approved baseline and monitoring methodology(ies) selected:

The following methodology has been applied
AMS-I.F. 'Renewable electricity generation for captive use and mini-grid' (AMS-I.F., version 02, Sectoral scope: 01, EB 61)[7].

[6] The above declarations will be provided by the CPA implementer.

Tool to calculate baseline, project, and/or leakage emission from electricity consumption[8]" (version 01)

D.2. Application of methodology(ies)

Para No	Applicability Criteria as per AMS-I.F. version 02	Project Scenario
1	This methodology comprises renewable energy generation units, such as solar, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s).	The CPA consists of run-of-river hydropower plant that supplies electricity to the users.
2	The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e., in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below: a) A national or a regional grid (grid hereafter); b) Fossil fuel fired captive power plant; c) A carbon intensive mini-grid.	The CPA will displace electricity from the Auki mini grid which consists of diesel based generating units.
3	For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e., the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid.	Under this CPA the electricity generated is supplied to Auki mini grid which has an installed capacity of 1.16 MW, less than 15 MW.
4	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: · The project activity is implemented in an existing reservoir with no change in the volume of reservoir; · The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; · The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater	The Auki Hydropower project is a run-of-river project. Hence this condition is not relevant.

[7] http://cdm.unfccc.int/filestorage/4/1/J/41JF08WD9MSEB5YLHTZ6KVAPUC7XNQ/EB61_repan18_Revision_%20AMS-I.F_ver02.pdf?t=UFN8bThjNXJyfDAx87Tr7qsShjwso533hH7T

[8] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

	than 4W/m^2.	
5	For biomass power plants, no other biomass other than renewable biomass is to be used in the project plant.	This PoA does not involve biomass power plant and hence this condition is Not Applicable.
6	This methodology is applicable for project activities that: a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); b) involve a capacity addition c) involve a retrofit of (an) existing plant(s); or d) involve a replacement of (an) existing plant(s).	The Auki Hydropower involves installation of a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant). Hence condition (a) is applicable.
7	In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The CPA is a greenfield project. Hence this condition is Not Applicable
8	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The CPA is a greenfield project. Hence this condition is Not Applicable
9	If the unit added has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The CPA is a greenfield run-of river hydro power project with capacity less than 15MW. Hence this condition is Not Applicable
10	Combined heat and power (co-generation) systems are not eligible under this category.	Combined heat and power systems are not considered in this PoA and CPA. Hence this condition is Not Applicable.
11	If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions.	The CPA will provide electricity to Auki mini grid. Even if the electricity produced is delivered to another facility or facilities within the project boundary the CPA implementer will enter into a contract with the consumer(s) of the electricity specifying that only the facility generating the electricity can claim emission reductions from the electricity displaced.
12	In the specific case of biomass project activities the applicability of the methodology is limited to either project activities that use biomass residues only or biomass from dedicated plantations complying with the applicability	This PoA and CPA does not involve biomass power plant and hence this condition is Not Applicable.

	conditions of AM0042.	
13	In the specific case of biomass project activities the determination of leakage shall be done following the general guidance for leakage in small-scale biomass project activities (attachment C of Appendix B of simplified modalities and procedures for small-scale clean development mechanism project activities; decision 4/CMP.1) or following the procedures included in the leakage section of AM0042.	This PoA and CPA does not involve biomass power plant and hence this condition is Not Applicable.
14	In case the project activity involves the replacement of equipment, and the leakage from the use of the replaced equipment in another activity is neglected because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.	This applicability condition is no more a requirement for PoA's under Type I methodology as concluded in SSC-WG 34th meeting[9].

In accordance with applicable provisions for project activity eligibility in the Project standard the proposed CPA qualifies as Type I project activity during every year of the crediting period. As proposed CPA is a renewable energy (small hydro) project with a maximum output capacity of 1.16 MW (i.e. less then allowed maximum capacity of 15 MW).

D.3. Sources and GHGs

The GHG emission sources included in or excluded from the project boundary are as follows:

[9] Please refer SSC-WG 34th meeting recommendations to the EB and corresponding EB decision http://cdm.unfccc.int/Panels/ssc_wg/meetings/034/ssc_034_report.pdf and http://cdm.unfccc.int/methodologies/SSCmethodologies/clarifications/63945

Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity (Auki Mini grid)	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	CO_2 emissions from combustion of fossil fuels for electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	No	Excluded as the project is a run of the river hydro power plant.
		N_2O	No	Minor emission source

The Auki Hydropower plant is located within the boundaries of the Solomon Islands.

As per AMS-I.F. version 02 - *In the case of electricity generated and supplied to distributed users (e.g. residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of renewable generating units. The boundary also extends to the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.*

For the project activity, the generated electricity of the project will be delivered to the Auki Mini grid, and the auxiliary internal power consumption of hydropower plant is also contained in the project boundary. A schematic view of the boundary for the CPA is shown in figure below:

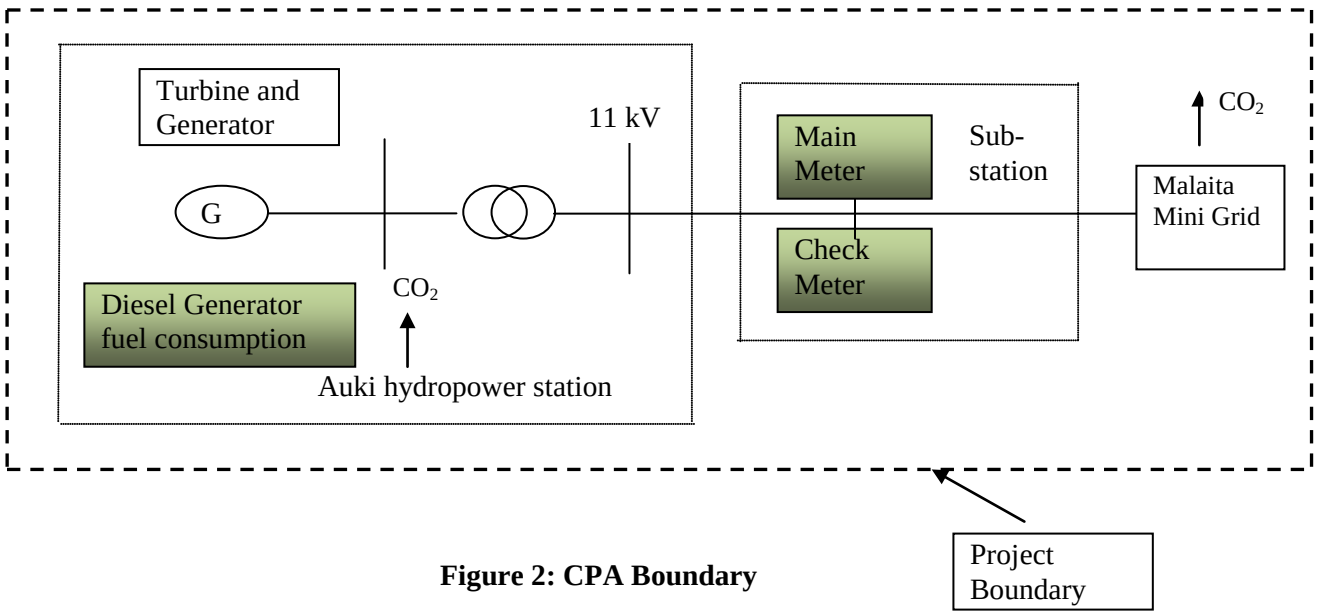

Figure 2: CPA Boundary

D.4. Description of the baseline scenario

The baseline scenario, being the most likely scenario that would occur in absence of the CPA, is the continuation of electricity generation using diesel in the Auki mini grid. As per AMS-I.F. Table I.F.1 the grid emission factor for Auki grid which exclusively operates on diesel is 0.8 tCO_2 /MWh.
The details of power plants supplying to Auki mini-grid is provided in Appendix 4.

D.5. Demonstration of eligibility for a CPA

The CPA will be able to apply for inclusion in the PoA as it meets the following criteria:

Sr. No	Eligibility Criteria	Justification
1	The CPA should be a new hydro power plant at a site where there is no other existing renewable energy power project.	The CPA is a new renewable energy power plant that will be installed at a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant). Hence the CPA meets the eligibility criteria.
2	The CPA should be located within the geographical boundary of Solomon Islands	The CPA is located within the geographical boundary of Solomon Islands. Hence the CPA meets the eligibility criteria.
3	The CPA should meet the applicability requirements of all the relevant CDM methodologies – AMS-I.F. version 02 EB 61, AMS-I.D. version 17, EB 60 as determined in section B.3	The CPA meets all the applicability requirements of AMS-I.F. version 02 as described below. Hence the CPA meets the eligibility criteria.
4	The CPA should have an installed capacity of $\leq$5 MW	The CPA has an installed capacity of 1.16 MW i.e. less than 5 MW. Hence the CPA meets the eligibility criteria.
5	The CPA should supply the renewable electricity generated to the relevant and clearly identified electricity distribution system - national/ regional/ mini grid. Details on name and type of grid (national/regional/mini) system shall be provided in each CPA-DD. OR The CPA should consist renewable electricity generation units that supply individual households/users or groups of households/users included in the project boundary of the CPA.	The CPA will supply the renewable electricity generated to the Auki mini grid. Please refer Appendix 4 for further information. Hence the CPA meets the eligibility criteria.
6	In case of project implementer other than SIEA, have a cooperation agreement with SIEA that governs the SSC-CPA's participation in the PoA. The roles and responsibility of the CME and the CPA implementer shall be as defined in the Operational and Management System for this	The CPA is implemented by SIEA and hence no cooperation agreement with SIEA is needed.

	PoA.	
7	The CPA should not result in the construction of new reservoirs or in an increase in the capacity of existing reservoirs where the power density of the power plant is less than 4 W/m^2.	The CPA does not result in construction of reservoir.
8	The CPA should demonstrate additionality as described in section B.1 of the PoA-DD.	The section below demonstrates CPA additionally as described in section B.1 of the PoA-DD.
9	The CPA should develop a record keeping system for each CPA under the PoA as described in Section C of PoA-DD and Annex 3 of EB 65	The CPA is a renewable electricity generation unit that will supply electricity to groups of households/users included in the project boundary.
10	The CPA should be have a system/procedure to avoid double accounting as described in Section C of PoA-DD.	The record keeping system for the CPA has been developed as described in PoA-DD section C.
11	Establish procedures for De-bundling check for the CPAs as described in Section C of PoA-DD.	The CPA is not a not a de-bundled component of another CDM programme activity (CPA) or CDM project activity as per the procedures described in section C of the PoA-DD.
12	Develop provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA.	The CPA implementer is aware of and have agreed that their activity is being subscribed to the PoA[10]
13	The CPA should have a start date after the commencement of PoA validation	The CPA has an expected start date of 01/11/2013, which is after the commencement of PoA validation which is tentatively planned as 01/06/2013
14	The CPA should conduct local stakeholder consultation at CPA level.	The CPA implementer has conducted local stakeholder consultation at CPA level. Please refer section C above.
15	The CPA implementer should confirm that funding from Annex I parties, if any, do not result in a diversion of official development assistance.	The CPA does not involve financing from Official Development Assistance (ODA).[11]
16	The CPA implementer should confirm that the technology will not be substituted within the project period (Declaration from the CPA implementer)	The CPA implementer confirms that the technology will not be substituted within the project period[12]

As per section B.1 of the PoA-DD and as per the paragraph 2 (a) of the "Guidelines for Demonstrating Additionality of Micro-scale Project Activities" EB 68 (version 4), project activities up to 5 megawatts that employ renewable energy as their primary technology are additional if the geographic location of the project activity is in LDCs/SIDs or in a special underdeveloped zone of the host country identified by the Government before 28 May 2010.

According to the United Nations, Solomon Islands is classified as Small Island Developing State (SIDS) and as Least Developed Country[13]. Hence under the proposed PoA, small hydro CPAs having less than 5 MW installed capacity is considered to be additional.

[10] Relevant document to be submitted to DOE
[11] Relevant document to be submitted to DOE
[12] Relevant document to be submitted to DOE

D.6. Estimation of emission reductions
D.6.1. Explanation of methodological choices

The procedure for calculating baseline emissions is as discussed below:
Baseline Emissions

Baseline scenario: Displacement of electricity from mini-grids comprising of exclusively fuel oil/or diesel fuel based generation.
As per AMS-I.F. version 02, paragraph 13:

'For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1'.

As the CPA involves displacement of electricity from mini-grid comprising of exclusively diesel fuel based generation the above mentioned baseline scenario will be adopted.

Project emissions *(PEy)*

The following project emissions have been considered for this CPA

a) Emissions from Hydro Power project

b) CO_2 emissions from on –site consumption of fossil fuel CO_2 emissions from electricity consumption by the project activity

a) Emissions from Hydro Power project

For hydro power CPAs that result in new reservoirs and/or the increase of existing reservoirs, the power density (*PD*) of the CPA shall be calculated as per ACM0002, version 13, as follows:

$PD = Cap_{PJ} / A_{PJ}$

Where[14]:

PD	Power density of the CPA, in W/m^2.
Cap_{PJ}	Installed capacity of the hydro power plant after the implementation of the CPA (W).
A_{PJ}	Area of the reservoir measured in the surface of the water, after the implementation of the CPA, when the reservoir is full (m^2).

If the *PD* is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$PE_y = EF_{Res} * TEG_y / 1000$

Where:

PE_y	Emission from reservoir expressed as tCO_2e/year
EF_{Res}	default emission factor for emissions from reservoirs

[13] http://www.un.org/special-rep/ohrlls/sid/list.htm
[14] Since the eligibility requirements admit only Greenfield hydropower projects the parameters Cap_{BL} and A_{BL} defined in version 12.2.0 of ACM0002 are set equal to zero.

TEG_y Total electricity produced by the CPA, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

If *PD* is greater than 10 W/m^2, then: $PE_y = 0$

The project is a run-of-river project. Hence emissions from reservoir are zero.

b) CO_2 emissions from on-site consumption of fossil fuel

For CPA's involving on-site consumption of fossil fuels, CO_2 emissions due to the project activity will be calculated using the latest version of the Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion.

As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 2)

CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$\mathbf{PE_{FC,j,y} = \Sigma\, FC_{i,j,y} * COEF_{i,y}}$$

$PE_{FC,j,y}$	=	CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr);
$FC_{i,j,y}$	=	quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr);
$COEF_{i,y}$	=	CO_2 emission coefficient of fuel type *i* in year y (tCO_2/mass or volume unit)
I	=	fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated as per option B below.

Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

$$\mathbf{COEF_{i,y} = NCV_{i,y} * EF_{CO2,i,y}}$$

Where:

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* (tCO_2/mass or volume unit);
$NCV_{i,y}$	=	Is the weighted average net calorific value of the fuel type *i* in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	Is the weighted average CO_2 emission factor of fuel type *i* in year y (tCO_2/GJ)
I	=	Are the fuel types combusted in process *j* during the year *y*

For ex-ante calculation it has been assumed that project emissions due to on-site fossil fuel consumption is assumed to be zero.

c) CO_2 emissions from electricity consumption by the project activity

In case of plant maintenance/shut down, if electricity is imported from the grid relevant project emissions will be calculated as per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" Version 1.

As per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption"*

The tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption:

Scenarios	Applicability
Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exists, it is not operating or it can physically not provide electricity to the source of electricity consumption.	Not Applicable as the electricity will be consumed from captive power plant installed at site.
Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.	Applicable. In case of exigencies/maintenance/plant shut down the electricity will be consumed from DG Set installed at site.
Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumption source. The captive power plant(s) can provide electricity to the electricity consumption source. The captive power plant(s) is/are also connected to the electricity grid.	Not Applicable as the electricity will be consumed from captive power plant installed at site which is not connected to grid.

As per the tool, project emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

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

Where;

$PE_{EC,y}$ = Project emissions from electricity consumption in year *y* (tCO_2/yr)
$EC_{PJ,j,y}$ = Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{EL,j,y}$ = Emission factor for electricity generation for source *j* in year y (tCO_2/MWh)
$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source *j* in year *y*

The emission factor is calculated as per Option B1 of the tool.

$$EF_{EL,j/k/l,y} = \frac{\sum_{n}\sum_{i} FC_{n,i,t} \times NCV_{i,t} \times EF_{CO2,i,t}}{\sum_{n} EG_{n,t}}$$

Where:

$EF_{EL,j/k/l,y}$ = Emission factor for electricity generation for source *j*, *k* or *l* in year *y* (tCO_2/MWh)
$FC_{n,i,t}$ = Quantity of fossil fuel type *i* fired in the captive power plant *n* in the time period *t*

		(mass or volume unit)
$NCV_{i,t}$	=	Average net calorific value of fossil fuel type *i* used in the period *t* (GJ / mass or volume unit)
$EF_{CO2,i,t}$	=	Average CO_2 emission factor of fossil fuel type *i* used in the period *t* (tCO_2 / GJ)
$EG_{n,t}$	=	Quantity of electricity generated in captive power plant *n* in the time period *t* (MWh)
i	=	are the fossil fuel types fired in captive power plant *n* in the time period *t*
j	=	Sources of electricity consumption in the project
k	=	Sources of electricity consumption in the baseline
l	=	Leakage sources of electricity consumption
n	=	Fossil fuel fired captive power plants installed at the site of the electricity consumption source *j*, *k* or *l*
t	=	Time period for which the emission factor for electricity generation is determined

For ex-ante calculation it has been assumed that project emissions due to electricity consumption from on-site DG set is assumed to be zero.

Leakage *(Ly)*

For CPA's not transferring energy generating equipment from another activity, the leakage is considered as zero.

Emission reductions *(ERy)*
Emission reductions are calculated as follows:

$ERy = BEy - PEy - Ly$

Where:

ERy	Emission reductions in year *y* (tCO_2e/yr).
BEy	Baseline emissions in year *y* (tCO_2e/yr)
PEy	Project emissions in year *y* (tCO_2/yr).
Ly	Leakage emissions in year *y* (tCO_2/yr).

D.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	$EF_{CO2,mini-grid}$
Unit	tCO_2e/MWh
Description	Emission factor of the mini-grid where the hydropower is exporting (or would have exported) its electricity to.
Source of data	As per AMS-I.F., version 2, Table I F.1
Value(s) applied	0.8 (ex-ante)
Choice of data or Measurement methods and procedures	Default values for diesel generator systems as per AMS-I.F., version 1, Table I F.1
Purpose of data	Calculation of baseline emissions
Additional comment	

D.6.3. Ex-ante calculation of emission reductions

>>

The total emission reductions of the CPA are calculated on the basis of the equations and parameters presented and explained in AMS-I.F., version 02.

In case of the Auki Hydropower Project (CPA), emission reductions are calculated as discussed below -
The CPA involves electricity supply to mini-grid and the baseline scenario is **Displacement of electricity from mini-grids comprising of exclusively fuel oil/or diesel fuel based generation**

As per AMS-I.F., version 02, paragraph 13:
'For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1'.

Baseline emissions *(BEy)*

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$BE_y = EG_{BL,y} * EF_{CO2,\ mini\ grid}$

Where:

BE_y = Baseline Emissions in year y (tCO_2)
$EG_{BL,\ y}$ = Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year y (MWh) 2736.25 (Year 1)
$EF_{CO2,\ mini\ grid}$ = Emission factor (tCO_2/MWh) 0.8 tCO_2/MWh as suggested in Table 1.F.1 of AMS-I.F. version 02.

$BE_y = 2{,}736.25 \times 0.8 = 2{,}189\ tCO_2e$

Installed Capacity	1.16	MW	As per Project Feasibility Study Report
Estimated Gross annual electricity Generation	2974.19	MWh	As per Project Feasibility Study Report
Station & Line losses (8%)	237.935	MWh	As per Project Feasibility Study Report
Estimated Net annual electricity Generation ($EG_{BL,y}$)	2,736.25	MWh	
Emission Factor for Diesel Generation System	0.8	$kgCO_2e$/kWh	As per AMS-I.F., Table I.F.1
Baseline Emissions	**2,189**	**tCO_2e/year**	

The net annual electricity from Year 2 is provided in the table below:

Year	Net Annual Electricity (MWh)	Baseline Emissions (tCO_{2e})
Year 2	3,093	2,277
Year 3	3,217	2,368
Year 4	3,346	2,462

Year 5	3,479	2,561
Year 6	3,619	2,663
Year 7	3,764	2,770

Project emissions *(PEy)*

In case of Auki hydropower CPA, the potential sources of project emissions are:

1. Emission from hydro power project.
2. Emissions due to electricity consumption

1. Emissions from Hydro Power project

The CPA is a run - of river project and does not involve any large reservoir development. Hence project emissions due to reservoir are zero.

2. CO_2 emissions from electricity consumption by the project activity

As mentioned in section D.6.1 above for ex-ante calculation it has been assumed that project emissions due to electricity consumption from on-site DG set is assumed to be zero.

Hence, PEy = 0

Leakage *(Ly)*

The CPA is not transferring energy generating equipment from another activity. Hence, the leakage is considered as zero, $L_y = 0$

Emission reductions *(ERy)*

Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y - L_y$
$= 2,189 - 0 - 0 (tCO_{2e})$
$= 2,189\ tCO_{2e}$

D.6.4. Summary of the ex-ante estimates of emission reduction

Year	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
Year 1	2,189	0	0	2,189
Year 2	2,277	0	0	2,277
Year 3	2,368	0	0	2,368
Year 4	2,462	0	0	2,462
Year 5	2,561	0	0	2,561
Year 6	2,663	0	0	2,663
Year 7	2,770	0	0	2,770
Total	**17,289**			**17,289**
Total number of crediting years	**7**			
Annual average over the crediting period	**2,470**	**0**	**0**	**2,470**

D.7. Application of the monitoring methodology and description of the monitoring plan
D.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity displaced in year y
Source of data	Measured by energy meter(s)
Value(s) applied	2,736
Measurement methods and procedures	Continuous monitoring by at least 0.5 class accuracy meter integrated hourly and recorded monthly and yearly. Data archiving would be done both electronically and on paper records. The Data will be stored for at least 2 years after last crediting period.
Monitoring frequency	Continuous monitoring
QA/QC procedures	If applicable, measurement results will be cross checked with records for sold/purchased electricity (e.g., invoices/receipts). A secondary meter will used in case of any problem in primary meter Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years.
Purpose of data	Baseline emissions
Additional comment	-

Data / Parameter	$EC_{PJ,j,y}$
Unit	MWh/yr
Description	Quantity of electricity consumed by the project electricity consumption source j in year y
Source of data	Electric meter readings located at the project site
Value(s) applied	0
Measurement methods and procedures	Continuous monitoring by at least 0.5 class accuracy meter integrated hourly and recorded monthly and yearly. Data archiving would be done both electronically and on paper records.
Monitoring frequency	Continuous monitoring
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years. Data will be stored for at least 2 years after last crediting period.
Purpose of data	Project emissions
Additional comment	-

Data / Parameter	$TDL_{i,y}$
Unit	-
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data	As per the Tool to calculate baseline, project and/or leakage emissions from electricity consumption this value is zero for Scenario B
Value(s) applied	0
Measurement methods and procedures	Not Applicable
Monitoring frequency	Not Applicable
QA/QC procedures	-
Purpose of data	To calculate relevant project emissions
Additional comment	

Data / Parameter	$FC_{i,j,y}$
Unit	Mass or volume unit/y
Description	Quantity of fossil fuel type i (diesel) fired in the captive power plant (j) in the year y
Source of data	On-site measurements
Value(s) applied	0
Measurement methods and procedures	As small tanks will be used, rulers will be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge will be calibrated at least once a year and have a book of control for recording the measurements. Data archiving would be done both electronically and on paper records The Data will be stored for at least 2 years after last crediting period.
Monitoring frequency	Daily basis
QA/QC procedures	Measuring equipment will be calibrated annually at appropriate intervals according to manufacturer specifications. The consistency of measured fuel consumption quantities will be cross-checked by an annual energy balance that is based on purchased quantities and stock change. The calibrations would be done as per manufacturer's specifications.
Purpose of data	To calculate relevant project emissions
Additional comment	-

Data / Parameter	NCV_i
Unit	GJ/tonne
Description	Average net calorific value of fossil fuel type i (diesel) used in the period t
Source of data	The following data sources to be used a) Supplier data b) If a) is not available, measurement by PP c) If a) is not available, regional or national default values will be taken for liquid fuels d) If a) is not available, IPCC default values at the upper limit of the uncertainty at a 95% confidence interval.
Value(s) applied	43.3 (IPCC default value)
Measurement methods and procedures	For a) and b), measurements to be undertaken in line with national or international fuel standards and at each fuel delivery. In case of c), appropriateness of the values will be reviewed annually. In case of d), any revisions of the IPCC Guidelines will be taken into account. Data archiving would be done both electronically and on paper records. The Data will be stored for at least 2 years after last crediting period.
Monitoring frequency	For a) and b) - Each fuel delivery For c) – annually For d) – as per revisions of the IPCC Guidelines
QA/QC procedures	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO 17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	To calculate relevant project emissions
Additional comment	-

Data / Parameter	$EF_{CO2\ i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in the period *t*
Source of data	The following data sources to be used a) Supplier data b) If a) is not available, measurement by PP c) If a)is not available, regional or national default values will be taken for liquid fuels d) If a) is not available, IPCC default values at the upper limit of the uncertainty at a 95% confidence interval.
Value(s) applied	Diesel 0.0748 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, table 1.4 (Upper limit of the uncertainty at a 95% confidence interval)
Measurement methods and procedures	For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average values for the period t should be calculated. In case of c), appropriateness of the values will be reviewed annually. In case of d), any revisions of the IPCC Guidelines will be taken into account. Data archiving would be done both electronically and on paper records .The Data will be stored for at least 2 years after last crediting period.
Monitoring frequency	For a) and b) - Each fuel delivery For c) – annually For d) – as per revisions of the IPCC Guidelines
QA/QC procedures	For a) and b): Measurements should be undertaken in line with national or international fuel standards. For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, options b), c) or d) should be used.
Purpose of data	To calculate relevant project emissions
Additional comment	-

D.7.2. Description of the monitoring plan

Monitoring Plan Objective and Organisation

SIEA will monitor the electricity delivered by the Auki hydropower CPA. SIEA personnel will be trained to carry out the monitoring as per the standard procedures. The monitored data will be archived electronically and will be stored for 2 years after the end of the crediting period of the CPA. To ensure that the data is reliable and transparent, SIEA will also establish Quality Assurance and Quality Control (QA/QC) measures to effectively control and manage data reading, recording, auditing as well as archiving data and all relevant documents.

Monitoring Data

Data to be monitored is the electricity delivered by the Auki hydropower project. The electricity delivered will be monitored using a meter at the point of generation before evacuation of the power to the transmission line. A check meter will be installed at the point of interconnection with the mini grid. The entity responsible for monitoring, SIEA, will record, document meter readings for electricity delivered and provide calibration certificates of the project-owned meter as required by the manufacturer's instructions.

Monitoring procedures will be elaborated in the monitoring manual which will include responsibilities, Management, Quality Assurance, means of Verification of data, data transferring and data trails. The procedures would ensure that no double accounting occurs and that the status of verification can be determined anytime for the CPA.

Quality Assurance and Quality Control

QA & QC procedures for recording, maintaining and archiving data shall be implemented as part of Auki hydropower CPA. These will be elaborated further in monitoring manual and available during verification. SIEA will implement QA & QC measures to calibrate and guarantee the accuracy of metering and safety of the project operation. The metering devices will be calibrated and inspected properly and periodically, according to manufactures' specifications, to ensure their accuracy.

Verification of Monitoring Results
SIEA will carry the responsibility for providing the DOE with all required information, before, during and in the event of queries, after the verification.

SECTION E. Approval and authorization

The request for Letter of Approval (LoA) will be applied to the host country DNA during the validation of the PoA.

- - - - -

Appendix 1: Contact information on entity/individual responsible for the CPA

Organization	Information is not yet available
Street/ P.O. Box	
Building	
City	
State/Region	
Postcode	
Country	
Telephone	
Fax	
E-mail	
Website	
Contact person	
Title	
Salutation	
Last name	
Middle name	
First name	
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2: Affirmation regarding public funding

The Project does not receive any public funding and do not have any diversion of ODA.

Appendix 3: Applicability of the selected methodology(ies)

The applicability of selected methodology for the project has been described in D.2 above.

Appendix 4: Further background information on ex ante calculation of emission reductions

Details of power plants in Auki Grid (Status as of April 2011)

Station	Model	Rated (kW)	De-rated (kW)	Available (kW)	Total Hours	Installed	Remarks
Auki power station	Cummins NT855 –G6	252	200	0	43,000	2001	Awaiting replacement
	Cummins VTA28G5	512	500	500	8,500	2010	In service
	Cummins NT855 –G6	252	180	180	32,000	2005	In service
Total kW		**1016**	**880**	**680**			

Source: Mini- hydro Prefeasibility report draft

Appendix 5: Further background information on monitoring plan

The monitoring plan has been discussed in section D.7.2 above.

- - - - -

History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the component project design document form for small-scale component project activities" (EB 66, Annex 17).
01	EB33, Annex44 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		