Capacity Development Support for CDM Project Implementation: Increased Access to Electricity Services in Zambia and Rural Electrification in Bhutan

Final Report

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Japan International Cooperation Agency

(JICA)

Mitsubishi UFJ Morgan Stanley Securities

Table of Contents

Annexes :

Increased access to electricity services in Zambia, small hydroelectric power generation plant

Annex A: AMS-I.A.version 16.0 “Electricity generation by the user”
Annex B: Environmental Project Brief
Annex C: ZEC approval
Annex D: Letter from Chief Kanyama
Annex E: Local stakeholders meeting participant list
Annex F: Host country approval for “Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station”
Annex G: Final Validation Report
Annex H: PDD “Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station” (ref 9533)

Development of a new CDM methodology for rural electrification projects involving extension of existing power distribution network, taking the rural electrification project in Bhutan as the example

Annex I: SSC-NM submission form
Annex J: SSC-WG Preliminary recommendation
Annex K: Response to Preliminary recommendation
Annex L: SSC-WG Final recommendation
Annex M: AMS-III.AW. version 1.0
Annex N: Draft revised PDD based on AMS-III.AW.
Annex O: Bhutan, List of CDM workshop attendee (17th and 18th April 2012)

List of Tables and Figures

List of abbreviations

BPC	Bhutan Power Corporation
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CMP	Conference of the Parties serving the meeting of the Parties to the Kyoto Protocol
COP	Conference of the Parties
DNA	Designated National Authority
DOE	Designated Operational Entity
DRE	Department of Renewable Energy
EB	CDM Executive Board
ECZ	Environmental Council of Zambia
EIA	Environmental Impact Assessment
EMA	Environmental Management Act No 12 of 2011
EPB	Environmental Project Brief
EPPCA	Environmental Protection and Pollution Control Act, 1990
EU	The European Union
EU-ETS	The European Union Emission Trading Scheme
FAR	Forward Action Request
JCI	Japan Consulting Institute
JCM/BOCM	The Joint Crediting Mechanism / Bilateral Offset Credit Mechanism
JICA	Japan International Cooperation Agency
LDC	Least Developed Country
MAL	Ministry of Agriculture and Livestock
MTENR	Ministry of Tourism, Environment and Natural Resources
NEC	National Environment Commission, Royal Government of Bhutan
PDD	Project Design Document
REA	Rural Electrification Authority
SAPP	Southern Africa Power Pool
SIDS	Small Island Developing States
SSC-WG	Small Scale CDM Working Group
UNEP	United Nations Environment Programme
URC	UNEP Riso Center
ZEMA	Zambia Environmental Management Agency
ZESCO	ZESCO Ltd.

1. Study Outline

1.1. Background

Japan International Cooperation Agency (hereafter JICA) assisted the Royal Government of Bhutan (hereafter Bhutan) and the Government of the Republic of Zambia (hereafter Zambia) in developing Rural Electrification Master Plans (the Master Plans) in the period 2004-2005 and 2006-2008 respectively. Rural electrification has long been recognized as a vehicle to eradicate poverty by stimulating rural economy. The Master Plans are aimed at seizing the opportunities for pro-poor economic growth and poverty reduction in rural areas of both countries through promoting electrification. Based on the outcome of the Master Plans, in May 2007 JICA approved an ODA loan for a rural electrification project in Bhutan that includes construction and extension of the existing distribution network (76 locations, totaling 2,390 km), and in March 2009 agreed to assist Zambia in carrying out two projects through JICA's yen loan program. One project is the construction of a small hydroelectric power plant with an installed capacity of 1.4 MW and the other is the extension of the power distribution network in the rural areas (12 locations, totaling 459 km).

Both Bhutan and Zambia are endowed with rich water resources and the sources of the grid electricity in both countries are predominantly hydropower. While the hydroelectric potential in these two countries is significant, many rural communities in Bhutan and Zambia have no access to electricity and residents of those communities rely on fossil fuels, such as kerosene, in their everyday lives. The projects in both Bhutan and Zambia promote electrification of rural communities by supplying domestically generated renewable electricity sourced from the hydro power plants within the country. As such, these projects contribute not only to the improvement of the living conditions in the rural communities, but also to the reduction of GHG emission by replacing fossil fuel consumption with renewable electricity. Due to this fact, JICA's counterparts in Bhutan (Department of Renewable Energy[1] (hereafter DRE) and Bhutan Power Corporation (hereafter BPC)) and in Zambia (ZESCO Ltd. (hereafter ZESCO)) expressed their desire to have the projects developed and registered as CDM project activities.

To fulfill the needs of Bhutan and Zambia, specific assistance in implementing the CDM projects was provided by JICA in 2009 by executing two CDM studies (hereafter 2009 CDM studies), assisting the development of the Project Design Documents (hereafter PDD) for rural electrification projects in both countries. To date, there were only a very few CDM projects implemented in these two countries[2] and further support in capacity development for CDM project implementation was considered essential for rural electrification projects. As a result of this, JICA has decided to provide further assistance in continuing the CDM registration process including provision of validation

[1] Formerly "Department of Energy". Since the government organization restructuring in 2011, rural electrification is under jurisdiction of DRE.

[2] As of the end of February 2013, there are total 6,633 registered CDM activities (including POA). Of all 6,633 registered activities, there are only two Bhutanese registered projects (Reference number 0062, 2746), and three Zambian registered projects (Reference number 2969, 7359, 8060).

support, revision of the original PDD drafted as part of the 2009 CDM study and corresponding with the Designated Operational Entity (hereafter DOE) during the validation process. JICA selected Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (hereafter MUMSS) as the consultant to execute the study. The study team of MUMSS commenced their work in October 2010.

1.2. Purpose of the study

The ultimate goal of the study is to enhance CDM implementation capacity of the Bhutanese and Zambian counterparts by supporting them going through CDM implementation process of the rural electrification projects. More specifically, the study will assist developing a new CDM methodology applicable for the rural electrification projects, as well as the CDM validation process, and communication with the Designated Operational Entity (hereafter DOE) during the validation process.

Based on the assessment result of the previous CDM study in 2009, it has been concluded that an existing CDM methodology is readily applicable to the small scale hydropower project in Zambia. The study team therefore aimed to submit the request for registration within the study duration, by providing assistance for the validation process. On the other hand, the study team had concluded that a new CDM methodology is necessary for the rural electrification project involving extension of existing power distribution system, and thus, the study team had aimed at developing a new CDM methodology and at the approval of the new methodology by the UN.

1.3. Scope of work

Scope of the study is outlined as follows:

Increased access to electricity services in Zambia, small hydroelectric power generation project CDM registration assistance

- Assessment of the latest project status and the PDD developed during the 2009 CDM study
- Revision/preparation of the PDD for CDM validation
- Assisting obtaining Zambian DNA approval for the project
- Corresponding for the CDM validation process
- Assisting the project through UN registration process

Development of a new CDM methodology for rural electrification projects involving extension of existing power distribution network, taking the rural electrification project in Bhutan as the example

- Assessment of the latest project status and the PDD developed during the 2009 CDM study
- Developing a new CDM methodology and preparing the document for the UN submission

- Corresponding for the evaluation process of the new methodology by the UN
- Revising the PDD based on the approved new methodology

1.4. Study flow and schedule

This study started in October 2010, and has completed in March 2013. The study flow and the schedule of the study are summarized in Figure 1-1 and Figure 1-2.

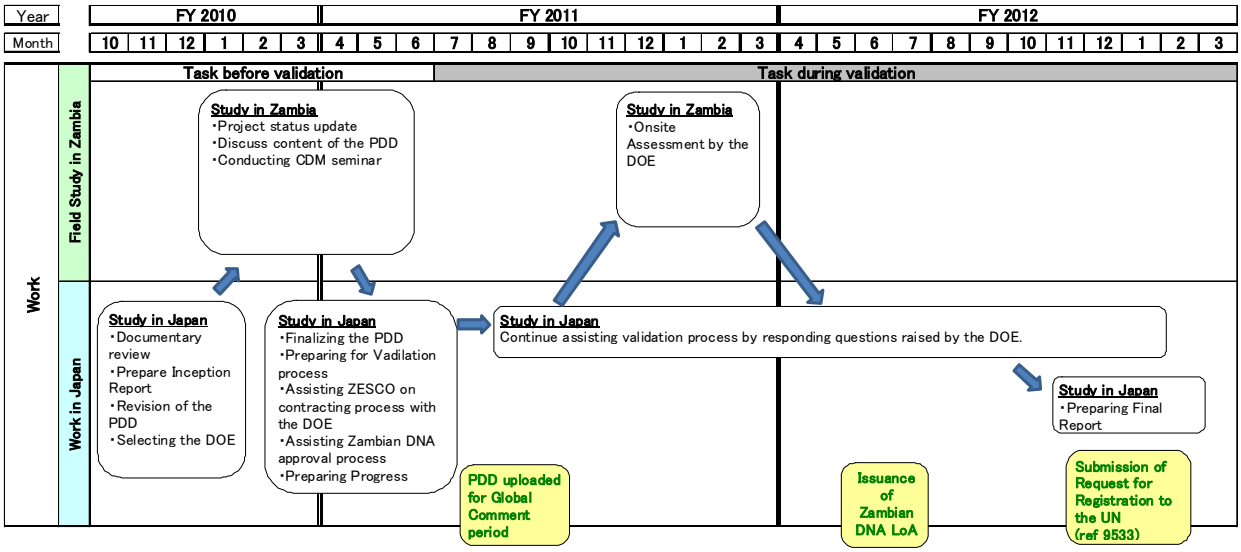
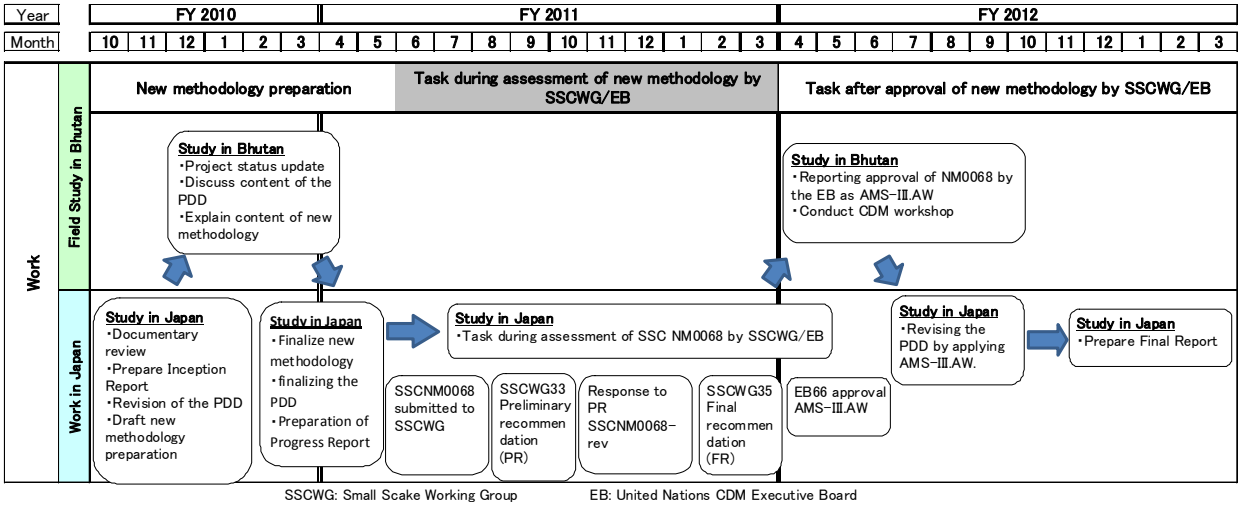


Figure 1-1: Study flow and schedule for increased access to electricity services in Zambia, small hydroelectric power generation project CDM registration assistance



SSCWG: Small Scake Working Group EB: United Nations CDM Executive Board

Figure 1-2: Study flow and schedule for development of a new CDM methodology for rural electrification projects involving extension of existing power distribution network, taking the rural electrification project in Bhutan as the example

2. Increased access to electricity services in Zambia, small hydroelectric power generation project CDM registration assistance

2.1. Project Description

Rural Electrification by "Increased Access to Electricity Services" (hereafter referred to as the "Project" or "project activity") involves construction of a mini-hydropower plant with the total installed capacity of 1.4MW in the North Western Province of Zambia. The main objective of the Project is to distribute clean, renewable electricity to rural communities without access to national/regional electricity grid, and to promote electrification in rural communities in Zambia. The electrification rate of the rural communities in the North Western Province of Zambia remains as low as 8.9%: while exceeding the average electrification of 4.5% in rural area in the country, it is significantly lower than that of the entire country stands at 21.9%[3]. The project will contribute to the improvement in a living standard of the local resident. Under the assistance of JICA, the project is developed and managed by ZESCO, the largest utility company in Zambia. The project will primarily provide electricity to four (4) communities, namely Kanyama, Kakoma, Mujila, and Kapundu Community, which locate outskirt of the town of Mwinilunga in North Western Province. The project is capable of fulfilling electricity demand in the area over 30 years, supplying maximum of 11GWh of electricity annually. Figure 2-1 shows the map of Zambia as well as the communities covered by the project.

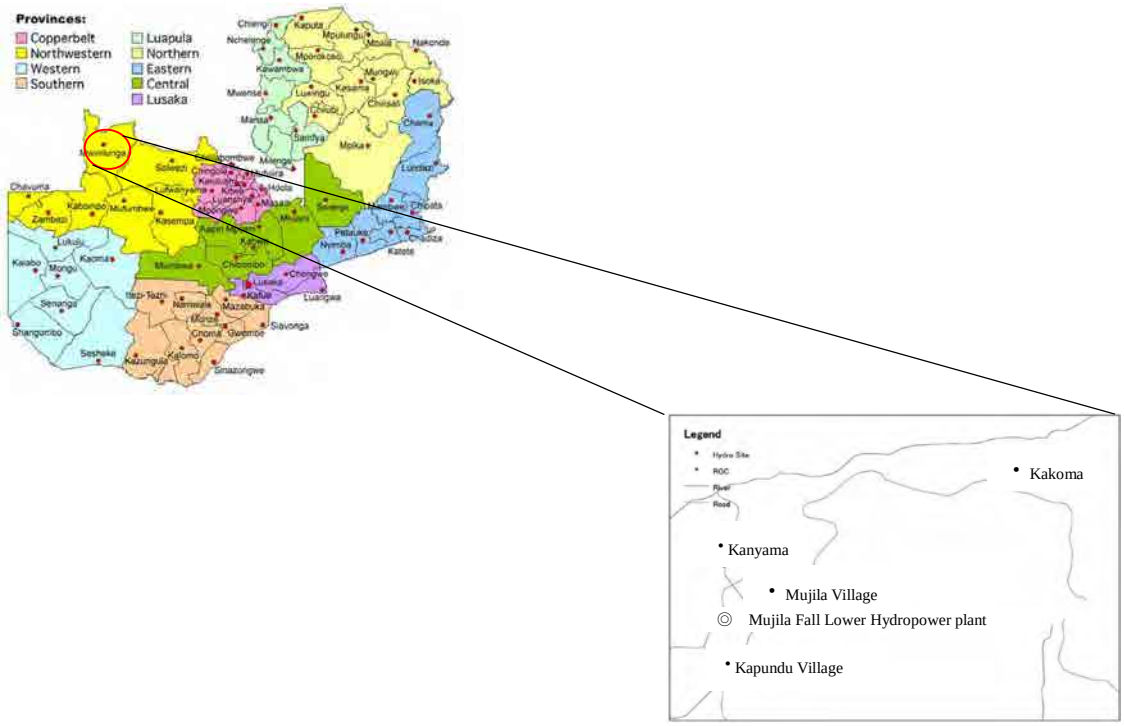


Figure 2-1: Map of Zambia and the communities electrified by the Project

Source: JICA The study for Development of the Rural Electrification Master Plan in Zambia, final report

[3] Electrification rate is based on "Living Condition Monitoring Survey 2010" (LCMS, published in June 2012).

2.2. Preparation for the validation process

The study team prepared for the validation process of the Project by assessing and revising the PDD developed during the 2009 CDM study, incorporating updated project information provided by ZESCO as well as the latest CDM rules.

2.2.1. Assessment of existing CDM methodologies and the methodology applicable to the Project

As part of the preparation toward the CDM verification of the Project, the study team had reassessed applicability of the existing approved CDM methodologies to the Project. Currently, there are the following three methodologies for the small-scale renewable energy generation projects (output capacity less than 15MW) which have been approved by the United Nations Framework Convention for Climate Change (hereunder "UNFCCC"):

- AMS-I.A. version 16.0 "Electricity generation by the user" (hereafter "AMS-I.A.")
- AMS-I.D. version 17.0 "Grid connected renewable electricity generation" (hereafter "AMS-I.D.")
- AMS-I.F. version 2.0 "Renewable electricity generation for captive use and mini-grid" (hereafter "AMS-I.F.")

AMS-I.A. is applicable for projects involving implementing renewable energy generation units that supply electricity to individual households or users or groups of households. The applicability is limited to households and users that do not have grid[4] connection. AMS-I.D targets projects that supply renewable electricity generated by the project activity to a grid. AMS-I.F. is aimed at projects that displace electricity from an electricity distribution system that is or would have been supplied either by a national /regional grid, fossil fuel fired captive power plant or a carbon intensive mini-grid.

The study team confirmed ZESCO that there is no grid connection plan for the small hydropower plant implemented under the Project, in the foreseeable future. Also, since this project directly supplies its electricity to be generated by the hydroelectric power station to households who do not have grid connection, the study team concluded AMS-I.A is the most applicable methodology to the Project. It is also noted that AMS-I.A. was applied to the PDD developed under the 2009 CDM study. As part of the preparation for the CDM validation, the study team had completed the PDD using the latest version of AMS-I.A.

Applicability conditions stipulated in the AMS-I.A. and suitability to the Project have been

[4] National/regional grid

summarized in Table 2-1 below. In conclusion, the Project fulfills the applicability conditions of AMS-I.A. A copy of AMS-I.A has been attached as Annex A.

Table 2-1: Applicability conditions of AMS-I.A. and their suitability to the project

Applicability conditions	Suitability to the project
1. This category comprises renewable electricity generation units that supply individual households/users or groups of households/users included in the project boundary. The applicability is limited to households and users that do not have a National/regional grid connection.	This project activity consists of the hydro electric power generation that supplies individual households and users or groups of households/users included in the project boundary. Prior to implementation of the project activity, the households and users in the project boundary do not have connection to the national/regional grid. According to the Master Plan, the users in the project boundary may be connected to the national grid sometime around the year 2030, but this is at the planning stage and has not yet been confirmed. Therefore the Project currently meets the applicability condition.
2. The renewable energy generation units include technologies such as solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which is used on-site/locally by the user, e.g. solar home systems, wind battery chargers. The renewable generating units may be new installations (Greenfield) or replace existing onsite fossil-fuel-fired generation. To qualify as a small-scale project, the total output of the unit(s) shall not exceed the limit of 15 MW.	The renewable energy hydro power generation unit implemented by the project activity is a new installation (Greenfield) project activity. Produced electricity is used on-site/locally by the users. The installed capacity of the generation unit will be 1.4 MW and does not exceed the limit of 15 MW. Therefore the Project meets the applicability condition.
3. 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 the reservoir; - The project activity is implemented in an existing reservoir, where the volume of the reservoir is increased and the power density[5] of the project activity, as per	The project activity is a run of river type hydropower project and no reservoir will be constructed. There will be no change with the volume of the reservoir[6]. Therefore the applicability condition is not relevant to the Project.

[5] Power density: in CDM term, it is defined as power output per unit reservoir surface area. It is calculated

Applicability conditions	Suitability to the project
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 than 4 W/m^2.	
4. Combined heat and power (cogeneration) systems are not eligible under this category.	The project activity does not involve a combined heat and power (cogeneration) system. Therefore the Project meets the applicability condition.
5. 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 unit to be installed consists of a 100% renewable component not exceeding the eligibility limit of 15 MW. Therefore the Project meets the applicability condition.
6. Project activities that involve retrofit or replacement of an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	The project activity does not involve any retrofitting or replacement of existing facilities.
7. In the case of project activities that involve the 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 project is Greenfield project with installed capacity of 1.4 MW and does not involve the addition of renewable energy generation units at an existing facility.

2.2.2. Setting the project boundary

According to AMS-I.A., the physical, geographical site of the renewable energy generating unit and the equipment that uses the electricity produced delineates the project boundary. The geographic boundary of the project activity includes the Lower Mujila Falls Mini Hydropower Plant, the new transmission and distribution lines, and four (4) remotely located non-electrified

by dividing the installed power capacity (unit: W) by surface area of the reservoir (unit: m^2).

[6] Increase in the water level upstream of the intake is expected due to the project implementation. The water level after the rise is within the normal flooding zone. Therefore, the project has claimed the raise is not considered as the volume increase of the existing reservoir. This argument was accepted by the DOE during the validation.

communities in the North Western Province of Zambia, namely Kanyama, Mujila Village, Kapundu Village, and Kakoma. Figure 2-2 depicts a graphical representation of the project boundary, as shown below.

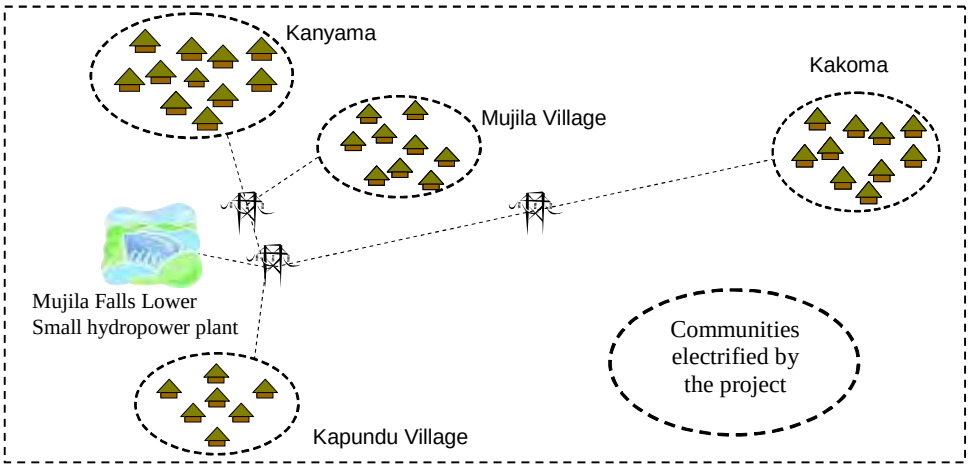


Figure 2-2: Project boundary

2.2.3. Baseline scenario

The baseline scenario is a hypothetical scenario which would have been taken place if a CDM project is not implemented. Baseline described in AMS-I.A. is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy, estimated using one of three possible options below:

Option 1： Average electric consumption of the group of renewable energy technologies (e.g. renewable energy technologies for households, rural health centers, rural schools, etc.) implemented as part of the project activity.

Option 2： Expected electricity generated from group of renewable energy technologies (e.g., renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity.

Option 3： The baseline based on a trend-adjusted projection of historic fuel consumption in situations where an existing technology is replaced.

In this study, Option 2 is selected to set the energy baseline. Applying Option 2, the energy baseline is calculated based on the annual electricity generation expected from the 1.4 MW hydropower plant implemented by the Project.

2.2.4. Demonstration of additionality

The Project is considered additional in accordance with "Guidelines for demonstrating additionality of microscale project activities", Version 04.0[7] (hereafter "microscale guidelines").

At its 54th meeting, as part of the effort in alleviating geographical imbalance of the CDM activities, the CDM EB has adopted a simplified guideline to demonstrate additionality; "Guidelines for demonstrating additionality of renewable energy projects less than or equal to 5 MW and energy efficiency projects with energy savings less than or equal to 20 GWh per year (version 01)"[8] (hereafter "microscale guideline"). One of the applicability conditions specified in this new microscale guideline, among others, is that the geographic location of the project activity is in a LDC. This microscale guideline went through several revisions and the scope is now extended to Type III project activities. Under microscale guideline, Type III project with less than 20 $ktCO_2e$ of annual emission reductions and located in a LDC will be considered additional.

According to the microscale guidelines, "the project activities up to five megawatts that employ renewable energy technology are additional if any one of the conditions below is satisfied:

1. The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDs) or in a special underdeveloped zone[9] of the host country.

2. The project activity is an off-grid activity supplying energy to households/communities (less than 12 hrs grid availability per 24 hrs day is also considered as 'off grid' for this assessment);

3. The project activity is designed for distributed energy generation (not connected to a national or regional grid) with both conditions (i) and (ii) satisfied;
   (i) Each of the independent subsystems/measures in the project activity is smaller than or equal to 1,500 kW electrical installed capacity;
   (ii) End users of the subsystems or measures are households/communities/SMEs.

4. The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.

The Project satisfies the conditions (a) above. Zambia is recognized by the UNFCCC as one of the

[7] Guidelines for demonstrating additionality of microscale project activities (version 04), EB 68, Annex 26, http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid22.pdf
[8] Guidelines for demonstrating additionality of renewable energy projects = < 5 MW and energy efficiency projects with energy savings <= 20 GWH per year (version 01), EB 54, Annex 15
[9] Special Underdeveloped Zone: SUZ

Least Developed Countries (LDC)[10]. As such the Project is considered additional. Above discussion was stated in the PDD.

2.2.5. Calculation of GHG emission reduction

Following the procedures stipulated in AMS-I.A., baseline emissions, project emissions and leakage emissions were calculated as follows and the results were reflected in the PDD.

1) Calculation of baseline emissions

As per the applied methodology AMS-I.A., the energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy. The Project applies Option 2 of AMS-I.A. and baseline emissions are calculated based on annual electricity generation from project renewable energy technologies as follows:

$$BE_{CO2,y} = E_{BL,y} * EF_{CO2}$$

Where:

$BE_{CO2,y}$ Emissions in the baseline in the year, *y*; tCO_2

EF_{CO2} CO_2 emission factor; tCO_2/kWh (default value of 0.0008 tCO_2e/kWh)

$E_{BL,y}$ Annual energy baseline in year, *y*; kWh

$$E_{BL,y} = \Sigma_i EG_{i,y} / (1 - l)$$

Where:

$E_{BL,y}$ Annual energy baseline; kWh

Σ_i The sum over the group of *i* renewable energy technologies (e.g. renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity.

$EG_{i,y}$ The estimated annual output of the renewable energy technologies of the group of *i* renewable energy technologies installed; kWh. Annual output of the renewable energy technologies for the project activity is estimated based on the available river flow and the generation capacity of the project activity (1.4MW). As such, for

[10] List of LDC: http://www.unohrlls.org/en/ldc/25/

ex-ante estimation purpose, it is set at 11,037,600kWh/y. This value will be rectified by the actual annual output of the renewable energy once project begins operation.

l Average technical and distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction. For the project activity, this value is set at 0.2, which is the default value as per the applied methodology AMS-I.A.

Ex-ante calculation is as follows:

$E_{BL,y}$ = $\Sigma_i EG_{i,y} / (1 - l)$

= 11,037,600 / (1 – 0.2)

= 13,797,000 kWh

$BE_{CO2,y}$ = $E_{BL,y} \times EF_{CO2}$

= 13,797,000 kWh × 0.0008 tCO_2/kWh

= **11,037 tCO_2**

2) Calculation of project emissions

The project activity is a small scale hydropower project with no change in the volume of the reservoir. Therefore, as per the applied methodology AMS-I.A., the GHG emission from the project activity is considered as zero. On the other hand, the project plans to install a diesel engine generator of 50 kVA capacity for emergency purpose. In case of emergency, when all the station power supply is out, the emergency diesel engine generator will be activated. While the project does not plan to activate the diesel engine generator during the project operation, any diesel fuel combusted during emergency will be counted toward project emissions as per Option B of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02)[11] as follows and reflected in the PDD accordingly:

$PE_y = PE_{FC,emergency,y} = \Sigma FC_{diesel,emergyncy,y} \times NCV_{diesel,y} \times EF_{CO2,diesel,y}$

Where:

PE_y Project emissions in the year, *y*; tCO_2e

[11] Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02)

$PE_{FC,emergency,y}$	CO_2 emissions from diesel combustion during emergency in year y; tCO_2e
$FC_{diesel,emergency,y}$	Quantity of diesel combusted during emergency in year y
$NCV_{diesel,y}$	Net calorific value of diesel in year y, as per IPCC default value at upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter1 of vol.2 of the 2006 IPCC Guidelines on national GHG inventories[12]
$EF_{CO2,diesel,y}$	CO_2 emission factor of diesel in year y, as per IPCC default value at upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of vol.2 of the 2006 IPCC Guidelines on national GHG inventories

As mentioned earlier, the emergency diesel power is activated only when the hydropower plant is completely out and no power can be supplied from the hydropower plant. Therefore, ex-ante estimation of the project emission from the diesel power unit is set at zero.

$$PE_y = PE_{FC,emergency,y} = \Sigma FC_{diesel,emergyncy,y} \times NCV_{diesel,y} \times EF_{CO2,diesel,y}$$

$$= 0\ tCO_2e$$

3) Calculation of leakage emissions

Leakage emissions are defined as the emission resulting from the CDM project, which take place outside the project boundary. In accordance with AMS-1.A., if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. This is not the case in this Project, and as such leakage emissions are not considered ($L = 0\ tCO_2e$). PDD was revised accordingly.

4) Calculation of emission reductions

Emission reductions for the Project are calculated as follows:

$$ER_{,y} = BE_{CO\,2,\,y} - PE_y - L$$

Where:

[12] 2006 IPCC Guidelines for national Greenhouse Gas Inventories (2006, IPCC)

ER_y	Emission reductions in the year *y*; tCO_2e
$BE_{CO2,y}$	Emissions in the baseline in the year, *y*; tCO_2e
PE_y	Project emissions in the year, *y*; tCO_2e
L	Leakage in the year, *y*; tCO_2e

Ex-ante calculation in the PDD is as follows:

$ER_{,y} = BE_{CO2,y} - PE_y - L$

$= 11{,}037\ tCO_2e - 0\ tCO_2e - 0\ tCO_2e$

$= 11{,}037\ tCO_2$

It is noted that the ex-ante estimation of the emission reduction in the PDD is based on the expected electricity power output and the maximum possible operating hours of the Project, in other word, it is the maximum possible emission reductions from the Project. The actual emission reduction will be recalculated based on the monitored amount of electricity actually distributed to the communities by the project activity, as well as the emergency operation of the diesel power generation system.

2.2.6. Project lifetime and the crediting period

Under the CDM, the project starting date is defined as "the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity"[13]. Based on this definition, the project start date is set at the expected date on which construction and equipment purchase contract for the Project activity will be finalized. Project implementation schedule have been revised and ZESCO expects finalizing the contract at the end of February 2013. Therefore, the starting date of the project activity is tentatively set on 28 February 2013, which is reflected in the PDD.

Also, the commercial operation of the project activity is planned to begin in March 2015. Therefore, in the PDD, the starting date of the first crediting period was set at 1 March 2015, or the actual starting date of the project operation, whichever is later.

The project lifetime for hydropower projects are expected to exceed thirty years. To maximize the emission reduction generated from the project, renewable crediting period was selected in the

[13] EB41, Meeting Report, paragraph 67 http://cdm.unfccc.int/EB/041/eb41rep.pdf

PDD. Therefore, the project expects to generate emission reductions for twenty one years (7 years, with twice renewal).

2.2.7. Environmental impact and accounting of local stakeholders' comments

The Environmental Protection and Pollution Control Act (EPPCA), the supreme environmental law in Zambia, has become effective in 1990. Environmental Council of Zambia (ECZ) was established as the result of EPPCA. EPPCA defines the capacity and authority of ECZ. By identifying projects or types of projects for which environmental impact assessment are necessary and by undertaking or requesting others to undertake such assessment for consideration, ECZ function as the organization for environmental clearance of the development activities in the country.

The Environmental Impact Assessment Regulation (EIA regulation), announced publicly in 1997, outlines the specific procedures required prior to implementing development activity in Zambia. The EIA regulation also provides the list of activities which requires environmental clearance in the country. EPPCA was revised in 1999, then further replaced by Environmental Management Act No 12 of 2011 (EMA) in April 2011. ECZ was renamed as Zambia Environmental Management Agency (ZEMA).

Development of small scale hydropower facility is listed under EIA regulation as the activity requires environmental clearance. For the development of the Project, following required procedures stipulated in the EIA regulation, preparation of Environmental Project Brief (EPB), assessment of EPB by ZEMA, and approval by ZEMA are required[14].

At the time of developing the Master Plan, the procedures of environmental clearance following the country's requirement was conducted, and the project was granted approval for development by ECZ, who is now known as ZEMA on 30 November 2007. To reflect the environmental clearance procedure the project gone through, the PDD was revised accordingly. Copy of EPB and approval of development issued by ECZ have been attached as Annex B and Annex C, respectively.

One of the CDM validation requirements is to invite local stakeholders' comments toward the Project, and to take due action of the received comments. For this, ZESCO organized a public consultation meeting and was held on 4th November 2010. Invitations were distributed to village heads inviting them to attend. Also the local residents were informed about the meeting through village heads. A letter from the local community chief and the list of meeting participants were submitted to the DOE their review. The letter from the community chief and the meeting

[14] In the EIA regulation, the construction of new electricity generation stations with electrical power transmission lines more than 1 km long and surface roads for electrical and transmission lines more than 1 km long requires to EPB assessment.

participants list are attached as Annex D, and Annex E, respectively.

The meeting and was held on at Kanyizhiwu Community School in Mwinilunga, a village in Northwestern state close to the project site. A total of 48 local residents, including village head, attended the meeting. Five officers from ZESCO, including an environmental coordinator, a chief civil engineer, a senior social scientist, a senior ecologist, and an environmental technologist, participated and assisted responding queries from the local residents/stakeholders.

Most of the comments by the local residents are related to the compensation for the farmland which is relocated due to the project. ZESCO explained that the values and method of compensation for the farmland relocation is evaluated and decided by Ministry of Agriculture and Livestock (MAL). Meeting participants were satisfied with the ZESCO explanation. There were no negative comments received during the public consultation meeting. Most local residents evaluate the project positively for its effect leading to stable electricity supply in the community. The process of collecting local stakeholders comments were summarized in the PDD. Photo 2-1 is the photo from the public meeting.

Village head and participants

Public meeting participants

Photo 2-1: Zambia small scale hydropower project public meeting

2.2.8. Monitoring plan

1) Monitoring parameters

It is required to monitor one of the following parameters under the small scale methodology AMS-I.A.

1. An annual check of all systems or a sample to ensure that they are still operating; or
2. Metering the electricity generated by all systems in a sample

AMS-I.A. targets project activities where multiple electricity generation systems (e.g. a solar power generation unit in the individual household) will be installed, thus the sampling is assumed to be the most appropriate monitoring method in the methodology. However, since only one electricity generation system will be constructed under 1.4 MW hydroelectric power generation project in Zambia, the sampling is not necessary. Thus, based on the monitoring requirement of AMS-I.A., it is deemed appropriate to monitor the amount of electricity supplied by the project system (net electricity generation)[15]. Also, ZESCO informed the study team that a 50kVA Diesel engine generator will be implemented at the project site to secure emergency power source. To account for the emergency diesel consumption by the project activity, Option B of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) was followed and relevant monitoring parameters were included. Monitoring parameters and measurement methods of each parameter for the Project are listed as follows.

Parameter:	$EG_{i,y}$
Data unit:	kWh/y
Description:	Annual net electricity generated during the year, *y*
Source of data to be used:	ZESCO
Value of data	11,037 ,600 Ex-ante estimation based on the installed capacity and the maximum operating hours per year:1,400 kW x 0.9 x 8,760 hrs/y = 11,037,600 kWh/y This value will be rectified by the project's actual annual output once the project begins operation.
Description of measurement methods and procedures to be applied:	Measured continuously by electricity meters and recorded at least once per day. The accuracy of the meters will be at least class 1.0[16].
Calibration frequency:	The electricity meters will be periodically calibrated according to the relevant national or industrial standards and regulations. Calibration will be done at least once per three years, which is the minimum requirement stipulated in the latest general guidelines to SSC CDM methodologies[17].

Parameter:	$FC_{diesel,emergency,y}$
Data unit:	ton/yr or m^3/yr

[15] It is not clear in AMS-I.A, however, by following the approach used in AMS-I.D., net amount of electricity generated will be monitored for this project activity.
[16] While the accuracy classes of energy meters are not clearly specified in the existing bidding documents, the project developer plans to request the contractor to provide minimum 1.0 class energy meter. Actual accuracy class of the installed energy meters will be verified at the time of verification.
[17] EB61 Report, Annex 21, "General guidelines to SSC CDM methodologies (version17)"

Description:	Quantity of diesel fuel combusted at the project power plant during emergency in the year y
Source of data to be used:	Onsite measurements
Value of data	0
Description of measurement methods and procedures to be applied:	Monitor continuously. · Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); · Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; · In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
Calibration frequency:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.

Parameter:	$NCV_{diesel,y}$
Data unit:	GJ/m^3 or GJ/ton
Description:	Weighted average net calorific value of diesel in year y
Source of data to be used:	IPCC default values for diesel oil at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines[18]. (Default As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" version 02)
Value of data	43.3 TJ/Gg
Description of measurement methods and procedures to be applied:	Confirm that the value is based on the latest IPCC Guidelines.
Calibration frequency:	Any future revision of the IPCC Guidelines should be taken into account.

Parameter:	$EF_{CO2,diesel,y}$
Data unit:	tCO2/GJ

[18] 2006 IPCC Guidelines for national Greenhouse Gas Inventories (2006, IPCC)

Description:	CO2 emission factor of diesel in year y
Source of data to be used:	IPCC default values for diesel oil at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines. (Default As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" version 02)
Value of data	74.8 ton/TJ
Description of measurement methods and procedures to be applied:	Confirm that the value is based on the latest IPCC Guidelines.
Calibration frequency:	Any future revision of the IPCC Guidelines should be taken into account.

2) Monitoring implementation structure

To ensure monitoring of the Project following the AMS-I.A. requirement, ZESCO plans to implement a monitoring implementation structure described in Figure 2-3 below.

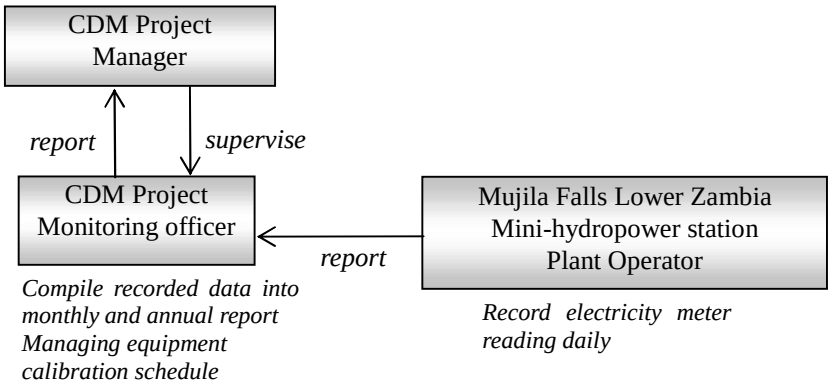


Figure 2-3: Monitoring implementation structure

The amount of electricity generated and provided to the communities by the Project will be continuously measured by electricity meters and electronically recorded. Under the monitoring structure ZESCO is currently considering implementing, the hydropower plant operator designated for CDM monitoring will check the data at the hydropower plant to ensure power distribution by the Project is appropriately recorded and accumulated and prepare daily log. Both the power distribution data and the daily log will be sent to ZESCO's headquarter in Lusaka, which will be further compiled as monthly report and annual report by the CDM Project monitoring officer. The

CDM Project Monitoring officer will report to the CDM Project Manager who will authorize the monitoring report.

All electricity meters used for CDM monitoring must be periodically calibrated in accordance with the industry standard. The study team confirmed through ZESCO that there is no clear standard for the electricity calibration in Zambia. Therefore, the study team decided to apply the minimum calibration frequency stipulated in the "General guidelines to SSC CDM methodologies (version17)", which is at least once per three years. PDD was revised to incorporate the equipment monitoring frequency accordingly. It is planned that the CDM project monitoring officer will be in charge of managing the equipment calibration schedule for the Project.

All the monitored data will be stored in an electronic data log at the Lusaka office during the crediting period and two years after the end of the last crediting period.

In the verification process for the CER issuance from the Project, CDM monitoring organization planned by ZESCO as well as management of equipment calibration schedule will be the subject of evaluation by the DOE. Preparing Standard Operating Procedures (SOP) for CDM management and monitoring, and to demonstrate that the project is managed/monitored in accordance with the SOP may be effective to show the sufficient quality of the management and monitoring of the project.

It is important to establish CDM monitoring implementation structure in advance of the start of the commercial operation of a project. After the start of the project operation, data collection and monitoring report preparation for CDM verification will continue throughout the project operation. It is expected that all the members in CDM monitoring implementation structure share and understand the CDM needs related to CDM monitoring.

2.2.9. Zambia DNA approval

Ministry of Lands, natural Resources and Environmental Protection plays the role of Designated national Authority (DNA) for Zambia[19]. Since there are currently very few CDM applications submitted to the DNA, ad hoc working group is called for very application, and the project is assessed based on the submitted PDD. Ad hoc working group provides comments to the CDM project participants submitted for the approval. The project participants are given opportunity to respond to the comments, reflecting the comments to the PDD. The CDM committee established in the DNA then decides whether to grant the DNA approval to the submitted request.

[19] Following organizational restructure in 2011, the role of the DNA was succeeded from Ministry of Tourism, Environment, Natural Resources (MTENR).

For the DNA approval of the Project, ZESCO submitted request for approval to the DNA along with the PDD in July 2011, at the time of the start of the validation process. Comments from ad hoc working group were provided, and the study team responded to the comments. DNA approval for the Project was delayed due to the organizational restructure in the government of Zambia, the project received a positive evaluation from the DNA at the time of on-site assessment conducted in December 2011. At last, Zambian DNA approval was granted to the project as of 18 June 2012[20]. The Zambian DNA approval letter is attached as Annex F.

The Project is a unilateral CDM project without identified Annex-I participants. Therefore no DNA approval from Annex-I country is required at the time of CDM registration. At the time of CER issuance, when participants from Annex-I countries are identified, DNA approval from the Annex-I country would be necessary.

2.3. Validation of the CDM project

Validation is the process of independent evaluation of a project activity against the requirements of the CDM on the basis of the PDD and related documents, which is carried out by a designated operating entity (DOE) appointed by the project participant.

For the validation of the Project, the study team began negotiation with DOEs in February 2011. Japan Consulting Institute (hereafter JCI) was selected as the DOE for the Project. Current CDM rules require that the project participants have a direct contractual arrangement with the DOE for the validation[21]. Therefore, the study team assisted ZESCO through the contract negotiation. The contract was finalized and signed as of 22 July 2011. After the signing of the contract, on 23 July 2011, JCI published the PDD on the UNFCCC website to seek for global public comments. There was no comment raised by global stakeholders to the project during the 4-week commenting period.

On-site assessment, as the part of validation for the Project, was carried out from 18 to 24 December 2011. During the on-site assessment, JCI assessor interviewed relevant organizations, such as ZESCO, ZEMA, Zambian DNA, Department of Energy, and Rural Electrification Authority (REA). Through the interviews, JCI had confirmed for the Project that ①ZESCO's participant to the project was voluntary, ②the project appropriately went through the environmental clearance of the host country, and ③the due action of the comments of local stakeholders to the project have been well taken. Schedule of on-site assessment for the Project is summarized in Table 2-2. Photo 2-2 shows the scenes of the meetings held during the on-site assessment.

[20] The DNA approval letter was re-issued on 12 November 2012, with the project title revised to match with the project title of the PDD.

[21] Paragraph 76, CDM Project Standard ver.01.0, EB 65, Annex 05

Table 2-2: Zambia small-scale hydropower CDM project Validation onsite assessment schedule

Year/month/date	Time	Schedule
2011/12/18	All day	Traveling
2011/12/19	Morning	traveling
	Afternoon	Reporting to JICA Zambia office Preparation for on-site assessment / meeting with ZESCO
2011/12/20	Morning	Visiting Zambian DNA
	Afternoon	Preparation for on-site assessment
2011/12/21	Morning	Interview by DOE：REA
	Afternoon	Interview by DOE：Zambian DNA
2011/12/22	Morning	Interview by DOE：ZEMA
	Afternoon	Interview by DOE：Department of Energy
		Interview by DOE：ZESCO
		Wrap-up meeting / on-site assessment overview by DOE
2011/12/23	Morning	Reporting to JICA Zambia office
	Afternoon	Traveling
2011/12/24	All day	traveling

Interview by DOE：REA

Interview by DOE：Zambian DNA

Interview by DOE：ZEMA

Interview by DOE：Department of Energy

Photo 2-2: Zambia small-scale hydropower CDM project Validation onsite assessment

After completion of the on-site assessment, JCI issued the draft validation report and the list of corrective actions and clarification requests, in which outstanding agenda for the Project are provided. The study team had outlined the countermeasures to the remarks in Table 2-3 below.

Table 2-3: Remarks made by DOE during the validation

	Remarks by the DOE	Countermeasures proposed by the study team
1	Controlling of the electricity generation below the power generation capacity needs further explanation.	According to the Master Plan, the electricity demand in 2030 will be 1416kW in the four rural communities where the project supplies electricity. While peak demand is 1400kW, demand of off-peak time zones is about 400 kW. By installing two 700-kW turbines to meet 1400 kW of peak demand, extreme low load operation can be avoided. More specifically, controlling of power generation is possible by changing number of operating units between 1 and 2. Each unit can be operated at 60 to 100% generating capacity, which allows matching with variation in electricity demand.
2	Justification of the duration of the project lifetime of 40 years is requested.	According to ZESCO, there is no defined lifetime for a hydropower station in Zambia, however, in general, equipment such as turbine has the life of thirty years and the dam structure has fifty years of lifetime. Also, an engineering handbook provides a default lifetime of 35 years for a hydropower plant. Based on the information gathered, assigning 40 years as the lifetime of a hydropower plant is adequate. The Master Plan states the lifetime of the hydropower plant of 40 years as well. (Even if the project lifetime of 30 years is used, the crediting period of the project will not be affected, as it exceeds the duration of the project crediting period of 21 years.)
3	Justification of the output capacity of 1.4MW	The installed capacity of 1.4 MW is in line with the Master Plan, which was determined based on the forecast maximum demand in 2030 as well as on the available flow of the water source.
4	The project being a Greenfield hydropower project without reservoir needs further justification.	Referring to the Environmental Project Brief (EPB), due to the project, it is expected that the depth of the river channel will increase within the immediate natural flooding zone. It is noted that, even before the project implementation, natural flooding zone is inundated during the wet season. As such, the project does not result in a new reservoir. If requested, inundated area of 250,000m^2 documented in the EPB is used to calculate the power density. This calculation results with the power density of 5.6W/m^2, which exceeds the threshold value of 4W/m^2.
5	Backup monitoring plan in the case of electricity meter failure is expected.	At the time of electricity meter failure, data log accumulated in the computer at Mujila Power Station will be used as the backup. During normal operation, signals of CT (Current Transformer) and VT (Voltage Transformer) will be sent to both electricity meter and to the computer at Mujila Power Station. Signals sent to the computer are kept as the data log. This data log is the duplicate of the electricity meter readings and can be used to calculate distributed electricity during the event of MWh meter failure. Since CT and VT are not electronic equipment, failure of CT and VT are rarely anticipated.

With assistance from ZESCO, the study team corresponded to the remarks made by the DOE, and all corrective actions and clarification requests in the remarks were clarified. The validation of the Project was concluded successfully and the request for registration was submitted to the UNFCCC CDM secretariat on 25 January 2013.

Following two Forward Action Requests (FARs) were raised by the DOE. These FARs must resolved by the time of verification for CER issuance from the Project.

FAR1：Preparation of “Operation and maintenance Manual”
FAR2：Preparation of “Monitoring Manual”

For the operation and maintenance manual, if there is a document that the ZESCO use for operation and maintenance of their hydropower plants, such document may be utilized to meet the CDM requirement. As for the monitoring manual, it is required that the document fully covers the monitoring requirements of the CDM activity. Especially for the management of the periodical calibration of monitoring equipments, a simple procedure which can be easily followed is desirable. These supplemental documents need to be prepared before the start of the commercial operation of the Project which is scheduled in March 2015.

The validation report and the final PDD submitted for requesting registration are attached as Annex G and Annex H, respectively. Please refer to the validation report about the validation details.

CDM reference number of 9533 (ref 9533) was assigned to the Project. The project is currently waiting for the commencement of completeness check. The process toward CDM registration after submission of the request for registration is as follows.

- Completeness check（7days）
- Information and reporting check (23days)
- Request for registration review period（28days）
- Registration of the project (registered date is the date when request for registration is submitted)

Normally, it takes approximately two months from the start of completeness check to the project registration. However, since there are over 650 submissions for registration waiting for the UN assessment, it will take a few months before commencement of the completeness check. By taking into account the registration request traffic jam currently observed, the study team anticipates registration of the Project around June 2012 at the most optimistic estimation.

2.4. CDM seminar

One of the objectives of this study is CDM capacity development for Zambian counterpart. To fulfill this objective, the study team organized a CDM seminar during the first on-site study carried out from 30 January to 5 February 2011. The CDM seminar was held on 2 February, and participants came from ZESCO, Ministry of Tourism, Environment and Natural Resources

(MTENR)[22], then the Zambian DNA, Japanese Embassy, and JICA. The study team introduced current trend of CDM in the world and in Africa, the CDM potential in Zambia, the programmatic CDM, and CDM case studies to the stakeholders in Zambia. Through the CDM seminar, the study team reinforced the participants' CDM knowledge, and aimed at supporting the seamless CDM implementation by the participants.

The questions and answers during the seminar have been summarized as follows.

Q1: (ZESCO) This is a query regarding Program CDM. Can a project with multiple donors be considered as a program CDM?
A1: (MUMSS study team) An activity with multiple donors can be considered as an activity under a program CDM.

Q2: (MTENR) Would like to know the details of Program CDM in Zambia.
A1: (MUMSS study team) Introduced Program CDM in Zambia, following the Program CDM PDD published under UNFCCC website.

Q3: (Japanese Embassy in Zambia) What is the definition of afforestation and Reforestation in Zambia? What is the status of afforestation/reforestation activities in Zambia?
A3: (MUMSS study team) Explained the definition of afforestation/reforestation under CDM context.
(MTENR) There is no fixed definition of forest in Zambia yet. However, emission reduction potential in the area of forestry is considered high in Zambia.

Q4: (ZESCO) How is the price of CERs determined?
A4: (MUMSS study team) Market in EU-ETS was explained. It was also explained that electrification projects in LDCs such as Zambia had high sustainable development impact and CERs from such projects would be well received by buyers.

Q5: (MTENR) How is the DOE selected for the programmatic CDM?
A5: (MUMSS study team) Liability issues of DOE in assessing the programmatic CDM were explained. Issues on the participation of the second CPA in the registered POA were also discussed.

Q6: (MTENR) Of solar power or micro scale hydroelectric power project, which project is ZESCO interested in implementing as a CDM project activity?
A6: (ZESCO) We are interested in a solar power project which is currently managed by Rural Electrification Authority (hereunder "REA"). We would like to focus on the existing small hydro electric power and grid extension projects for the time being.

[22] Zambian DNA: Ministry of Lands, Natural Resources and Environmental Protection

3. Development of a new CDM methodology for rural electrification projects involving extension of existing power distribution network, taking the rural electrification project in Bhutan as the example

3.1. Approach of the study

Both the rural electrification in Bhutan and the extension of power distribution network in Zambia aim to reduce the GHG emissions by replacing the conventional fossil fuels currently being used at households with the low carbon intensive grid electricity. The sources of the grid electricity in both Bhutan and Zambia are predominantly hydropower plants and because both countries are blessed with abundant water resources[23], it is expected that the extension of the existing distribution network to households will continue to contribute to the reduction of GHG emissions.

JICA's counterparts, DRE, BPC in Bhutan and ZESCO in Zambia, all expressed their desire to have the rural electrification projects mentioned above developed and registered as CDM project activities. Especially, CDM qualification and feasibility was assessed for the rural electrification activity in Bhutan as part of the rural electrification Master Plan study carried out from 2001 to 2003. Based on the results of the Master Plan study, specific assistance in implementing the CDM project has been provided by JICA since 2009. Although a draft PDD was produced by applying the existing approved CDM methodology, it was concluded that the revision to the applied methodology was necessary in order to make it applicable to the specific nature of the proposed electrification project in Bhutan.

The Study Team has conducted a thorough analysis on the results of the 2009 CDM Study, and has concluded that developing a new methodology will be best fit to the nature of the rural electrification project, instead of the revision of existing methodologies. Therefore the Study Team has set the goal of the study to development of the CDM methodology applicable to the rural electrification activity involving extension of electricity distribution network, as well as to achieve UN approval of the CDM methodology within the study duration.

While there are similarities between electricity distribution system in Bhutan and in Zambia, there are also differences between two systems; such as the type of power sources, and the balance of import/export among the trans-national grid systems. The study team proposed to develop a new methodology tailored to rural electrification project in Bhutan. This way, the required period for the approval of the methodology by the UNFCCC is expected to be minimized and will be able to achieve the goal of a new methodology approval within the study period. Once the methodology is approved, it will be much easier to cater the approved methodology to modify and make it applicable to Zambian project as well. This approach was accepted by JICA. As such, the study

[23] Of more than 23 GW hydroelectric potential in Bhutan, only 5% has been exploited and it is expected that quality hydroelectric power plants will be built (excerpt from Master Plan Study). Of 6GW hydroelectric potential in Zambia, only 1.7GW has been exploited (excerpt from Master Plan Study).

team developed a new CDM methodology applicable for the rural electrification in Bhutan, and aimed at the UN approval.

Figure 3-1 schematically summarizes electricity distribution system in Bhutan and in Zambia.

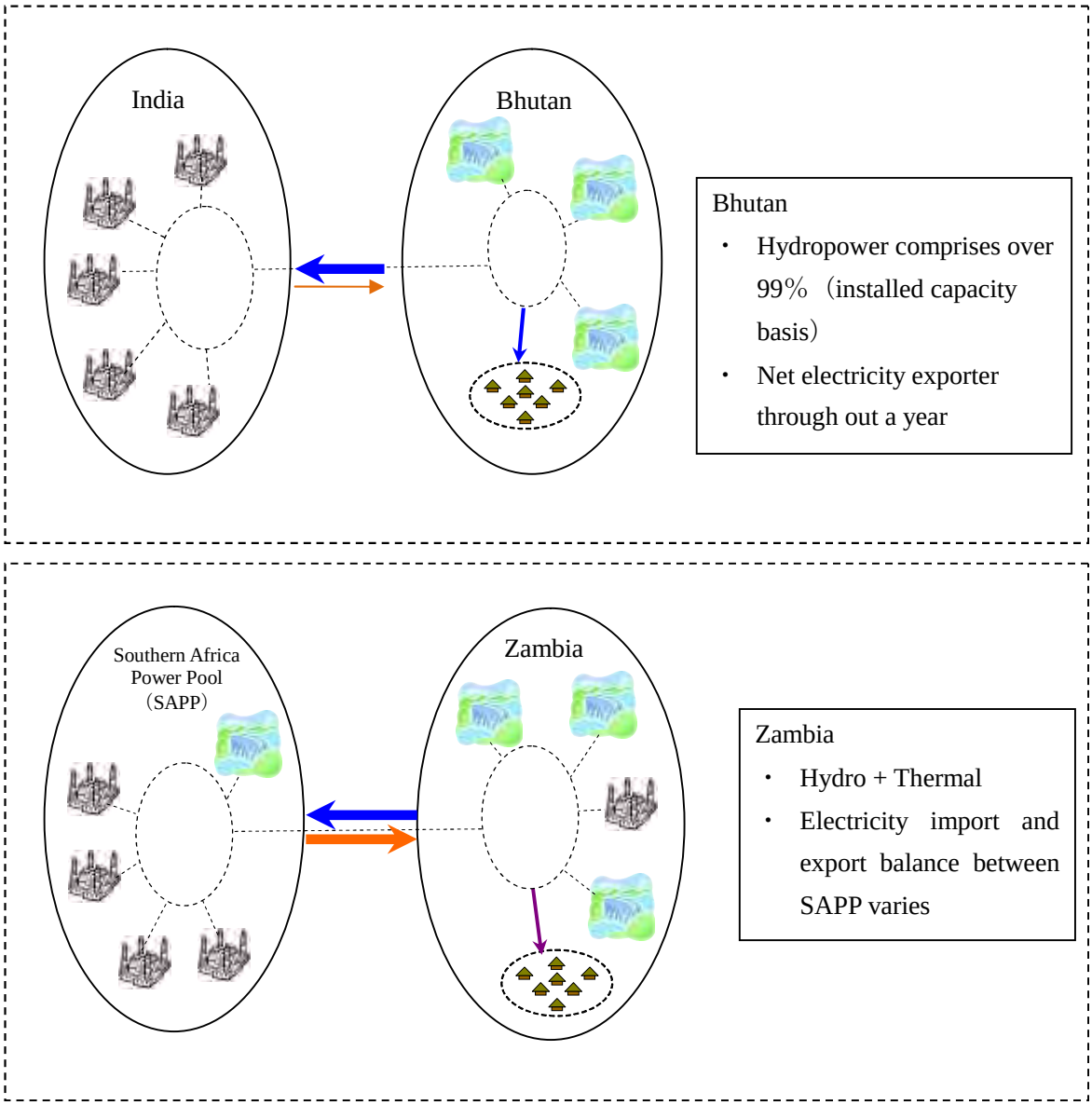


Figure 3-1: Image of the power distribution system in Bhutan and in Zambia

3.2. Assessment of the existing approved CDM methodologies

In the 2009 CDM study, applicability of existing CDM methodologies was discussed. In this study, taking the result of the 2009 CDM study in account, the study team had reassessed the applicability of the existing CDM methodologies to the Project activities. The result of assessment has been summarized in Table 3-1 below.

Table 3-1: Assessment of existing CDM methodologies possibly applicable to the Projects

	Existing CDM methodology assessed	Assessment result of the 2009 CDM study	View of the study team
Bhutan rural electrification project	AMS-I.C. Thermal energy production with or without electricity[24]	Since the project activity involves with fuel switch in household cooking, AMS-I.C. is deemed to be applicable.	This methodology comprises renewable energy technology that supply users with thermal energy that displaces fossil fuel use. In addition project needs to meet one of the following conditions: 1) supply electricity to the grid, 2) generate electricity or thermal energy on site, 3) combination of 1) and 2) The project is not a cogeneration project and does not meet any of above conditions. **→Methodology is not applicable to the rural electrification project with extension of power distribution network**
	AMS-I.E. Switch from non-renewable biomass for thermal application by the user[25]	Fuel wood currently used in house could be defined as non renewable biomass based on the results of literature review. It is highly recommended to apply this methodology.	In The methodology, the project is expected to reduce emissions by replacing utilization of non-renewable biomass with renewable energy technology such as biogas stoves or solar cookers. Since extension of the grid distribution network is not included in the applicability conditions of the methodology, it is necessary to obtain the approval from UNFCCC. **→Methodology is not applicable to the rural electrification project with extension of power distribution network**

[24] AMS-I.C.ver.19.0: "Thermal energy production with or without electricity", http://cdm.unfccc.int/methodologies/DB/6EL4AG49US2S1DNH55Y4S7GDQFA2JF

[25] AMS-I.E.ver.5.0: "Switch from non-renewable biomass for thermal application by the user", http://cdm.unfccc.int/methodologies/DB/WHTQUFLWCVNB9CIUZC198A712WGQR4

	Existing CDM methodology assessed	Assessment result of the 2009 CDM study	View of the study team
Zambia increased access to electricity project	AMS-III.AG Switching from high carbon intensive grid electricity to low carbon intensive fossil fuel [26]	This methodology will be applicable if a new scenario for the project activity involving switching from high carbon intensive fossil fuel to low carbon intensive grid electricity.	It is stipulated that "This methodology is not applicable to renewable biomass, biofuel or renewable energy in the project scenario" in the applicability conditions in AMS-III.AG [27]. Since the grid is supplied by hydroelectric power plants, it is highly likely that such grid electricity is regarded as renewable energy even the methodology is revised. **→Methodology is not applicable to the rural electrification project with extension of power distribution network**
	AM0045 Grid connection of isolated electricity systems [28]	Include not only isolated system but also un-electrified households and commercial facilities in the applicability condition. Revise the monitoring methodology to make sure all the units discontinue the use of fossil fuels and not to sell new units after connected to the grid.	Since the methodology intends for a standalone fossil fuel based power plant, revision or inclusion of new applicability condition as described in the left column is less likely to be approved. **→Methodology is not applicable to the rural electrification project with extension of power distribution network**

As shown in Table 3-1 above, both projects in Bhutan or in Zambia do not completely meet applicability conditions of the methodologies reviewed during the 2009 CDM study. For Bhutan particularly, small scale Type I methodologies were assessed. Since the rural electrification project in Bhutan aims to replace the fossil fuels currently being used in households by renewable energy through extending the existing grid distribution network which is supplied by hydroelectric power, methodologies developed for a project activity that will produce power or heat from renewable energy, such as AMS-I.C., is not applicable. In addition, in the Study conducted in 2009, AMS-I.C. was deemed applicable in view of the replacement of heat being used for cooking purposes with renewable energy. However, it is electricity that will be supplied by the existing distribution network in Bhutan hence it is less likely that the electricity will displace heat under the proposed project activity.

[26] AMS-III.AG ver.2.0: "Switching from high carbon intensive grid electricity to low carbon intensive fossil fuel", http://cdm.unfccc.int/methodologies/DB/HEQMKL062SLZM9K35LZCR9OJHDEALX

[27] AMS-III.AG paragraph 5 : "This methodology is not applicable to project activities that propose switch from fossil fuel use in the baseline to renewable biomass, biofuel or renewable energy in the project scenario."

[28] AM0045 ver.2.0: "Grid connection of isolated electricity systems", http://cdm.unfccc.int/methodologies/DB/0XHXSW8OSSITEWX2YMKTBIL4R05OX5

Most of the approved CDM methodologies intend to replace high carbon intensive grid electricity with low carbon intensive energy such as biogas, biomass or natural gas. For example, AMS-III.AG whose applicability was assessed for Extension of Power Distribution Network project in Zambia in 2009 targets a project that will replace high carbon intensive grid electricity with low carbon intensive fossil fuel. Going through all other approved CDM methodologies with potential in applying to rural electrification projects, there exists methodologies which are applicable to the following project types: ① New installation of grid connected renewable power generation system, ② New installation of standalone renewable power generation system, and ③ Connection of isolated electricity system to an existing grid system. However, there is no approved CDM methodology which is applicable to the project type ④ Extension of the existing grid / electricity distribution system. Therefore, the study team has proposed to develop a new methodology and JICA, as well as DRE/BPC in Bhutan, and ZESCO in Zambia agreed on this approach. Table 3-2 lists the existing approved CDM methodologies which may be applicable to rural electrification projects.

Table 3-2: List of CDM methodologies may be applicable to electrification projects

Project Type	Applicable CDM Methodologies
① New installation of grid connected renewable power generation system (including cogeneration)	AMS-I.D. ACM0002
② New installation of standalone renewable power generation system (including replacement of mini-grid)	AMS-I.A. AMS-I.F.
③ Connection of isolated electricity system to an existing grid system	AM0045
④ Extension of the existing grid / electricity distribution system	No approved CDM methodologies Developing a new methodology in this study

In addition to Type I that is applicable to a renewable energy project activity, two more types are eligible under small scale CDM methodologies, namely Type II for improvements in energy efficiency and III for other project types than Type I and II that result in emission reductions of less than or equal to 60kt CO_2 equivalent annually.

The proposed project activity in Bhutan is neither a renewable energy (Type I) nor an energy efficiency related project (Type II) thus, it is concluded that a new methodology will be developed under the category of Type III.

3.3. Characteristics of Bhutan and Bhutanese grid

3.3.1. Characteristics of Bhutan in association with additionality demonstration

As described in the previous section, the microscale guideline approved at the 54th meeting of the CDM EB based on decision 2/CMP.5 and 3/CMP.6[29] was revised to extend the scope to Type III project activities with less than 20 $ktCO_2e$ of annual emission reductions[30]. Under this new guideline, Type III project with less than 20 $ktCO_2e$ of annual emission reductions and located in a LDC will be considered additional and no further demonstration of additionality is required.

At the time of study, in accordance with the definitions set forth by the United Nations, Bhutan is categorized as a Least Development Country (LDC)[31]. Also, rural electrification project with extension of existing electricity distribution network will fall into Type III project category. DRE and BPC as well as the study team recognized that the above said microscale guideline would benefit the rural electrification project in Bhutan to be registered as CDM project activity.

According to DRE, the delegates of Bhutan government at COP16 in Cancun lobbied the CDM EB to extend the eligibility criteria of "Guidelines for demonstrating additionality of microscale project activities", to underrepresented countries with 10 or fewer registered CDM project activities as of 31 December 2010[32]. By doing so, the Bhutan delegates attempted to make sure the guideline continue to be applicable to its projects even after the country graduates from LDC status in the future. However the study team confirmed through DRE that there is no high risk of Bhutan graduating from LDC in immediate future. To achieve methodology approval within the scope of the study, the study team and DRE/BPC agreed to relay on the microscale guideline and not to include additionality demonstration waiver to underrepresented countries with 10 or fewer registered CDM project activities in the proposed new methodology.

The study team had also informed DRE and BPC that in case when Bhutan graduates from LDC before the crediting period of the CDM project ends, a clarification request to the CDM EB may be necessary to confirm that the CDM status for the project activity is granted to the project so long as the country is LDC at the time of project investment decision or at the time of registration.

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[29] "Guidelines for demonstrating additionality of renewable energy projects less than or equal to 5 MW and energy efficiency projects with energy savings less than or equal to 20 GWh per year (version 01)", EB 54, Annex 15

[30] "Guidelines for demonstrating additionality of microscale project activities (version 04)", EB68, Annex 26

[31] As of December 2012, Bhutan is considered as a LDC. Bhutan was added to the LDC list in 1971. http://www.un.org/en/development/desa/policy/cdp/ldc/profile/country_23.shtml）

[32] The Conference of Parties serving as the meeting of the Parties to the Kyoto Protocol requested, at its sixth meeting (CMP6), the CDM EB to develop standardized baselines prioritizing methodologies that are applicable to LDCs, Small Island Developing States (hereunder "SIDs"), Parties with 10 or fewer registered CDM project activities as of 31 December 2010 (Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its sixth session, held in Cancun from 29 November to 10 December 2010, Part Two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its sixth session, Further guidance relating to the clean development mechanism, Para 46)

3.3.2. Characteristics of Bhutanese grid

Currently there are two registered CDM projects in Bhutan. One is to construct an off-grid small hydropower plant to supply electricity to an un-electrified area of the country[33] and the other to build a large grid-connected hydropower station to sell the generated electricity to India[34]. In addition, two projects that involve the construction of grid-connected hydropower plants with the purpose of selling the electricity to India are currently going through the validation process.

In the PDD for the project that will sell the renewable electricity to India, it is stated that the Bhutanese and Indian grids are fully integrated without transmission constraints and hence considered as "trans-national grid". It is also mentioned that the electricity from Bhutan (mainly hydro power) is delivered to India through an integrated electricity system. Based on these circumstances, the grid emission factor of the said project was derived for a regional grid consisting of Bhutan and Indian grid, resulting in a higher grid emission factor. When the grid emission factor accounting only power plants in Bhutan, which are nearly 100% hydropower, is used as the baseline emission factor, there will be no emission reduction expected from grid extension project in Bhutan. However, emission reduction may be generated if the trans-national grid emission factor between Bhutan and India is applied as the baseline emission factor. Table 3-3 below summarizes the emission factors applied for Bhutan CDM projects that were registered and are under validation. Among those projects, "e7 Bhutan Micro Hydro Power CDM Project" is the non-grid-connected mini-hydropower generation project, where as remaining three projects sells electricity to India.

Table 3-3: Baseline scenario emission factor used in Bhutanese CDM activities

Project Title	Project Type (CDM methodology)	Status (Registered date)	Emission Factor
e7 Bhutan Micro Hydro Power CDM Project (Ref#0062)	Hydropower (AMS-I.A.)	Registered/issued (2005/5/23)	0.8 $kgCO_2$/kWh (Emission factor for diesel power generation)
Dagachhu Hydropower Project (Ref#2746)	Hydropower (ACM0002)	Registered (2010/2/26)	1.004 tCO_2/MWh (Trans-national grid of Bhutan and India)
Substitution of grid generation through transmission of renewable electricity generated in a hydro power generation station	Hydropower (ACM0002)	Validation	0.793 tCO_2/MWh (Trans-national grid of Bhutan and India)
Punatsangchhu-I-Hydroelectric Project	Hydropower (ACM0002)	Validation	0.779 tCO_2/MWh (Trans-national grid of Bhutan and India)

[33] "e7Bhutan Micro Hydro Power CDM Project (Project 0062)"
http://cdm.unfccc.int/Projects/DB/JACO1113389887.76/view
[34] "Dagachhu Hydropower Project, Bhutan (Project 2746)"
http://cdm.unfccc.int/Projects/DB/DNV-CUK1247228633.76/view

As seen in the Table 3-3 above, activity replacing electricity of the trans-national electricity grid between Bhutan and India by Bhutanese hydropower is more common as CDM in Bhutan. Also, under CDM, the grid emission factor for the trans-national grid (0.78～1.0 tCO2/MMh) is recognized as the grid emission factor of Bhutan.

On the other hand, the rural electrification project in Bhutan achieves GHG emissions reductions by replacing fossil fuels currently being used in non-electrified area with the low carbon intensive grid electricity by the means of extending the power distribution network. If the baseline emission factor for the rural electrification project in Bhutan is the grid emission factor of the trans-national grid between Bhutan and India, the Project will be considered promoting distribution of carbon intensive electricity within Bhutan and there will be no emission reduction associated with the Project. However, as it is obvious from the fact that Bhutan produces electricity exceeding its in-house demand and continuously supplying it to India by exporting it via trans-national grid, extension of electricity distribution network within Bhutan will not lead to electricity import from the trans-grid, but the hydropower electricity generated within Bhutan will be distributed to the communities newly connected to the power distribution network. In this regard, the study team found it is necessary to develop a new procedure to quantify emission reduction from rural electrification, without relying on the Bhutan grid emission factor recognized under the CDM.

Issues and concerns related to the grid emission factor explained above were discussed in detail with DRE and BPC during the first on-site study. The Study Team confirmed the Bhutanese counterparts' strong wish not to interfere with the existing trans-national grid emission factor of Bhutan and India. In this regard, the study team suggested including applicability conditions which ensure the new methodology is for the project in which renewable electricity generated within the host country being distributed to non-electrified communities within the host country and electricity sourced from outside the host country is not accounted for emission reductions. This suggestion by the study team was accepted by DRE and BPC:

- Existing power plants/units located within the host country[35] connected to the existing electricity distribution network are of primarily renewable (or low carbon) sources.
- National power development plan of the host country, if publicly available, confirms that power generation mix in the host country in the foreseeable future continues to be constituted primarily by renewable (or low carbon) sources.
- Electricity procured internationally and consumed by the host country is quantifiable, and the value is available to the project developer.
- Annual electricity consumption by the host country is quantifiable, and the value is available to the project developer.

[35] Power plant/unit physically located within the host country and connected to the grid is counted. Power plant/unit connected to the grid but located outside the host country is excluded.

By fulfilling the above applicability conditions, the study team ensured the project scenario under the new methodology being extension of renewable based electricity distribution network. Furthermore, by including applicability conditions ensuring the ratio of electricity sourced from outside the host country, the study team tried to ensure that imported electricity will be subject to project emissions so that emission reduction due to the rural electrification project is not overestimated. The concept of project emission is discussed in detail in the following section "Development of a new CDM methodology and the UN approval process".

3.4. Development of a new CDM methodology and the UN approval process

3.4.1. New methodology submitted to the UN evaluation (SSC-NM0068)

Based on the discussion held between the study team and Bhutanese counterpart, a new methodology titled "Rural electrification by extension of existing low carbon intensive electricity distribution network" was developed and submitted to the United Nations on 27th June 2011, assigned reference as SSC-NM0068. The small-Scale Working Group (hereafter referred as SSC WG), which is established to prepare recommendations on submitted proposals for new baseline and monitoring methodologies for CDM Small Scale project activities, assessed the proposed new methodology SSC-NM0068 at its 34th meeting scheduled in August 2011, and concluded their recommendation at its 36th meeting held in February 2012. Following Table 3-4 summarizes the development timeline of the new methodology.

Table 3-4: UN evaluation process for New Methodology SSC-NM0068

June 2011	New Methodology was submitted to SSC WG. Reference SSC-NM0068 was assigned to the submitted methodology.
August 2011	SSC-NM0068 was considered at the 33rd meeting of SSC WG. Preliminary-recommendation is provided to the proposed new methodology.
November 2011	Response to the preliminary recommendation for SSC-NM0068 was submitted to SSC WG.
February 2012	SSC-NM0068 received final recommendation by SSC WG at its 35th meeting. The proposed new methodology was recommended to be approved as AMS-III.AW "Electrification of rural communities by grid extension---Version 1.0"
March 2012	At the 66th meeting, the CDM Executive Board approved the final recommendation of SSC-WG for SSC-NM0068. Proposed new methodology is approved as AMS-III.AW "Electrification of rural communities by grid extension---Version 1.0"[36].

A copy of the proposed new methodology submitted to the UN is attached as Annex I.

Details of the proposed new methodology are summarized as below:

[36] http://cdm.unfccc.int/methodologies/DB/GRH88B4S68PO9H0YELQ8ZMVANO14JR

1） Applicability conditions

Each CDM methodology contains specific conditions to identify the type of project activity applicable to the underlying methodology. The applicability conditions in the new methodology for the rural electrification project are fine-tuned though the discussion with DRE and BPC, and following conditions listed in Table 3-5 were included in the new methodology submitted to the UN.

Table 3-5: Applicability of proposed new methodology

	Proposed applicability for SSC-NM0068	**Remarks**
1	The project does not involve construction of new electricity generation plants/units, but involves the extension of the existing power distribution network in the host country.	Segregation from Type I small scale CDM project activity.
2	Existing power plants/units located within the host country connected to the existing electricity distribution network are of primarily renewable sources [37].	A condition ensuring distributed electricity comes from renewable sources.
3	Electricity distributed by the project activity is quantifiable, and the value is available to the project developer.	A condition required for emission reduction calculations.
4	National power development plan of the host country, if publicly available, confirms that power generation mix in the host country in the foreseeable future continues to be constituted primarily by renewable sources[38].	A condition to ensure the electricity distributed by extension of distribution network in the host country is renewable electricity.
5	Electricity procured internationally and consumed by the host country is quantifiable, and the value is available to the project developer.	A condition required for project emission calculations associated with consumption of electricity supplied outside the host country.
6	Annual electricity consumption by the host country is quantifiable, and the value is available to the project developer.	Information required for determination of fraction of electricity supplied by outside sources.
7	Geographical area where electricity is supplied by the project activity (i.e. project region) is defined in the PDD.	A condition required to identify project boundary.
8	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	Threshold for Type III small scale CDM project activity.

[37] Examples of renewable sources include, but not limited to, hydro, solar, wind, and renewable biomass.
[38] Examples of renewable sources include, but not limited to, hydro, solar, wind, and renewable biomass.

2） Project boundary

The project boundary encompasses all anthropogenic emissions by sources of GHG under the control of the project participants that are significant and reasonably attributable to the project activity. Under the proposed new methodology encompasses the following:

- The physical extent of the power distribution network extended by the project activity.
- The physical, geographical site where the extended network distributes electricity (i.e. project region).

3） Baseline and project scenarios

Baseline scenario is a scenario that would happen in the absence of the CDM project activity. For the case of Rural Electrification Project, the baseline scenario is the fossil fuel consumption of the technology in use or that would have been used in the absence of the project activity (kerosene or diesel) to generate the equivalent quantity of energy.

Project scenario represents the scenario occurring due to the CDM project activity. For the case of Rural Electrification Project, the project scenario is the extension of the existing low carbon electricity distribution network to un-electrified area of the country.

4） Demonstration of additionality

The proposed new methodology does not explicitly discuss demonstration of additionality, but it simply follows existing CDM guidelines for additionality demonstration. Depending on the size of project activity, either of the following guidelines for additionality of the small scale CDM project activities and/or of the micro scale CDM projects will be referred for additionality demonstration:

- Guidelines on the demonstration of additionality of small-scale project activities[39]
- Guidelines for demonstrating additionality of microscale project activities[40]

In accordance with the guidelines on the demonstration of additionality of small-scale project activities, the project participant are required to demonstrate one of the following barriers exist to implementation of the project activity, thus the project is not realized without CDM assistance.

[39] Guidelines on the demonstration of additionality of small-scale project activities , EB 68 Annex 27 http://cdm.unfccc.int/Reference/Guidclarif/meth/methSSC_guid05.pdf

[40] Guidelines for demonstrating additionality of microscale project activities , EB68 Annex 26 http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid22.pdf

Investment barrier:	A financially more viable alternative to the project activity would have led to higher emissions.
Technological barrier:	A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.
Barrier due to prevailing practice:	Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.
Other barriers:	Without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

According to the microscale guideline, the type III project activities that aim to achieve emission reductions at a scale of no more than 20 ktCO_2e per year are additional if any one of the following conditions is satisfied:

1. The geographical location of the project activity is in one of the Least Developed Countries or the Small Island Countries (LDCs/SIDs) or in a special underdeveloped zone[41] of the host country identified by the Government before 28 May 2010;
2. The project activity is an emission reduction activity with both conditions (i) and (ii) below satisfied:
    1) Each of the independent subsystems/measures in the project activity achieves an estimated annual emission reduction equal to or less than 600 tCO2e per year; and
    2) End users of the subsystems or measures are households/communities/SMEs.

When the project exceeds the limit to apply the microscale guideline, the additionality of the project activity needs to be demonstrated using the procedures outlined in the guidelines on the demonstration of additionality of small-scale project activities.

5） Baseline emission calculation

Baseline scenario of the Rural Electrification Project is the continuation of the current consumption of fossil fuels. Two options to quantify baseline emissions are proposed in the new methodology:

[41] Special Underdeveloped Zone (SUZ)

Option 1: The emission baseline based on the fuel consumed to generate equivalent quantity of electricity distributed by the project activity.

$$BE_{CO2,y} = \sum_i ED_{i,y} * EF_{CO2}$$

Where:

EBCO2,y	Emissions in the baseline in year y, tCO_2e/yr
EFCO2	CO_2 emission factor, tCO_2e/MWh
$\sum i$	The sum of the group of project regions
EDi,y	Electricity distributed by the extended electricity distribution network to the project region i in year y, MWh/yr

A default value of 0.8 tCO_{2e}/MWh[42] may be used for EF_{CO2} if it is confirmed that the project activity does not replace electricity distribution from stand-alone renewable electricity generation facilities existing in the project region. In case where the project replaces electricity from renewable sources, the default emission factor of 0.8 tCO_{2e}/MWh must be adjusted taking into account the renewable electricity replaced by the project activity.

The following procedure is used to adjust the emission factor.

$$EF_{CO2,y} = (1 - \beta) * 0.8$$
$$\beta = E_{renewable} / \sum_i ED_{i,y}$$

Where:

$EF_{CO2,y}$	CO_2 emission factor, tCO_{2e}/MWh
β	Fraction of electricity distributed by the project activity that replaces renewable electricity generated by the existing renewable power generation units.
$E_{renewable}$	Renewable electricity distribution in the project region expected to be replaced by the project activity, MWh/yr This value will be estimated ex-ante using publicly available information and will be fixed throughout the project crediting period. The validity of the estimated value will be examined by the DOE at the time of the validation.

[42] A default value is derived from diesel generation units, which is adopted in an approved small scale CDM methodology, AMS-I.A.

$\sum_i$ The sum of the group of project regions

$ED_{i,y}$ Electricity distributed by the extended electricity distribution system to the project region *i* in year *y*, MWh/yr

Option 2: The emissions baseline based on the historic fuel consumption in the project region and the CO_2 emission factors for the fuels displaced.

$$BE_{CO2,y} = \sum_j FC_{j,baseline} \times NCV_j \times EF_{CO2,j}$$

Where:

$BE_{CO2,y}$ Emissions in the baseline in year *y*; tCO_2

$FC_{j,baseline}$ Amount of consumption of fuel type *j*; mass or volume unit in baseline year, prior to the project implementation.

This value will be fixed ex-ante throughout the project crediting period. The validity of the baseline sampling survey will be examined by the DOE at the time of the validation.

NCV_j Net calorific value of fuel type *j*; gigajoule per mass or volume unit

$EF_{CO2,j}$ CO_2 emission factor of fuel type *j*; tCO_2/GJ

j Fuel type used for combustion

In the case of Option 2, IPCC default values for emission factors may be used. Amount of fuel consumption of fuel type j in baseline year ($FC_{j, baseline}$) is quantified by conducting baseline sampling survey following the relevant guidance provided for small scale CDM project activity[43].

6） Project emissions calculation

The proposed new methodology takes account of the project activity emissions relating to the consumption of internationally procured electricity in the host country. This project emission is conservatively quantified by assuming that all internationally procured electricity by the host country is from fossil fuel sources. In the case of the host country importing electricity from outside the country, it is difficult to demonstrate that all electricity distributed by the project is the renewable energy. To conservatively estimate the emission reduction for such situation, the study team decided to provide a procedure in the proposed new methodology to deduct project emissions

[43] General guidelines for sampling and surveys for SSC project activities (version 01.1) http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid20.pdf

associated with imported electricity. Only the fraction of the electricity distribution by the project activity that would have been attributed to the internationally procured electricity will lead to project emissions. The fraction of electricity in the host country's annual electricity consumption, α, is adopted for this purpose.

In addition, all imported electricity is treated as electricity generated by thermal power plant. For CO_2 emission factor for the electricity the host country procured internationally, $EF_{CO2,\,y}$, a conservative emission factor of 1.3 tCO_2/MWh, the conservative emission factor adopted in the tool to calculate baseline, project and/or leakage emissions from electricity consumption[44] shall be applied.

The project emission is calculated as follows:

$$PE_{CO2,y} = \alpha * ED_{PJ,y} * EF_{CO2,y}$$

$$\alpha = E_{import} / E_{domestic}$$

$$ED_{PJ,y} = \sum_i ED_{i,y} / (1 - L)$$

Where:

$PB_{CO2,y}$	Project emissions in year y, tCO_{2e}/yr
α	The fraction of electricity in the host country's annual electricity consumption which is procured internationally
$ED_{PJ,y}$	Amount of electricity distributed in year y by the project activity including distribution loss, MWh/yr
$EF_{CO2,y}$	CO_2 emission factor for the electricity the host country procured internationally, tCO_{2e}/MWh
E_{import}	Amount of electricity the host country procured internationally in a given year for domestic consumption, MWh/yr Data from the latest year with available information is adopted.
$E_{domestic}$	Total amount of electricity the host country consumes domestically in a given year, MWh/yr Data from the latest year with available information is adopted.

[44] "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", EB39, Annex 7, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

$\sum_i$	The sum of the group of project regions
$ED_{i,y}$	Amount of electricity distributed by the extended electricity distribution system to the project region *i* in year *y*, MWh/yr
L	Average technical distribution losses, expressed as a fraction[45]

7） Leakage emissions calculation

Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary and which is measurable and attributable to the CDM project activity. For electricity sector projects in the CDM, leakage associated with construction of the project need not be counted[46]. Following the precedence, the project activity does not envisage leakage emissions associated with the project construction. Also, for the purpose of the new methodology submission, it may be better to claim no leakage source associated with the project activity, to keep the methodology as simple as possible. If Small Scale Working Group (SSC-WG) suggests otherwise, the leakage source may need to be included in the methodology.

8） Monitoring

In the process of developing a new methodology, the study team aimed to develop a simple monitoring procedure with minimum monitoring requirement after the project implementation. In the rural electrification by the mean of extension of the existing electricity distribution system requires monitoring of the quantity of electricity distributed by the project activity. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to extrapolate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity. "General guidelines for sampling and surveys for SSC project activities"[47] may be referred for sampling procedures. Monitoring parameters, measurement methods/procedures proposed in the new methodology are listed in shall consist of the following parameters listed in Table 3-6 below.

[45] For the project emissions calculation, default value of 20% shall be used as distribution loss.

[46] "The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction…. These emissions sources are neglected.", ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources --- Version 13.0.0" http://cdm.unfccc.int/filestorage/D/Y/P/DYPFI935XBG274NWH6O8CM1KEZR0VU/EB67_repan13_ACM0002_ver13.0.0.pdf?t=RFB8bWhxaTlxfDCwO2OI9a-5jatS3AzPlLWN

[47] "Guidelines for sampling and surveys for CDM project activities and programme of activities", EB69 Annex 05 http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid48.pdf

Table 3-6: Monitoring parameters suggested by the new methodology

No.	Parameter	Description	Unit	Monitoring /recording Frequency	Measurement Methods and Procedures
1	$ED_{i,y}$	Amount of electricity distributed by the extended electricity distribution system to the project region i in year y	MWh/yr	Continuous measurement by electricity meter(s), aggregated annually	Measured using calibrated electricity meter(s). Meter(s) is/are calibrated in accordance with the host country regulation. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to extrapolate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity (N_{meter}). "General guidelines for sampling and surveys for SSC project activities" may be referred for sampling procedures. Document from electricity authority (or equivalent entity) of the host country may be used in place of direct measurement records of electricity meter. Validity of information source will be verified by DOE at the time of verification. Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method. Where necessary, refer to the "General guidelines for sampling and surveys for SSC project activities". Used for baseline emissions calculation. Monitored only when Option 1 in baseline emission calculation is selected.
2	N_{meter}	Number of electricity meters	-	Recorded annually	Recorded by project developer

No.	Parameter	Description	Unit	Monitoring /recording Frequency	Measurement Methods and Procedures
		installed by the project activity			
3	E_{import}	Amount of electricity the host country procured internationally for domestic consumption	MWh/yr	The latest data is evaluated annually	Data is sourced from host country energy statistics. Data from the latest year with available information is adopted.
4	$E_{domestic}$	Amount of electricity the host country consumes domestically	MWh/yr	The latest data is evaluated annually	Data is sourced from host country energy statistics. Data from the latest year with available information is adopted.

3.4.2. Evaluation results of SSC-NM0068 (Preliminary[48] and the final recommendation[49])

SSC WG had considered NM0068 at its 33rd meeting and provided preliminary recommendation (SSC WG preliminary recommendation) with the aim to improve the proposed new methodology to be qualified for SSC WG approval. The preliminary recommendation by SSC WG for NM0068 has encompassed improvement in applicability conditions, project emissions, leakage emissions, and monitoring. Subsequently response to preliminary recommendation (SSC-NM0068-rev) was submitted to SSC WG on 21st November 2011. After consideration of the response to the preliminary recommendation, the SSC WG had reached to their final recommendation (SSCWG final recommendation) to approve the NM0068-rev with modifications at its 35th meeting held in February 2012. The SSC WG preliminary recommendation, response to the SSC WG preliminary recommendation, and the SSC WG final recommendation are attached as Annex 2, Annex 3, and Annex 4, respectively.

Details of the SSC WG preliminary recommendations, the response to the recommendations, and the SSC WG final recommendation are summarized as follows:

1) Comment toward applicability condition 1

SSC-WG Preliminary recommendation:	A threshold for primarily renewable should be provided and the applicability condition which check primarily renewable in the current and future grid) should be monitored throughout the crediting period. If monitoring of this condition is included, the applicability condition is not needed. Also, the

[48] SSC-WG Preliminary recommendation
[49] SSC-WG Final recommendation

	consequence of non compliance should be specified in the methodology.
Study team Response to the recommendation:	Methodology is revised to include monitoring of fraction of domestic renewable and non-renewable electricity supplied to the host country's electricity distribution network. Emissions associated with domestic non-renewable electricity are now factored into the project emission calculations. As suggested by the SSC-WG, this applicability condition was removed in the revised methodology, SSCNM-0068-rev.
SSC-WG Final recommendation:	SSC WG has included an applicability condition as such "Emission reductions can only be claimed if the share of electricity generation from renewable energy plants connected to the grid of the host country is greater than or equal to 99% in total electricity generation in the grid of that host country in each year during the crediting period". The purpose of keeping this threshold stringent is to simplify project emission calculations associated with incremental demand due to the project implementation in the grid and avoid complexity of calculating emissions from the operation of marginal power plants in the system required to cover the project activity demand. The concept of operating margin and build margin in the .Tool to calculate the emission factor for an electricity system is to estimate baseline emissions and thus it would not be conservative to use the same concept in this methodology for project emissions. The project proponents are however encouraged to submit a request for revision of the methodology to include an alternative threshold or to exclude thresholds altogether with adequate provisions to determine project emissions.
Study team Comment:	SSC-WG was aware that power generation mix in Bhutan is over 99 % renewable. SSC-WG suggested revising the methodology in case the methodology is applied to the cases with the renewable ratio less than 99%. Applicability of the methodology is somewhat limited since there will be very few host countries with the power generation mix with over 99% renewable.

2) Comment toward applicability condition 2

SSC-WG Preliminary recommendation:	The methodology should have an applicability condition to avoid possible double counting among electricity generation companies, transmission companies, distribution companies, electricity users, and other possible implementers.
Study team Response to the recommendation:	To avoid possible double counting among electricity generation companies, transmission companies, distribution companies, and electricity users, it is proposed to include two new applicability conditions which avoid double counting.
SSC-WG Final	SSCWG has accepted the applicability conditions suggested as part of response to preliminary recommendation.

recommendation:	
Study team Comment:	No further comment.

3) Comment toward definition of "rural electrification"

SSC-WG Preliminary recommendation:	Further specification and definition regarding rural electrification should be provided in order to ensure that the project activity is related with rural (and not urban) electrification.
Study team Response to the recommendation:	Definition of "rural electrification" in the context of this methodology has been included in the revised methodology as follows: "Definition of rural electrification in the context of this methodology is electrification of communities that does not have access to the host country's electricity distribution network prior to implementation of the project activity."
SSC-WG Final recommendation:	SSC WG did not address above preliminary recommendation in their final recommendation. No definition is given to rural electrification in their recommended draft methodology.
Study team Comment:	No further comment.

4) Comment toward Project emissions

SSC-WG Preliminary recommendation:	For project emissions, in case electricity is imported in the country, a value of 1.3 tCO_2/MWh is used as emission factor for the electricity imported. In principle, this is a very conservative assumption. However, the implicit assumption is that imports of electricity are not related with this project, as the emissions from the imported electricity are allocated over the whole electricity used in the country. This assumption should be further justified.
Study team Response to the recommendation:	The implicit assumption for the project applying this methodology is that the host country is a net electricity exporter, i.e. the host country has surplus electricity generation capacity and the same condition continues even after project implementation. Thus electricity import in the host country is independent of the project activity. To ensure that the project activity only occurs in the host country who are either net exporter or who does not import electricity from neighboring countries, a new applicability condition is suggested to be included.
SSC-WG Final recommendation:	SSC WG suggested simplifying project emission determination by including a stringent applicability condition associated with 99% renewable ratio in the host country's grid composition. With this, project emission is accounted only for the time period when host country is net electricity importer. This is going to be determined based on the host country's data complied hourly, daily, or

	monthly.
Study team Comment:	Electricity import/export data for the host country will be required.

5) Comment toward Leakage emissions

SSC-WG Preliminary recommendation:	The project activity could result in deforestation. Leakage provision to address such a situation should be provided in the methodology.
Study team Response to the recommendation:	Provision for the possible leakage emission associated with deforestation due to the project was included in the revised methodology. Proposed leakage provision is the modification of the provision in approved methodology AM0045"Grid connection of isolated electricity systems" aiming to limit the subject of leakage emissions to protected forest land area, rather than entire deforested area.
SSC-WG Final recommendation:	SSC WG suggested to simplify leakage measure by referring directly to AM0045 "Grid connection of isolated electricity systems" and not to limit the leakage to protected forest land. If the estimated leakage is within 5% of the estimated emission reductions of the project, then this leakage source may be neglected.
Study team Comment:	This suggested change to the methodology may significantly affect the amount of CER generated from the project. Two parameters necessary to quantify leakage, deforested area due to the project activity and carbon stock removed per unit area needs to be assessed closely to confirm the project generates positive CERs throughout the crediting period.

6) Comment toward Monitoring

SSC-WG Preliminary recommendation:	For the monitoring of the amount of electricity distributed by the project activity, the proposed source is document from electricity authority. This specification should be further clarified. We expect that this parameter is determined based on direct measurement say for example at nearest distribution substation(s).
Study team Response to the recommendation:	To ensure that the parameter is determined based on direct measurement, the methodology is suggested to be revised as follows: "Document from electricity authority (or equivalent entity) of the host country, if it is the compilation of direct measurement of electricity distributed by the project activity, may be used in place of direct measurement records of electricity meters."
SSC-WG Final recommendation:	SSC WG has suggested limiting monitoring of amount of electricity distributed by the extended electricity distribution system to direct measurement. Measurement methods and procedures are modified as follows: "Measured from

	the supply point that serves the project area, whether that is the nearest existing transmission/distribution sub-station, a feeder from that station, or a new branch in a distribution line that serves the project area. The distribution losses shall be deducted from the amount of electricity measured. A default value of 10% shall be used for average annual technical distributions losses. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to extrapolate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity (M_{eter}). Standard for sampling and surveys for CDM project activities and programmed of activities may be referred for sampling procedures. Validity of information source will be verified by DOE at the time of verification. Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method"
Study team Comment:	Distributed electricity will be monitored either by individually installed meters, or by the electricity meters at the distribution substation(s). For monitoring of individual meters, sampling and survey may be effective. Details of monitoring plan needs to be established accounting for the actual meter installation plan as well as work required for individual meter monitoring.

3.4.3. Evaluation result by the UN (Approved Small scale CDM methodology, AMS-III.AW)

At its 65th Meeting, the CDM Executive Board accepted recommendation by SSC WG for SSC-NM0068, and approved proposed new methodology as AMS-III.AW "Electrification of rural communities by grid extension---version 1.0". This is the first approved CDM methodology which is applicable to electrification of a rural community through extension of a national grid/regional grid in the host country. AMS-III.AW is attached as Annex M.

The components of AMS-III.AW are summarized as follows:

1） Applicable conditions

Applicability conditions adopted in AMS-III.AW are listed in Table 3-7 below.

Table 3-7: Applicability condition of AMS-III.AW

	Applicability conditions	Comparison with SSC-NM0068
1.	This methodology comprises electrification of a rural community through extension of a national grid/regional grid (grid hereafter).	Based on SSC-NM0068. To clarify the type of project that can apply the methodology.
2.	The applicability is limited to households and users that do not have access to a grid.	Based on SSC-NM0068. To clarify the type of project that can apply the methodology.
3.	Emission reductions can only be claimed if the share of electricity generation from renewable energy plants connected to the grid of the host country is greater than or equal to 99% in total electricity generation in the grid of that host country in each year during the crediting period.	Included based on the SSC-WG recommendation to simplify the methodology.
4.	Cross border electricity export and import by the host country is quantifiable, and the data on import/export is available to the project developer.	Based on SSC-NM0068. To confirm the host country being a net electricity exporter.
5.	The project does not involve construction of new electricity generation plants/units, but involves the extension of the existing power distribution network in the host country.	Based on SSC-NM0068. To clarify the type of project that can apply the methodology.
6.	The project does not displace existing renewable based mini-grid electricity. To ensure compliance with this condition, existing renewable based mini-grid system and their service area shall be identified and it is confirmed that the project does not provide electricity to the area serviced by the renewable based existing mini-grid system.	Included based on the SSC-WG recommendation to provide justification for baseline emissions calculations.
7.	To avoid possible double counting of emission reduction claims from electricity generation companies, transmission companies, distribution companies, either all relevant parties are listed as participants to the project activity, or the project developer shall obtain a written consent from other relevant entities stating voluntary release of their right to develop CDM project activity and to claim emission reductions from the same electrification project activity. End users of the electricity distributed as a result of project activity are not eligible to apply this methodology to claim emission reductions from consumption of electricity distributed by the project	Included based on the SSC-WG recommendation to avoid double counting of emission reduction.

	activity.	
8.	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	Based on SSC-NM0068. A threshold for the small scale CDM type III project.

2） Project boundary

Under AMS-III.AW, the project boundary includes all power plants within the host country physically connected through transmission and distribution lines to the national electricity system to which the CDM project is being connected to, and the physical sites of the households, public services and the facilities that are supplied with electricity by the project activity.

3） Baseline scenario

Under AMS-III.AW, as proposed in NM0068, the energy baseline is the fossil fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

4） Demonstration of additionality

As suggested in NM0068-rev, demonstration of additionality under AMS-III.AW follows existing guidelines follows existing CDM guidelines for additionality demonstration. Depending on the size of project activity, either of the following guidelines for additionality of the small scale CDM project activities and/or of the micro scale CDM projects will be referred for additionality demonstration:

- Guidelines on the demonstration of additionality of small-scale project activities
- Guidelines for demonstrating additionality of microscale project activities

5） Baseline emissions

Under AMS-III.AW, Option 1, one of the two options for baseline emissions calculation procedures suggested in NM0068-rev, was adopted. Also, AMS-III.AW provides a new option for baseline emissions calculation in case where the grid electricity extension project displaces an existing mini-grid that is exclusively powered by diesel generators.

Under AM-III.AW, the energy baseline is the fossil fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy, and is calculated as follows.

$$BE_{CO2,y} = \sum_i ED_{i,y} * EF_{CO2}$$

Where:

$EB_{CO2,y}$	Emissions in the baseline in year *y*, tCO2e/yr
EF_{CO2}	CO2 emission factor, tCO2e/MWh
$\sum_i$	The sum of the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution network to the project region *i* in year *y*, MWh/yr

A default value of 0.8 tCO_2e/MWh may be used for EF_{CO2} if it is confirmed that the project activity does not replace electricity distribution from stand-alone renewable electricity generation facilities existing in the project region. In case where the project replaces electricity from renewable sources, the default emission factor must be adjusted taking into account the renewable electricity replaced by the project activity using the following procedure:

$$EF_{CO2,y} = (1 - \beta) * 0.8$$

$$\beta = EG_{renewable} / \sum_i ED_{i,y}$$

Where:

$EF_{CO2,y}$	CO_2 emission factor, tCO_2e/MWh
β	Discount fraction for electricity distributed by the project activity that replaces renewable electricity generated by the existing stand-alone renewable power generation units (e.g. solar PV system)
$EG_{renewable}$	Renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity, MWh/yr
$\sum_i$	The sum of the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution system to the project region *i* in year *y*, MWh/yr

Under AMS-III.AW, where the grid electricity extension project displaces an existing mini-grid that is exclusively powered by diesel generators, the baseline for the amount of electricity historically supplied through the mini-grid will be different and base line emissions are calculated based on the historical emissions of the existing mini-grid as follows.

$$BE_{hist,y} = EG_{hist} * EF_{hist}$$

Where:

$EB_{hist,y}$	Baseline emissions from consumers historically connected to a mini-grid (tCO_2)
EG_{hist}	Historical electricity generation from existing mini-grid (MWh)
EF_{hist}	Historical emissions factor for the mini-grid (tCO_2/MWh)

The historical emissions factor for the mini-grid is calculated from total fuel consumption and generation from mini-grid connected plants for the most recent three years as follows.

$$EF_{hist} = \frac{\sum_i \left(FC_{hist,i} \times NCV_i \times EF_{co2,i} \right)}{\sum GEN_{hist}}$$

Where:

EF_{hist}	Historical emissions factor for the mini-grid (tCO_2/MWh)
FC_{hist}	Historical consumption of fossil fuel type *i* in all mini-grid plants (tons)
NCV_i	Net Calorific Value of fossil fuel type *i* (GJ/ton)
$EF_{CO2,i}$	Emission factor for fossil fuel type *i* (tCO_2/GJ)
GEN_{hist}	Historical electricity generation from all mini-grid plants (MWh)

6） Project emissions

Under AMS-III.AW, project emission is calculated for the period where the host country is a net importer. The project emissions shall be calculated for that period at least on a monthly basis using the following equation. Project emissions are zero during the period the host country is net exporter.

$$PE_y = \sum_t^P ED_{i,t} \times EF_{CO2,import,y}$$

If $EG_{export,t} > EG_{import}$, then

$EF_{CO2,import,y} = 0$

Where:

PE_y	Project emissions in year *y*, tCO_2e/yr
$\sum_t^P$	The sum of period during which the country is net importer, *t* can be hourly or daily or monthly
$EG_{import,t}$	Amount of electricity imported into the grid from other countries and monitored hourly or daily or monthly in a given year *y*, MWh
$EG_{export,t}$	Amount of electricity exported from the grid to other countries and monitored hourly or daily or monthly in a given year *y*, MWh
$ED_{i,t}$	Amount of electricity distributed by the extended electricity distribution system to project region i, monitored hourly or daily or monthly in a given year *y*, MWh
$EF_{CO2,import,y}$	CO_2 emission factor for the electricity the host country procured internationally, tCO_2e/MWh (Use 1.3 tCO_2/MWh)

7） Leakage emissions

Under AMS-III.AW, leakage on account of construction of new transmission/distribution lines (e.g. carbon stock loss due to deforestation) shall be calculated using the method indicated in baseline and monitoring methodology AM0045. If the estimated leakage is within 5% of the estimated emission reductions of the project, then this leakage source may be neglected, otherwise the leakage shall be deducted from the emissions reductions.

A procedure for leakage calculation in AM0045 is shown as follow:

$$LE_1 = A_{def} \times L_C$$

Where:

LE_1	Leakage emissions to be accounted in the first year of project crediting period
A_{def}	The area of land deforested in hectares.

L_C The carbon stock per unit area, in tons of CO2 per hectare.

8） Emission reduction

Emission reduction under AMS-III.AW is calculated as follows:

$$ER_y = BE_y - PE_y - LE_1$$

9） Monitoring

Monitoring parameters required under AMS-III.AW are listed in Table 3-8 below.

Table 3-8: Parameters monitoring in AMS-III.AW

No.	Parameter	Description	Unit	Monitoring /recording frequency	Measurement methods and procedures
1	ED_y	Amount of electricity distributed by the extended electricity distribution system to the project region *i* in year *y*	MWh/y	Continuous measurement by electricity meter(s), aggregated hourly or daily or monthly	Measured using calibrated electricity meter(s). Measured from the supply point that serves the project area, whether that is the nearest existing transmission / distribution sub-station, a feeder from that station, or a new branch in a distribution line that serves the project area. The distribution losses shall be deducted from the amount of electricity measured. A default value of 10% shall be used for average annual technical distributions losses. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to estimate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed

					under the project activity (N_{meter}). Standard for sampling and surveys for CDM project activities and programme of activities may be referred for sampling procedures. Validity of information source will be verified by DOE at the time of verification. Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method
2	N_{meter}	Number of electricity meters installed by the project activity	-	Recorded annually	Recorded by project developer
3	$EG_{import,t}$	The amount of electricity the host country imported from other countries in year *y*	MWh/yr	Continuous measurement by electricity meter(s) aggregated hourly or daily or monthly	Data is sourced from host country electric authority/utility (e.g. from load dispatch centers)
4	$EG_{export,t}$	The amount of electricity the host country imported from other countries in year *y*	MWh/y	Continuous measurement by electricity meter(s) aggregated hourly or daily or monthly	Data is sourced from host country electric authority/utility (e.g. from load dispatch centers)
5		Electricity generation in year *y* from all the power plants (renewable and others), that are within the host country, and are physically connected to the grid to which the CDM project is connected to (as per paragraph 3)	MWh/y	At least monthly, aggregated annually	Data is sourced from host country electric authority/utility (e.g. from load dispatch centers)

3.4.4. Approved new CDM methodology, AMS-III.AW, and its outstanding issues

In the process of evaluating proposed new methodology and drafting it into an approved methodology, SSC WG has suggested and made several modifications to the SSC-NM0068 or the originally proposed new methodology. The major modifications adopted in AMS-III.AW which was not addressed in the proposed methodology are summarized in Table 3-9 below.

Table 3-9: Modifications adopted in AMS-III.AW and required action

	Modifications adopted in AMS-III.AW	**Required Action**
Applicability Condition:	Emission reductions can only be claimed if the share of electricity generation from renewable energy plants connected to the grid of the host country is greater than or equal to 99% in total electricity generation in the grid of that host country in each year during the crediting period.	Generation mix of the host country needs to be evaluated annually to ensure renewable share is greater than or equal to 99%.
Project emissions:	For the period where the host country is a net importer, the project emissions shall be calculated for that period at least on a monthly basis using the following equation. Project emissions are zero during the period the host country is net exporter.	Record of electricity import and export for the host country needs to be monitored and aggregated either hourly, daily, or monthly. For the period where host country is net electricity importer, project emission is calculated using a conservative default emission factor of 1.3 tCO_2/MWh.
Leakage emissions:	Leakage on account of construction of new transmission/distribution lines (e.g. carbon stock loss due to deforestation) shall be calculated using the method indicated in baseline and monitoring methodology AM0045 .Grid connection of isolated electricity systems. If the estimated leakage is within 5% of the estimated emission reductions of the project, then this leakage source may be neglected, otherwise the leakage shall be deducted from the emissions reductions.	To determine leakage emissions, project requires following two parameters: Protected forest land area deforested due to transmission lines construction by the project activity (A_{def}, in hectares) Carbon stock removed per unit area by the project activity, (L_c, in tCO_2e/hectare) Leakage emission can be significant and may lead to negative emission reductions during the beginning of the crediting period. CER can be claimed only when all leakage emissions are offset by subsequent emission reductions.

3.4.5. Revision of the PDD based on the approved methodology AMS-III.AW

A draft PDD submitted to SSC WG at the time of new methodology submission was revised based on the approved methodology AMS-III.AW, using the latest PDD template adopted at 66th CDM Executive Board Meeting in April 2012. Emissions reductions were recalculated using the procedures outlined in AMS-III.AW as follow.

1) Calculation of baseline emissions

For the purpose of ex-ante calculation, average household monthly electricity consumption is set at 60kW/month[50] for the 33,436 households within the project region. Also, it is assumed that there will be no replacement of off-grid renewable electricity. Baseline emissions are calculated as follow.

$$\beta = EG_{renewable,y} / \sum_i ED_{i,y}$$

$$= 0 / 24{,}074$$

$$= 0$$

$$EF_{CO2,y} = (1 - \beta) * 0.8$$

$$= (1 - 0) * 0.8$$

$$= 0.8$$

$$BE_{CO2,y} = \sum_i ED_{i,y} * EF_{CO2}$$

$$= 24{,}074 * 0.8$$

$$= 19{,}259\ tCO_2e/yr$$

2) Calculation of project emissions

Assuming the host country is a net electricity exporter throughout a whole year, project emissions are calculated as follows.

Since $EG_{export,month} > EG_{import,month}$ all year round, then, $EF_{CO2,import,y} = 0$.

Therefore project emissions are zero.

[50] Assumption confirmed by BPC. This value will be replaced by actual monitored data after the project implementation.

$$PE_y = \sum_t^P ED_{i,t} \times EF_{CO2,import,y}$$
$$= 24{,}074 \times 0$$
$$= 0$$

3) Calculation of leakage emissions

As described in the previous section, the proposed new methodology NM0068 was modified during the process of UN approval as AM-III. AW to account for the deforestation related leakage emissions. For the purpose of deforestation leakage calculation, deforestation area and the carbon intensity for unit deforested area are necessary. For the purpose of ex-ante calculation, following assumption were adopted to quantify leakage emissions from the project.

(a) Deforestation area: 1,000 hectares[51]
(b) Carbon intensity for unit deforested area: 75.4tC/hectare[52].

Based on the assumption, the leakage emission due to deforestation is calculated as 276,500 tCO_2e.

$LE_1 = A_{def} \times L_C$

= 1,000 ha $\times$ 276.5 tCO_2e/ha

= 276,500 tCO_2e

4) Calculation of emission reductions

In conclusion, the emission reduction achieved by the project activity is estimated as follows.

$ER_{,y} = BE_y - PE_y - LE_1$

Where:

ER_y Emission reduction in year *y*, tCO2e/yr

$BE_{CO2,y}$ Emissions in the baseline in year *y*, tCO2e/yr

[51] Master Plan Chapter 14.3.1 Table 14.3.1. It is assumed that only part of the area for setting of the distribution system is subject to deforestation.
[52] Global Forest Resources Assessment 2010 (FRA 2010) available via FAO website, http://www.fao.org/forestry/fra/fra2010/en/

PE_y Project emissions in year *y*, tCO2e/yr

LE_1 Leakage emissions to be accounted in the first year of project crediting period, tCO2e/yr

Ex-ante calculation in the PDD is summarized as follows.

$ER_1 = BE_{CO2,1} - PE_{CO2,1} - LE_1$

$ER_y = 0$ *if Cumulative ER<0 for the year, else,*

$Ery = BE_{CO2,y} - PE_{CO2,y}$

Year (y)	ER_y	*Cumulative ER*	$BE_{CO2,y}$	PE_y	LE_y
Year 1	0 tCO_2	-267,234 tCO_2	19,259 tCO_2	0 tCO_2	276,500 tCO_2
Year 2	0 tCO_2	-247,975 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 3	0 tCO_2	-228,716 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 4	0 tCO_2	-209,457 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 5	0 tCO_2	-190,198 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 6	0 tCO_2	-170,939 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 7	0 tCO_2	-151680tCO_2	19,259 tCO_2	0 tCO_2	0
Year 8	0 tCO_2	-132421tCO_2	19,259 tCO_2	0 tCO_2	0
Year 9	0 tCO_2	-116162tCO_2	19,259 tCO_2	0 tCO_2	0
Year 10	0 tCO_2	-93903tCO_2	19,259 tCO_2	0 tCO_2	0
Year 11	0 tCO_2	-74644tCO_2	19,259 tCO_2	0 tCO_2	0
Year 12	0 tCO_2	-55385tCO_2	19,259 tCO_2	0 tCO_2	0
Year 13	0 tCO_2	-36126tCO_2	19,259 tCO_2	0 tCO_2	0
Year 14	0 tCO_2	-16867tCO_2	19,259 tCO_2	0 tCO_2	0
Year 15	2,392 tCO_2	2,392 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 16	19,259 tCO_2	21,651 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 17	19,259 tCO_2	40,910 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 18	19,259 tCO_2	60,169 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 19	19,259 tCO_2	79,428 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 20	19,259 tCO_2	98,687 tCO_2	19,259 tCO_2	0 tCO_2	0
Year 21	19,259 tCO_2	117,946 tCO_2	19,259 tCO_2	0 tCO_2	0

Positive emission reduction will occur after all leakage emission is offset. Based on the assumptions for ex-ante calculation, a full annual emission reduction occurs from the 16th year[53].

[53] The project is currently at the validation stage. Based on the detailed leakage study conducted for the preparation to the validation, the project may not be subject to the full-scale leakage due to the deforestation. Validation suggests that not all deforestation occurring within the project site is attributed to the project activity. In this regard, the validation continues with an assumption that there may be positive

5) Outstanding issues to be resolved before validation

When projects involve deforestation and apply the methodology AMS-III.AW, leakage emissions due to deforestation by the project affects the CER generated from the project. To determine leakage emissions, total area deforested due to the project activity (hectare) and carbon stock removed per unit area by the project activity (tCO_2e/hectare) are required. Accurate estimation of deforestation related leakage emissions can be achieved by establishing project specific values of both deforested area, and carbon stock removed per unit area; the two components composing deforestation leakage emissions. To calculate project emissions, data of the amount of electricity import and export are necessary. The import/export balance may be assessed on hourly, daily or monthly basis. The project participant can select the interval for the balance assessment. Moreover, details of monitoring procedures of the electricity supplied by the project need to be established: whether to place meters at each household/users, or to use the meter at the substation; establishment of the monitoring and management team; sampling procedures when multiple meters are installed for the monitoring purpose.

It is emphasized that determination of the basis for the leakage is the subject for future investigation. Also, for the project to move forward to validation process, further update of PDD is necessary to complete Section D (Environmental impact) and Section E (Local Stakeholder consultation).

Revised draft PDD based on AMS-III.AW is attached as Annex N.

3.5. CDM Capacity development workshop

Bhutanese counterpart had gone through a major restructuring in 2011. Department of Renewable Energy (DRE) was established and became the agency responsible for rural electrification project, in place of Department of Energy (DOE). To develop CDM capacity within the newly formed DRE, as well as in other related agencies, DRE had requested the study team to hold a CDM Capacity Development Workshop as part of the study. As the capacity development is listed as one of the objective for the study, a two-day CDM workshop was arranged on 17th and 18th of April 2012. Together with reporting of approval of the new methodology, the CDM capacity development workshop became the main objective of the 2nd on-site study, which was carried out from 15th to 21st of April 2012. There were about thirty participants each day for the workshop from various agencies including DRE and BPC.

The list of workshop participants is attached as Annex O.

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emission reduction from the project starting at the first year of implementation. However, before the registration of the project, it may be required to deduct larger leakage for the project.

3.5.1. Workshop agenda and the schedule

Workshop agenda and time schedule was discussed with DRE and BPC thoroughly and topics were selected to cater to attendees with various CDM back ground from introductory to advance. The final workshop agenda and the time schedule is shown in the below table:

Day 1: 17 April 2012, Tuesday

Time	Topics
09:00-09:15	**Workshop Schedule/Introduction of JICA study**
09:15-10:30	**Topic 1** Trend in CDM and CDM beyond Kyoto Protocol 1st Commitment Period - CDM in LDCs - CDM Programmes of Activities - Second commitment period and new market mechanism after 2020
	Q&A / Discussion
10:30-11:00	Tea Break
11:00-12:30	**Topic 2** Rural Electrification Project and CDM New Methodology development - Outcome of CDM New Methodology development - How to apply the newly approved CDM methodology to the rural electrification project in Bhutan
	Q&A / Discussion
12:30-13:30	Lunch
13:30-15:30	**Topic 3** How to design CDM project - Case study#1: Solar PV project - Case study#2: Mini hydropower project - Case study#3: Biogas collection and utilization Q&A / Discussions.
15:30-16:00	Tea Break
16:15-16:30	Closing for the 1st day Introduction of the Workshop Schedule for the 2nd day

Day 2: 18 April 2012, Wednesday

Time	Topics
09:00-09:15	**Workshop Schedule/Introduction of JICA study**
09:15-10:15	**Topic 4** Understanding and application of different CDM methodologies applied for different types of projects - Case Study 1: Solar Water Heating System (AMS-I.J) - Case Study 2: Transportation Energy Efficiency Activities using Retrofit Technologies (AMS-III.AA)
10:15-10:30	Tea Break.
10:30-12:00	**Topic 4(continued)** Understanding and application of different CDM methodologies applied for different types of projects - Case Study 3: Recovery and recycling of materials from solid waste (AMS-III.AJ)
	Q&A / Discussions
12:00-13:00	Lunch
13:00-14:15	**Topic 5** CDM Monitoring and issuance of CERs
	Q&A / Discussions
14:15-14:30	Conclusion/Closing

3.5.2. Main topics of questions/answer and discussion session during the workshop

Workshop participants actively exchanged opinions and asked questions. Main topics of Q&A/Discussions session during the workshop is summarized as follows:

Session 1: Trend in CDM and CDM beyond Kyoto Protocol 1st Commitment Period

- Workshop attendee actively sought for information about the bundling scheme of a small-scale CDM project as well as about the program CDM activity (POA) scheme. Bundling scheme especially drew attention of many attendees because it may reduce CDM transaction costs by compiling multiple small scale CDM components into one bundled activity.
- Some workshop attendees with CDM experience showed concerns about the exemption measure for additionality proof for microscale CDM activities: Because this measure automatically grants additionality status to some selected activities, spirit of CDM may be undermined.

- Many of the workshop participants were interested in China's domination of CDM community as indicated by the number of registered projects. The study team had explained that the streamlined CDM support provided by Chinese government is the major reason for China's success in CDM.

Attendees involved in CDM project development in Bhutan expressed their opinion about the needs for capacity development toward Bhutanese DNA, because, due to the lack of resources, Bhutanese DNA approval process takes much longer than it is expected.

- The study team shared information about several program CDM under validation in which Bhutan is listed as one of the multiple host countries. No workshop attendee, including Bhutanese DNA, was aware of these projects. NEC (as Bhutanese DNA) was keen to find out whether host country approval would be necessary for these projects prior to requesting registration. The study team commented as follows: because host countries of the program CDM activity is determined ex-ante, most likely DNA approvals from all listed host countries are required prior to the registration of the project activity.

- Bilateral Offset Credit Mechanism (BOCM), which Japanese government is promoting, also draw attention of Bhutanese participants. They, especially individuals facing difficulty going through actual CDM procedures, are keen to know if projects facing difficulty in CDM scheme can be promoted under BOCM. The study team answered that that is one of the major reasons for BOCM to be promoted.

-Workshop attendees were also keen to know the difference between MRV under United Nations, and MRV under BOCM, as well as CDM methodologies.

Session 2: Rural Electrification Project and CDM New Methodology development

- Workshop participants requested explanation about the difference between the approved methodology and other existing renewable power capacity addition methodologies (e.g. ACM0002, AMS-I.D.etc), regarding the handling of deforestation associated leakage. The study team explained that the current CDM rule exempts accounting of deforestation related leakage from renewable power generation methodology.

- Workshop participants requested clarification about the monitoring requirements for the leakage. The study team clarified that, in accordance with the approved methodology, leakage is quantified at the time of validation and there is no monitoring requirement associated with deforestation related leakage.

- Workshop participant requested clarification on possibility of replacement of the conservative emission factor used for project emission calculation, 1.3 tCO2/MWh), by actual emission factor of the import electricity. The study team clarified that the approved methodology fixes the emission factor for import electricity conservatively. The study team also indicated possibility of methodology revision to include other emission factors.

Session 3: How to design CDM Projects (Solar PV, Mini-Hydro, Biogas)

- One of the workshop participants who are involved in large scale trans-national grid connected hydropower project activity questioned whether DNA approval from both Bhutan and India are required for CDM registration of trans-national grid connected project. The study team shared the opinion that both DNA approval would be required for such case. The study team also suggested the participant to communicate with UN via DOE to confirm the requirement and take necessary action.

- Among case studies covered, some participants indicated that Bhutan has higher potential in biogas utilization projects. Varieties of biogas generation potential for different livestock were also questioned. The study team clarified that CDM methodology for animal waste utilization for biogas production adopts IPCC procedures, and default biogas potential for livestock types are provided. The study team also clarified that, in order to claim methane avoidance, animal waste in the absence of the project activity must be treated anaerobically, which is difficult to prove especially in case of grazing cattle.

Session 4: Understanding and application of different methodologies for CDM Projects (Solar Water Heater, Transport, Waste recycling)

- Question was raised about possibility for CDM registration of ODA project. The study team clarified that ODA project can be registered as CDM if donor and host country government provides documented proof that ODA funding to the project is not considered as diversion of ODA.

- One of the participants shared difficulty his project is facing during validation because the project receives funding from Indian Government.
- Participants showed high interest in CDM potential in transportation sector in Bhutan. Participants shared information about traffic master plan of the Bhutan government, and the discussion of introducing Bus Rapid Transit System[54]. The study team introduced their experience of a project associated with transportation Nationally Appropriate Mitigation Actions (NAMAs) in Laos, and suggested similar study may be possible in Bhutan as well.

- Regarding waste recycling, participant expressed opinion as follows: There is very low emission reduction potential in this field in Bhutan, mainly because all plastic are sourced from outside the country (mainly India) and recycled plastics are sold to India. Also, emission reduction achieved from this type of project is not sufficient to promote CDM in this field.

Session 5: Monitoring and Verification of the Project

- Question was raised whether there is any restriction about the timing for conducting verification for monitored results. The study team clarified that currently there is no restriction about the

[54] Bus Rapid Transit System: BRTs

timing for conducting verification or the limit for the duration of one monitoring period. Realistically speaking, however, considering the time and cost required for verification process, one calendar year is reasonable time period covered by verification. The study team also explained that the amount of emissions cut (CER) expected from verification also influence frequency of verification.

Photo 3-1: CDM Workshop in Bhutan

4. Discussion

4.1. Increased access to electricity services in Zambia, small hydroelectric power generation project CDM registration assistance

The validation of “Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station” project (hereafter “the Project”), which is part of the “Increased Access to Electricity Services Project” in Zambia, has been successfully concluded within the study duration and the request for CDM registration has been submitted to the UN. The CDM reference number of 9533 has been assigned to the Project. The project is currently waiting the scheduling of the document process required for CDM registration evaluation by the UN. Considering the current timeframe required for the project registration, the Project will be registered in June 2013 at the earliest. Considering the current timeframe required for the project registration, at the earliest possible timing of registration of the Project will be in June 2013.

The Project construction will begin after the finalization of the construction and equipment purchase contract which is scheduled at the end of February 2013. The project will begin its commercial operation in March 2015. As such, there will be nearly two years between the registration and the beginning of the project operation. Considering the true objective being the successful issuance of emission reduction credit from the project activity, not mere CDM registration, it is the most important that the monitoring of the project will be carried out as stipulated in the PDD, which is essential for the successful verification and certification process leading to successful issuance of CER from the Project.

4.2. Development of a new CDM methodology for rural electrification projects involving extension of existing power distribution network, taking the rural electrification project in Bhutan as the example

The approval of AMS-III.AW, a small scale CDM methodology for rural electrification by grid extension, opened new opportunity to the host countries whose domestic energy supply is nearly 100% renewable sources to participate in CDM. The approved methodology, however, imposed a hurdle to activities implemented in the forest area. As described in earlier section, to approve the proposed methodology, SSC WG modified the proposed methodology to become more conservative during their consideration. The most significant modification to the approved methodology is inclusion of leakage emission associated with distribution line extension. The modification affects feasibility of such project to be developed as CDM, especially when the project involves large area of deforestation. In this regards, the approved methodology gives advantage to rural electrification project located in deserted area by including deforestation leakage in the methodology.

On the other hand, AMS-III.AW does not provide detailed procedures for the determination of

deforestation area and the carbon intensity for unit deforested area. Therefore, there is some room for adopting project specific procedures in leakage emission determination. One way to minimize deforestation leakage is to minimize deforestation area of the project activity. This may be achieved by detailed classification of area covered by the distribution line extension. For example, area where the power distribution line is set along existing roads or over existing cultivated land can be excluded from deforested area. Also, in case where trees cut within the distribution line extension are utilized, and it can be said that the project offsets the deforestation possibly occurred elsewhere, such carbon removal may not be attributed to the project and may be excluded from the leakage emission calculation. In order to evaluate the leakage emission due to the project accurately, there will be a need for the careful assessment of the project specific information to determine the deforestation leakage attributable to the project.

As such, for CDM implementation of rural electrification project by applying AMS-III.AW, accurate assessment of leakage emission is critical. Accurate estimation of deforestation related leakage emissions can be achieved by establishing project specific values of both deforested area, and carbon stock removed per unit area; the two components composing deforestation leakage emissions. Because leakage emission will be deducted from emission reductions of the project activity, CDM feasibility of the project is inversely proportional to the size of leakage emissions. Therefore, CDM Feasibility of rural electrification project in Bhutan may be enhanced by minimizing leakage emission. One way to minimize deforestation leakage is to minimize deforestation area of the project activity. This may be achieved by detailed classification of area covered by the distribution line extension. For example, area where the power distribution line is set along existing roads or over existing cultivated land can be excluded from deforested area.

Also, one way to maximize the amount of emission reductions generated from the project activity is to adopt renewable crediting period with maximum 21 years of crediting period with successful crediting period renewable every seven years. Renewable crediting period has an advantage over the fixed crediting period (10 years) because the project can claim emission reduction for a longer period. However, there is a specific procedure for crediting period renewal adopted by the UN and the process requires re-examination of the baseline emissions applying the latest version of the applied methodology at the time of crediting renewal. If there is a significant revision to the applied methodology, and the latest methodology version is no longer applicable to the project, further process, such as submitting a requesting deviation, maybe necessary. According to the "procedure for renewal of the crediting period of a registered CDM project activity (version 06.0)"[55], for the purpose of crediting period renewal, reassessment of baseline scenario is not required. When renewal of the crediting period is planned, project participant must notify the secretariat by email or through a dedicated web interface, of their intention to request a renewal by submitting an updated PDD and informing their selection of a DOE, within 9 to 6 months prior to the date of

[55] EB 63, Annex 29: http://cdm.unfccc.int/Reference/Procedures/reg_proc04.pdf

expiration of the current crediting period. It is highlighted that to fulfill this requisite and not to miss the communication with the secretariat on time, project schedule management is essential.

The study team revised the draft PDD based on AMS-III.AW to fully reflect modification made to the proposed new methodology. To achieve maximum emission reductions from the project activity, the maximum crediting period allowed under current CDM rule, or 21 years (7years, twice renewal), was applied in the revised draft PDD. For rural electrification project in Bhutan, with the forest covers over 60% of the country, expected emission reduction may be reduced significantly due to the account of deforestation leakage emissions. Emission reduction achieved by the rural electrification project would be approximately 19,000 tCO_2e/yr without accounting leakage. With accounting for deforestation leakage, the emission reduction achieved by the project becomes as low as 6,000 tCO_2e/yr on annual average[56].

[56] Assuming 1,000ha deforested area and 75.4tC/hectare of carbon intensity for unit deforested area, emission reduction occurs only from the 15th years after the project implementation. Until then, emission reduction is used to offset the leakage emission due to the deforestation.

5. Conclusion and recommendation

In this section, in addition to the summary of the study results, opportunities and challenges Bhutan and Zambia may face during CDM implementation.

5.1. Summary of the study result

5.1.1. Increased access to electricity services in Zambia, small hydroelectric power generation project CDM registration assistance

The request for registration for the project "Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station" (ref 9533) was submitted to the UN on 25 January 2013. The objective of the study has been accomplished within the study duration. The study team anticipates registration of the Project around June 2012 in the most optimistic estimation. There will be nearly two years between the time of registration and the commencement of commercial operation of the project. Implementation of reliable monitoring procedures/structure for the project before the project begins commercial operation is important. During the validation, preparation of operation/maintenance manual and monitoring manual were identified as FARs, items requires future action for resolution. In addition to the operation requirement for normal hydropower plant, CDM monitoring requirement needs to be met. Following the assistance in validation process, support in verification process would be expected to ensure successful emission reduction issuance from the project.

The project will begin the commercial operation in March 2015. As such, there will be nearly two years between the registration and the beginning of the project operation. Considering the true objective being the successful issuance of emission reduction credit from the project activity, not mere CDM registration, it is the most important that the monitoring of the project will be carried out as stipulated in the PDD, which is essential for the successful verification and certification process leading to successful issuance of CER from the Project.

5.1.2. Development of a new CDM methodology for rural electrification projects involving extension of existing power distribution network, taking the rural electrification project in Bhutan as the example

The study team and DRE/BPC agreed on the scope of the study up to the approval of the new CDM methodology by the UN. CDM methodology developed in this study has been successfully approved by the UNFCCC CDM Executive Board as AMS-III.AW "Electrification of rural communities by grid extension---version 1.0". This is the first approved CDM methodology applicable to rural electrification activity by extending existing power distribution network.

Since there was no approved CDM methodology applicable to the project at the start of the study, rural electrification project by extension of grid distribution network was no able to proceed to the validation stage within the study duration. However, the study team successfully developed a new methodology for the project and achieved the objective of UN approval. In this regard, the study team believes that the study was effective in paving the road toward CDM implementation of rural electrification projects.

In the process of approval process for the new methodology, it turned out that it is critical to accurately assess the amount of deforestation leakage emission to make the Project's CDM implementation successful. The study team wishes DRE and BPC receive required assistance and continue the CDM implementation process. In this regard, the study team informed DRE and BPC about the opportunity for obtaining financial assistance from Japanese government through a CDM feasibility study grant program, and DRE and BPC agreed to apply for the grant program. The project was selected by the grant program and is currently undergoing the validation process with a detailed deforestation study. Although there is no guarantee for CDM registration of the project, however, from the thorough deforestation study conducted within the CDM feasibility grant program, the deforestation within the project site may not be fully attributed to the project. Reflecting this deforestation study result, validation of the project may be concluded with positive emission reduction of approximately 19,000 ton/yr from the first year of implementation[57].

5.2. Potential and challenges for CDM activities in Bhutan and in Zambia

5.2.1. Current trend in CDM and Carbon Market: Effect on the study projects

① CDM under the second commitment period of the Kyoto Protocol, and Japan's position

COP 18 /CMP 8 took place in Doha, Qatar from 26 November to 8 December 2012. Following the decision at Durban[58] in the previous year, at Doha, it was decided that elements for a draft negotiating text will be considered toward COP 20 at the end of 2014. As for the amendments to the Kyoto Protocol for setting the second commitment period, the draft amendment including Annex B was adopted and Japan's non-participation to the second commitment period was also reflected. The second commitment period was set to be eight years from 2013 to 2020. Annex I countries which do not participate in the second commitment period, including Japan, as well as developing countries will continue their GHG emission mitigation under Cancun Agreement, until 2020 when a new legally binding international

[57] Published PDD for validation：
http://cdm.unfccc.int/Projects/Validation/DB/RAF02M1RO8Q7V2WW1RPI9ZB6U3QWM2/view.html
Based on the detailed leakage study conducted for the preparation to the validation, the project may not be subject to the full-scale leakage due to the deforestation. In this regard, the validation continues with an assumption that there may be positive emission reduction from the project starting at the first year of implementation. However, the risk of larger leakage remains until the registration of the project.

[58] Durban Platform, adopted at 2011's COP17 in Durban, South Africa, agreed on negotiating a new legally binding international climate agreement by 2015 for the post-2020 time period.

climate agreement becomes effective.

At Doha, as for the Clean Development Mechanism (CDM), it was confirmed that those countries not participating in the second commitment period could participate in the CDM projects and primitively acquire the Certified Emission Reductions (CER) (transfer the credits to national registry once the credits are issued). Also, although the international acquisition and transfer of credits through participating in the Joint Implementations (JI) and in the International Emissions Trading (IET) during the second commitment period are allowed only for the countries participating in the second commitment period, current UN rule does not limit the trading of CERs in domestic markets of the countries not participating in the second commitment period. As such it is anticipated that CERs primitively acquired will be used domestically, such as to meet voluntary reduction target.

Developed countries which participate in the second commitment period with the pledges for reduction listed in the Annex B of the Kyoto Protocol include EU, Australia, Liechtenstein, Monaco, Norway, and Switzerland.

② CER Market and regulations

The EU introduced a cap and trade emission trading system (EU-ETS) covering all member states in January 2005. After the second phase (2008-2012) was completed, the third phase started in 2013[59]. The current rules allow the use of CERs for compliance under the EU-ETS. The price of CERs is influenced by the investors' behavior; however, EU-ETS being the first to be established and the largest carbon market has also been affecting the price of CERs. Since January 2013, the use of CERs from industrial gas projects[60] as well as projects registered in or after 2013 was banned in the EU-ETS. However, CERs from projects hosted by LDCs as well as countries having bilateral agreements with the EU are still allowed.

In addition to the EU-ETS, the Australian carbon market is another place where CERs can be used. In October 2011, Australian parliament adopted a federal law introducing carbon tax on major emitters. The law came into force in July 2012. As a result of this, major emitters are required to pay 23 AUD per ton of CO_2 emitted. The payments will increase by 2.5% annually until the end of 2014. From July 2015, the price is expected to be determined by the market as a part of an emission trading scheme (ETS), which will allow the use of internationally recognized emission reduction credits including CERs. Also, as described earlier, countries not participating the second commitment period of Kyoto Protocol are allowed to participate in CDM projects and primitively acquire the CERs. CERs from second commitment period may be allowed to be use in meeting

[59] Participants of EU-ETS: besides EU, non-EU members such as Liechtenstein and Norway also participate in EU-ETS. Switzerland has established its own ETS, and is now in negotiation with EU-ETS for interlinking their system to EU-ETS. http://www.bafu.admin.ch/emissionshandel/10923/index.html?lang=en

[60] HFCs and Adipic acid_N_2O projects

voluntary reduction target domestically.

③ Trend of CER price in EU-ETS and the price of CER from LDC projects

Carbon prices have been continuing to exhibit a downward trend since the middle of 2011, recently reaching the historical lows. The first downward trend in carbon prices was observed in 2009 following the global financial crisis triggered by the bankruptcy of Lehman Brothers in 2008 (the so called "Lehman Crisis" or "Lehman Shock"). Since then, with the expectation for recovery in the world economy, the prices had leveled out for about two years. In the middle of 2011, following the flow of news on the fiscal instability in several European countries, the second downward trend of carbon prices was formed. The trend was eased during the first half of 2012, however, without any incentive to reverse the downward trend, the carbon prices continued to seek for the historical lowest price levels since the summer of 2012. As of February 2013, CER futures for December 2013 are around 0.3 EUR, whereas CER spot price is around 0.1 EUR. Forecast by European analysts put the average CER price in 2013 at approximately 0.71 EUR. Figure 5-1 shows the trend of CER futures, indicating that the CER price in December 2013 is expected to be 0.33 EUR. Additionally, the CER spot trading price ranges between 0.11 to 0.22 EUR. Based on the above, it is difficult to claim anymore that the CER revenue is an effective incentive for businesses to invest in CDM projects.

Figure 5-1: Trend in CER futures (from January 2011 to February 2013)

Source: Point Carbon http://www.pointcarbon.com/

As CER prices are fluctuating at historically lowest levels, it is hard to foresee any drastic price improvement in the immediate future. However, there are several developments which may suggest potential recovery in the CER price. EU-ETS' exclusion of CERs from industrial gas projects (more than half of the current supply) and post-2012 CDM projects in non-LDC countries will slash the volume of CER supply to the market. In addition, in the long run, European economy is expected to recover, which will boost the demand for carbon units in the future. Also, new market for CERs will be opened in the future, such as Australian ETS allowing the use of CERs starting from July 2015. It is also anticipated that a new market for CERs from LDCs will be generated considering the added value from supporting sustainable development of the LDCs.

④ Expected CDM profit for the rural electrification projects in Bhutan and in Zambia

Expected CDM profit for the rural electrification projects in Bhutan and in Zambia are estimated using several scenarios of CER price, including current market CER price, as summarized in Table 5-1 below.

Table 5-1: Expected profit from CER sales for the rural electrification projects in Bhutan and in Zambia

Project	Annual CER[61] (tCO_2e/yr)	Expected profit from CER sales		
		Spot CER price at February 2013 (0.10€/tCO_2e)	CER price level at the first half of year 2011 (10€/tCO_2e)	Newly established CER price for LDC project
Zambia "Increased access to electricity" small hydropower project	11,037	1103.7 €/yr	110,370 €/yr	unknown*
Bhutan "rural electrification" project	19,259[62]	1925.9 €/yr	192,590 €/yr	unknown*

* Though unknown, it is expected that there will be investors who show interest in purchasing LDC CERs at a suitably high price from a viewpoint of LDC support.

[61] Annual CER based on the PDD under validation process. (These values are subject to downward adjustment based on the actual electricity distribution by the Project.)

[62] Currently the validation continues with an assumption that there may be positive emission reduction from the project starting at the first year of implementation. However, before the registration of the project, it may be required to deduct larger leakage for the project. If this is the case, and full-scale deforestation leakage is deducted, positive CER will only be generated at the 16th year of the project implementation, with average annual CER of 6,000 ton.

5.2.2. The UN action for mitigating inequality in geographical distribution of CDM projects

In addition to the potential in development of a new market for CERs from LDCs, CDM system is also heading toward supporting CDM implementation in LDCs. The geographical distribution of CDM projects is sharply skewed toward specific countries, such as China and India. Mitigating the inequality in the geographical distribution of CDM projects has long been recognized as the challenge among the CDM community. As of February 2013, among the total of 6,602 registered CDM projects, only 78 projects are located in LDC, which comprise only 1% of the total registered projects. CMP has been taking actions continuously to alleviate geographical distribution inequality. Followings list some of the effort toward resolving unequal distribution of the CDM activity.

① Guidelines for demonstrating additionality of microscale project activities

One of the challenges in CDM has been the demonstration of additionality: to demonstrate that the project will not be implemented without CDM assistance. This has been a big burden to the project developers who seek for CDM registration of their activities, especially in LDC/SIDs or in a special underdeveloped zone with limited resources and capacity for CDM implementation. As one of the measures for alleviating the unequal geographical distribution of projects, CDM Executive Board considered providing guidelines for demonstrating additionality of microscale project activities. As the result, the CDM Executive board adopted a simplified guideline to demonstrate additionality for microscale project activities[63]. As stipulated in the latest microscale guidelines renewable energy technology projects up to 5 MW output capacity (Type I project), energy efficiency projects with the energy saving no more than 20GWh/yr (Type II project), and other projects with no more than 20 kt CO2e/yr of emission reductions (Type III project) are additional if the projects meet conditions stipulated in the microscale guidelines, which includes the geographic location of the project in one of LDCs/SIDs or in a special underdeveloped zone (SUZ). Since the adoption of the simplified guidelines, the number of CDM projects in LDC has shown a clear trend of increase[64].

Zambian small scale hydropower project under the study were fully benefitted from the microscale guidelines by exempted from demonstration of additionality during the validation. The study team believes that the projects in LDC will continue to be benefitted from the use of microscale guidelines, reducing the burden related to the additionality demonstration.

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[63] Initially approved at EB 54 in May 2010. The latest is "Guidelines for demonstrating additionality of microscale project activities (version 04)", EB 68, Annex 26

[64] The number of LDC projects registered between November 2004 and May 2010 are 15 projects. Since then as of February 2013, number of registered LDC projects has increased to 78 projects.

② Standardized baseline

At CMP6 in 2010, development of standardized methodologies was decided. Standardized baselines are the baseline established for a Party or a group of Parties to facilitate the calculation of emission reduction and removals and/or the determination of additionality for clean development mechanism project activities, while providing assistance for assuring environmental integrity. The application of the standardized baselines shall be at the discretion of the host country's DNA. The CDM EB to develop standardized baselines as appropriate, in consultation with relevant DNA, prioritizing methodologies that are applicable to least developed countries, small island developing States, Parties with 10 or less registered CDM project and underrepresented project types or regions.

As of February 2013, there is no approved standardized baseline. Four proposed standardized baselines are currently under consideration by the CDM EB. Table 5-2 summarizes those for proposed standardized baselines.

Table 5-2: Proposed standardized baselines currently under consideration[65]

Reference	Proposal	Submitted by/on	Current status
PSB-0001	New standardized baselines for charcoal projects	Uganda / 16 May 2012	Initial assessment successfully concluded
PSB-0002	Standardized baselines for clinker production in Ethiopia	Ethiopia / 24 July 2012	Initial assessment successfully concluded
PSB-0003	Standardized baseline on Grid emission factor for the Southern African Power Pool	The Republic of Botswana / 21 August 2012	Initial assessment successfully concluded
PSB-0004	Standardized baseline of energy use in rice mill sector of Cambodia	Cambodia / 27 September 2012	Initial assessment successfully concluded

The standardized baseline on Grid emission factor for the Southern African Power Pool (SAPP) (PSB-0003) is the standardized baseline developed by UNEP Riso Center and SAPP secretariat. This standardized baseline, when approved, provides a grid emission factor for the nine countries[66] which are connected to the SAPP and also agreed to the use of the standardized baseline. With the use of the standardized baseline, there will be no need for calculating the grid emission factor for each project. Zambia is connected to SAPP and also listed within the nine countries agreed to the use of the standardized baseline. Due to the high hydro ratio in the grid mix in Zambia, it has been difficult to develop the grid connected hydropower project as CDM project. Once this standardized baseline is approved, gird connected hydropower projects in Zambia can be implemented as CDM project.

[65] http://cdm.unfccc.int/methodologies/standard_base/index.html
[66] Botswana, the Democratic Republic of the Congo, Lesotho, Mozambique, Namibia, South Africa, Swaziland, Zambia,and Zimbabwe

③ CDM loan scheme[67]

At CMP6, "Guidelines and modalities for operationalization of a loan scheme to support the development of CDM project activities in countries with fewer than 10 registered CDM project activities" was adopted. Following the adoption, CDM Loan scheme[68] was established in April 2012. CDM loan scheme provides interest free loans to CDM project activities in countries with fewer than 10 registered CDM project activities. Most LDC countries fall into this category. Loans will cover the PDD development, validation, registration, monitoring and verification up to the first issuance. Because requirement varies for each project, there is no specific loan limit, as long as the estimated costs are deemed reasonable. Loans are supposed to be repaid no later than 12 months after the first issuance of CERs from the project. Loans are supposed to be repaid full. However, in case where CER issuance does not generate sufficient income, loan repayment may succeed over a period up to a maximum of 36 months after the first issuance of CERs. Because the CDM consultant will be a Party to the loan agreement, CDM consultant must be identified and listed in the agreement.

Both Bhutan and Zambia qualifies for applying loans through the CDM loan scheme[69]. The CDM loan scheme may be utilized in the future to mitigate the burden of up-front payment related to CDM transaction. However, since the loan must be repaid, payback plan must be considered seriously before applying for the loan.

5.2.3. CDM Implementation in Bhutan and in Zambia: opportunities and challenges

As a result of the EU-ETS' restrictions effective from January 1, 2013 on the use of CERs from industrial gas projects and projects registered after 2012 that are hosted by non-LDCs, CERs from LDC are the only CERs with a sure market; only CDM project activities which are registered in and after January 2013 located in LDC can be used in EU-ETS. Since both Bhutan and Zambia are LDCs, CERs from CDM projects in both countries can continue to be used by EU-ETS buyers. The reform in the CDM system is also aimed at supporting wider implementation of CDM project activities in LDCs.

It observed that CDM projects in LDC tend to be small in scale, with only few projects in LDC which can expect a large amount of CERs. However, CDM projects in LDC are valued for their quality in terms of sustainability, not for the volume of CERs. Despite the small volume of CERs generated, there are investors or other entities who are motivated in endorsing sustainable development in LDCs through investing in CDM activities.

[67] http://www.cdmloanscheme.org/
[68] http://cdm.unfccc.int/press/releases/2012_08.pdf
[69] http://www.cdmloanscheme.org/eligible-countries

With the current CER market price, it is difficult for the CDM to play its original role, i.e. supporting project developers by providing additional revenue through CER sales. However, for CDM projects in LDC, different CER price formation may be expected in the future. Moreover, the hurdle of CDM implementation in LDC has been lowered through efforts by various UN agencies in providing various schemes to assist CDM development in LDC. Therefore, various opportunities for CDM project development in LDCs still remain.

The major challenges for CDM implementation in LDCs, including Bhutan and Zambia, continue to be the lack of capacity for PDD development, as well as limited skills for undergoing the validation and verification processes, conducting GHG monitoring and securing financial resources for covering the CDM transaction costs. This study is considered to have assisted in enhancing the CDM capacity of both Bhutanese and Zambian counterparts, by providing opportunities for hands on practice of actual CDM process. Additionally, future improvement in CDM capacity for monitoring and verification for smooth CER issuance would support the successful CDM implementation. Finally, various means such as CDM loan schemes, international assistance similar to this study or positive reevaluation on CERs from LDC by investors are expected to play pivotal role in securing the financial needs of LDC countries for CDM implementation.

UNFCCC/CCNUCC

CDM – Executive Board

I.A./Version 16.0
Sectoral Scope: 01
EB 69

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

TYPE I - RENEWABLE ENERGY PROJECTS

Project participants shall apply the general guidelines to small-scale (SSC) clean development mechanism (CDM) methodologies, general guidance on leakage in biomass project activities (attachment C to Appendix B) and the "Guidelines on the demonstrating of additionality of SSC project activities" provided at <http://cdm.unfccc.int/Reference/Guidclarif/index.html#meth> *mutatis mutandis*.

I.A. Electricity generation by the user

Technology/measure

1. This category comprises renewable electricity generation units that supply individual households/users or groups of households/users included in the project boundary. The applicability is limited to individual households and users that do not have a grid[1] connection except when:

(a) A group of households or users are supplied electricity through a standalone mini-grid[2] powered by renewable energy generation unit(s) where the capacity of the generating units does not exceed 15 MW (i.e. the sum of installed capacities of all renewable energy generators connected to the mini-grid is less than 15 MW) e.g. a community based stand-alone off-the-grid renewable electricity systems; or

(b) The emissions reduction per renewable energy based lighting system is less than 5 tonnes of CO_2e a year and where it can be shown that fossil fuel would have been used in the absence of the project activity by:

(i) A representative sample survey (90% confidence interval, ±10% error margin) of target households; or

(ii) Official statistics from the host country government agencies;

(c) A group of households or users are connected to a grid prior to the start date of the project activity (or the start date of validation with due justification), however the electricity from the grid is available for the households and users for less than 36 hours in any given calendar month during the crediting period. If based on actual monitoring it can be demonstrated that during a specific month the power supply from the grid to the households and users is for less than 36 hours, emission reductions can be calculated for that specific month. The methodology is not applicable in cases where, the project activity plant, which supplies electricity to this category of users, is connected to the grid at any time during the crediting period.

The renewable energy generation units include technologies such as solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which is used on-site/locally by the user, e.g. solar home systems, wind battery chargers. The renewable generating units may be new installations (Greenfield) or replace existing onsite fossil-fuel-fired generation. To qualify as a small-scale project, the total output of the unit(s) shall not exceed the limit of 15 MW.

[1] National/regional grid.

[2] Not connected to a national/regional grid.

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

2. 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/m2;
- 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 than 4 W/m2.

3. Combined heat and power (cogeneration) systems are not eligible under this category.

4. 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.

5. Project activities that involve retrofit or replacement of an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

6. In the case of project activities that involve the 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[3] from the existing units.

Boundary

7. The physical, geographical site of the renewable energy generating unit and the equipment that uses the electricity produced delineates the project boundary.

[3] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the replacement of the nacelle assembly or blades of a wind battery charger would not be considered “physically distinct”.

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

Baseline

8. The energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy,[4] estimated using one of the following three options:

(a) Option 1: the energy baseline is calculated based on the average annual electricity consumption of the consumers as per the below:

$$E_{BL,y} = \sum_i \left(n_i * EC_{i,y}\right) / \left(1 - l\right) \quad \textbf{(1)}$$

Where:

$E_{BL,y}$	Annual energy baseline; kWh
$\sum_i$	The sum over the group of *i* renewable energy technologies (e.g. renewable energy technologies for households, rural health centres, rural schools, grain milling, water pumping, irrigation, etc.) implemented as part of the project activity
n_i	Number of consumers supplied by installations of the renewable energy technology belonging to the group of *i* renewable energy technologies during the year
$EC_{i,y}$	Average annual individual energy consumption observed in closest grid electricity systems among rural grid connected consumers belonging to the same group of *i* renewable energy technologies. If energy consumption is metered, $EC_{i,y}$ is the average energy consumed[5] by consumers belonging to the group of *i* renewable energy technologies; kWh
l	Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction[6]

[4] Renewable energy lighting applications shall consider the equivalent level of lighting service instead of energy (See annex 1 of EB 08).

[5] Potential oversizing of the power capacity installed or energy generated by the CDM project activity shall not be reflected in the baseline and emissions reduction calculation. For this reason, the energy value taken into account shall be the energy consumed. It cannot be the electricity output, except if the project participant justifies that it represents a reasonable estimate of the energy that would have been generated by a diesel generator larger than 35 kW and operating with a load factor of at least 50% to provide similar electricity services.

[6] A reasonable default value for distribution losses on low voltage rural distribution grid could be 20%. Project proponents shall demonstrate in the PDD that in the absence of the project activity electricity supply would have entailed distribution losses e.g. users are in distributed locations, else a value of L=0 shall be used.

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

(b) Option 2: the energy baseline is calculated based on annual electricity generation from project renewable energy technologies as per the below:

$$E_{BL,y} = \sum_i EG_{i,y} / (1 - l) \quad \textbf{(2)}$$

Where:

$E_{BL,y}$	Annual energy baseline; kWh
$\sum_i$	The sum over the group of *i* renewable energy technologies (e.g. renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity
$EG_{i,y}$	Annual output of the renewable energy technologies of the group of *i* renewable energy technologies installed; kWh
l	Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction[6]

In the case of project activity applying paragraph 1(c), $EG_{i,y}$ corresponds to electricity generation in specific calendar months during which power is available from the grid for delivery to the households or other users for less than 36 hours a month. The availability of grid electricity for delivery to the households or other users shall be determined based on continuous power monitoring and hourly recording in order to determine the grid availability for any given calendar month.

The energy baseline $E_{BL,y}$ =0, for any hour during which power is available from the grid for delivery to the households or other users. For example, if the grid is available to deliver power for 15 hours in April, energy baseline can be calculated for April, but the calculation must account for the requirement that during those 15 hours when the grid is available in April, the energy baseline is zero.

(c) Option 3: the baseline can be a trend-adjusted projection of historic fuel consumption in situations where an existing technology is replaced. For the specific case of lighting devices a daily usage of 3.5 hours shall be assumed, unless it is demonstrated that the actual usage hours adjusted for seasonal variation of lighting is different based on representatives sample survey (90% confidence interval ±10% error) done for minimum of 90 days.

9. For Option 1 and Option 2 above the emissions baseline is the energy baseline calculated in accordance with paragraphs 8(a) and 8(b) above times a default emission factor:

$$BE_{CO2,y} = E_{BL,y} * EF_{CO2} \quad \textbf{(3)}$$

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

Where:

$BE_{CO2,y}$ Emissions in the baseline in year *y*; tCO_2

$E_{BL,y}$ Annual energy baseline in year *y*; kWh

EF_{CO2} CO_2 emission factor; tCO_2/kWh

For EF_{CO2}, default value of 0.8 kg CO_2-e/kWh, which is derived from diesel generation units, may be used. A small-scale project proponent may, with adequate justification use a higher emissions factor from Table I.F.1 under the category AMS-I.F "Renewable electricity generation for captive use and mini-grid".

In case where the project activity displaces existing fossil fuel captive electricity generation, EF_{CO2} of the captive electricity generation shall be determined using Scenario B of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

10. In the case of Option 3, the emissions baseline is the historic fuel consumption calculated in accordance with paragraph 8(c) above times the CO_2 emission factor for the fuel displaced. IPCC default values for emission factors may be used.

$$BE_{CO2,y} = \sum_j FC_{j,y} * NCV_j * EF_{CO2,j} \quad \textbf{(4)}$$

Where:

$BE_{CO2,y}$ Emissions in the baseline in year *y*; tCO_2

$FC_{j,y}$ Amount of fuel consumption of fuel type *j*; mass or volume unit in year *y*

NCV_j Net calorific value of fuel type *j*; gigajoule per mass or volume unit

$EF_{CO_2,j}$ CO_2 emission factor of fuel type *j*; tCO_2/GJ

J Fuel type used for combustion

11. The baseline emissions of project activities that involve retrofit/replacement of an existing facility or capacity addition at an existing facility, shall be calculated following the procedures prescribed in AMS-I.D "Grid connected renewable electricity generation" with the exception that the applicable emission factor (EF_{CO2}) is calculated as described in this methodology.

12. For project activities that introduce renewable-based electricity to communities,[7] baseline emissions can also be determined using the provisions of AMS-I.L "Electrification of rural communities using renewable energy", provided that the relevant applicability and monitoring requirements of AMS-I.L are also met.

[7] "Communities" of consumers may for example include households, schools, commercial facilities such as shops, and small, medium and micro enterprises (SMMEs).

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

Project emissions

13. For most renewable energy project activities, $PE_y = 0$. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

- Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption);
- Emissions from water reservoirs of hydro power plants.

Leakage

14. If the energy generating equipment is transferred from another activity, leakage is to be considered.

Monitoring

15. Monitoring shall consist of:

(a) An annual check of all systems or a sample thereof to ensure that they are still operating (other evidence of continuing operation, such as on-going rental/lease payments could be a substitute); or

(b) Metering the electricity generated by all systems in a sample thereof.

16. For projects where only biomass or biomass and fossil fuel are used the amount of biomass and fossil fuel input shall be monitored.

17. For projects consuming biomass, a specific fuel consumption[8] of each type of fuel (biomass or fossil) to be used should be specified ex ante. The consumption of each type of fuel shall be monitored.

18. If fossil fuel is used, the electricity generation metered should be adjusted by deducting the electricity generation from fossil fuels using the specific fuel consumption and the quantity of fossil fuel consumed.

19. If more than one type of biomass fuel is consumed, each shall be monitored separately.

20. The amount of electricity generated using biomass fuels calculated as per paragraph 17 shall be compared with the amount of electricity generated calculated using specific fuel consumption and amount of each type of biomass fuel used. The lower of the two values should be used to calculate emission reductions.

21. In the case of project activity applying paragraph 1(c), the availability of grid electricity for delivery to the households or other users shall be determined with continuous monitoring in order to determine the grid availability for any given calendar month. The project proponents shall install

[8] Specific fuel consumption is the fuel consumption per unit of electricity generated (e.g. tonnes of bagasse per megawatt-hour).

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

meters that continuously monitor the status of the grid electricity supply to households and users and record the number of hours during which the grid was not available in the given calendar month.

22. For project activities implemented under paragraph 12, the corresponding monitoring procedures prescribed in AMS-I.L apply.

Project activity under a Programme of Activities

The following conditions apply for use of this methodology in a project activity under a programme of activities:

21. In the specific case of biomass project activities, the multiple types of biomass, i.e. biomass residues and biomass from dedicated plantations can be used for a PoA, provided all the other requirements in the methodology such as: (a) leakage emissions in case of biomass residues following the general guidance for leakage in small-scale biomass project activities (attachment C of Appendix B;[9] and (b) consistency with AM0042 "Grid-connected electricity generation using biomass from newly developed dedicated plantations" in case of dedicated plantation are satisfied.

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[9] Available on <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>.

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

History of the document*

Version	Date	Nature of revision
16.0	13 September 2012	EB 69, Annex 26 To account for suppressed demand in baseline calculations using AMS-I.L provisions for community electrification projects.
15.0	11 May 2012	EB 67, Annex 18 To include guidelines to determine the baseline emission factor for activities displacing existing fossil fuel captive electricity generation. The revision clarifies that users connected to very weak grids (grid supply available for <5% of time) are eligible to apply the methodology.
14	EB 54, Annex 8 28 May 2010	To include a definition of mini-grid and additional procedure to estimate baseline emissions for retrofit/capacity expansion project activities.
13	EB 42, Annex 16 26 September 2008	To include project activities for renewable energy based lighting (e.g. solar-lamps) to displace fossil fuel usage in lighting in rural households that are not grid connected or connected to a weak grid prone to blackouts/brownouts.
12	EB 33, Annex 19 22 June 2007	To clarify the applicability of the methodology and maintain consistency with the revision AMS-I.B, which provides guidance for situations where electricity is a co-product of the project activity, providing mechanical energy for the user.
11	EB 32, Annex 25 22 June 2007	To clarify the monitoring of biomass in project activities that apply this methodology which is consistent with monitoring of biomass in the approved methodology AMS-I.D.
10	EB 31, Annex 19 04 May 2007	To clarify that all cogeneration project activities should apply AMS-I.C.
09	EB 28, Annex 24 15 December 2006	To maintain consistency across categories particularly in relation to AMS-I.D; Revised guidance on capacity addition activities and a default emission coefficient of 0.8 kg CO2 /kWh for diesel generation, as opposed to 0.9 kg CO2 /kWh.
08	EB 23, Annex 29 24 February 2006	To include provisions for retrofit and renewable energy capacity additions as eligible activities; Provide clarification for baseline calculations under category I.D; Provide clarification on the applicability of Category I.A as against Category I.D.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		

* This document, together with the 'General Guidance' and all other approved SSC methodologies, was part of a single document entitled: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities until version 07.

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

I.A. Electricity generation by the user (cont)

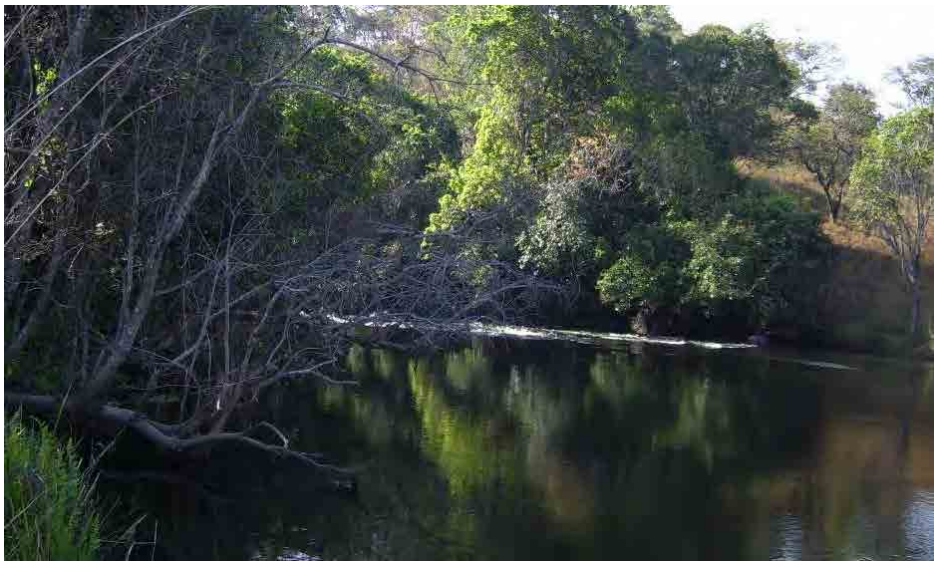
History of the document: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities

Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities contained both the General Guidance and Approved Methodologies until version 07. After version 07 the document was divided into separate documents: 'General Guidance' and separate approved small-scale methodologies (AMS).		
Version	**Date**	**Nature of revision**
07	EB 22, Para. 59 25 November 2005	References to "non-renewable biomass" in Appendix B deleted.
06	EB 21, Annex 22 20 September 2005	Guidance on consideration of non-renewable biomass in Type I methodologies, thermal equivalence of Type II GWhe limits included.
05	EB 18, Annex 6 25 February 2005	Guidance on 'capacity addition' and 'cofiring' in Type I methodologies and monitoring of methane in AMS-III.D included.
04	EB 16, Annex 2 22 October 2004	AMS-II.F was adopted, leakage due to equipment transfer was included in all Type I and Type II methodologies.
03	EB 14, Annex 2 30 June 2004	New methodology AMS-III.E was adopted.
02	EB 12, Annex 2 28 November 2003	Definition of build margin included in AMS-I.D, minor revisions to AMS-I.A, AMS-III.D, AMS-II.E.
01	EB 7, Annex 6 21 January 2003	Initial adoption. The Board at its seventh meeting noted the adoption by the Conference of the Parties (COP), by its decision 21/CP.8, of simplified modalities and procedures for small-scale CDM project activities (SSC M&P).
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		

ENVIRONMENTAL PROJECT BRIEF

FOR

MUJILA MINI-HYDRO POWER PLANT AND ASSOCIATED 33 kV DISTRIBUTION NETWORK



Prepared for

THE DEPARTMENT OF ENERGY AND THE RURAL ELECTRIFICATION AUTHORITY

By

ZESCO LIMITED
ENVIRONMENT AND SOCIAL AFFAIRS UNIT

NOVEMBER 2007

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND SYMBOLS

^{o}C	Degrees Celsius
CEC	Copper belt Energy Corporation PLC
ECO	Environmental Coordinator
EMP	Environmental Management Plan
HPC	Hydropower Committee
JICA	Japan International Cooperation Agency
KM	Kilometers
KW	Kilowatts
kV	Kilovolts
MW	Mega Watts
PFA	Protected Forest Area
REF	Rural Electrification Fund
REA	Rural Electrification Authority
REMP	Rural Electrification Master Plan
TEPCO	Tokyo Electric Power Company Inc.
EMP	Environmental Management Plan

EXECUTIVE SUMMARY

Zambia is a landlocked country located in Southern Africa between latitudes 8^{O} and 18^{0} South of the equator and between longitude 22^{0} and 34^{0} East. It has a land surface of about 752,610km^2 with various open water bodies and river systems. It is surrounded by eight neighbours, namely: Angola, Botswana, Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania and Zimbabwe. Zambia lies on a plateau with an average altitude between 1000 and 1300metres. The vegetation is broadly described as woodland, forest and grassland. The country is divided into nine provinces with 72 districts and has a population of about 10.3million people. The country has a mild climate with three distinct seasons: warm rainy summer (November – April) with temperatures ranging from 27^{0}C to 34^{0}C), cool dry (May-July) with temperature varying from 4^{0}C to 25^{0}C and a hot dry season (August – October) with temperature ranging from 26^{0}C to 38^{0}C). The country receives rainfall ranging from 600 mm in the south to 1500 mm in the north of the country.

The country is endowed with river systems that are suitable for hydropower generation. However, the national power grid has not reached outlying rural areas and only about 20.3% of the population has access to electricity. Rural electrification was identified by Government as a vehicle to eradicate poverty through stimulation of rural economy development, hence the establishment of the Rural Electrification Fund (REF) in 1994. In 2003, the Rural Electrification Act was enacted to establish the Rural Electrification Authority (REA) and to improve the management of REF. To this effect, a rural electrification master plan is under development. The objective of the master plan is to among others develop suitable sites to supply power to rural growth centres.

Mujila Lower Falls in the North-Western Province was identified as a suitable site for mini hydro-power development. It is located about 50km east of Mwinilunga town and about 2km off district road number RD 277 on the Mujila River. The proposed power plant is located about 50m from the weir site and has a potential of 1.13MW. The project has a component of about 100km of 33kV distribution network to various schools, health centres and traditional administrative locations at Kanyama and Kakoma.

The development of Mujila Lower Falls will have impacts that include: general disturbance during construction, , increase in sediment load due to construction works, harvesting of natural resources in the vicinity of the power plant, population influx (seeking employment), changes in river flow during operations, enhanced economic and other production activities in agriculture, mining, service provision (health and education); inundation of the immediate natural flooding zone upstream of the weir (250,000m^2), back water effect (approximately 1km), enhanced fisheries, bush clearing (22m of way-leave in the power distribution network) and restricted land use for agriculture around the reservoir.

The power plant and its associated infrastructure will be in an area that shall be protected to prevent activities such as tree cutting, farming and illegal fishing activities in the inundation zone. The power distribution network shall be confined in road reserves and only a swath of 22m maximum vegetation shall be removed in the way-

leaves. In order to reduce on influx of people into the area, the project implementation team shall work with the local Hydropower Committee to recruit general and relevant local staff during project implementation. The project shall have two components (Hydropower Plant Development and the Power Distribution Network) with appropriate Environmental Management Plans.

It is envisaged that in order to implement the appropriate mitigation measures through the Environmental Management Plans, a budget of about US$42,000 (ZMK171,360,000=00) should be provided for under the total project budget.

1.0 INTRODUCTION

1.1.1 Brief Country profile

Zambia is located in the Southern African Region. It has a land surface of about 752,610km^2 with various open water bodies such as; Lake Tanganyika (2100km^2), Lake Bangweulu (2700km^2) and Lake Kariba (5580 km^2 at maximum retention). Zambia is a landlocked country located between latitudes 8^O and 18^0 South of the equator and between longitude 22 and 34 east. It is surrounded by eight neighbours, namely: Angola, Botswana, Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania and Zimbabwe. Zambia lies on a plateau with an average altitude between 1000 and 1300metres though with some high spot (the Muchinga escarpment) standing at 2000metres above sea level. The vegetation can be broadly described as woodland, forest and grassland. The country is divided into nine provinces with 72 districts and has a population of about 10.3million people.

The country has a mild climate with three distinct seasons: warm rainy summer (November – April) with temperatures ranging from 27^{o}C to 34^{o}C), cool dry (May-July) with temperature varying from 4^{o}C to 25^{o}C and a hot dry season (August – October) with temperature ranging from 26^{o}C to 38^{o}C). The country receives rainfall ranging from 600 mm in the south (agro ecological region I) to 1500 mm in the north of the country. This gives the country three main ecological regions (I, II and III) based mainly on the rainfall pattern. Region I (low rainfall zone) covers 42% of the total land area of the country and comprises Luangwa and Zambezi Valleys as well as the western plains. Region II covers 12% of the country's total land area made up of most parts of Central, Eastern, Lusaka and Southern Provinces and part of Western Province. Region III (high rainfall area) represents nearly half of the Country, which covers the Northern, Copperbelt, Luapula, Northern and North-Western Provinces. Refer to Figure 1.

1.1.2 Hydropower Resources, Current Schemes & Power Connectivity

Zambia is mainly drained by two river systems, namely, the Zambezi and the Congo River systems. The Zambezi River system is the largest with sub-catchments of the, Kabompo, Luangwa and the Kafue Rivers. The three rivers are wholly in Zambia while the Zambezi is shared by Angola, Namibia, Botswana, Zimbabwe and Mozambique. The Congo system drains north wards and has two major tributaries, the Chambishi and the Luapula Rivers.

There are three power companies in the country, namely: the Copperbelt Energy Corporation (CEC), Lunsemfwa Hydropower Company and the national power utility, ZESCO Limited that was formed through an Act of Parliament in 1970. ZESCO Limited has three major hydro power stations with a total installed capacity of 1608 MW located at: Kafue Gorge (900 MW), Kariba North (600 MW) and Victoria Falls Power station (108 MW).

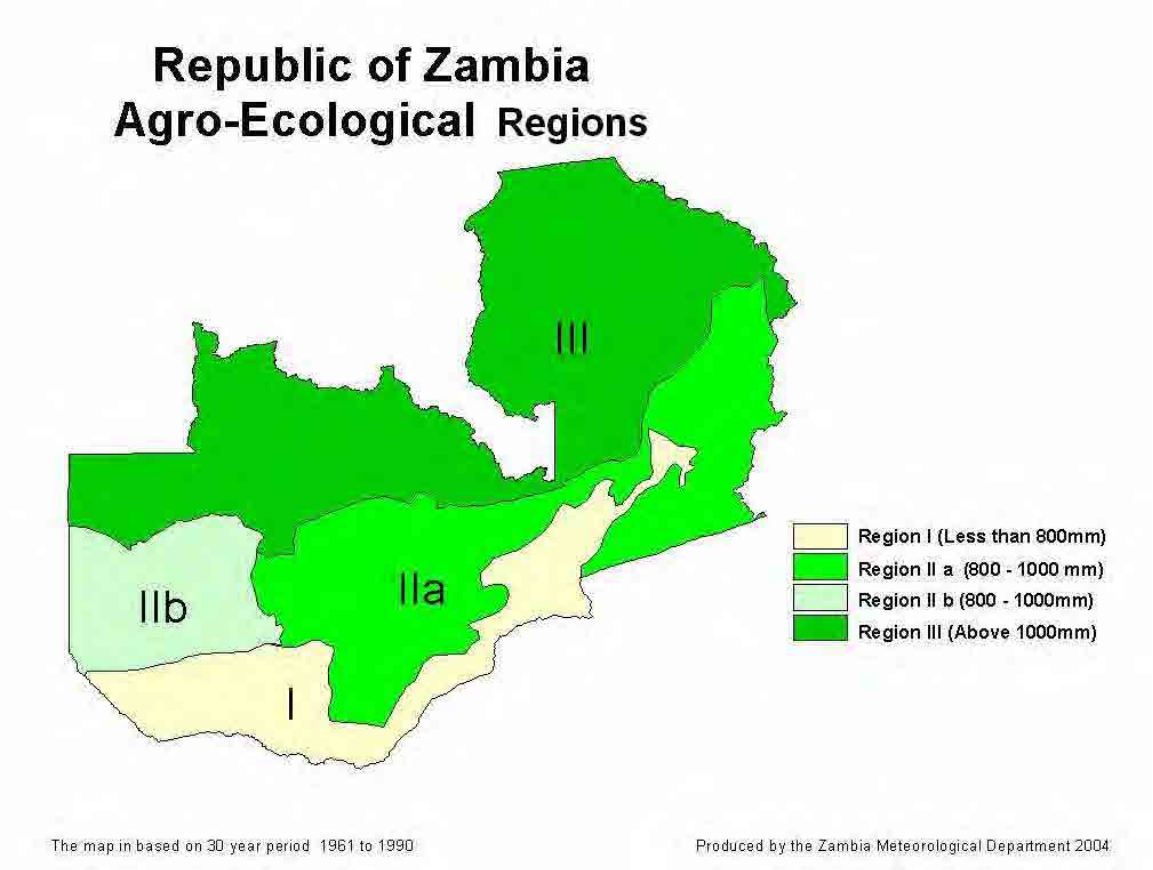


Figure 1: Agro-ecological Regions of Zambia

Additionally, ZESCO has four small hydro power stations (Lusiwasi, Chishimba Falls, Musonda Falls, and Lunzua) with a total installed capacity of 24 MW bringing the total installed capacity under ZESCO to 1632 MW. Lunsemfwa Hydro Power Company has two other small hydro power stations (Mulungushi -20MW and Lunsemfwa-18MW) with a total installed capacity of 38 MW. CEC is mainly in power transmission to the mines on the Copperbelt.

The transmission system originates from the major generation centers in Kafue Gorge, Kariba North and Victoria Falls and a system of 330kV to 66 kV bulk transmission lines interconnects the major substations. The total 330kV and 220kV line coverage is about 2500 km while the 132kV, 88kV and the 66 kV lines cover about 3500 km. Additional lines at 330kV (190km), 220kV (231km) and 66kV (200km) have been constructed and some are still under construction to supply power to the new mines in the north west of the country and to interconnect with Namibia and some isolated towns within the country. Refer to Figure 2.

The national hydropower grid however, is limited in extent and only about 20% of the population has access to electricity.

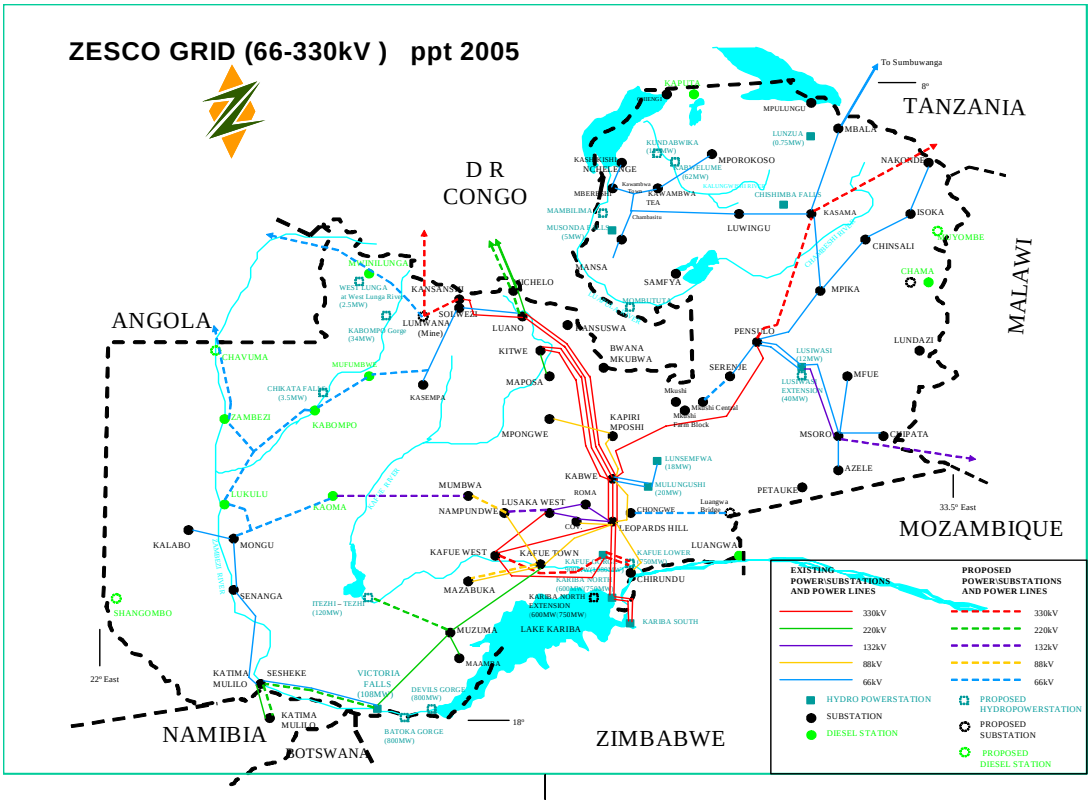


Figure 2 ZESCO Limited power grid

1.1.3 Rural Electrification

Rural electrification was identified by Government as vehicle to eradicate poverty through stimulation of rural economy development, hence the establishment of the Rural Electrification Fund (REF) in 1994. In 2003, the Rural Electrification Act was enacted to establish the Rural Electrification Authority (REA) and to improve the management of REF. In May 2006 the Government of Zambia with funding from the Japanese Government, initiated a programme to develop a Rural Electrification Master Plan in Zambia (REMP). The Japan International Cooperate Agency (JICA) is the official agency for implementing the technical cooperation programme on behalf of the Japanese Government. JICA selected Tokyo Electric Power Company Inc. (TEPCO) as consultant to develop the master plan.

The overall goal of the study is to among others:

- Development of a Rural Electrification Master Plan up to 2030
  - Development of selection criteria for rural electrification projects
  - Selection of candidate site for rural electrification considering socio-economic and technical aspects
  - Selection of electrification methods (grid extension; isolated mini-grid with renewable energy such as mini-hydro power generation, biomass,

solar home system and mini-grid with diesel power generation)
- Case study executions

The project is being carried out in collaboration with the Rural Electrification Authority (REA) and the Department of Energy (DoE) in the Ministry of Energy and Water Development.

1.2 Legal requirement

In Zambia, it is a legal requirement under the Environmental Protection and Pollution Control Act No. 12 of 1990, that developers should implement projects in line with the provisions of the law. Section 3 (1) of Statutory Instrument No. 28 of 1997 of the above Act states that "A developer shall not implement a project for which a project brief or environmental impact statement is required under these Regulations, unless the project brief or an environmental impact statement has been concluded in accordance with these regulations and the Environmental Council of Zambia has issued a decision letter."

In the category of electrical infrastructure, the types of projects which need Project Briefs are new electricity generation stations, electrical power transmission lines more than 1 km long and surface roads for electrical and transmission lines more than 1 km long. The project under consideration falls within the types of projects which require an Environmental Project Brief. The project brief highlights the important environmental issues pertaining to the project and the mitigation measures to be taken.

Other environmental legislation and international protocols and conventions which may be applicable to the Mujila Lower Mini-Hydropower plant and distribution network include:

The Electricity Act of 1995
The Rural Electrification Act of 2003
The Energy Regulation Act of 1995
The Town and Country Planning Act of 1989
The Forestry Act of 1999
The Zambia Wildlife Act No. 12 of 1998
The National Heritage Conservation Commission Act of 1989
The Natural Resources Conservation Act of 1970
The Water Act of 1998
The Public Health Act of 1992
The Factories Act, 1967
Natural Resources Conservation Act, 1970
Zambezi River Authority Act, 1987
Local Government Act, 1991
Town and Country Planning Act, 1995
Lands Act, 1995 and Lands Acquisition Act, 1995

Fisheries Act, 1998
Rural Electrification Act, 2003
International and Regional Conventions such as;

- Convention on the Protection of World Cultural and Natural Heritage
- Convention on Wetlands of International Importance, especially as waterfowl habitat
- Statutes for the International Union for the Conservation of Nature and Natural Resources
- African Convention on the Conservation of Nature and Natural Resources
- Convention on International Trade in Endangered Species of Wild Fauna and Flora
- Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol on Substances that Deplete the Ozone Layer
- Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System
- Convention on Biological Diversity
- United Nations Framework Convention of Climate Change
- United Nations Convention to Combat Desertification
- Bonn Convention

1.3 Purpose of the environmental study

The development of a Rural Electrification Master Plan for the country and the development of some selected sites into mini-hydropower plants is likely to have environmental and social impacts due to the nature of activities, raw material usage, other inputs, processes and waste generation. Conducting an environmental screening for the proposed mini-hydro at Mujila Lower Falls will allow for anticipated economic benefits of the project to be weighed against environmental and social impacts that may arise from the project during all project phases and during operation. This environmental project brief has been prepared based on other environmental screening carried out during other feasibility studies in the North Western Province and various field assessments. This is in line with the provisions of the Environmental Protection and Pollution Control Act No.12 of 1990 - Environmental Impact Assessment Regulations, Statutory Instrument No. 28 of 1997.

Through an environmental screening and public consultation process, adverse and positive environmental and social impacts were identified and mitigation measures recommended for the adverse impacts and measures to enhance the positive impacts were also recommended. The possible environmental benefits were weighed against the negative impacts.

The study was concerned with the ecological and social aspects of the project,

particularly the possible adverse consequences such as pollution, disturbance of habitat, depletion of forest resources, changes in land uses and other forms of social distress and dangers to local communities and animals.

2.0 METHODOLOGY

The study methodology on the project included: literature review, scoping, data collection and public consultation.

2.1 Literature Review

A set of documents and reports was reviewed as part of the study. It included topographic maps, hand drafted local maps and various reports.

2.2 Scoping and public consultation

The study team had an opportunity to meet the local leadership at Kanyama including his Royal Highness, Chief Kanyama. Other people and officers that were consulted included, the Council Secretary for Mwinilunga Council (see appendix 8.1). Refer to Figures 3 and 4 for some group discussions held with the local people.

Figure 3 Chief Kanyama (far left) during the scoping meeting

Figure 4 Study team during the scoping meeting at Kanyama Palace

2.3 Field Studies

In order to acquaint themselves, the study team conducted field studies for both the proposed site of the mini-hydro and the power distribution network.

3.0 PROJECT DESCRIPTION

3.1 Need for the Project

The electrification and access to electricity in Zambia is still low with an average 20.3% access for the whole country, however, the access to electricity in the rural areas is as low as 3.1%. In rural areas, people use various sources of energy for cooking, lighting etc and these include: diesel power generators, solar and candles, kerosene, charcoal, firewood and many others. It is against this background that the Government has embarked on a programme with a systematic approach to increase rural area's access to electricity. This is driven by a statutory body, the Rural Electrification Authority, to develop a rural electrification master plan for the country.

The North-Western Province for instance, is among regions in the country with high potential for development. The Province is endowed in addition to the hard working people, with a wide variety of natural resources such as minerals, timber, good soils, good rainfall and perennial rivers. The area has great potential for manufacturing, agricultural, mining and tourism development. One of the fundamental prerequisites for such economic development is the availability of reliable electricity supply.

The province has only two districts that are currently connected to the national hydropower grid while the rest of the province depends on diesel generators for power supply. The fuel and running costs are high, some machines are old and in the case of Mwinilunga, only one machine is reliable, hence reliability of power supply has been deteriorating. Because of generation capacity limitations, the power generated is hardly enough for the town center in the district. This has made extention of the electricity network into the rural areas difficult.

3.2 Project Objectives

The main objective of the Master Plan Study is to formulate the master plan for rural electrification in Zambia up to the year 2030 and to bring technology transfer to counterpart staff on the project for updating and implementing the Master plan.

The Study consists of the following:

Rural Electrification Plan up to 2030

(a) Development of selection criteria for rural electrification projects
(b) Selection of candidate site for rural electrification considering socio-economic and technical aspects
(c) Selection of electrification methods
    - Extension of existing grid
    - Isolated mini grid with renewable energy such as mini- and micro-hydro power generation, biomass, including a possibility of applying new technology e.g. the hydro system combining micro-hydro, photovoltaic and storage pumps
    - Solar home system (SHS)
    - Mini-grid with diesel power generation, if none of the above is feasible
(d) Case study executions

Financial Plan for Rural Electrification

(e) Study on financing strategy
(f) Cost estimation of implementing the Master Plan at each phase
(g) Evaluation of the validity of rural electrification projects

Policy Recommendation for Acceleration and Dissemination of Rural Electrification

(h) Organization structure for promoting rural electrification
(i) Operation management of Rural Electrification Fund
(j) Framework of promoting the participation of private sector (IPP and ZESCO)
(k) Affordable initial connection fee and sustainable electricity tariff
(l) Policy on curbing the negative impact of electrification on society and environment

Development of Comprehensive Rural Electrification Program

(m) Implementing procedure of long-term rural electrification
(n) Prioritization of execution plans
(o) Consensus-oriented rural electrification plan with donors ; ex. Japanese Bank for International Cooperation (JBIC), African Development Bank (AfDB) and World Bank (WB).

3.3 Scope of the Project

The Mujila Lower Mini-hydro plant is part of the case study execution under the rural electrification master plan development project. The proposed project has a mini-hydropower plant with a generation potential of about 1.13MW and an associated 33kV distribution network of about 100km. Table 1 outlines details on the Mujila catchment, discharge, head and capacity. Table 2 outlines power plant information with associated infrastructure.

Table: 1 Plant and site information on Mujila Falls Lower

Aspect	Specification
Location	Lat. 11:30:51.6 S Long. 24:46:23.9 E
Catchment Area	1,146km^2
Discharge 80% of time	5m^3/s
Design Discharge	8.0m^3/s
Effective Head	18m
Generation Capacity	1,130kW

Table: 2 Design information

Aspect	Specification
Length of Channel	260m
Length of Penstock	40m
Length of Tailrace	50m
Length of Spillway	100m
Length of Weir	30m
Height of the Weir	5m
Length of 33kV Line	98km

With the 5 meters weir to be constructed across the river channel, it is expected that a small area which is within the immediate natural flooding zone will be permanently inundated. The approximate size of the area of inundation is about 250,000 square meters within the normal flooding zone with the back water effect extending for about 1 km upstream of the weir and before the next rapids. Refer to figure 5 for the proposed location of the weir.

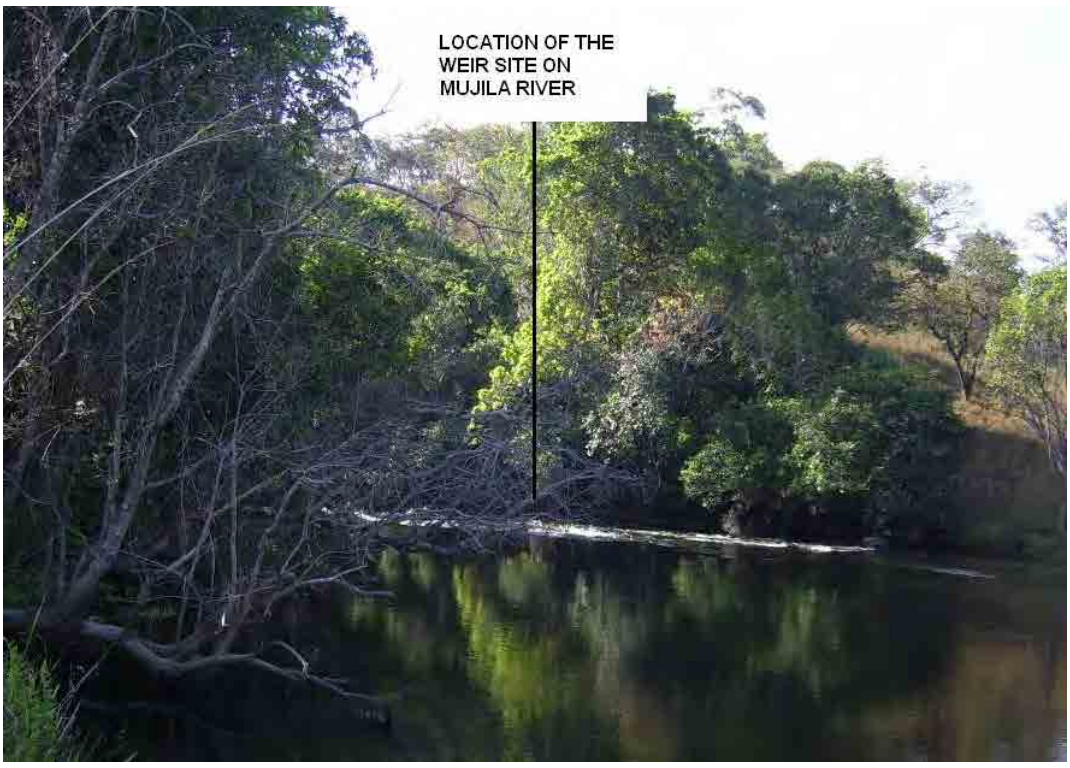


Figure 5: Proposed location of the Weir on Mujila River

The 33kV distribution network on the project will originate from the mini-hydropower plant, about 2km west of Mujila Village and will have various segments and tee offs. The

first segment will be along the district road RD277, from Mujila to Kanyama, through to Munwa and Nyaminkanda Community Schools. On this segment, there is a proposed link to Mujila Community School to the east. One segment of the line will run south in the road reserve of road RD277 to Kupundu School and Rural health centre. A new segment will tee off on road RD278 to Nsweta school through Lake Chibeshya to Kakoma (see table 3). It is however, feasible to extend the line to Kapundu to Mwinilunga town since it is only about 45 to 50km.

Table 3. The proposed 33kV Distribution Network

No.	Line Segment Description	Distance (km)
1	Mujila mini-hydro plant to Mujila village on RD277	02.00
2	Mujila Village to Kanyama –north on RD277	09.75
3	Kanyama to RD 276 Congo Border Road	12.25
4	RD 276 west to Munwa and Nyaminkanda Schools	15.00
5	Kanyama Centre to Nyaminkanda School (option 2)	10.00
6	RD 276 east to Mujila Basic School	15.00
7	Mujila Village-Mujila Agricultural Training Centre tee off	04.00
8	RD 277 south Mujila Village to Kapundu Basic School	06.00
9	RD 277 south Mujila Village to Lake Chibeshya on RD278	12.00
10	Lake Chibeshya on RD278 to Kakoma Centre	40.00

3.4 Power Supply Description Options and alternatives

Various studies have been conducted in the North-Western Province about power supply options. These include: building more diesel power stations, extension of the hydropower grid, mini-hydros development, solar power and the Zero option.

3.4.1 Diesel Power Station

The option of putting up a diesel power station at a Rural Growth Centre like Kanyama, has very high cost implications, such as the running costs of the plant (due to high cost of diesel). The experience from other diesel power stations in the province, show that spare parts are usually difficult to obtain because of changes in machine design and manufacturers stop making spare parts for older designs. The generation capacities are normally limited hence there are difficulties in local grid extension to outlying areas for activities such as mining, manufacturing etc. Diesel stations are also a source of air pollution by the very nature of using diesel (emission of sulphur dioxides and other pollutants are common). Extension of the existing 11kV power network to Kanyama's area was not feasible due to the limited generation capacity from the current diesel generator in Mwinilunga town.

3.4.2 Extension of the national hydropower grid

The current power demand (load) at Kanyama and Kakoma is estimated to be about 600kW, hence it would be very costly to construct a dedicated transmission line to the two load centres and surrounding areas. The option of extending the current grid from Mwinilunga to Chief Kanyama's centre which is about 54km, was also considered but dropped due to limited power capacity at the Mwinilunga Diesel Power station. Increased load would have led to increased fuel costs and an increase in sulphur emissions into the atmosphere.

3.4.3 Mini-Hydropower Stations

The project area is endowed with high rainfall, reliable river flows throughout the year, suitable sites (two water falls) hence mini-hydro power development is a viable option. The development of a mini-hydropower station in the area will provide a reliable source of power. Currently, the development of hydropower is envisaged to be cheaper than many other forms of energy. It is considered clean energy since it has under most conditions less adverse environmental impacts than for instance diesel or long grid extensions. This was found to provide a better power supply option than the alternative sources of energy discussed.

3.4.4 Solar power

The use of solar would have limited application in the event of full development of the potential in mining, tourism and agriculture. Vandalism (mainly by foreigners) and lack of technical know-how in maintenance has rendered some of the few existing and installed solar systems at some rural health centres in the study area inoperable.

3.4.5 "No Project" Option

The "no option or zero option" alternative was not considered because the rural area has grown and has potential to contribute to national economic growth. The area has potential in agriculture, manufacturing, mining and tourism. Power supply is one of the key ingredients to economic growth and subsequently poverty alleviation. Doing nothing therefore, would go against Government Policy on rural development.

3.5 Construction Works

Project activities for the development of the mini-hydro power station will include the construction of a 5m high weir at the proposed site, construction of a spillway, construction of intakes, construction of penstock and tail race, construction of power house, construction of staff and administrative houses and the construction of the distribution network of close to 100km. Detailed construction activities, schedules and

materials such as cement, steel, wood, sand, stones (aggregates) and other materials would be outlined in the respective technical specifications in the tender documents for the works. The 33kV power distribution network will be constructed mainly on wooden poles, with appropriate accessories such as conductors, insulators and step-down transformers.

4.0 DESCRIPTION OF THE ENVIRONMENT

4.1 Physical Environment

4.1.1 Location

The Mujila Lower proposed mini-hydropower station is located about 50km east of Mwinilunga town. It is about 2km off district road number RD 277 on the Mujila River. The proposed power plant is located about 50m from the weir site. The project component has a distribution network of 33kV lines from the power plant to various schools, health centres and traditional administrative centres at Kanyama and Kakoma . Figure 6 outlines the location of the Mujila Lower Fall Power Plant and its associated distribution network. Figures 7 and 8 shows pictorial view of the immediate upstream area of the proposed weir site.

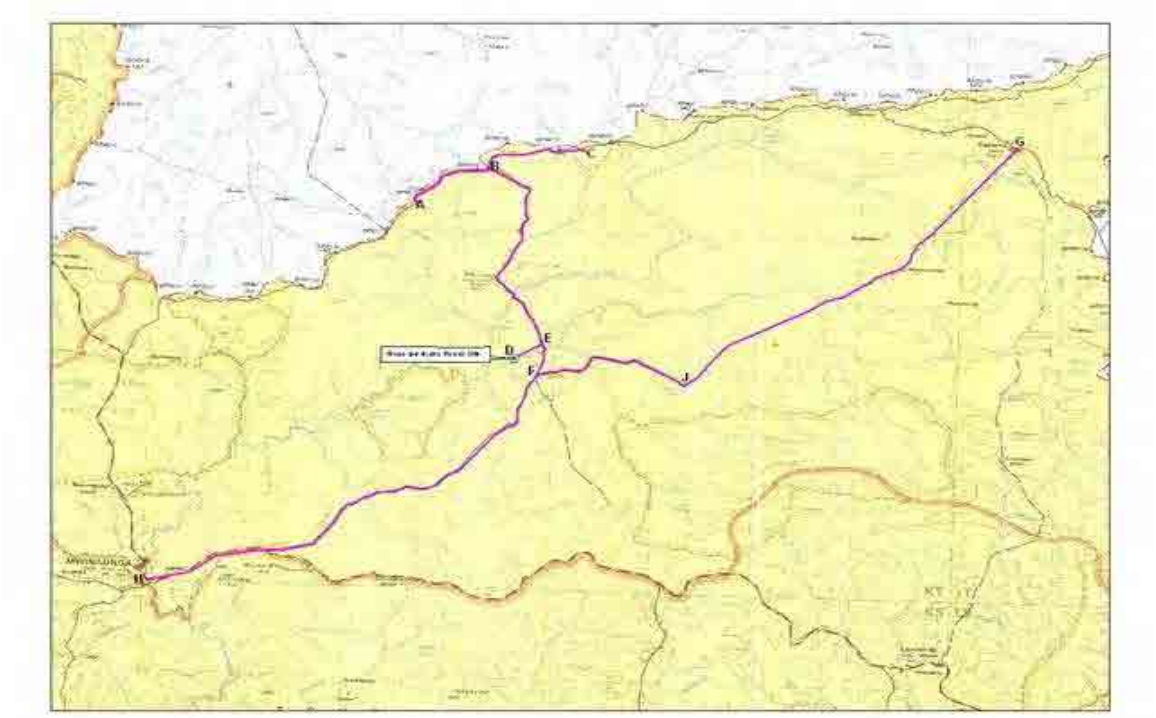


Figure 6: Location of Mujila Mini-Hydropower Station and proposed electricity grid

Figure 7: Upstream of the proposed weir site

Figure 8: Upstream of the proposed weir site

4.1.2 Climate

Mwinilunga is located in the third agro-ecological region of the country. In this Zone, the rainfall is over 1000mm in a season as outlined in Figure 1. Mwinilunga area in particular has average annual rainfall of 1402mm which occurs in about 142 rainy days. The rainfall mainly commences in the month of September and ends in the month of May. The temperatures in this area are moderate with the minimum temperatures of around 6.5^{0}C occurring in the month of July while the maximum temperature of around 31.0^{0}C occurring in the month of October.

Table 4: Average annual Climatic parameters for Mwininlunga

Pan evaporation(mm)	Rainfall(mm)	Temperature (^{0}C)	Evapo-transpiration – Actual (mm)	Evapo-transpiration – Potential (mm)
1666.0	1402.0	20.1	936.0	1406.0

Source: Yachiyo Engineering Co.,1995, NWRMP

4.1.3 Topography

The study area is generally hilly and gently undulating with some low lying areas. The power plant and weir will be located in a gorge downstream and upstream of Mujila

Lower Falls, respectively. The general topography ranges from 1350m above sea level for low lying areas to 1450m above sea level in hilly areas. Moderate and undulating areas occur in the 1400m above sea level topography ranges. Within the gorge which forms the Mujila Lower Falls, steep slopes are a common characteristic of the hills. The general pattern is that the wider parts of the river valleys form wetland type of marshes characterized with grasslands. These are the normal flooding zones when the river flows are at peak flood flows.

4.1.4 Soils and Geology

Soil types in the study area differ from upland to low lying areas: in low lying areas (the valley floors) soils are poorly drained to very poorly drained , very deep, grayish brown to grey, slightly firm, fine loamy to clayey soils with humic top soils (orthic-dystric GLEYSOLS). Soils in upland areas are predominantly Kanyama Series that are some what excessively drained, very deep, very pale brown to yellowish brown, loose to very friable sandy soils (orthic-ferralic ARENOSOLS).

The soils in the study area are mainly derived from acidic rocks that are rich in various minerals such as iron and copper.

4.1.5 Hydrology

The study area is endowed with unpolluted water bodies such as the West Lunga River with its tributaries such as the Mujila River, Kapundu, Mundwiji, and others. Most of the streams are perennial while some recharge zones known as dambos are wide spread in the headwaters and the sides of streams. The presence of these stable recharge zones called dambos act as temporal water storage for the streams and release the flows to the river systems in form of subsurface flows.

The presence of dambos account for the high base flows that the rivers in this region have. This confirms their perennial nature even in the years when rainfall is below normal, such as drought years. The dambos are key features that also provide much needed rich breeding grounds for most of the fish found in the area. This explains why most of the small scale fishing done with traditional fishing baskets, mainly by women and children is done in the dambos.

The side stream dambos are a key feature providing the much needed riverine flood control in this high rainfall area. This means that at peak flood flows, the river would overflow its banks and flood the side stream dambos to reduce the amount of water the river is carrying. The water is then released slowly back to the river when the water level goes down.

4.1.6 Wetlands

Dambos form the main type of wetlands in the study area. There are two types of dambos, the head water dambos and the side stream dambos. The headwater dambos are mainly found at the sources of the streams and the various tributaries while the side stream dambos are found in low laying areas of the river systems. The headwater dambos act as temporal storage for runoff at peak flows and recharge the streams slowly through out the year. The side stream dambos areas are key for flood control as they are able to act as temporal storage for peak flood river flows. Lake Chibeshya is one such head water wetland which is a good tourist attraction and is located upstream of the Mujila Lower Falls project site on district road RD278 of the study area.

The proposed distribution line network to the east of the mini-hydro will traverse through edges of wetlands such as the Lunga Muzela swamp.

4.1.7 Water Quality

Water sources in the study area for both domestic and agricultural use, are mainly from surface (stream run off) and underground (wells and boreholes). The water quality in the study area, especially surface water can be said to be of good quality. Both domestic animals and humans use water from streams and dambos for drinking. The baseline data on water quality indicate that the water quality is good for domestic and other uses (see table 4 below).

Table 5 Water Quality Analysis Results

Sample Number	**071312**	**WHO Guideline**
Parameter	Mujila	(Maximum Permissible value for drinking water)
pH	7.67	6.5-8.5
Turbidity (N	1.21	5.0
Conductivity (mMhos/cm)	50	1500
Total Dissolved Solids (mg/l)	33	1000
Total Suspended Solids (mg/l)	<1.0	-
Total hardness (as mg $CaCO_3$/l)	72	500
Calcium hardness (as mg $CaCO_3$/l)	22	500
Alkalinity (as mg $CaCO_3$/l)	64	500
Iron (mg/l)	<0.01	0.30
Ammonia (as NH_4-Nmg/l)	<0.01	1.50
Sulphates (mg/l)	<0.01	250
Chlorides (mg/l)	2.0	250
Nitrites (as NO_2-Nmg/l)	<0.001	0.100
Nitrates (as NO_3-Nmg/l)	<0.01	10.0
Acidity (as $CaCO_3$/l)	Nil	500
Total phosphates (mg/l)	0.46	5.0
Magnesium (mg/l)	12.0	-
Calcium (mg/l)	8.80	200
Fluorides (mg/l)	0.04	1.50
Potassium (mg/l)	1.16	-
Sodium (mg/l)	46.6	200
Manganese (mg/l)	3.11	0.50
Dissolved oxygen (as O_2 mg/l)	6.8	-

The above baseline water quality data (physical and chemical) results at Mujila Lower Falls, show that the water quality is good, although not tested bacteriologically. The water could be used for several activities such as drinking water (after treatment) hydropower, general agriculture, animal watering and many other uses. The chemical and physical water quality parameter values are much higher than the minimum set by the World Health Organization's maximum permissible for drinking water although biologically the water needs to be treated before drinking. The water was also analyzed for dissolved oxygen. The results (6.8mg/l) showed that dissolved oxygen was highly sufficient for marine life. The Nitrate and Phosphate, which may encourage eutrophication if in high amounts, are also very low.

4.1.8 Air Quality

The air quality in the area is generally and naturally good since there are no gas emitting industries nor construction activities. The proposed site for the mini-hydropower station is located in an isolated place away from major settlements. The site is in a gorge where the air quality is good and the area has pristine vegetation. The expected area of inundation upstream of the weir is likely to be disturbed during construction but would soon be filled with water suppressing any dust emissions.

4.1.9 Noise Levels

The location of the proposed project site is in a gorge where the main source of noise is the water falls at Mujila Lower Falls. Natural noise levels are generally low in the area. However, it is anticipated that during construction, there will be noise from construction equipment.

4.1.10 Protected Areas (National Parks & Forest Reserves)

The proposed site for the Mujila Lower Mini-hydro is located in a gorge and in an area that is under traditional land ownership system. The nearest protected area, the Kalenga PFA No. 95, is located several kilometers west of the proposed site for the mini-hydro and associated distribution network.

4.1.11 Waste

Waste management in the study area vary from locality to locality. The well established theological training centres, clinics and schools, use appropriate waste pits and some incineration facilities. However, traditional practices of waste dumping and burning are common in villages. Use of pit latrines is common in the study area although the standard and quality differ from place to place.

4.1.12 Visual Impact

The Mujila site is located in a gorge and is rarely noticed from the access road to the Discipleship Centre. The weir site too is in a gorge upstream of Mujila Lower Falls.

4.2 Biological Environment

4.2.1 Flora

The vegetation in Mwinilunga is quite intact compared to other areas in the province. This can be attributed to the high regeneration rates due to the high rainfall and rich soils in the area. The other reason for the intact forests is the people's reliance on dry dead wood and not charcoal for their energy needs.

The sawmilling business in the area is also relatively new and therefore, the forests have not yet been exploited.

The vegetation between Mwinilunga boma and the project area forms a thick, three-storeyed forest with a closed evergreen canopy comprising either *Parinari*

or *Marquesia* species or both existing together. A few open areas are predominantly miombos comprising *Jubernardia, Isoberslinia* and *Brachystegia* species. Some sections around the high areas of Mujila are purely *Uaapaca* forest with a few miombo species.

Common hard wood tree species harvested by the local community include: *Pterocarpus angolensis, Guibourtia coleosperma, Faurea intermedia, F. saligna, Afzelia quanzensis* (Pod Mahogany), *Swartzia madagascariensis, Burkea africana, Pericopsis angolensis,* etc.

Charcoal production is not common in the area. Tree cutting for domestic use is done mainly for brick kilns and construction of houses, canoes, furniture, hoe and axe handles and other utensils.

Mujila River is characterized by fast flowing waters and a rich riverine forest. The common plants growing around the river are palms like *Phoenix reclinata*, and *Raphia farinifera*, ferns such as Royal fern (*Osmunda regalis*), Bog scaly lady fern (*Thelypteris confluence*), and various types of grasses.

Riverine trees that are prominent in the project area include *Syzygium cordatum, Syzygium guineense ssp afromontanum, S. owariense, Gardenia imperialis, Rothmmania whitfieldii* and *Swatrzia madagascariensis.*

Due to its meandering nature, Mujila River forms a number of small islands. Most of these islands are sandy and are covered with soft broomy grass. The common tree species on the sandy islands is *Gardenia imperialis* which in most cases look rather stunted. A sedge like plant that produces red fruit locally known as *intungulu* (see figure 9 below), is also common on the islands.

The typical miombo woodland as found in the area is as can be seen in Figure 10, while the riverine riparian thick forests along the river channels is as seen in Figure 11. Refer to appendix 8.2 for a detailed list of tree species found in the project area.

Figure 9: Intungulu fruits

Figure 10: Typical Miombo woodland vegetation in the study area

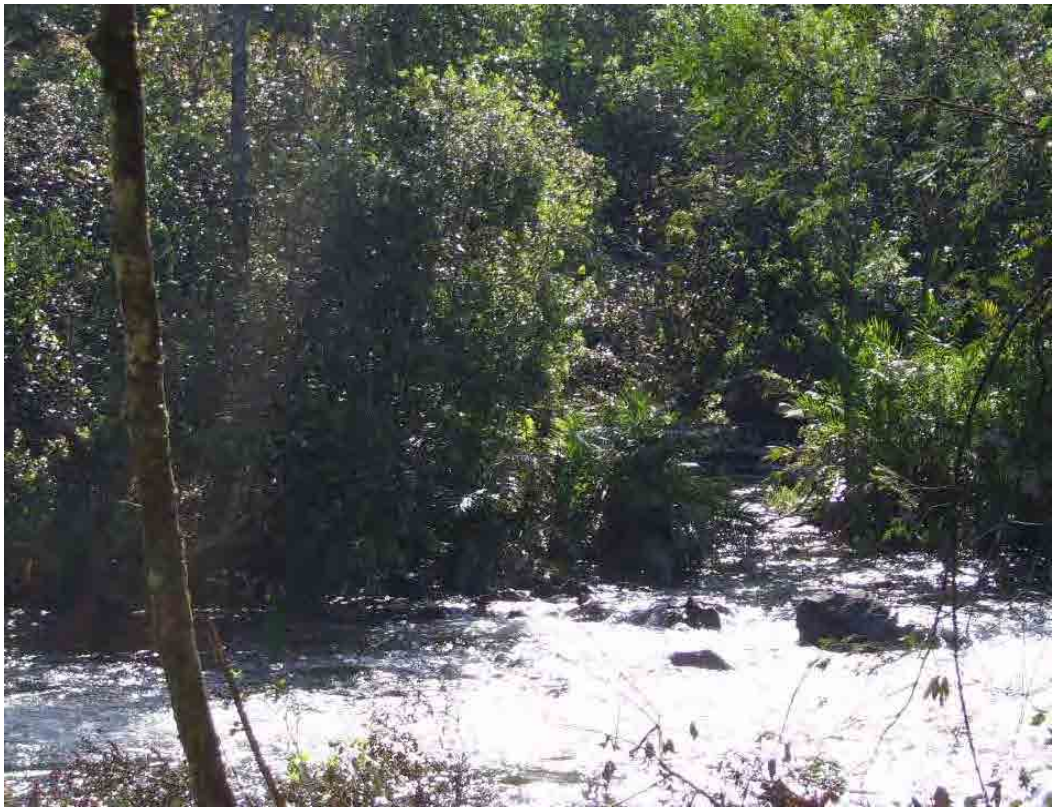


Figure 11: Riverine riparian forests along the Mujila stream

4.2.2 Fauna

Traditionally and from time immemorial the people of North-Western Province have been traditional hunters of wildlife. However, following the Government's development of wildlife policies and strict hunting regulations after independence, hunting of wildlife in many parts of the country is now controlled. The establishment of the Zambia Wildlife Authority (ZAWA), a more efficient and semi autonomous body compared to the National Parks and Wildlife Services, has also contributed to the conservation of wildlife in many parts of Zambia.

The project area has remained undisturbed over the years, however, large game such as Elephants do not exist any more in the area. The common mammals found in the study area are antelopes such as Waterbuck, Duiker, Baboons, Monkey, Hippos and various species of rodents such as cane rats.

Reptiles in the project area include Crocodile, Water monitor, Snakes such as Spitting Cobra, Puff adder, Black mamba, Python, green tree snake. Others are common lizards, Chameleon, Blue headed lizards and others.

The project area is a good water fowl habitat. Birds enjoy the nectar rich vegetation alongside the fresh waters. The common birds noticed in the area include the Fish eagle, Sun bird, Cuckoo, King Fisher and owls.

There are no National Parks in the Project area.

4.3 Socio-economic Environment

4.3.1 Population

According to the Mwinilunga district office of the Central Statistics office (CSO) estimated the population to be 124, 485. The male comprise of 59, 753 (48%) of the population and female 64, 732 (52%). The population density of the area is 6 people per square kilometer. The study area start about 40.0km from the main town of Mwinilunga and has a population of 7, 920, which was estimated by using the population catered by Kanyama clinic and information from the Ward Councilor.

4.3.2 Settlements

Mwinilunga town is a planned and zoned area into residential and commercial/offices and has settlements in the rural parts of the districts that are organized in form of villages. A village is made up of many households living in a defined geographical area under the leadership of a headman. A group of villages in a defined geographical area make up a chiefdom that is headed by a chief. The project area has 48 settlements all in Chief Kanyama's village. The project area is located on land that belongs to the Lunda speaking people of Mwinilunga district and under Chief Kanyama. The power distribution network however, is expected to be extended to Chief Kakoma's area where a rural load centre was also identified.

4.3.3 Agriculture and Fisheries

Agriculture is the most predominant and important economic activity in the study area, though it is mainly at subsistence level. Most people grow crops for their livelihood and to sale. The crops that are grown for commercial purposes are maize, cassava, beans and pineapples. Chitemene system of agriculture (see figure 12) is also practiced though minimal. Chitemene system is used to grow Finger Millet, which is mostly used to brew beer. Rice and sweet potatoes are also grown on a small scale.

Figure 12: Typical Chitemene system of agriculture

In addition, fruit trees such as mango, avocado, guava, lemon, orange and banana are also grown on a small scale. Although production in the district is low, there is great potential for increasing agricultural production. The abundant water in streams, dambos and wetlands can support large scale irrigation farming.

There is some emerging commercial farming in the project area with most farmers getting good maize harvests. The agricultural activities are being spearheaded by the local Chief in the area as can be seen from harvest captured in the Chief's grainary (Figure 13).

Figure 13: Granary showing a good harvest of maize

Some of the people combine crop farming with rearing of livestock such as cattle, sheep, pigs, goats, village chickens and guinea fowls. Refer to Figures 14 and 15

Figure 14: Agricultural activities at the United Methodist Church Mujila Agriculture Training Centre in the project area

Figure 15: Training in the use of oxen at Mujila Falls Agriculture Centre (Source – Mujila Falls Agriculture Centre Website)

Fishing activities are also significant in the project area since River Mujila and other streams in the area have a wide variety of fish species. There are different species in the river channel along the study area. The dominant ones are also of commercial value and these include; Snake Barbel *(Clarias theodorae*), Silver barbel (*Shilbe mystus*), Snake barble *(Clarias theodorae*), Blunt toothed barbel (*Clarias mellandi*), Squaker *(Syndontis macrostigma*), stripe tailed citharinid *(Alestes lateralis*), Red breasted bream (*Tilapia rendalli), Oreochromis niloticus,* Salmon, *(Anguilla nebullosa labiata*), Three spotted bream (*Oechromis anersonnii*), Mpumbu (*Labeo ativelis*), Pike *(Hepsetus odoe)*, Parrot fish *(Gnathonenus macroleptus*), Banded bream *(Tilapia sparmannii*), Red breasted bream (*Tilapia rendalli*), Dwarf bream *(Haplochronis philander)*, Climbing perch (*Ctenopoma multispine*), English eel *(Mastasembals mellanchi)* and Green headed bream, (*Oreochromis machrochir*), *Marcusenius macrolepidotus* as shown in figures 16 and 17.

Figure 16: Green headed breams (*Oreochromis machrochir*) and thin faced breams (Serranochromis angusticeps)

Figure 17: Common fish (*Marcusenius macrolepidotus*) found in the study area

The numerous rocks on the river bed and banks, the side stream dambos along the river channel and the headwater dambos provide good breeding grounds for the fish.

4.3.4 Local Economy

The economy of the project area depends largely on farmers who produce maize, cassava, beans and millet and a few civil servants in the Ministries of Agriculture, Health and Education. Other activities that generate income or contribute to the local economy are honey production, handicrafts, timber, bricklaying and fishing. Even though the project is not very big but it is expected to have some improvement in the income levels and in turn, the standard of living. There is great potential in the area in mining, fishing, carpentry, welding, tourism and many others.

4.3.5 Mining

The area is rich in minerals though not fully utilized. The minerals mined in this area are: copper, iron and amethyst.

4.3.6 Energy

The residents of Kanyama village largely depend on firewood and charcoal for energy for cooking and heating. The rural health center, Kanyama clinic and some basic schools use solar panels for their energy requirements, but most of these solar panels are non functional as they have been either vandalized (some components stolen) or batteries discharged and are not working. Isolated places such as the United Methodist Mujila Agricultural Centre, use a combination of solar and diesel generators for energy, especially for water pumping. Figure 18 shows one of the fields with irrigated crop at the agricultural centre.

Figure 18: Irrigated crop of strawberry at United Methodist Agricultural training Centre

4.3.7 Water and Sanitation

Mwinilunga is endowed with abundant water supplies since it is in the equatorial region that is an extension of the rain forest of Congo. Many villages are located near streams and this enhances easy accessibility to water. Villages largely depend on water from the streams and rivers in the area. The water is used for drinking and other domestic uses such as cooking, washing, bathing and watering their gardens along the riverbanks. Despite the abundance of water, accessibility to safe water still remains a challenge.

A number of houses have pit latrines and bathing shelters that are constructed of local materials with thatched roofs. Use of open bush is common in villages without pit latrines.

4.3.8 Health

Kanyama village has one major clinic, Kanyama clinic, which is the second largest from the main District Hospital in Mwinilunga. Kanyama clinic (see figure 19 below) has a medical officer and a nurse with other daily employees. The clinic used to rely on solar panels but the batteries are no longer working. The clinic relies on fuel wood for heating to sterilize equipment and candles for light. There are a number of rural health centers in the area Kapundu and Muuwa centers which also rely on solar panels distributed by the Ministry of Health. The area also has health posts, namely; Nyangala, Nyaminkanda and Chanuvu.

Common diseases in the project area are; malaria, diarrhea, upper respiratory trunk infection, pneumonia, malnutrition and sexually transmitted diseases (STIs) especially among young people. The village has not reported any HIV/AIDS cases as there are no screening facilities hence there is no definite information regarding the magnitude of the problem. The area does get Voluntary Counseling and Testing (VCT) conducted by a mobile clinic, which comes from the Mwinilunga Hospital when requested upon by the clinic in Kanyama.

The clinic also has provided Traditional Birth Attendants (TBA) to help pregnant women to deliver. The clinic lacks mid wives and nurses and has no maternity ward. The bed space is also limited from the 25 beds there are only 10 in good condition. The infant mortality and mortality rate is quite low in this area and they have not reported any deaths through the clinic and the health centers since 2004.

The capacity of the existing health facilities to meet demand is very low. The health centers do not have any electrical or adequate medical equipment. Drugs and other necessities are in low supply, as the Ministry of Health does not deliver on time. The clinic and health centers do not have ambulance nor mortuary facilities. This makes work difficult since the clinic has to radio Mwinilungu hospital for assistance.

Figure 19: Kanyama Rural Health Centre (left) and basic school

4.3.9 Education

There are a number of schools in the area; primary, basic and secondary. The only secondary school in the area is Kanyama Secondary School with classes from grade 1 to grade 12 and the population of the school is 703. The progression of pupils is generally very low among pupils of both genders however, there are more girl-child pupils dropping out of school in higher grades than among boys. The attribution of low levels of progression among girls is early marriages and lack of role models. The secondary school caters for all the pupils in the area and some students have to travel long distances as far as 12km from the school. The school has 17 teachers though they are supposed to be more but they refuse to come because of the non-availability of power.

The Ministry of Education runs most of the basic schools which are Munwa, Nsweta, Kapundu, Kamaneng'u, Kanyama and the Ministry of Community Development and Social Services runs the community schools which are; Mujila (see figure 20 below) Kansang'a, Lokokwa and Changuvu. The community schools have been established mainly because of the inadequate number of public schools in the area and the long distance it takes for pupils to go to school. The pass mark of the pupils is fairly average and this is attributed to lack of electricity for studying.

Figure 20: Mujila Community School 30km from Kanyama

4.2.10 Employment

The main activities in the village that involve formal employment are the civil servants (Government) such as teachers, health workers, agricultural extension officers and magistrate.

Subsistence farming is the most common occupation in the project area. During the farming season from October to February people are engaged in cultivation and from April, in sales of agricultural produce and in sale of honey in October.

4.3.11 Infrastructure and Social Services

Basic infrastructure in the area such as: clinics, schools that are government owned and some churches, is poor. There are no recreation centers although the area has national radio coverage. The road leading to the village is not gravelled nor tarred so it is not in good condition. The distance to the village from the main road is 30km and from the main town of Mwinilunga is about 60km.

4.3.12 Archaeological and cultural

The study area has no known archeological sites. However, Kanyama village has a cultural site used for the rain festival called "Chidika cha Mvula." However, the festival has since evolved from traditional type of worship to a modern Christian festival that attracts various preachers and clergy.

4.3.13 Tourism

The study area has no organized tourism activity although plans are now underway to put up a nature conservation area around Lake Chibeshya. The National Heritage Conservation Commission (NHCC) is spearheading the project in collaboration with the local community.

The site for construction of the power station has no tourist attraction and nor facilities. There are no lodging facilities, restaurants and other facilities that can promote tourism in the area but there is potential for tourism. There is Lake Chibeshya that is within the project area and two water falls, Mujila Lower and Mujila upper.

5.0 POTENTIAL IMPACTS

5.1 Physical Environment

5.1.1 Location

The Mujila Lower Mini-Hydro will be located in a small gorge on the Mujila River and surrounding area will be developed for administrative, residential and support services infrastructure. The construction activities shall cause the introduction of new equipment, people and services in the locality. A new zone for power development shall be curved out of the traditional land.

5.1.2 Climate

The construction of a weir on the Mujila River shall introduce changes to the local micro climate due to inundation of a defined area and the submerging of some islands. Cooler temperatures are expected to be experienced in the vicinity of the reservoir due to the effect of evaporation.

5.1.3 Topography

Land elevation in the project area, especially around the proposed power plant site, range from 1350 to 1450m above sea level. Construction activities however, will entail making alterations and modifications to the topography. Tunneling, blasting, cutting and back filling is anticipated during construction. Access road construction will also have some significant impacts as the project area has steep slopes. Special attention will be needed to ensure soil erosion is not induced. However, no topographical changes are anticipation during power distribution network construction since the lines will generally follow flat to gently undulating sections of road reserves.

5.1.4 Soils and Geology

Construction works for the mini-hydro power plant shall among others include: excavation, tunneling blasting, cutting and back filling, construction of penstocks of 40m. This will inevitably affect the soils and general geological stability of the area. In addition, the tailrace of 50 meters will create a new source of water and may induce some river bank erosion down stream if not well reinforced and protected.

5.1.5 Hydrology

The construction of a weir on Mujila River shall inevitably affect the natural flow regime of the river. However, the low height of the weir (5 meters) will encourage free flow of water over the weir to ensure minimal disturbance to the natural flow regime. It is expected that the area extending not more than one kilometer upstream will be permanently inundated along the river channel and its flood plains on both left and right bank of the Mujila river.

Due to the diversion of 4 cubic meters per second of flow, it is expected that there will be minimal reduction in the flows over the Mujila Lower Falls, although this will be only noticeable during times of low flows. The periods of high flows, the diversion will be insignificant. Refer to figure 21 that show the weir site and zone of inundation.

The tailrace discharge point will create a modification in the river channel and may induce erosion on the river banks. However, the gorge has a very stable geological formation which will entail confining of the river channel within the gorge channel.

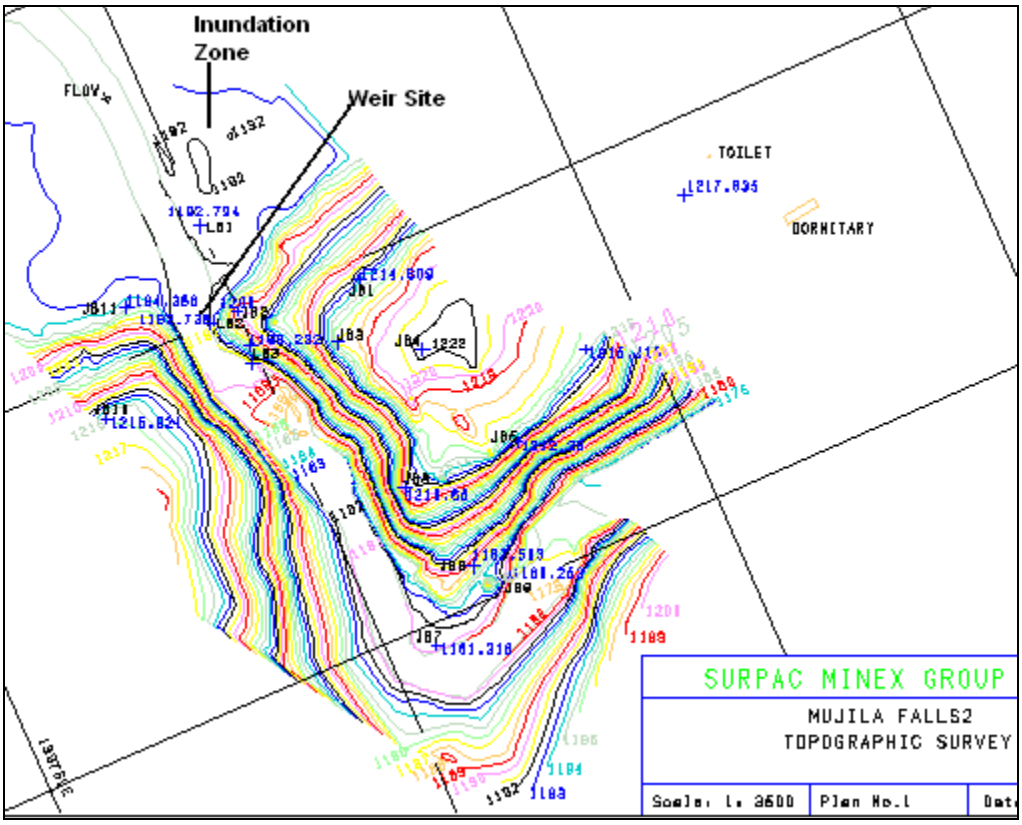


Figure 21: Topographical survey diagram showing weir site and the zone of inundation

5.1.6 Wetlands

The resulting reservoir from weir construction on the Mujila River shall create an expanse of localized wetland on the islands and areas of inundation. Upstream of the proposed weir site there exist a natural flood plain which will be permanently inundated for a distance of about 1 km. Since the weir level is low, at peak flows, it will allow free flow of water over the weir crest, and therefore it is not expected that the area of inundation will extend beyond the existing natural flood zone.

5.1.7 Water Quality

The preliminary base line water quality data showed that the water is generally suitable (with treatment) for domestic consumption. However, the impoundment arising from weir construction may alter some water quality parameters such as dissolved oxygen. The potential impacts will be minimal since the area of impoundment will be confined within the natural flood zone of the immediate upstream of the weir site.

5.1.8 Air Quality

Hydropower is clean energy in a broad sense, however, during construction, air quality is likely to be affected due to excavations, blasting (where applicable) and construction equipment use and general movement. The power distribution network too shall have limited impact on air quality during line construction due to excavation works and use of heavy duty construction equipment such as trucks.

With the creation of a small impoundment of water, there is likely to be a micro-climate cooling effect in the area around the reservoir.

5.1.9 Noise Levels

Noise levels are likely to go up during power plant construction and distribution line network construction. However, noise levels will reduce after completion of all construction works.

During operational stage, the power plant will produce some noise from the power generation process, the noise will be confined within the power house and the immediate surrounding areas within the gorge.

5.1.10 Protected Areas (National Parks & Forest Reserves)

The proposed project is not in a protected area, however, it is envisaged that the power plant zone and the immediate catchment area would be declared a protected zone for security of equipment and reservoir protection from siltation arising from farming activities around the reservoir banks and surrounding areas.

5.1.11 Waste

Construction works shall result in the production of various construction wastes such as steel, packaging, lubricants, scrap metal, human waste among others. On the power distribution network, poles, insulators, conductors and accessories such as nuts, bolts, wires and steel cuttings, are some of the anticipated wastes.

5.1.12 Visual Impact

The proposed power plant location and weir sites are in a gorge hence not visible from the currently access. However, it is anticipated that the inundation zone spread will be visible from the current access in some sections. The power distribution network on the other hand, will have a visual impact since the lines shall be placed in gazetted road reserves.

5.2 Biological Environment

5.2.1 Flora

The proposed mini-hydropower plant has an estimated inundation area of about 1km in length upstream of the weir site. In the inundation zone, vegetation such as palms like *Phoenix reclinata*, and *Raphia farinifera*, ferns such as Royal fern (*Osmunda regalis*), Bog scaly lady fern (*Thelypteris confluence*), and various types of grasses are likely to be affected. Riverine trees such as *Syzygium cordatum, Syzygium guineense ssp afromontanum, S. owariense, Gardenia imperialis, Rothmmania whitfieldii, Swatrzia madagascariensis* will be affected too. Island vegetation such as soft broomy grass, *Gardenia imperialis* and sedge like plant that produces red fruit locally known as *intungulu* is likely to be affected due to flooding arising from weir construction.

It is expected that plants and trees that are more tolerant to water will establish themselves more than those that are suitable to flooding and recession cycles.

5.2.2 Fauna

The flooding of the inundation zone upstream of the weir is likely to create conditions that may displace some animals. However, the flooding could enhance the development of a wider habitat for animals such as Waterbuck, Duiker, Baboons, Monkey, Hippos and various species of rodents such as cane rats. The expanded water habitat will be good for water fowls such as fish eagles, king fishers and others.

More favorable habitat will be created to lead to fisheries improvement in the inundation zones hence contributing to incomes of local people. The areas of inundation may become a suitable habitat that will attract water fowl from different areas.

5.3 Socio-economic Environment

5.3.1. Population

There will be a temporal increase in population during the construction of the power station, as some of the skilled workers will be employed from outside the project area. Some people will be coming to look for employment from other

villages and this will lead to a slight increase to the population. The deliberate policy to employ local people will keep the increase of population in check. At operational phase, only a few operational staff will be retained , therefore in the long term, the impact on population will be minimal.

5.3.2 Settlements

The proposed mini-hydro and associated distribution network will bring about improved quality of life among the local people. The mini-hydro is located in an isolated area hence there will be no resettlement. The distribution network may affect some settlements, however, it is envisaged that all the lines shall be confined to the road reserves.

A new workers' compound is planned for construction with a few houses, this will be built in an area close to the power plant, but will not require resettling any communities.

5.3.3. Agriculture and fisheries

Some potential agricultural land will be taken up for construction of the mini-hydro power station. However, the construction of the power lines will not cause any land shortage as land is abundant in the project area. It is anticipated that the creation of reservoir will enhance fish stocks the area of inundation. However, some fish species may be confined between the weir and the first rapids upstream of the inundation zone even during high flows.

Cultivation in the immediate catchment area of the power house will be prohibited to ensure conservation of the area for protection of the storage facility from siltation

5.3.4. Local Economy

Although the project is small, it is expected to create some improvements on the local economy. Some people in the project area will be employed on the project and will lead to an improvement in the income levels and in turn in the standard of living. From the improved incomes, people will be able to buy foodstuffs, groceries, clothes and other essential commodities and this will have a multiplier effect.

As the project is located in Chief Kanyama's area, a percentage of the proceeds

the sale of power will be expected to be paid back to the local communities in form of loyalties to the Chief (see appendix 8.5).

5.3.5 Mining

The area is endowed with a variety of minerals such as copper, cobalt and others. The introduction of power in the area would enhance mining activities to the benefit of the communities and mining companies. The economic spill over effect would be improved livelihoods and general living conditions, of people in the area.

5.3.6 Energy

The introduction of power will also improve the lives of the villagers. The clinics and schools will benefit from the power as they depend on the solar panels which are being stolen or vandalized and have stopped working.

A change in livelihoods of the local people is anticipated as they switch to the use of electricity as a main form of energy.

5.3.7. Water and Sanitation

There is likely to be more pressure on the existing water and sanitation facilities with an increase in the population during the construction phase. It is envisaged that appropriate and adequate sanitary facilities like pit latrines and places to bath shall be constructed for workers during the construction phase of the project.

During operations, a water supply scheme and environmentally friendly water borne sanitation shall be put in place.

5.3.8. Health

With the coming in of labour from outside of the area, it is expected that there would be the spreading of communicable diseases. Health education on the dangers and prevention of communicable diseases shall be given to construction workers and the local community at regular intervals throughout the construction period.

The workers may be exposed to the risk of accidents during construction phase

and therefore First Aid kits should be available on site for emergencies.

With the construction of power station, power will be supplied to the clinics and will improve the services of the clinics.

The area of impoundment may lead to the increase in breeding ground for mosquitoes which may lead to increased incidence of malaria. The water in reservoir may also serve as habitat for snails that are carriers of the bilhazia parasites.

5.3.9 Education

Schools in the area have no electricity currently. Construction of the mini-hydropower station will make it possible to electrify the schools and teachers houses and this will improve the quality of conditions for learning. Pupils will be able to study at night and this could lead to improved performance in tests and examinations.

With the provision of electricity, the teachers will have an incentive when sent to these rural areas, for they they will be able to access better conditions of service as their counterparts in Mwinilunga town.

5.3.10 Employment

In order to maximize benefits to the local community, local people shall be given priority when employing workers as temporal workers during the construction of the power station and the power line as well as during annual way-leave maintenance along the power lines. Since Kanyama village may not have all the semi-skilled and skilled workers needed by the project, some of the workers will come from outside the chiefdom.

It is highly recommended that all the required skills that can be found locally should be sourced from Chief Kanyama's area. The skills that can easily be developed should be taught to the local people. This will enhance the sense of ownership.

5.3.11 Infrastructure and Social Services

Although the reconnaissance survey which was conducted showed that houses and other buildings will be avoided completely, care should be taken during line

construction to ensure that all houses, shops and other buildings are avoided. In case some houses or other buildings are affected, the property owners shall be adequately compensated.

The area lacks recreation facilities and therefore the project should plan to put up some recreation facilities especially near the discipleship centre.

The road is in a poor state of disrepair, which if not improved will get worse with the high volume of traffic during construction.

5.3.12. Archaeological and cultural

The study area has no known archeological sites. If there are any not yet known and will be discovered during construction, National Heritage Conservation Commission will be contacted for advice on how to conserve the artifacts.

5.3.13 Tourism

The study area has great tourism potential and it is envisaged that the introduction of power will enhance the development of the tourism potential. The site itself has such great scenic beauty which will be exposed to the public as the area is improved.

6.0 MITIGATION MEASURES

6.1 Physical Environment

6.1.1 Location

The proposed location of the mini-hydro is in a gorge and in an isolated area away from settlements. The construction activities and associated infrastructure support shall be confined within the designated area of the power plant zone. There is need therefore, to define the power plant zone at an early stage.

The distribution network shall be restricted to road reserves as much as possible to avoid scaring the landscape and removal of pristine vegetation.

To ensure conservation of the area, the immediate catchment area shall be protected from land use aspects such as shifting cultivation, side stream cultivation and settlements.

6.1.2 Climate

The construction of a weir near Mujila Lower Falls, will create changes in the micro-climate. However, in order to avoid any extreme changes, the weir dimensions and height shall be as designed. This will confine the inundation zone within the islands and low lying areas.

To ensure that low levels of green house gasses are emitted from the area of inundation, vegetation shall be cleared from the area before filling up with water.

6.1.3 Topography

Construction works at the proposed mini-hydro shall be confined to designated and outlined access areas in order to avoid disturbance to the general topography. It is envisaged that appropriate vegetation planting and management shall be introduced to protect steep slopes from erosion.

6.1.4 Soils and Geology

The construction of the mini-hydro at Mujila Lower, will involve among other activities, excavation works, tunneling and construction of the weir. The soils so excavated, shall be used to back fill (in cut and fill areas and for administrative and residential structures) and to construct access roads within the power plant zone.

The works on the distribution network shall also involve excavation of holes for pole planting and back filling. The excess soils in this case shall be spread out within the way-leaves to enhance vegetation growth and to reduce soil erosion hazard.

Care shall be undertaken to ensure rehabilitation of the construction areas. Rehabilitation will include landscaping, tree and grass planting. All the waste rock from the tunneling process shall be utilized in the construction of both the weir and other infrastructure.

6.1.5 Hydrology

The construction of the weir for the mini-hydro power plant shall cause to introduce changes in the river flow regime. It is proposed that operating rules at the mini-hydro shall take into account the required minimum water flows for ecological restoration between the weir and the tail race of the power plant.

The distribution network lines shall cross many streams and rivers in the project area. However, in order to avoid stream bank erosion, all poles shall be placed at least 50m away from stream banks, this has to be taken into account during line constriction.

6.1.6 Wetlands

The expected zone of inundation is likely to create a new habitat for some animals and fish species. Access to the new reservoir and all activities such as fishing, recreation etc, shall be controlled by the power station administration. This action is envisaged to enhance habitat development that could improve the fisheries in the area.

The distribution network shall avoid as much as possible crossing the wetlands.

6.1.7 Water Quality

The baseline water quality data show that the water is suitable for human consumption. However, since there was no feacal coli analysis, it is recommended that all domestic water should be treated in accordance with the local standards for drinking water.

The immediate catchment area shall be protected from settlements and agricultural activities to ensure that sediment loads and pollutants in water flowing into the area of inundation is kept to the minimum.

The creation of the area of inundation will have a micro-climate cooling effect, the area should therefore be managed for recreational purposes.

6.1.8 Air Quality

The National Construction Council standards shall be applied to all construction works during the construction of the Mujila Lower mini-hydropower plant. In order to maintain the air quality during this period will all be temporal roads and access areas, shall be well watered to keep dust levels low as will be outlined in the EMP. The contractors shall be served with copies of the environmental management plans for the project.

6.1.9 Noise Levels

The use of heavy construction equipment will inevitably produce noise. However, in order to avoid severe impact of noise, the contractors shall be advised to follow the provisions of the environmental management plans on use of heavy equipment and noise mitigation.

Minimization of noise level at the power house shall be included in the design of the power plant. The areas where noise control cannot be minimized in the power house, adequate labeling shall be done to ensure workers wear ear protection when working in

such areas.

6.1.10 Protected Areas (National Parks & Forest Reserves)

The proposed site for the Mujila Lower mini-hydro plant and the immediate catchment area should be declared a protected area in order to keep off development of settlements and agricultural activities around the power facility.

6.1.11 Waste

The Environmental management Plan for each component of the project shall outline appropriate methods for disposal of the various wastes likely to be produced on the project. However, the EMP shall take and draw from appropriate legislation and national regulations on waste management and project budget. In the case of human, waste, pit latrines or modern toilets and effluent discharge shall be away from river systems and domestic water intakes.

6.1.12 Visual Impact

The power plant location and weir sites are in a gorge hence not visible from the currently access. The power distribution network shall be placed in gazetted road reserves where regular bush clearing during road maintenance is common. This will also minimize cutting down of prestine vegetation.

Care should be taken to the colours to be painted on the power house and associated infrastructure, so that they can blend well with the environment.

6.2 Biological Environment

6.2.1 Flora

The proposed weir for the mini-hydropower plant shall be 5m in height as outlined in the preliminary design. The weir height shall not be raised to avoid extending the inundation zone beyond the designed area. Vegetation establishment around the reservoir shall be encouraged in order to protect the reservoir banks from erosion.

The construction site shall be rehabilitated through landscaping, planting of trees and grass and clearing of any disused materials.

The power distribution network shall be confined in road reserve and during

construction, bush clearing in the way-leave shall be restricted to the standard 22m way-leave and trees shall be stamped as opposed to uprooting. The trees cut during way-leave clearing shall be donated to the nearby villages for local use.

6.2.2 Fauna

The expected zone of inundation upstream of the weir is likely to create conditions and a new habitat that may attract some animals. In order to protect such animals, the area around the reservoir and the entire power plant zone should be protected.

Construction teams (power plant and distribution network), shall be sensitized against poaching and general conservation methods.

In the event of improved fisheries in the reservoir, local communities shall be sensitized on sustainable fishing methods and conservation practices.

6.3 Socio-economic Environment

The proposed mitigation measures will be implemented in liaison with the local hydropower committee that has been established in the study area (see appendix 8.4). This will ensure local participation in the project and unsure that the local communities derive the maximum benefits from the project to lead to an improvement in their socio-economic environment. This is in line with the local leadership expectation (see appendix 8.5).

6.3.1. Population

There will be a temporal increase in population during the construction of the power station, as some of the skilled workers will be employed outside the project area. Camps for construction workers shall be located far from the power station area to avoid environmental degradation in the vicinity of the power plant.

To ensure protection of morals in the project area, there shall be strict screening of workers to be recruited from outside the area. The married workers from outside the area should be encouraged to bring their spouses.

6.3.2 Settlements

The proposed mini-hydro and associated distribution network will bring about improved quality of life among the local people. The mini-hydro is located in an isolated area, hence there will be no resettlement. However, a new residential area for power plant workers shall be built based on well planned and approved structures. The distribution network may affect some settlements, however, it is envisaged that all the lines shall be confined to the road reserves.

The project site already has a CMML Church Discipleship Centre, this should be preserved and all activities should avoid disturbance to the area.

6.3.3. Agriculture and fisheries

The proposed site for Mujila Lower Mini-Hydro will not affect any agricultural land. However, with the creation of a reservoir, it is anticipated that there will be some improvements in fisheries. Access and use of the water resources in the reservoir will be monitored and all traditional farming activities near the reservoir prohibited. This will protect the reservoir from siltation arising from clearing of vegetation for agricultural purposes.

The proposed power distribution network to Kakoma shall be routed through productive areas around Nsweta School and near Lake Chibeshya. This will enable farmers in the area to embark on irrigated agriculture. The power supply shall also improve the agricultural production and training at the Methodist Agricultural Training Centre at Mujila Upper Falls.

The creation of a reservoir is likely to have an improved habitat for some fish species. However, in order to avoid over fishing of such species, fishing activities shall be restricted to defined periods and as approved by the Fisheries Department. The reservoir may require restocking to ensure improvement of the fish stock.

6.3.4. Local Economy

The introduction of power in the area is anticipated to give the local communities an opportunity to improve production capacities in various sectors of the local economy such as crafts, agro processing, carpentry etc. Employment of local people shall be encouraged for this will lead to an improvement in the income levels and in turn in the standard of living.

Deliberate effort should be included in the power supply to ensure the crafts centres are equipped with good electrical machinery to ensure creation of wealth. A complete change of livelihoods is anticipated in the local communities since the communities are already hard working, innovative and doing well.

6.3.5 Mining

The area is endowed with a variety of minerals such as copper, cobalt and others. The introduction of power in the area would enhance mining activities to the benefit of the communities and mining companies. The economic spill over effect would be improved livelihoods and general living conditions, of people in the area. Though the available power may not be sufficient for establishment of refineries, the available power would be sufficient for basic processing of minerals which can be taken to nearby refineries.

6.3.6 Energy

The introduction of power will also improve the lives of the villagers. The clinics and schools will benefit from the power as they currently depend on solar which are being stolen or have stopped working.

6.3.7. Water and Sanitation

There is likely to be more pressure on the existing water and sanitation facilities with an increase in the population during construction. It is envisaged that the environmental management plan will have provisions for construction of appropriate sanitary facilities and domestic water supply services.

6.3.9. Health

In order to prevent the spreading of communicable diseases, health education on the dangers and prevention of communicable diseases shall be given to the construction workers and the local community at regular intervals throughout the construction period. First Aid kits shall be available on site for emergencies.

With the construction of power station, power will be supplied to the clinics to improve service delivery at the clinics.

6.3.10. Education

The community and government schools without electricity currently shall be connected with power. This power connection scheme shall be based on the feasibility study in the Rural Electrification Master Plan. This shall improve the education standards and facilitate establishment of boarding high schools in the area. The Teachers' houses shall also be electrified to help with retention of the much needed teaching staff.

5.3.8. Employment

In order to maximize benefits to the local community, local people shall be given priority when employing workers during the construction of the power station and the associated power distribution network. Locals could also be given priority for employment during annual way-leave maintenance along the power lines. Since Kanyama village may not have all the semi-skilled and skilled workers needed by the project, some of the skilled workers will however, come from outside the district.

A consideration should be made as much as possible to develop skills in the area to ensure that the local people benefit from the project.

6.3.11 Infrastructure and Social Services

The power distribution network shall be constructed in such a way that most structures shall be avoided. In case some houses or other buildings are affected, the property owners shall be adequately compensated based on an independent property valuation report.

The power plant facilities shall contribute to infrastructural development with recreation facilities enhanced. The project should have a deliberate plan to establish recreation facilities as part of the CMML Discipleship Centre.

6.3.12. Archaeological and cultural

The construction of the mini-hydro power plant and its associated distribution power network will involve among other activities, excavations. In the even of any discovery of any artifact during excavations, the works would be suspended and the National Heritage Conservation Commission contacted for advice and or recovery of such artifact.

6.3.13 Tourism

The proposed power distribution network coverage shall be extended to potential tourism sites such as Mujila Upper Falls and Lake Chibeshya. The arena for the Chidika Cha Mvula ceremony will also have access to power through the distribution line to Kanyama's palace. It is envisaged that any potential tourist attraction in the area, could have power connection to enhance its development.

The Power plant area itself shall also serve as a tourist attraction area as it is in an area of great scenic beauty

Table 6 Summary of potential impacts and mitigation measures

TOPIC	TYPE OF IMPACT	MITIGATION MEASURE & COMMENTS
1.0 Physical Environment		
1.1 Climate	Changes in the micro-climate	Minimum; reservoir will be confined in the gorge & inundation zone
1.2 Topography	Changes in gradients etc	Slope protection through re-vegetation
1.3 Soils & geology	Soil erosion	Backfilling, spreading, & use for stream bank protection
1.4 Hydrology	Soil erosion, siltation & flow changes	New operating regime & slope protection & declaring power plant area a protected zone
1.5 Wetlands	Barrier creation	Introduce sustainable management systems
1.6 Water quality	Pollution of surface & ground water	Treat water before supply for domestic use & restrict access and activities on the reservoir.
1.7 Air Quality	Air pollution	Confined to construction period; watering access ways
1.8 Noise	Noise disturbance to the community	Confined to construction period: use of appropriate ear protection for employees
1.9 Protected areas	Disturbance to habits	Power plant not in protected area; declare a protected zone around power plant area.
1.10 Waste Products	Building materials Pollution from liquid waste Pollution from domestic waste Soil, gravel & aggregates	Re-use & disposal in designated areas Use of proper storage & disposal in approved manner Construction of appropriate toilets Spreading leftovers & donation to

		locals
1.11 Visual	Scenic beauty distortion	The reservoir confined to inundation zone. Lines will be placed in road reserves
2. 0 Biological Environment		
2.1 Fauna 2.2 Flora	Disturbance to wildlife Bush clearing debris	Declare the power plant area protected. Restrict bush clearing within the way-leave and in road reserves.
3.0 Socio Economic Environment		
3.1 Population	Increase in population	Use HPC to recruit locals
3.2 Settlements	Resettlements/relocation	Not anticipated; full compensation
3.3 Agriculture and fisheries	Encroachment on agricultural land	Restricted activities in and around reservoir area
3.4 Local Economy	Effects on the local economy	Supply power to potential load centres to enhance economic growth. Plough back of profits through loyalties
3.5 Mining	Increase & improved activities	Supply power to enhance mining sector development
3.6 Energy	Improved and reliable	Increase access to power in the area
3.7 Water & Sanitation	Sanitation problems	Construction & use of appropriate sanitary facilities.
3.8 Health	Spreading of communicable diseases	Sensitatization/awareness
3.9 Education	Study enhancement	Power Supply to schools
3.10 Employment	Employment opportunities	Local recruitment through HPC
3.11 Infrastructure & social services	Improved, enhanced	Power supply to social centres and improved social services through loyalties from the sale of power
3.12Archaeological & Heritage site	Disturbance to Archaeological & Heritage sites	Liaise with the NHCC & local people
3.13 Tourism	Likely to improve and enhanced	Supply power to potential sites
3.14 Land Tenure & Land use	Disturbance to Land tenure & land use	Restrict use around reservoir & under power lines
3.15 Safety	Accidents from work & attacks from animals & snakes	Stock appropriate medicines & follow provisions of the EMP

Table 7 Mitigation plan, budget and responsible agency

ACTIVITY	IMPLEMENTING AGENCY	ESTIMATED COST US$ (ZMK)
1. Land acquisition • For power plant & power distribution network.	Project proponents (Government through REA & Project Contractors) Contingency for Compensation Token of appreciation to Local Leaders	15,000 (ZMK61,200,000=00)
2. Health Education • Conducting health awareness campaigns to construction workers & the local community	Ministry of Health – Mwinilunga (Kanyama & Kakoma) Project ECO: 1XUS$ 100/dayX 28 days Health staff: 2XUS$ 70/dayX 28 days HPC Member: 2XUS$ 70/dayX 28 days Local Leader 1XUS$ 70/dayX 28 days Logistics (fuel etc) US$1,220/tripsX2 Note that the awareness would be conducted twice during the respective project component implementation.	10,000 (ZMK40,800,000=00)
3. Access and Road • Purchase or fabrication of appropriate signage & warnings	REA & Project contractors (Note that the contractor may opt to buy already made signage or could fabricate all signage on site).	10,000 (ZMK40,800,000=00)
4. EMP Development • Two sets for power plant development & the power distribution network	Competent Firm/Company in Environmental Management (Note that the activities for developing the EMP include: review of the technical & tender documents).	5,000 (ZMK20,400,000=00)
5. Monitoring & Auditing • Regular monitoring of implementation of mitigation measures	Competent Firm/Company in Environmental Management Project ECO: 1XUS$ 100/dayX 7days/month (X10 months) Logistics (fuel etc) US$3,000 for the Project duration	10,000 (ZMK40,800,000=00)
6. Regulatory Fees Review fees for an EPB to Environmental Council of Zambia	Project Proponents (Government through REA)	2,000 (ZMK8,000,000=00)
Total		42,000 (ZMK171,360,000=00)

6.4 ENVIRONMENTAL MANAGEMENT PLAN FRAMEWORK

6.4.1 Introduction

This section of the Environmental Management Plan (EMP) shall outline the background to the activities to be undertaken as provided for in the detailed technical and tender documents. Background information to the project, purpose of the EMP, awareness (health, safety etc) and monitoring (compliance) programmes shall be outlined in this section.

6.4.2 Main Components of the EMP

The main components of the EMP shall include:

- Awareness and training: with general code of conduct (for contractors, employees etc), employment procedures, protection and management of cultural, heritage and archeological sites, protection of infrastructure and property (communal and private), anti-poaching (protection of fauna), health, safety, compensation procedures, working hours,
- Waste management; refuse and waste management, water pollution control, sanitation, waste oil and solid waste, stock piles and spoil dumps,
- General guidelines on project implementation that shall include: camp site selection, temporal works, road signage, plant and equipment service area, explosives and other construction materials storage, fuel storage and workshop area, borrow pits and quarry sites, access roads and road transport, water supply,
- Environmental management: slope protection, erosion protection, noise pollution control, air pollution control, water pollution control, vegetation management (bush clearing, plant species protection, cut wood management), landscaping and rehabilitation of construction sites, monitoring and audit programme.
- Work plan and phasing of environmental management plan implementation activities with responsible persons or parties.

It is envisaged that the project proponents shall have among the staff on the project, a full time Environmental Coordinator. This will enhance the implementation of the mitigation measures through the Environmental Management Plan.

It is envisaged also that all awareness programmes to the community shall be conducted in liaison and consultation with the Hydropower Committee in the area.

6.5 RECOMMENDATIONS AND CONCLUSION

The proposed Mujila Lower mini-hydro power plant and associated power distribution network has great potential to improve the lives of the local community. It is therefore, recommended that the project be developed:

- Due to limited current generation capacity in Mwinilunga town grid extension is limited.
- The proposed site is suitable for hydropower development which is clean energy
- The identified load centres have high potential for development in agriculture, service provision, tourism and mining, among others.
- The local people are proactive and have formed a Hydropower Committee in anticipation of the proposed development. This demonstrates commitment and eagerness of the local community towards the proposed project.

It is envisaged that the implementation of such case studies shall meet one of the project objectives, thus case study case execution. This will also be in line with Government objectives of taking economic development to rural areas through the provision of clean and reliable energy.

7.0 REFERENCES

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ZESCO Limited 2005. Environmental project brief, Kaputa electrification project, Lusaka,

8.0 APPENDICES

8.1 List of people at the scoping meeting & or interviewed

His Royal Highness -	Chief Kanyama – Chief of the Lunda People
Pastor Kaluji Evon -	Councilor Kanyama Ward
Edson Munzha –	Council Secretary - Mwinilungu District Council
Steven Kamwandi –	Clergy in charge of Mujila Discipleship Center
The Headmaster –	Mujila School
Clinical Officer in charge -	Kanyama and Kapundu Clinics
Mr. Mubanga –	Veterinarian
Readith Majimela –	Farmer
Telesi Kuyindama –	Farmer
Salias Nkinda –	Farmer
Kanawa Davies –	Farmer
Francis Chishiba –	Farmer
Pharacy Kamuhuza –	Farmer
David Kamwandi –	Farmer
David Sakuwaha –	Farmer
Bulawayo Chuka –	Farmer
Judith Bulawayo –	Farmer
Kamau J –	Farmer
Katoka Moses –	Farmer
Metdah Kapanji –	Farmer
Kafololo Munsa –	Farmer
John Sakuwaha –	Farmer
Kulamba Wisdom –	Farmer
Rev. Paul L. Webster -	United Methodist Church Missionary at Mujila Falls Agriculture Centre
Tshala Mwengo -	United Methodist Church Missionary at Mujila Falls Agricultre Centre

8.2 Common trees in the study area

Tree species	Local Name (Kaonde and Lunda)
Cyathea dregei	mushilu
Phoenix reclinata	chisonga
Anisophyllea bohemii	mufungo
Raphia farinifera	mudidi
Chrysophyllum magalismontanum	mbilo
Diplorynchus condylocarpon	mulya
Euphobia ingens	chinsembu
Ficus ingens	chilembalemba
Acacia sieberana	muzenze
Dalbegia melanoxylon	kafundula
Ximenia americana	muvulama
Strychnos cocculoides	mukolo
Strychnos spinosa	mwijimbe i
Guibourtia coleosperma	mushib
Oldfieldia dactylophylla	kasonga
Vitex doniana	kashilumbulu
Afzelia quanzensis	mwala
Brachystegia spiciformis	mpuuchi
Cryptsepalum exfolintum ssp pseudotaxus	muilungu
Ekerbergia benguensis	mubanja, mupembe
Isoberlinia angolensis	mutobo
Jubernadia paniculata	mwanda
Percopsis angolensis	mubanga
Pterocarpus angolensis	kapwipwi
Swartzia madagascariensis	mukula
Faurea intermedia	musokoto
Faurea saligna	musokoto
Marquesia macroura	mufuka
Parinari curatellifolia	mucha
Protea spp	chikelele
Uapaca kikiana	kabofa
Uapaca nitida	mudengiula
Uapaca sansibarica	mudengiula
Gardenia imperialis	utoto
Combretum spp	musense
Gardenia jovis-tonantis	kababeje
Strychnos innocua	mukunkampombo
Strychnos punges	munilulunilulu
Syzygium codatum	musombo
Syzygium guineense ssp afrmontanum	musombo
Syzygium owariense	musombo
Olax obtusifolia	mwalu
ozoroa reticulata	muliila
ochna pulchra	musengu
diospyros mespiliformis	mutomwa

8.3 Heritage and cultural sites in Mwinilunga District

SITE NAME	HERITAGE TYPE	CATEGORY	SITE TYPE
Zambezi Rapids	Natural	Geomorphology	Rapids
Zambezi Petrified Forest	Natural	Geology	Fossil
Mujimbeji caverns	Cultural	Archaeological	Cave + finds
Zambezi Source	Natural	Geomorphology	Cold water spring
Kamapanda	Cultural	Architectural	
Chibesha Lake	Natural	Geomorphology	Sunken Lake
Kalalua Boma	Cultural	Historical	Administrative post
Kalene Hill Mission	Cultural	Historical	Church/Mission
Wisaki River	Natural	Geomorphology	Hot spring
Ngombi Village Grave	Cultural	Historical	Cemetery/Grave
Sandeji	Cultural	Archaeological	Iron smelting
Caenby Farm Lone Grave	Cultural	Historical	Grave
Bushingwe Waterfalls	Natural	Geomorphology	Waterfalls
Mwinilunga area	Cultural	Archaeological	Chance surface find
Muzhimbezhi caverns	Natural	Geomorphology	Cave + Finds
Mwinilunga Boma	Cultural	Archaeological	Settlement
Brackenbury farm Surface	Cultural	Archaeological	Open Site
Sakulenga Hill	Cultural	Historical	Cemetery/Grave
Jeanie Gilchrist	Cultural	Archaeological	Grave
Nyambwezu Shelter	Cultural	Archaeological	Art/pet + cave
Muzhila Falls	Natural	Geomorphology	Waterfalls
Brackenbury farm	Cultural	Archaeological	Iron Smelting
Kabompo Gorge	Natural	Geomorphology	Gorge
Njoji Plain	Cultural	Archaeological	Chance surface find

8.4 Hydro Electric Power Committee at Kanyama

METDAH KAPAYI	NSWELA
READITH MAJIMELA	KAMIHINYI
MUJINGA CHIKWAMA	NYANGALA
TELESI KAYINDAMA	NGOMA
SALIAS NKINDA	NYAMINKANDA
KANAWA DAIRES	KANYAMA
CHISHIMBA K FRANCIS	C D O
PHARACY KAMUHUZA	LUKOKWA
DAVID KAMWANDI	MUJILA
DAVID SAKUWAHA	KANYAMA (SECRETARY)

8.5 Request from Chief Kanyama for community benefits

HIS ROYAL HIGHNESS CHIEF
KANYAMA MAKANDA KANDA.
OWN PALACE
P.O BOX 160008
MWINILUNGA

The Director,
ZESCO LTD,
(ENVIRONMENTAL SOCIAL AFFAIRS UNIT)
BO.X 33304,
LUSAKA.

Dear Sir/Madam,

ATTENTION MRS. MWELWA
MANAGER - ENVIROMENTAL.

Dear Sir,

REF: REQUEST FOR COMMUNITY BENEFITS
FROM THE PHYDRO PROJECT

I wish to thank the Management of ZESCO Ltd for having thought it wise to bring the Hydro Project in my area. This will have a great impart of development in my area and improve the livelihood of my Subjects.

While I appreciate this effort that is taking place, I wish to request your humble office to consider plaughing back some of the profits to the community. This will assist the community in improving the infrastructure such as Roads, Schools and the Rural Health Centre. The other percentage will be in form of tribute to the Palace.

I hope my request will be taken into consideration.

I am His Royal Highness,
Chief Kanyama,
Makanda Kanda.

Kanyama
.....

ENVIRONMENTAL COUNCIL OF ZAMBIA

Head Office
Corner Suez & Church Roads
P. O. Box 35131
Lusaka, Zambia
Tel: 254130/254023/254059
Fax: 254164
necz@zamnet.zm

Copperbelt Regional Office
Jacaranda Road
P. O. Box 71302
Ndola, Zambia
Tel: 260-2-621048/610407
Fax: 610246
eczndola@necz.org

Livingstone Office
1st Floor, Stanley House
P. O. Box 60195
Livingstone, Zambia
Tel/Fax: 260-32-321297

Chirundu Border Office
Lusaka Road
P. O. Box CRU31
Chirundu, Zambia
Tel/Fax. 260-1-515261

In reply please quote
No. **ECZ/INS/101/4/1**

December 26, 2007

The Permanent Secretary
Ministry of Energy and Water Development
Department of Energy
LUSAKA

Dear Sir,

REF: Proposed Mujila Mini-Hydro Power Plant and an Associated 33Kv Distribution Network in Mwinilunga By the Ministry of Energy and Water Development.

Reference is made to the above captioned project submitted to the Environmental Council of Zambia (ECZ) on **30th November, 2007** for consideration in accordance with the requirements of the Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, Statutory Instrument No. 28 of 1997.

The ECZ has since reviewed the Environmental Project Brief (EPB) and based on the information provided by yourselves and from written and verbal statements by interested and affected parties and our site verification inspection findings, we have **approved** your project proposal.

Find attached to this Decision Letter, conditions of approval.

Yours faithfully,

Edward H. Zulu
Director
ENVIRONMENTAL COUNCIL OF ZAMBIA

Cc: The Council Secretary– Mwinilunga District Council
The Executive Director– Energy Regulation Board, Lusaka

ENVIRONMENTAL COUNCIL OF ZAMBIA (ECZ)

DECISION LETTER

1.0 PROJECT BACKGROUND

1.1 PROJECT TITLE:

Proposed Mujila Mini-Hydro Power Plant and an associated 33Kv Distribution Network in Mwinilunga by the Ministry of Energy and Water Development.

PROJECT PROPONENTS

Department of Energy
Ministry of Energy and Water Development
P.O Box 51254
Lusaka.

Contact Person:
Mr. O. S Kalumiana
Tel: 211 251 337
Cell: 097 7 115 429

1.3 PROJECT LOCATION:

The site for the proposed Mini-hydro power station is about 50km east of Mwinilunga town. It is about 2km off district road RD 227 on the Mujila River. The actual site is proposed to be about 50m from the weir site. The project area for the power distribution network will cover a total length of 126km subdivided as follows:

i. A stretch of 2km from Mujila Mini-hydro plant to Mujila Village;
ii. A 9.75km stretch from Mujila Village to Kanyama;
iii. A 12. 25 km stretch from Kanyama RD 276 Congo Border Road;
iv. A 15km stretch from RD 276 west to Munwa and Nyaminkanda School;
v. A 10km stretch from Kanyama Center to Nyaminkanda School;
vi. A 15km stretch from RD 276 east to Mujila Basic School;
vii. A 4km stretch from Mujila Village to Mujila Agricultual Training Centre tee off;
viii. A 6km stretch from RD 227 south of Mujila Village to Kapundu Basic School;
ix. A 12 km stretch from South of Mujila to Lake Chibeshya on RD 278;and
x. A 40km stretch from Lake Chibeshya on RD 278 to Kakoma Centre.

1.4 DATE OF SUBMISSION BY PROPONENT:

30th November, 2007

1.5 DATE OF CONSIDERATION BY COUNCIL:

21st December, 2007

2.0 DETAILS OF THE PROJECT:

The project will involve construction of a 5m weir across Mujila River. The approximated size of the area of inundation will be about **250 000m^2** within the normal flooding zone with the back water effect extending about 1km upstream of the weir. The constructed Mini-hydro power plant will have a generation potential of about 1.13 MW and an associated 33kV distribution network of 126km. The 33kV distribution network will originate from the mini-hydropower plant to various schools, health centers and traditional administrative centers at Kakoma and Kanyama.

3.0 DECISION BY COUNCIL

3.1 The project is **approved** subject to the following conditions:

3.1.1 Ministry of Energy and Water Development shall implement the project as stated in the Environmental Project Brief (EPB).

3.1.2 All proposed mitigation measures shall be implemented as stated in the EPB.

3.1.3 Ministry of Energy and Water Development shall provide ECZ with detailed information relating to environmental impacts on the area, likely to be inundated as a result of the project **before** implementation of the project.

3.1.4 Ministry of Energy and Water Development shall comply with Energy Regulation Board (ERB) and Mwinilunga District Council specifications.

3.1.5 Ministry of Energy and Water Development shall ensure that in all areas where displacement and/or resettlement of people is necessary, a Resettlement Action Plan is developed and submitted to ECZ for approval prior to resettlement and implementation of the project.

3.1.6 Ministry of Energy and Water Development shall erect signage around the project area warning the public on the general risks surrounding the project.

3.1.7 Ministry of Energy and Water Development shall try to leave the area as pristine as possible and restrict vegetation clearing to areas of construction.

3.1.8 In order to ensure soil erosion control, stamping of trees as opposed to uprooting shall be used to clear vegetation; trees shall be replanted in sensitive areas to facilitate ecological restoration.

3.1.9 Ministry of Energy and Water Development shall ensure that the ecology of the Lunga-Muzela Swamp is not disturbed.

3.1.10 During re-vegetation and landscaping, no exotic tree/plant species shall be introduced without consultation with the Environmental Council of Zambia and other relevant authorities.

3.1.11 Ministry of Energy and Water Development shall ensure that landscaping and replanting of trees is done in places where vegetation woul have been lost. Further to this, banks of the weir shall be vegetated to minimize erosion.

3.1.12 Ministry of Energy and water Development shall ensure that settlements along the banks of the river and illegal hunting by members of staff are prohibited.

3.1.13 Ministry of Energy and Water Development shall ensure that disturbance of archaeological and heritage sites including grave yards are avoided at all costs. Should such be found the National Heritage and Conservation Commission should be contacted to provide the necessary guidance.

3.1.14 In order to ensure that pollution is avoided, transformers shall be inspected regularly for leakages and only PCB-free oil shall be used and all transformers shall be bunded.

3.1.15 Reusable oil shall be placed in drums and stored in a bunded storage facility in accordance with environmental regulations.

3.1.16 Ministry of Energy and Water Development shall obtain permits from ECZ and comply in full with the following regulations throughout the project cycle:

a) Waste Management Regulations, SI No.71 of 1993;
b) Water Pollution Control Regulations, SI. No. 72 of 1993.
c) Hazardous Waste Management Regulations SI No. 125 of 2001.
d) Pesticides and Toxic Substances Regulations, SI No. 20 of 1994

3.1.17 Noise levels throughout project cycle shall be maintained within acceptable levels.

3.1.18 Ministry of Energy and Water Development shall only use PCB-free capacitors and transformers for the project.

3.1.19 Ministry of Energy and Water Development shall erect signage around the project area warning the public on the general risks surrounding the project.

3.2 The Council **advises** Ministry of Energy and Water Development:

3.2.1 To obtain any other relevant authorizations such as but not limited to:

a) The Energy Act;
b) The Water Act;
c) The Electricity Act;
d) The Forest Act;
e) The Zambia Wildlife Act
f) The National Heritage Conservation;
g) The Rural Electrification Act;
h) The Town and Country Planning Act;
i) The Lands Act.

3.2.2 To make available information on Malaria control and HIV/AIDS to employees.

3.2.3 To provide all workers with appropriate fire fighting equipment and train all workers in fire fighting.

3.2.4 To provide all workers with Personal Protective Equipment and medical checkups.

3.3 To comply with environmental standards and/or specific limits of particular pollutants as its responsibility. Thus, compliance with ECZ recommended measures **does not** absolve Ministry of Energy and Water Development from its responsibility if such measures do not achieve compliance with environmental control standards.

3.4 Ministry of Energy and Water Development shall implement the project within **three years** from the date of approval. Failure to implement the project within the said period shall render this decision letter invalid and the developer shall resubmit the EPB.

3.5 The Council may suspend or cancel this Decision Letter **without notice** should Ministry of Energy and Water Development fail to comply with any of these conditions.

ENVIRONMENTAL COUNCIL OF ZAMBIA
26 DEC 2007
DIRECTOR'S OFFICE
P.O. BOX 35131, LUSAKA

.....26 DEC 2007.....
Date

.....
Edward H. Zulu
Director
Environmental Council of Zambia

ENVIRONMENTAL COUNCIL OF ZAMBIA
CARING INTO THE FUTURE

REPUBLIC OF ZAMBIA

CHIEF KANYAMA MAKANDA - KANDA ROYAL ESTABLISHMENT

P.O. BOX 160008, MWINILUNGA DISTRICT

REPUBLIC OF ZAMBIA
CHIEF KANYAMA
07 DEC 2011
MWINILUNGA DISTRICT

The Managing Director
ZESCO Limited
LUSAKA.

Sir,

RE: THE DEVELOPMENT OF THE MUJILA MINI-HYDRO PROJECT

First of all, we wish to congratulate you on your appointment as ZESCO MD! We wish you well in your new assignment.

This serves to confirm that on behalf of the community at Mujila, we want to continue cooperating with Government as before in order to see the successful implementation of the project. We also wish to confirm that we have participated in all the consultative meetings about the project that we were verbally invited to. All future verbal invitations for consultative meetings about the project shall be honoured as before.

As a community and indeed the entire chiefdom, we look forward to the successful implementation of the project.

REPUBLIC OF ZAMBIA
CHIEF KANYAMA
07 DEC 2011
MWINILUNGA DISTRICT

His Royal Highness
Chief Kanyama

ZESCO AUTHORITY			
FROM	TO	SIGN	ACTION
Managing Director			
Director HR & Admin			
Director Finance			
Director - Distribution & CS			
Director Generation			
Director Transmission			
Director Corp. Affairs & Business Admin.			
Company Secretary			
DATE 12-12-11			

ZESCO LTD

MUJILA MINI HYDRO PROJECT CONSULTATIVE MEETING HELD AT: KANYIZHIWU C. SCHOOL DATE: 04/11/2010

No.	NAME	VILLAGE	OCCUPATION	SIGNATURE
1	CHITUMBAFUMU SACHIMONA	SACHIMONA	FARMING	F. Sachimona
2	HEADMAN CHIMOVU	CHIMOVU	"	S. Chimovu
3	HEAD WOMAN KAFWALI	KAFWALI	"	J. KAFWALI.
4	KAMWANA LASTICKY	KAFWALI	"	L. Kamwana
5	MUKOSAYI MAYANYI	"	"	M. Mayanyi
6	HEADMAN SAMPULI	SAMPULI	"	SAMPULI
7	JACK SAMAKAYI	"	"	J. Samakayi
8	STEVEN KALUSAMBU	"	"	S. Kalusambu
9	DRYDEN KAMWANA	KAFWALI	"	D. Kamwana
10	FWALANGA KASELUMUNA	SAMPULI	"	F. Kaselumuna
11	KEFWASI MWANAUTA	"	"	K. Mwanauta
12	ALBERT ALUBE	KAFWALI	"	Albert B Alube

Annex E

ZESCO LTD

MUJILA MINI HYDRO PROJECT CONSULTATIVE MEETING HELD AT: KANYIZHIWA DATE: 4.11.2020

No.	NAME	VILLAGE	OCCUPATION	SIGNATURE
1.	Kamwana L	Kafwili	Farmer	
2.	Komwambi H	Kafwili	Farmer	
3.	MUTANTANWA DAYIMONI	"	"	Mutantanwa
4.	KAMWANA DRYDAN	"	"	Kamwana
5.	MUZALIWA KENSON	"	"	
6.	VINCENT WAHISHA	"	"	
7.	ERESTY MWA KAMA	"	"	
8.	FRANCIS KAMWANA	"	PASTOR	
9.	JOSEPH KASONU	"	Farmer	
10.	LEWIS KATOOKA	"	"	
11.	VALICK MUTEBA	"	"	V. Muteba
12	JOWENT WAHISHA	"	"	J. Wahisha

Annex E

ZESCO LTD

MUJILA MINI HYDRO PROJECT CONSULTATIVE MEETING HELD AT:.....KANYIZHIWU C. SCHOOL.....DATE:.....

No.	NAME	VILLAGE	OCCUPATION	SIGNATURE
1	FRANCIS KAMWANA	KAFWALI	PASTOR/FARMING	
2	PAUL MALOZA	SAMPULI	FARMING	P. Kasita
3	KASTO CHITEMBU	KAFWALI	"	K. Chitembu
4	GODEN KULONGA	SAMPULI	"	G. Kulonga
5	CHRISTOPHER KATOOKA	KAFWALI	"	C. Katooka
6	KELVIN KALITONGI	KAFWALI	"	
7	FREDRICK ALUBE	KAFWALI	"	
8	PEPHIAS KATOOKA	"	"	pKatooka
9	VENANSI MUSONA	"	"	V. musonakantu
10	DEVORA KAMWANA	"	"	D. Kamwana
11	SUSAN MUKOSAYI	"	"	
12	ENIYA KULUZA	"	"	E Kuluza

Annex E

ZESCO LTD

MUJILA MINI HYDRO PROJECT CONSULTATIVE MEETING HELD AT: KANYIZHIWU C. SCHOOL DATE:.....

No.	NAME	VILLAGE	OCCUPATION	SIGNATURE
1	MARY ALUBE	KAFWALI	FARMING	M. MUSONA
2	GRACE KAMWANA	"	"	G. Kamwana
3	LANIS KAMWANA	"	"	L. Kamwana
4	SELESTINA SAMAKAYI	SAMPULI	"	S. Samakayi
5	YONEYA KANCHINYI	"	"	Y. Kanchinyi
6	JANE MUNENGI	MAIDON	"	J. munengi
7	ELIDA NDUWA	SEMBETI	"	E. nduwa.
8	CHRISTINE ZALETA	MAIDON	"	C. Zaleta
9	MARY SAFWALANGA	SAMPULI	"	M. Safwalanga.
10	FONIS FWALANGA	"	"	F FWALANGA.
11	JOCE WAYISHA	KAFWALI	"	J. Wayisha
12	BEUTY SONEKA	SAMPULI	"	B. Soneka

Annex E

Telephone 252288/252323/252320
Fax: Lusaka 250170
Telelax: 40681 MIDLANDS ZA
Telegrams: LANDS

In reply please quote

No.....

REPUBLIC OF ZAMBIA

MINISTRY OF LANDS, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION

OFFICE OF THE PERMANENT SECRETARY
P. O. BOX 50694
15101 RIDGEWAY
LUSAKA

MLNREP/6/6/25

12th November, 2012

Managing Director
Zambia Electricity Supply Corporation (ZESCO) Limited
P.O BOX 33304
Lusaka
ZAMBIA

HOST COUNTRY APPROVAL FOR "RURAL ELECTRIFICATION BY MUJILA FALLS LOWER ZAMBIA MINI-HYDRO POWER STATION"

On behalf of the officially Designated National Authority (DNA) for purposes of the Clean Development Mechanism (CDM) under article 12 of the Kyoto Protocol, I am directed to state that the Project Design Document (PDD) for the proposed Clean Development Mechanism (CDM) project ***"Rural Electrification by Mujila Falls Lower Zambia Mini-Hydro Power Station"*** was considered by the National CDM Board of the DNA meeting held on 1st June, 2012 and subsequently through electronic clarification of a number of points raised at the meeting. The DNA confirms that:

1. The Government of Zambia ratified the Kyoto Protocol in July 2006;
2. This is approval of voluntary participation in the proposed CDM project activity;
3. The project contributes to sustainable development in Zambia;
4. The DNA authorizes the ZESCO to participate in the project.

Lungu M. Richard
Principal Natural Resources Management Officer
Natural Resources and Environmental Protection Department
UNFCCC National Focal Point/Secretary to the DNA
For/Permanent Secretary
MINISTRY OF LANDS, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION

VALIDATION REPORT

Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station

25 January, 2013

Japan Consulting Institute

REPORT NO. JCI-VAL 10-061
REVISION NO.00

CDM Validation Report for Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station

Date of first issue 25 January 2013	Report Number JCI-CDM-VAL-10-61	
Approved by Akio Yoshida, Executive Director	Organizational Unit CDM Centre, Japan Consulting Institute (JCI)	
Client ZESCO Ltd	Client ref., Mr. Kennedy Sichone	
Project name	Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station	
Host Country Zambia	Methodology version AMS-I.A. (Version16)	Sectoral Scope Technical Area(s) Sectoral Scope 1 TA 1.2
Size Small Scale	ER estimate 11,037 tCO_2e / year (average)	
GHG Reducing Measure/ Technology	Electricity Generation by the User	

A summary of the validation process and its conclusions, validation opinion

Japan Consulting Institute (JCI) has performed a validation work of the "Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station". The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

- The review of the PDD and the subsequent follow-up interview has provided JCI with sufficient evidence, to determine the fulfilment of stated criteria.
- The host country is Zambia and it fulfils the participation criteria and has approved the project and authorized the project participant. The DNA of Zambia has confirmed that the project assists in achieving sustainable development.
- The project correctly applies "AMS-I.A. Electricity Generation by the User", (Version16).
- The total emission reductions from the project are estimated to be on the average 11,037 tCO_2e per year over the selected 7 years crediting period. The starting date of crediting period is from 01/03/2015. The emission reduction forecast has been assessed and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.
- Adequate training and monitoring procedures are sure to be implemented in due course.

In summary, it is JCI's opinion that the "Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station" as described in the PDD version 06 dated "24/01/2013" meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria and correctly applies the methodology AMS-I.A. (Version16).

JCI thus provides a positive opinion and requests the registration of the proposed project as a CDM project activity.

Date of revision	
Checked by Hideyuki Sato, Manager, Evaluation Group, JCI CDM Center	☑ No distribution without permission from the Client or responsible organisational unit
Technical Reviewed by Hideyuki Sato, Technical Reviewer	☐ Limited distribution
Work carried out by Masaki Okada, Shigeo Aoki, Mitsuo Takano	☐ Unrestricted distribution

Abbreviations

AMS-I.A.	Electricity Generation by the User", (Version16)
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CL	Clarification Request
DNA	Designated National Authority
DOE	Designated Operation Entity
EB	Executive Board
ECZ	Environmental Council of Zambia (ECZ is now known as Zambian Environmental Management Agency (ZEMA) due to organizational restructure in 2011)
EIA	Environmental Impact Assessment
EPB	Environmental Project Brief
ERPA	Emission Reduction Purchase Agreement
ERs	Emissions Reductions
GHG	Greenhouse Gas
GSC	Global Stakeholder Consultation
JCI	Japan Consulting Institute
JICA	Japan International Cooperation Agency
KP	Kyoto Protocol
LoA	Letter of Approval
MEWD	Ministry of Energy and Water Development
MUMSS	Mitsubishi UFJ Morgan Stanley Securities
NREPD	Natural Resources and Environmental Protection Department, Zambia
PDD	Project Design Document
REA	Rural Electrification Authority
UNFCCC	United Nations Framework Convention on Climate Change
VVM	CDM Validation and Verification Manual (Version 01.2)
ZEMA	Zambian Environmental Management Agency (Ref. ECZ above in this table)
ZESCO	Zambia Electricity Supply Corporation

TABLE OF CONTENTS

I. VALIDATION SUMMARY AND OPINION

Japan Consulting Institute (JCI) has performed a validation of the "Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station (hereafter called "the proposed project)". The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The review of the project design documentation and the subsequent follow-up interviews have provided JCI with sufficient evidence to determine the fulfillment of stated criteria.

The host country is Zambia and fulfills the participation criteria and has approved the project and authorized the project participants The DNA of Zambia has confirmed that the project assists in achieving sustainable development.

The project correctly applies AMS-I.A. "Electricity Generation by the User" (Version 16).

The total emission reductions from the project are estimated to be on the average 11,037 tCO_2e per year over the selected 7 year crediting period. The starting date of crediting period is from 01/03/2015. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

Adequate training is planned before commissioning of the project activity featuring the contracted CDM consultant and monitoring procedures can be expected to be appropriately established for implementation.

In summary, it is JCI's validation conclusion that the proposed project as described in the PDD version 06 dated "24/01/2013" meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria and correctly applies the AMS-I.A. (Version 16).

JCI thus provides a positive validation opinion and requests for the registration of the proposed project as a CDM project activity.

II. INTRODUCTION OF CDM VALIDATION

ZESCO Ltd has commissioned JCI to perform the validation of the proposed project. This report summarises the findings of the validation of the project, performed on the basis of CDM VVM (version 01.2), and related UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, and the subsequent decisions by the CDM Executive Board.

1. Objective of CDM Validation

The purpose of validation is to ensure a thorough, independent assessment of the proposed project activities submitted for registration as a proposed CDM project activity against the applicable CDM requirements.

JCI reports the results of its assessment in a validation report. JCI submits this validation report, along with the supporting documents to the CDM Executive Board as part of the request for registration of a project activity as a proposed CDM project activity.

The validation report shall include a positive validation opinion only if the proposed project activity complies with the applicable CDM requirements.

2. Validation approach

The CDM is a rules-based mechanism. Therefore, it shall be JCI's responsibility to ensure that, in accordance with the Clean Development Mechanism Validation and Verification Manual (CDM VVM) version 01.2 and CDM requirements, these rules are complied with for any project activities requesting registration as a proposed CDM project activity.

During validation, JCI assesses whether the project design of the proposed CDM project activity meets the CDM requirements. For this, JCI, using objective evidence, assesses the completeness and accuracy of the claims and conservativeness of the assumptions made in the project design document (PDD). The evidence used in this assessment is not limited to that provided by the project participants.

In assessing evidence, JCI does not omit evidence that is likely to alter the validation opinion. In the assessment of evidence, JCI uses the acceptable approaches as specified in Chapter V. CDM Validation of section E. in CDM VVM version 01.2, and JCI ensures that the project activity complies with the relevant requirements set out in the CDM modalities and procedures, the applicability conditions of the selected methodology and guidance issued by the CDM Executive Board before submitting a request for registration.

In case the validation report includes a negative validation opinion the validation report shall be sent to the CDM Executive Board.

3. Validation Methods

3.1 Means of validation

JCI applies standard auditing techniques to assess the correctness of the information provided by the project participants, including, where appropriate, but not limited to:

1) Document review, involving:
   (i) Review of data and information to verify the correctness, credibility and interpretation of presented information;
   (ii) Cross checks between information provided in the PDD and information from sources other than that used, if available, and if necessary independent background investigations
2) Follow-up actions (On-site Interviews with Relevant Stakeholders in the Host Country), including:
   (i) Interviews with relevant stakeholders in the host country, personnel with knowledge of the project design and implementation;
   (ii) Cross-check of information provided by interviewed personnel (i.e. by checking sources or other interviews) to ensure that no relevant information has been omitted from the validation;
3) Reference to available information relating to projects or technologies similar to the proposed CDM project activity under validation; and
4) Review, based on the approved methodology being applied, of the appropriateness of formulae and correctness of calculations.

3.2 Clarification requests, corrective action requests and forward action requests

If, during the validation of a project activity, the DOE identifies issues that need to be further elaborated upon, researched or added to in order to confirm that the project activity meets the CDM requirements and can achieve credible emission reductions, the DOE shall ensure that these issues are correctly identified, discussed and concluded in the validation report.

The DOE shall raise a corrective action request (CAR) if one of the following occurs:
   (a) The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
   (b) The CDM requirements have not been met;
   (c) There is a risk that emission reductions cannot be monitored or calculated.

The DOE shall raise a clarification request (CL) if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.
The DOE shall raise a forward action request (FAR) during validation to highlight issues related to project implementation that require review during the first verification of the project activity. FARs shall not relate to the CDM requirements for registration.

The DOE shall resolve or "close out" CARs and CLs only if the project participants modify the project design, rectify the PDD or provide adequate additional explanations or evidence that satisfies the DOE's concerns. If this is not done, the DOE shall not recommend the project activity for registration to the CDM Executive Board.

The DOE shall report on all CARs, CLs and FARs in its validation report. This reporting shall be undertaken in a transparent and unambiguous manner that allows the reader to understand the nature of the raised issue, the nature of the responses provided by the project participants, the means of validation of such responses and clear reference to any resulting changes in the PDD or supporting annexes. The validation protocol consists of two tables. The different columns in these tables are described as followings.

Validation protocol tables

Table 1: Requirement checklist

- ✧ Requirement (Checklist Question) :
  The various requirements in Table 1 are checklist questions the project should meet. The checklist is organised in different sections, following the logic of the latest VVM, the PDD Guidelines and the small-scale PDD template, version 03 - in effect as of 22 December 2006. Each section is then further sub-divided.
- ✧ Reference :
  Gives reference to documents where the checklist question or item is found. Paragraph No. of VVM is referred.
- ✧ Check Comment :
  The column is used to elaborate and discuss the checklist question and/or the conformance to the question.
- ✧ ID No. of CAR, CL and FAR :
  - · *ID No. of CAR, CL and FAR is described.*
  - · *Corrective Action Request (CAR) is used due to non-compliance with the checklist question.*
  - · *Clarification Request (CL) is used when the validation team has identified a need for further clarification.*
  - · *Forward Action request (FAR) is used to highlight issues related to project implementation that require review during the first verification of the project activity.*

Table 2: Resolution of Corrective Action and Clarification Requests

- ✧ Clarifications and corrective action requests :
  If the conclusions from the draft Validation are a CAR, a CL or a FAR, these should be listed in this section.
- ✧ Ref. to checklist question in Table1 :
  Reference to the checklist question number in Table1 where the CAR, CL or FAR is explained.
- ✧ Summary of project owner response :
  The responses given by the project participants during the communications with the validation team should be summarised in this section.
- ✧ Validation team conclusion :
  This section should summarise the validation team's responses and final conclusions.

The completed validation protocol for the proposed project is enclosed in Appendix A to this report.

4. Stakeholder consultation process

JCI has made the PDD of the project activity under consideration publicly available in accordance with the latest version of the "Procedures for Processing and Reporting on Validation of CDM Project Activities".

During the validation of the project activity, JCI takes into account the comments received and the validation report shall include details of actions taken to take due account of the comments during the validation process.

If comments are not sufficiently substantiated or indicate that the project activity does not comply with the CDM requirements, then JCI requests further clarification from the entity providing the comment. However, JCI is not required to enter into a dialogue with Parties, stakeholders or NGOs that comment on the CDM requirements. If no additional information or substantiation is provided in response to a request for clarification, JCI proceeds to assess the comments as originally provided.

III. VALIDATION WORK

JCI carried out the validation work to ensure that the project activity complies with the requirements of paragraph 37 of the CDM modalities and procedures.

1. Validation Team

Details of the validation team are shown in below Table.

Table 3A. Details of Validation Team members

Role/Qualification	Name	Qualified Technical Areas related to the Project	On-site Visit
All relevant issues / Team Leader	Masaki OKADA	1.2. Energy generation from renewable energy source	---
CDM auditor / Team Member	Shigeo AOKI	1.2. Energy generation from renewable energy source	✓
CDM auditor / Team Member	Mitsuo TAKANO	1.2. Energy generation from renewable energy source	---

Table 3B. Technical Reviewer

Name	Qualified Technical Areas related to the Project
Hideyuki SATO	1.2. Energy generation from renewable energy source

2. Appointment certificate of JCI validation team member

The certificate of appointment of the validation team members is attached in Appendix B to this report.

3. Quality Control of the Validation Process

The validation report worked out by the team underwent a series of review processes for the assurance of its conformance with the requirements of the applied methodology, VVM, relevant guidance/guidelines /tools.

According to JCI's Quality Management Program, the series of the reviews have been conducted with the following three steps:
1) Interim review by the internal audit team including the technical reviewer
2) Review by the CDM evaluation committee consisting of the external experts
3) Final review by the internal audit team including the technical reviewer

All the reviewers including the external experts have been selected based on JCI's qualification standard on the competency required for CDM validation and verification.

4. Desk Review

4.1 Document list

The following table outlines the documentation reviewed during the validation.

Table 3. Document list

No.	Title
/1/	PDD version 01 "Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station" for Global Stakeholder Process (GSP) dated 21 July 2011
/2/	PDD version 06 dated 24 January 2013
/3/	LDC country list : ***http://unfccc.int/resource/docs/publications/ldc_brochure2009.pdf***
/4/	Master Plan (MASTER PLAN equivalent) prepared by JICA (Japan International Corporation Agency) issued in January 2008
/5/	EPB (Environmental Project Brief) prepared by ZESCO dated 30th November 2007
/6/	Approval letter for EPB by ECZ (Environmental Council of Zambia) on 26th December 2007
/7/	LoA (Letter of Approval) by Zambia DNA dated 12 November 2012
/9/	Guidelines on the Demonstration and assessment of Prior Consideration of the CDM, Version 04
/10/	AMS-I.A. "Electricity Generation by the User" (Version 16)
/11/	Guideline for demonstrating additionality of microscale project activities (version 04.0)
/12/	CDM validation and verification manual (VVM) Version 01.2
/13/	Guidelines of the Demonstration of Additionarity of Small-Scale Project Activities version 09.0
/14/	Glossary of CDM terms (Version 07)
/15/	CDM validation and verification manual (Version 01.2)
/16/	Signed Participant List in the Consultative Meeting held on 4th November 2010
/17/	On-site Assessment Summary prepared by JCI dated 22 December 2011
/18/	Estimation of the availability of full power during the life time of the project by technical expert (= 0.9) based on the "Available Generation of Mujila Falls P/S" by the author of Master Plan dated 26th December 2012
/19/	Monitoring Manual

No.	Title
/20/	Operation and Maintenance Manual
/21/	"Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02)
/22/	GUIDELINES ON ASSESSMENT OF DEBUNDLING FOR SSC PROJECT ACTIVITIES (Version 03)

Main changes between the version published for the 30 days stakeholder commenting period and the final version submitted for registration:

Table 4. Major Changes in the Content of the PDDs.

Subject and section in the PDD	Original content in the PDD/1/	Revised content in the PDD/2/	Issued CAR or CL. Relevant methodology, tool, guidance, or guidelines applied.
A.3 Project participant	- ZESCO Ltd. - Ministry of Energy and Water Development (MEWD) - Rural Electrification Authority (REA)	Only ZESCO has remained as PP and other two has declined.	CL-21
A.4.2 Table 1: plant Information	Plant Information originally selected	More relevant items are raised instead of original ones and a column added for giving "Source of Information" as well as some correction of specs.	Revised based on CL-7, 8 and 9 issued in the validation protocol.
B.1 Applied baseline and monitoring methodology	AMS-I.A Version 14	AMS-I.A Version 16 due to effective period of version 14	CAR-2
B.2 Table for applicability and compliance with applied methodology	Based on the version 14 of AMS-I.A.	Based on the version 16 of AMS-I.A	CAR-2
B.6.3 Project emissions	No mention of PE by diesel engine generator	Project emissions taking diesel engine into consideration	CAR-4
B.7.2 Description of the monitoring plan: Location of monitoring meter	No figure of location of monitoring meter	Figure B.3 is added for clarification of location of monitoring meter.	CL-17

B.7.2 Description of the monitoring plan: Monitoring organization chart	No figure of monitoring organization chart	Figure B.2 for monitoring organization chart is added.	CL-18
C.1.1 Starting date of the project activity	August 2012	28 February 2013	Revised based on the revision of expected date of purchase contract of main equipment
C.2.1.1 The starting date of the first crediting period	01/08/2014	01/03/2015 or the actual starting date of the project operation, whichever is later	"Guidelines on completeness check of request for registration" EB48 Annex60

5. Follow-up actions (On-site Interviews with Relevant Stakeholders in the Host Country)

The on-site Interviews with relevant stakeholders in the host country were held on 12 and 13 July 2011 at the project site in Jiangsu Province, PRC.

The names of interviewees are listed as follows:

Table 5. List of interviewees

No.	Date	Name	Organization	Topics
/80/	21 Dec. 2011	Mr. Kennedy Sichone Mr. Chinjila H. Mellon Ms. Cholwe Hamusunse Chanda Mr. Fredrick Mbesuma	ZESCO	**Interview with Project Owner** ・Outline of ZESCO's business operation ・The project history/Timeline ・Confirmation of project boundary ・Project site selection ・Compensation agreement with local community ・Others
		Ms. Chisato Nakade Mr. Atsushi Yamanaka	MUMSS	**Interview with REA** ・Role and responsibility of REA ・Long-term renewable energy development prospect in Zambia
		Mr. Stanley Lyalabi	REA	
/81/	22 Dec. 2011	Mr. Kennedy Sichone Mr. Chinjila H. Mellon Ms. Chisato Nakade Mr. Atsushi Yamanaka	ZESCO	**Interview with DNA** ・Criteria for approval of the CDM project ・Required documentation on the application of the CDM project ・Required days for assessment of the applied CDM project.
		Mr. Lung M. Richard Mr. Godwin F. Gondwe	DNA	・Registered CDM project in Zambia as past record. **Interview with ZEMA, formerly**

		Mr. Edwin Soko Mr. Humphrey K. Mwale Mr. Maxwell M. Nkoya	ZEMA	**Environmental Council of Zambia (ECZ)** · Criteria for approval EIA. · Procedure of assessment of submitted EIA for ZEMA's approval. · ZEMA's assessment procedure at site during and after construction of the CDM project
		Mr. Arnold Mizmer Simwaba Mr. Malama Chileshe Mr. William Sinkala Mr. Nkusuwila Silomba Ms. Annie Banda Chandi Ms. Lukonde Kaunda	DOE	**Interview with DOE** · Background of DOE involvement in the CDM project. · Regarding the master plan as the basis of the development of the CDM project.
		Mr. Takashi Okuyama Mr. Hanyinda Kelvin	JICA	

IV. VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of validation and the results from the validation process are identified and documented in more detail in the validation protocol in Appendix A.

Findings issued through the validation;

JCI issued the four (4) CARs, twenty-one (21) CLs and three (3) FARs as shown in the Validation Protocol, Appendix A of this report.
All CARs and CLs were resolved and then closed as shown in the Table 2 of the Appendix A.

1. Approval

JCI has finally received the Letter of Approval (LoA) from project participants provided.
As the proposed project is uni-lateral project, no Annex I country is involved.

JCI has further confirmed with the LoA the following:
1) Thae government of Zambia ratified the Kyoto protocol in July 2006.
2) The DNA of Zambia approved the proposed project and authorized ZESCO as voluntary participant to the proposed project, and addressed its assistance to sustainable development in the host country. There found no indication during the validation process that the proposed project activity uses the official development assistance funding for Zambia.

JCI validated and concluded that the LoA is appropriately issued, credible and fully comply with the requirements by VVM/12/.

2. Participation

JCI has confirmed that the proposed project participant is ZESCO Ltd. in Zambia as being listed in tabular form in section A.3 of the PDD/2/, and also has confirmed that this information is consistent

with the contact details provided in Annex 1 of the PDD/2/. It is further confirmed that no entities other than those approved as project participant is included in these sections of the PDD/2/.
Also, it is confirmed that the proposed project is unilateral CDM project.
As described above, JCI has validated and concluded that the project participants are authorized with the LoAs issued by the relevant DNAs as a voluntary participant to the project activity.

3. Project Design Document

Through desk reviews and Q&A sessions with the PDD author, JCI has confirmed that the PDD is described based on and referring to the following methodology, emission tools, guidance, guidelines, and manual:

(1) AMS-I.A. "Electricity Generation by the User" (Version 16)/10/
(2) Guideline for demonstrating additionality of microscale project activities (version 04)/11/
(3) Guidelines of the Demonstration of Additionarity of Small-Scale Project Activities version 09.0/13/
(4) Glossary of CDM terms (Version 07)/14/
(5) CDM Validation and Verification Manual (VVM) Version 01.2/12/

The project design was described using the PDD template of the latest version 03 as shown in the PDD/2/, that was confirmed through comparison with the template listed on the UNFCCC website.

As described above, JCI has validated and concluded that the PDD is compiled with use of the appropriate format and is described based on appropriate tools, guidelines, manual and guidance which are specified and requested by the CDM procedures.

4. Project Description

The context of the PDD/1/ was checked during the on-site assessment conducted from 21 through 22 December 2011 with the following measures:

1) Cross-check of the PDD/1/ with relevant drawings provided by the project participant
2) Interviews with the project participant, relevant organizations/entities and the PDD author as shown in Table 5 of section III. 5.

The major features of the project activity described in the PDD/2/ are summarized below:

- Project type : Construction of a new mini-hydropower project
- Installed capacity : 1.4 MW (0.7MW x 2 units)
- Connecting grid : Off-grid to rural communities in the North Western Province of Zambia
- Annual power generation (Baseline energy) : 13,797,000kWh /year
- Estimated emission reductions: 11,037 tCO2e/year
- Project lifetime : 30 years (40 years in the p.6 of PDD sourced from Master Plan/4/ , however commonly 30 years is applied for elctro-mechanical parts used for hydropower plant in Zambia, accordingly determined as 30 years in the section C.1.2. in the PDD/2/.
- 1st crediting period : 7 years (a total of 21 years: 7 years x 3)

5. Baseline and monitoring methodology

5.1. Applicability of selected methodology to the project activity

JCI has judged that application of AMS-I.A."Electricity Generation by the User" (Version 16)/10/ to the project activity is appropriate by the following steps and viewpoints;

1) Document Review

JCI has reviewed the MASTER PLAN/4/, EPB/5/ of the proposed project, and project related documentation and confirmed the proposed project is a newly installed mini-hydropower plant where no renewable energy power plant operating prior to the implementation of the project activity.

2) On-site visit dated 21 and 22 December 2011/17/
JCI has confirmed through interview with the project participant that the newly installed hydro-power plant is planned to construct and it has not started yet.
JCI also conduct hearing to relevant authorities such as REA, ZEMA and DNA and found that the project activity is accepted and welcome in the eyes of those authorities in the country.
JCI has also confirmed that the plant is designed and constructed in accordance with National and Local laws and regulations.

As shown in B.2 of the PDD/2/, the applicability was sufficiently demonstrated that the Project activity meets with the applicable conditions specified by the methodology AMS-I.A. (Version 16) /10/:

Table IV. 1 Applicability compliance check with AMS-I.A. (Version 16)

AMS-I.A., Ver.16 Applicability Conditions	Compliance	JCI Confirmation
1. This category comprises renewable electricity generation units that supply individual households/users or groups of households/users included in the project boundary. The applicability is limited to households and users that do not have a National/regional grid connection	This project activity consists of the supply of hydroelectric power generation that supply to individual households and users or groups of households/users included in the project boundary. Prior to implementation of the project activity, the households and users in the project boundary do not have connection to the national/regional grid. Zambia's electricity grid system is interconnected to neighbouring countries as part of the Southern African Power Pool (SAPP), which consists of power systems in southern African Countries. According to the Master Plan, the users in the project boundary may be connected to the national grid sometime around the year 2030, but this is at the planning stage and has	Confirmed during on-site assessment through interviews with stakeholders and document review such as Master Plan/4/ and EPB/5/.

	not yet been confirmed. The Project's interconnection with the national grid will be reported at the time of verification, if such event occurs in the future.	
2.The renewable energy generation units include technologies such as solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which is used on-site/locally by the user, e.g. solar home systems, wind battery chargers. The renewable generating units may be new installations (Greenfield) or replace existing onsite fossil-fuel-fired generation. To qualify as a small-scale project, the total output of the unit(s) shall not exceed the limit of 15 MW.	The renewable energy hydro power generation unit implemented by the project activity is a new installation (Greenfield) project activity. The installed capacity of the generation unit will be 1.4 MW and does not exceed the limit of 15 MW.	Confirmed during on-site assessment through interviews with stakeholders and document review such as Master Plan/4/ and EPB/5/.
3. 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 the reservoir; - The project activity is implemented in an existing reservoir, where the volume of the 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/m2; - 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 than 4 W/m2.	The project activity is a run of river type hydropower project and no reservoir will be constructed. There will be no change with the volume of the reservoir.	Confirmed during on-site assessment through interviews with stakeholders and document review such as Master Plan/4/ and EPB/5/.
4. Combined heat and power (cogeneration) systems are not eligible under this category.	The project activity does not involve a combined heat and power (cogeneration) system.	Confirmed during on-site assessment through interviews with stakeholders and document review such as Master Plan/4/ and EPB/5/.

5. 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 unit to be installed consists of a 100% renewable component not exceeding the eligibility limit of 15 MW.	Confirmed during on-site assessment through interviews with stakeholders and document review such as Master Plan/4/ and EPB/5/.
6. Project activities that involve retrofit or replacement of an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	The project activity does not involve any retrofitting or replacement of existing facilities.	Confirmed during on-site assessment through interviews with stakeholders and document review such as Master Plan/4/ and EPB/5/.
7. In the case of project activities that involve the 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 project is Greenfield project and does not involve the addition of renewable energy generation units at an existing facility.	Confirmed during on-site assessment through interviews with stakeholders and document review such as Master Plan/4/ and EPB/5/.

JCI has validated and concluded that applicability of methodology AMS-I.A."Electricity Generation by the User" (Version 16) /10/ to the project activity is appropriately demonstrated and justified in the PDD/2/.

5.2. Project boundary

JCI confirms that the project boundary is appropriate for this project activity from the following steps and viewpoints:

1) Document review

JCI has reviewed the MASTER PLAN/4/ and has confirmed that the project activity is to construct a new mini-hydropower plant, and generated power is to be delivered to the Off-grid to rural communities in the North Western Province of Zambia .

2) Interview with the independent consultants to ZESCO in technical matters of the proposed project in Japan before conducting on-site assessment

3) On-site visit on 21 and 22 December 2011/17/

JCI has confirmed that the electricity delivery conditions through the interviews with the project owner (ZESCO) based on the relevant documentation.

According to the applied methodology AMS-I.A. (Version 16) /10/, the project boundary encompasses the physical, geographical site of the renewable energy generating unit and the equipment that uses the electricity produced delineates the project boundary.

As the electricity delivered by the project is displace of fossil fuel based energy such as kerosene, the baseline emission factor can be a default value according to Baseline Methodology Procedure in AMS-I.A. (Version 16) /10/.

Therefore the PDD/2/ described that the project boundary covers the project site and the Off-grid as the relevant electricity system, including all households connected to the grid system.

JCI has validated and concluded that the project boundary is appropriately defined in the PDD/2/ and fully complies with the methodology AMS-I.A. (Version 16) /10/.

In addition, JCI confirmed that the proposed project is not a debundled component of a large-scale project as stated in the PDD/2/, in accordance with GUIDELINES ON ASSESSMENT OF DEBUNDLING FOR SSC PROJECT ACTIVITIES (Version 03)/22/ in following manner.

There is no registered small-scale project activity under the CDM or an application to register another CDM small-scale project activity under the CDM by the project proponent within the previous two years with the same project category and technology within 1km of the project boundary of the proposed project. This is confirmed by the audit team during on-site interview with the project owner & relevant government officals. In addition, the audit team is able to check up with the UNFCCC website and identify no other hydropower project being developed by the project onwer. Therefore, the proposed project is not deemed to be a debundled component of a large project activity.

5.3. Baseline identification

JCI confirms that the baseline identification for this project is appropriate from the following steps and viewpoints:

1) Document review
   JCI has reviewed the MASTER PLAN/4/ and has confirmed that the project activity is to construct a new mini-hydropower plant, and generated power is delivered to the Off-grid to rural communities in the North Western Province of Zambia.
   According to the demand of forecast of required capacity in the relevant community in the Master Plan/4/, it is estimated 1,416kW in the year of 2030.
   PO has decided to install the project of 1.4MW capacity along with the result of the Master Plan/4/.
2) On-site visit on 21 and 22 December 2011/17/
   JCI has confirmed that the electricity delivery conditions through the interviews with project owner.

During the on-site audit, PO explained the background of the forecast of the rise of energy demand based on the Master Plan/4/ and JCI acknowledged its credibility.

Regarding the baseline scenario, the selected methodology AMS-I.A. version 16/10/ stipulates as follows;

The energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy, estimated using one of the following three options:

Option 1: the energy baseline is calculated based on the average annual electricity consumption of the consumers as per the below:

$$E_{BL,y} = \sum_i \left(n_i * EC_{i,y}\right) / \left(1 - l\right)$$

Where:

$E_{BL,y}$	*Annual energy baseline; kWh*
$\sum_i$	*The sum over the group of i renewable energy technologies (e.g. renewable energy technologies for households, rural health centres, rural schools, grain milling, water pumping, irrigation, etc.) implemented as part of the project activity*
n_i	*Number of consumers supplied by installations of the renewable energy technology belonging to the group of i renewable energy technologies during the year*
$EC_{i,y}$	*Average annual individual energy consumption observed in closest grid electricity systems among rural grid connected consumers belonging to the same group of i renewable energy technologies. If energy consumption is metered, $EC_{i,y}$ is the average energy consumed by consumers belonging to the*

group of i renewable energy technologies; kWh

l	*Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction*

Option 2: the energy baseline is calculated based on annual electricity generation from project renewable energy technologies as per the below:

$$E_{BL,y} = \sum_i EG_{i,y} / (1 - l)$$

Where:

$E_{BL,y}$	*Annual energy baseline; kWh*
$\sum_i$	*The sum over the group of i renewable energy technologies (e.g. renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity*
$EG_{i,y}$	*Annual output of the renewable energy technologies of the group of i renewable energy technologies installed; kWh*
l	*Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction* *Value applied: 0.2 as default value (AMS-I.A Version 16)*

In the case of project activity applying paragraph 1(c), $EG_{i,y}$ corresponds to electricity generation in specific calendar months during which power is available from the grid for delivery to the households or other users for less than 36 hours a month. The availability of grid electricity for delivery to the households or other users shall be determined based on continuous power monitoring and hourly recording in order to determine the grid availability for any given calendar month.

The energy baseline $E_{BL,y}=0$, for any hour during which power is available from the grid for delivery to the households or other users. For example, if the grid is available to deliver power for 15 hours in April, energy baseline can be calculated for April, but the calculation must account for the requirement that during those 15 hours when the grid is available in April, the energy baseline is zero.

Option 3: the baseline can be a trend-adjusted projection of historic fuel consumption in situations where an existing technology is replaced. For the specific case of lighting devices a daily usage of 3.5 hours shall be assumed, unless it is demonstrated that the actual usage hours adjusted for seasonal variation of lighting is different based on representatives sample survey (90% confidence interval ±10% error) done for minimum of 90 days.

In the PDD/2/ for this proposed project, above option 2 is appropriately chosen as baseline due to its simplicity of calculation procedure.
And as stated above in the methodology, the annual energy baseline should be estimated based on the installed capacity (1.4MW) for the proposed project activity.

JCI has validated and concluded the baseline scenario and calculation of emissions are appropriately defined by applying Option 2 above in the PDD/2/ complying with AMS-I.A. (Version 16) /10/.

5.4. Algorithms and/or formulae used to determine emission reductions

JCI has reviewed that the algorithms and/or formulae including data and values used to determine the emission reductions of the proposed project comply with the Methodology AMS-I.A. (Version 16) /10/ through the document review, discussion during the on-site visit and the findings.

JCI also confirmed that the data and parameters used in the calculations are sourced from appropriate documents and correct interpretation and application through cross-checks with comparison of the data available in public.
Through cross-checks with the submitted objective evidences, JCI validated and concluded the correctness of the parameters listed in the PDD/2/ in the manner shown in below Table IV.2.;

Table IV.2 Data/Parameters for the calculation for the Emission reductions (ER)

Data/ Parameter	Description	PDD		JCI's Check Result
		Value applied	Source of data	
Section B.6.2 Data and parameters fixed ex-ante				
EF_{CO2}	CO_2 emission factor of the fossil fuel that would have been used in the baseline plant	0.0008 tCO_2e/kWh	Default value (AMS-I.A, Version 16)/10/	OK, confirmed consistency with AMS-I.A, Version 16)/10/
l	Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes in isolated areas	0.2	Default value (AMS-I.A, Version 16)	OK, confirmed consistency with the methodology AMS-I.A, Version 16)/10/
Section B.7.1 Data and parameters to be monitored				
$EG_{i,y}$	Annual net electricity generated during the year, *y*	11,037 ,600 kWh/y	*Ex ante* estimation based on the installed capacity and the maximum operating hours per year:1,400 kW x 0.9 x 8,760 hrs/y = 11,037,600 kWh/y	OK, confirmed appropriateness as ex-ante estimation derived under assumption of the available river flow and the generation capacity of the project activity (1.4MW) as calculated in the PDD/2/ Refer to below validation in the section 5.4.1- 1) and CL-4 and CL-14
$FC_{diesel,emergency,y}$	Quantity of diesel fuel combusted at the project power plant during emergency in the year y	0 ton/y	Onsite measurements	OK, confirmed the appropriateness of estimation of consumption, however to be checked measured value during the verification

$NCV_{diesel,y}$	Weighted average net calorific value of diesel in year y	43.3 TJ/ton	PCC default values for diesel oil at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (Default As per "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" version 02)	OK, basis of estimation defined can be deemed appropriate with reference to IPCC publications and relevant tool.
$EF_{CO2,diesel,y}$	CO2 emission factor of diesel in year y	74.8 ton/TJ	IPCC default values for diesel oil at the upper limit of the 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. (Default As per "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" version 02)	OK, basis of estimation defined can be deemed appropriate with reference to IPCC publications and relevant tool.

JCI has validated and confirmed that the ER calculation was correctly conducted as described in Section B.6 of the PDD /2/ complying with the selected methodology AMS-I.A./10/ as below:

5.4.1. Baseline emission

1) The emission baseline is the energy baseline calculated in accordance with Paragraph 8(b) of AMS-I.A. times a default emission factor as below:

$BE_{CO2,y} = E_{BL,y} * EF_{CO2}$

Where:

$BE_{CO2,y}$ Emissions in the baseline in year, y; tCO2

$E_{BL,y}$ Annual energy baseline in year, y; kWh

EF_{CO2} CO2 emission factor; tCO2/kWh

For EF_{CO2}, the default value of 0.8 kg CO2e/kWh (= 0.0008 tonCO2/kWh) under AMS-I.A version 16/10/ is used.

For $EG_{i,y}$, ex-ante calculation can be done as follows;

$EG_{i,y}$ = (Capacity of the project) x (Annual operation hours)
= 1,400kW x 0.9 x 8,760hours/y
= 11,037,600kWh/y

The assumption here is based on the availability of expected steady output capacity by the project activity throughout a year (8,760h) sourced from the Master Plan/4/.
The Co-efficient (=0.9) to estimate available capacity is assumed and endorsed in the letter titled "Available Generation of Mujila Falls P/S" by the independent consultants to ZESCO in technical matters dated 26th December 2012/18/.
In order to validate the appropriateness of the annual average generation (1.4MW x 0.9) here, JCI issued CL-4 and CL-14, and PO has properly responded with reference to Master Plan/4/ in its justification as well as with the above mentioned "Endorsement Letter/18/", and JCI fully satisfied with the clarifications for CL-4 and CL-14.
Therefore CL-4 and CL-14 is closed.

Accordingly the baseline energy ($E_{BL,y}$) can be obtained based on the result of the section 5.3 (above) , namely;

$$E_{BL,y} = \sum_i EG_{i,y} / (1 - l)$$
= 11,037,600/0.8 = 13,797,000kWh/y

As a result, baseline emissions ($BE_{CO2,y}$) can be calculated as below;

$BE_{CO2,y}$ = $E_{BL,y}$ * EF_{CO2}
= 13,797,000kWh x 0.0008 tonCO2/kWh
= 11,037 tonCO2

The resulted value above is exactly same as described in the PDD, so that JCI concluded the baseline emissions is correctly calculated in line with the applied methodology.

5.4.2. Project emission

According to the applied methodology AMS-I.A. (Version 16) /10/, it reads that "For most renewable energy project activities, *PEy* = 0.
However, for the following categories of project activities, project emissions have to be considered in line with the procedure described in the most recent version of ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

- Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption);
- Emissions from water reservoirs of hydro power plants.

In the PDD, it says that "*the project activity is a small scale hydropower project with no change in the volume of the reservoir*."

As for the emissions from water reservoir, JCI issued CL-11 in order to cross-check with some objective reference and PO responded explaining the features of the flooded area with reference to EPB/5/.
JCI reviewed the relevant part of EPB/5/ and acknowledged that the response is appropriate and as a result CL-11 is closed.

In the meantime, referring to the section B.6.1 of the PDD/2/, the project plans to install a diesel engine generator of 50 kVA capacity for emergency purpose. According to the PDD/2/, in case of emergency, all the station power supply is out and the emergency diesel engine generator will be activated.

It is reasonable to think that it is not too often to activate the diesel engine generator during the operation of the project activity, however it is appropriate that any diesel fuel consumption during emergency is counted toward project emissions as per Option B of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (version 02) as follows:

$$PE_{FC,emergency,y} = \Sigma FC_{diesel,emergyncy,y} \times NCV_{diesel,y} \times EF_{CO2,diesel,y}$$

Where:

$PE_{FC,emergency,y}$	CO2 emissions from diesel combustion during emergency in year y
$FC_{diesel,emergency,y}$	Quantity of diesel combusted during emergency in year y
$NCV_{diesel,y}$	Net calorific value of diesel in year y, as per IPCC default value at upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter1 of vol.2 of the 2006 IPCC Guidelines on national GHG inventories
$EF_{CO2,diesel,y}$	CO2 emission factor of diesel in year y, as per IPCC default value at upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of vol.2 of the 2006 IPCC Guidelines on national GHG inventories

JCI considers that it is appropriate to estimate $FC_{diesel,emergency,y}$ is zero because of its scarcity.
In consideration above, JCI has confirmed that PEy can be estimated as follows;

$PE_y = PE_{FC,emergency,y} = 0$

5.4.3. Leakage emissions

In the PDD, it says that *"in accordance with AMS-1.A., Version 16, if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. This is not the case in this Project and as such leakage emissions are not considered."*

With reference to the credible relevant documents such as "Master Plan/4/", "EPB/5/" and also through interviews with stakeholders to this project during the on-site observation/17/, JCI regards the description in the PDD/2/ above as trustworthy, accordingly JCI has concluded that the PDD/2/ estimates no leakage associated with the project activity appropriately based on the methodology AMS-I.A. (Version 16) /10/, which requires to consider leakage emissions only when equipment transfer is involved. (L = 0)

5.4.4. Emission reductions

The PDD/2/ estimated both the project and leakage emissions at zero appropriately complying with the methodology/10/. And then it calculated the emission reductions by the project activity to be 11,037tCO_2 /y as below;

Emission reductions are calculated as:

$$ER_y = BE_{CO\,2,\,y} - PE_y - L$$

Where:

ER_y	Emission reductions in the year y; tCO2e
$BE_{CO2,y}$	Emissions in the baseline in the year, y; tCO2e
PE_y	Project emissions in the year, y; tCO2e

L Leakage in the year, y; tCO2e

JCI has confirmed that the calculations here are appropriate and correct.

In conclusion, JCI validates and concludes that the emission reductions are appropriately worked out complying with applied methodology/10/, and parameters and data for the calculations are sourced from proper data sources.

Complying with VVM (Version 01.2)/12/ paragraph 92, JCI hereby confirms that:

(a) All assumptions and data used by the project participants are listed in the PDD/2/, including their references and sources;

(b) All documentation used by project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD/2/;

(c) All values used in the PDD/2/ are considered reasonable in the context of the proposed CDM project activity;

(d) The baseline methodology AMS-I.A. (Version 16) /10/ has been applied correctly to calculate project emissions, baseline emissions, leakage emissions and emission reductions;

(e) All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD.

6. Additionality of project activity

6.1 Prior considerationof CDM

(1) Prior consideration

As for the prior consideration of the CDM, it is automatically fulfilled because the starting date of the CDM project is scheduled after the publication of the PDD for global stakeholder consultation (23/07/2011 to 21/08/2011) in reference to EB62 Report Annex 13 ”Guidelines on the Demonstration and assessment of Prior Consideration of the CDM, Version 04”/9/.

(2) Project starting date

JCI has assessed that the project starting date with the following issues.

According to the Glossary of CDM terms, Version 07/14/ the starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project activity begins. Furthermore it shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity.

In the case of the proposed project, the starting date of the project activity is expected 28/02/2013 when the project participant is expecting to conclude the contract for the purchase of main equipment which is considered as the earliest real action of the project activity.

6.2 Identification of alternative

JCI has judged that as described in the above section "5.3 Baseline identification", the PDD/2/ has appropriately described the baseline scenario and emissions, according to the applied methodology AMS-I.A. (Version 16) /10/.

6.3 Additionality of the project in the least developed country

In the section B.5. of the PDD/2/, it refers to "Guidelines for demonstrating additionality of microscale project activities", Version 04.0/11/, in which it is described that;
"*Project activities up to five megawatts that employ renewable energy technology are additional if any one of the conditions below is satisfied:*

(a) The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country.

(i) SUZ is a region in the host country (zone, municipality or any other designated official administrative unit) identified by the Government in official notifications for development assistance including for planning, management, and investment satisfying any one of the following conditions using most recent available data:

- *The proportion of population with income less than USD 2 per day (PPP)4 in the region is greater than 50%;*
- *The GNI per capita in the country is less than USD 30005 and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures;6*

(ii) In cases where, based on the recommendation of the designated national authority of the host country, the SUZ in the host country has been approved by Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM), the list of such SUZ shall be maintained on the UNFCCC website (e.g. at <http://cdm.unfccc.int/DNA/submissions/index.html>). In the case of these SUZ listed on the CDM website there is no need for the project proponents to provide proofs as indicated in paragraph 2 (a).

(b) The project activity is an off-grid activity supplying energy to households/communities (less than 12 hours grid availability per 24 hrs is also considered "off-grid" for this assessment);

(c) The project activity is designed for distributed energy generation (not connected to a national or regional grid)9 with both conditions (i) and (ii) satisfied;

(i) Each of the independent subsystems/measures in the project activity is smaller than or equal to 1500kW electrical installed capacity;

(ii) End users of the subsystems or measures are households/communities/small and medium enterprises (SMEs).10

(d) The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country. The following conditions shall apply for DNA recommendations:

(i) "Specific renewable energy technologies/measures" refers to grid connected renewable energy technologies11 of installed capacity equal to or smaller than 5 MW;

(ii) The ratio of installed capacity of the specific grid connected renewable energy technology in the total installed grid connected power generation capacity in the host country shall be equal to or less than 3 per cent;12

(iii) Most recent available data on the percentage of contributions of specific renewable energy technologies shall be provided to demonstrate compliance with the 3 per cent threshold. In no case shall data older than three years from the date of submission be used;

(iv) Technologies/measures recommended by DNAs and approved by the Board to be additional in the host country remain valid for three years from the date of approval. However, additionality of eligible project activities applying the guidelines remains valid for the entire crediting period;

(v) DNA submissions shall include the specific grid connected renewable electricity generation technologies that are being recommended and provide the required data as indicated above (e.g. wind power, biomass power, geothermal power, hydropower).

The Project is 1.4MW hydro-power project and satisfies the conditions (a) above.

The host country, Zambia, is recognised by the UNFCCC as one of the Least Developed Countries (LDC)/3/.

Accordingly, the proposed project is considered additional.

6.4 Investment analysis

The investment analysis has been skipped, because the additionality of the project has demonstrated in above 6.3 such that the project was less than 5 MW and located in one of the Least Developed Countries (LDC)/3/.

6.5 Barrier analysis

With the above 6.3, it was concluded that the project activity is additional, accordingly the barrier analysis provided in "Guidelines of the Demonstration of Additionarity of Small-Scale Project Activities /13/" was skipped.

6.6 Common practice analysis

As a small-scale CDM project, the PDD /2/ skipped the common practice analysis.

6.7 Conclusion of assessment of additionality

As stated in the section 6.3 above, JCI validated and concluded that the project satisfied the relevant provision of above Guidelines and then the project is additional.

7. Monitoring plan

It is stated in the PDD/2/ about "*the monitoring plan that the net electricity generated by the project activity will be monitored continuously by digital electricity meter(s) at the mini hydropower plant by ZESCO. Designated power plant operator will read the electricity meter situated in the power plant every day, then record the daily readings to the log book. These recorded data will be sent to ZESCO's project monitoring officer in Lusaka who compiles the aggregate of the electricity generated from the project activity monthly. The monitoring officer will then compile the annual net electricity generation data of the mini hydropower plant into a monitoring report. CDM Project Manager will review the monitoring report.*

JCI usually assesses the monitoring plan through 1) the document review including the relevant methodology/10/, the PDD/2/, the monitoring manual/19/, the operation and maintenance manual/20/, etc.,) and the on-site visit including physical observation and interviews with project participants and other stakeholders such like local residents.

However no such documents as the monitoring manual/19/, the operation and maintenance manual/20/ , etc are available at this validation stage.

In addition, it was not available to conduct physical observation at the project implementation site during on-site visit at Lusaka, Zambia because of difficulty of visit due to the dangerous conditions at site for various reasons. Further the project construction has not yet started at that time.

Accordingly JCI issued the FARs (FAR-1, 2) to prepare those key documents before the starting date of hydro-plant itself.

As a result, the validation for "Monitoring Plan" was done based on the provided documents available at the validation stage, which still can be deemed effective and credible.

7.1 Parameters to be monitored ex-post

In the PDD/2/, emission factor of the Project is determined ex-ante. Therefore, the quantity of electricity supplied by the Project to the community in year y which is used to calculate emission reductions will be monitored.

The PDD/2/, in section B.7.1.Data and parameters monitored, specifies to monitor the following parameters ex-post:

$EG_{i,y}$: Quantity of electricity supplied to the community in year y, as a result of the implementation of the CDM project in year y, which is measured by the installed electricity meter below at the Project site (The location is shown in the Figure B.3 in the PDD/2/ as E_m; Electricity mete).

$FC_{diesel,emergency,y}$: Quantity of diesel fuel combusted at the project power plant during emergency in the year y.
It is reasonable to think as described in the PDD/2/ that it is not too often to activate the diesel engine generator during the operation of the project activity, however it is appropriate that any diesel fuel consumption during emergency is counted toward project emissions as per Option B of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (version 02)/21/ as follows:

$NCV_{diesel,y}$: Weighted average net calorific value of diesel in year y

$EF_{CO2,diesel,y}$: CO2 emission factor of diesel in year y

JCI has cross-checked these parameters with the relevant methodology/10/ and tool/21/, and confirmed that the above parameters and monitoring plan based on those parameters is appropriate with reference to the description for the relevant part in the PDD/2/.

Also JCI noted that the transmission loss is considered in the applied methodology as default value. Thus JCI concludes that the monitoring plan based on the parameters above can be deemed appropriate.

7.2 Monitoring of $EG_{i,y}$, $FC_{diesel,emergency,y}$

The implementation plan of monitoring of the parameters has already been covered in 7.1 above. About the measuring equipments and monitoring organization is as follows;

1) Arrangements of measuring equipments

The arrangements of measuring equipments installed at the Project site are detailed in the section B.7.1 and JCI has validated and concluded that this arrangements are sufficient to monitor the planned parameters as confirmed in the below table:

Table IV.3 Parameters monitored

Parameter	Description	Ex-ante value	Measurement method & procedure	JCI's confirmation

$EG_{i,y}$	Annual net electricity generated during the year, *y*	11,037 ,600 kWh/y *Ex ante* estimation based on the installed capacity and the maximum operating hours per year:1,400 kW x 0.9 x 8,760 hrs/y = 11,037,600 kWh/y	Measured continuously by electricity meters and recorded at least once per day. The accuracy of the meters will be at least class 1.0. Applied meter is export reading only because no electricity source on the off-grid network.	OK, JCI confirmed that the monitoring approach is realistic and practical.
$FC_{diesel,emergency,y}$	Quantity of diesel fuel combusted at the project power plant during emergency in the year y	0 ton/y	Monitor continuously. · Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); · Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; · In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.	OK, JCI confirmed that the monitoring approach is realistic and practical. Details of the equipment have not been decided by the project owner. JCI issued the FAR-3 for choosing appropriate equipment of which features are to be along with as stated in the left column.

2) Monitoring organization

PDD/2/ explains that designated power plant operator will read the electricity meter situated in the power plant every day, and then record the daily readings to the log book. These recorded data will be sent to ZESCO's project monitoring officer in Lusaka who compiles the aggregate of the electricity generated from the project activity monthly. The monitoring officer will then compile the annual net electricity generation data of the mini hydropower plant into a monitoring report. CDM Project Manager will review the monitoring report.

JCI considers that the above monitoring organization can be expected to function well.
JCI confirmed details of team formation and the responsibility of each of members.
JCI has validated and concluded that the monitoring organization is appropriately described in the PDD/2/ fully satisfying CDM requirements.

8. Sustainable development

JCI has confirmed that the LoA issued by DNA of the host Party authorizes the contribution of the proposed CDM project activity to the sustainable development of the host Party, which has been already described at section 2 in LoA/7/.

9. Local stakeholder consultation

JCI has assessed the local stakeholder consultation through the document review such as the EPB/5/.
The notice to hold the stakeholders' meeting were distributed to village heads and the local residents were informed about the meeting through village heads. The stakeholders' meeting (Consultative Meeting) was held on 4th November 2010 at Kanyizhiwu school under attendance of 48 local residents according to the PDD/2/.
Also the breakdown of participants are described in the PDD/2/. JCI cross-checked the description in the PDD/2/ with the submitted EPB/5/ and signed participant list/16/ in the Consultative Meeting.

JCI interviewed with local governments and confirmed there is no serious concern about the proposed project.

Based on the above findings, JCI judges that the project activity, supported by local stakeholders, gives no significant adverse impacts on local environment, and instead is expected to contribute to the development of local economy and the improvement of living conditions of local residents.

10. Environmental impacts

The Environmental Impact Assessment (EIA) study for the project activity was conducted to ensure that the project complies with relevant national, regional and local regulations. Based on the study, EPB (Environmental Project Brief) was issued in November 2007. EPB was submitted to ECZ (Environmental Council of Zambia, ZEMA since 2011) on 30th November 2007 and the EPB was approved on 26th December 2007 by MEWD (Ministry of Energy and Water Development)/6/.

The EPB report refers to anticipated environmental impacts by the project activity both during the construction period and after the operation start, and suggested mitigation measures against anticipated air pollution, water pollution, noise, solid waste and ecological environment.
No significant ecological impact on the local area was anticipated.

JCI has confirmed that appropriate mitigation measures had been taken as described in the PDD/2/ and no serious issues were found.

JCI validated and concluded that the project participant took necessary mitigation measures and anticipated environmental impacts by the project activity are controlled at a minimum level.

11. Comments by Parties, Stakeholder through the consultation process

The PDD version 01 dated 21 July 2011 for Global Stakeholder Comments (GSC) was uploaded to UNFCCC CDM website on 23 July 2011.

https://cdm.unfccc.int/Projects/Validation/DB/8WFAZ8GL9LXQN292WAWDLHIIEQB3HW/view.html

It was made publicly available and Parties, stakeholders and NGOs were through the website invited to provide comments during a 30 days period from "23/07/2011" to "21/08/2011".

As a result of consultation, no comment was received.

APPENDIX A :CDM VALIDATION PROTOCOL

(Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)

1. INTRODUCTION

This document is prepared as the Validation Protocol on Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station.
The validation protocol is prepared for the following purposes:

- To ensure that, in accordance with the Validation Verification Manual version 01.2 (Annex 1, CDM-EB55, "VVM"), and CDM requirements, these rules are complied with for any project activities requesting registration as a proposed CDM project activity.
- To ensure a thorough, independent assessment of proposed project activities submitted for registration as a proposed CDM project activity against the applicable CDM requirements.
- To assess whether the project design of the proposed CDM project activity meets the CDM requirements, using objective evidence, and to assess the completeness and accuracy of the claims and conservativeness of the assumptions made in the project design document.

The validation protocol is consisted of the following two types of tables, which are effective for the purposes of validation above.

TABLE-1 contains the checklist with questions along with the thematic chapter of VVM.
TABLE-2 shows the corrective actions or clarifications which are requested to be taken in **TABLE-1** and the response from the PP.

<Index>

2. CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUESTS

If, during the validation of a project activity, issues are identified that need to be further elaborated upon, researched or added to in order to confirm that the project activity meets the CDM requirements and can achieve credible emission reductions, these issues shall be ensured that are correctly identified, discussed and concluded in the validation report.

- **CAR** : a corrective action request (**CAR**) is raised, if one of the following occurs:
  (a) The PPs have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
  (b) The CDM requirements have not been met;
  (c) There is a risk that emission reductions cannot be monitored or calculated.
- **CL** : a clarification request (**CL**) is raised,
  if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.
- **FAR** : a forward action request (**FAR**) is raised,
  during validation to highlight issues related to project implementation that require review during the first verification of the project activity.
  FARs shall not relate to the CDM requirements for registration.

The CARs and CLs are resolved or "closed out" only if the project participants modify the project design, rectify the PDD or provide adequate additional explanations or evidences that satisfy the requirements. If this is not done, the project activity will not be recommended for registration to the CDM EB.All CARs, CLs and FARs will be reported on in its validation report. This reporting shall be undertaken in a transparent and unambiguous manner that allows the reader to understand the nature of the issue raised, the nature of the responses provided by the project participants, the means of validation of such responses and clear reference to any resulting changes in the PDD or supporting annexes.

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

	TABLE-1 REQUIREMENTS CHECKLIST		(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
1.	**Approval**	Para.44-50 VVM	--	--
	<Requirement to be validated> All Parties involved shall approve the project activity.	Para.44 VVM	--	--
	The LoA (Letter of Approval) s of all parties involved shall be provided together with its information source and route.			
1.1	The LoA shall confirm that: (a) The Party is a Party to the Kyoto Protocol (b) Participation is voluntary (c) The proposed CDM project activity contributes to the sustainable development of the country (d) It refers to the precise proposed SSC-CDM project activity title in the PDD being submitted for registration	Para.45 VVM		CAR-1 CAR-3
2.	**Participation**	Para.51-54 VVM	--	--
	<Requirement to be validated> All project participants shall be listed in a consistent manner in the project documentation, and their participation in the project activity shall be approved by a Party to the Kyoto Protocol.	Para.51 VVM	--	--
2.1 1)	The project participants shall be listed in tabular form in section A.3 of the PDD, and this information shall be consistent with the contact details provided in annex 1 of the SSC-PDD.	Para.52 VVM		CAR-1 CAR-3 CL-2
2)	The participation of each project participant shall be approved by at least one Party involved, either in a letter of approval or in a separate letter specifically to approve participation.	ditto		CAR-1 CAR-3 CL-2
3)	No entities other than those approved as project participants shall be included in these sections of the SSC-PDD.	ditto		CAR-1 CAR-3 CL-2
2.2	The approval of participation shall be issued from the relevant DNA.	Para.53 VVM		CAR-1 CAR-3 CL-2
3.	**Project Design Document**	Para.55-57 VVM	--	--
	<Requirement to be validated> The SSC-PDD used as a basis for validation shall be prepared in accordance with the latest template and guidance from the CDM Executive Board available on the UNFCCC CDM website. **http://cdm.unfccc.int/Reference/PDDs_Forms/PDDs/index.html**	Para.55 VVM SSC-PDDs Forms	--	--
3.1	The SSC-PDD shall be in accordance with the applicable SSC-CDM requirements for completing PDDs. <http://cdm.unfccc.int/Reference/Guidclarif/pdd/index.html>	Para.56 VVM	OK	
3.2 1)	SSC-PDD template shall not be altered, that is, shall be completed using the same font without modifying its format, headings or logo. Tables and their columns shall not be modified or deleted. Rows may be added, as needed. If sections of the CDM-PDD are not applicable, it shall be explicitly	SSC-PDD Guidelines	OK	

CAR: Corrective Action Request, **CL**: Clarification Request, **FAR**: Forward Action Request, **NA**: Not Applicable, **Tbv**:To be verified

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

TABLE-1 REQUIREMENTS CHECKLIST			(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	stated that the section is left blank on purpose.			
2)	The presentation of values in the PDD should be international standard format.	ditto	OK	
3.3	The validation report shall contain a statement regarding the compliance of the SSC-PDD with relevant forms and guidance. (See guideline currently located at http://cdm.unfccc.int/Reference/Guidclarif/pdd/index.html.)	Para.57	OK	
4.	**Project Description**	Para.58-64 VVM	--	--
	<Requirement to be validated> The PDD shall contain a clear description of the project activity that provides the reader with a clear understanding of the precise nature of the project activity and the technical aspects of its implementation.	Para.58 VVM	--	--
4.1	In section A.2 of the SSC-PDD the following description shall be included: - the purpose of the project activity; -explain how the proposed project activity reduces greenhouse gas emissions (i.e. what type of technology is being employed, what measures are undertaken as part of the project activity, etc); - the view of the project participants on the contribution of the project activity to sustainable development (max. one page)	SSC-PDD Guidelines		CL-1 CL-3 CL-4 CL-5 CL-6
4.2	In section A.4.2 of SSC-PDD, The type and category of the project activity using the categorization of Appendix B to the simplified modalities and procedures for small-scale CDM project activities, hereafter referred to as Appendix B, shall be specified. Note that Appendix B may be revised over time and that the most recent version will be available on the UNFCCC CDM web site http://cdm.unfccc.int/methodologies/SSCmethodologies/. This section should also include a description of how environmentally safe and sound technology and knowhow is being applied by the project activity *interalia* technology transfer to the Host Party(ies) for application in the project activity.	ditto		CL-1 CL-7 CL-8 CL-9 CL-10
4.3	In section A.4.4 of the SSC-PDD, In case public funding from Parties included in Annex I to the Convention is involved, it shall be necessary to provide in Annex 2 information on sources of public funding for the project activity from Parties included in Annex I providing an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those Parties.	ditto	OK	
4.4	In section A.4.5 of the SSC-PDD, It shall be described on how to determine whether the proposed project activity is not a debundled component of a large scale project activity. Please refer to Appendix C to the simplified modalities and procedures for the small-scale CDM project activities for guidance.	ditto	OK	
4.5	The SSC-DOE shall determine whether a proposed small-scale CDM project activity meets the requirements of the simplified modalities and procedures for small-scale CDM project activities. (See decision 4/CMP.1, annex II.)	Para.135	OK	

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JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00

CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)

TABLE-1 REQUIREMENTS CHECKLIST (OK/No/NA/Tbv)

No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
4.6	During its validation of a small-scale project activity, the DOE shall confirm that: (a) The project activity qualifies within the thresholds of the three possible types of small-scale project activities. It may include more than one component; for example, a type III methane recovery component activity and a type I electricity component activity; (See CDM EB 28 report, paragraphs 56 and 57, currently located at <http://cdm.unfccc.int/EB/028/eb28rep.pdf> for guidance on size limits for the components.) (b) The project activity conforms to one of the approved small-scale categories and applies the relevant tool or methodology. The DOE shall confirm that the small-scale methodologies are applied in conjunction with the general guidelines to SSC CDM methodologies, which provides guidelines on equipment capacity, equipment performance/lifetime, baseline identification for type-II/III Greenfield project activities, sampling and other monitoring-related issues; (Small-scale project activities that follow the simplified modalities and procedures for small-scale CDM project activities may not apply a large-scale approved methodology. However, a project activity that is within the small scale project activity thresholds may apply a large-scale approved methodology if it follows the modalities and procedures for large-scale project activities defined in decision 4/CMP.1, annex II.) (See EB 54 report, paragraph 37, currently located at <https://cdm.unfccc.int/UserManagement/FileStorage/JFZ3XEVTQP4S2AH5OMD8RL19WBU60Y> and its annex 14 .General guidelines to SSC methodologies., currently located at http://cdm.unfccc.int/Reference/Guidclarif /ssc/methSSC_guid06.pdf> for further clarification.) (. In the EB 44 report, paragraph 49, currently located at <http://cdm.unfccc.int/EB/044/eb44rep.pdf>, Board clarified that the header of SSC methodologies stating .Project participants shall take into account the general guidance to the methodologies, information on additionality, abbreviations and general guidance on leakage provided at the same link mentioned above, which also implies attachment C of appendix B <http://cdm.unfccc.int/methodologies/SSCmethodologies/history/c_leak_biomass/guid_biomass_v03.pdf> is to be applied in conjunction with a SSC methodology *mutatis mutandis*.) (See EB 50 report, paragraph 51 and its annex 30, .General guidelines for sampling and surveys for smallscale CDM project activities., currently located at <http://cdm.unfccc.int/EB/050/eb50_repan30.pdf> for sampling guidance. In accordance with the CDM EB 44 report, paragraph 50, currently located at <http://cdm.unfccc.int/EB/044/eb44rep.pdf>, leakage from equipment transfer from within to outside the project boundary may be excluded from consideration in SSC methodologies.)	Para.136		CAR-2

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JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00

CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)

TABLE-1 REQUIREMENTS CHECKLIST (OK/No/NA/Tbv)

No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	(c) The project activity is not a debundled component of a large-scale project, in accordance with the rules defined in appendix C of the simplified modalities and procedures for small-scale CDM project activities; (See EB 36, annex 27. Compendium of guidance on the debundling for SSC project activities., currently located at <http://cdm.unfccc.int/EB/036/eb36_repan27.pdf>, and the EB 46 report, paragraph 60, currently located at <http://cdm.unfccc.int/EB/046/eb46rep.pdf> for further clarification on determining the occurrence of debundling do not require the consideration of the start date of the proposed CDM project.) (d) Whether an assessment of the environmental impacts of the proposed SSC-CDM project activity is required by the host Party.			
4.7	In assessing the additionality of small scale CDM project activities, the DOE shall refer to the specific requirements on demonstration of additionality for small scale project activities together with the guidance in chapter V, section E, subsection 6740 and the .Non-binding best practice examples to demonstrate additionality for SSC project activities. (See Attachment A to Appendix B of 4/CMP.1, annex II, currently located at <http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf >.) (For assessing additionality in the case of small scale renewable energy projects less than or equal to 5 MW and energy efficiency projects with energy saving less than or equal to 20 GWH per year, see EB 54 report, paragraph 38, currently located at <https://cdm.unfccc.int/UserManagement/FileStorage/JFZ3XEVTQP4S2AH5OMD8RL19WBU60Y> and its annex15. Guidelines for demonstrating additionality of renewable energy projects =< 5 MW and energy efficiency projects with energy savings <= 20 GWH per year., currently located at <https://cdm.unfccc.int/UserManagement/FileStorage/VK80BI3SAU4ROHX7MTN1LQ2DPJ5GZE> for further clarification.) (See EB35, annex 34, currently located at < http://cdm.unfccc.int/EB/035/eb35_repan34.pdf>.)	Para.137 VVM	OK	
4.8	If the DOE does not undertake a physical site inspection, it shall be appropriately justified.	Para.62 VVM	NA	
4.9	If the proposed SSC-CDM project activity involves the alteration of an existing installation or process, Does the project description clearly state the differences resulting from the project activity compared to the pre-project situation?	Para.63 VVM	NA	
5.	**Baseline and monitoring methodology**	Para.65-93 VVM	--	--
(a)	**General requirement**	Para.65-67 VVM	--	--
1.	The baseline and monitoring methodologies selected by the project participants shall comply with the methodologies previously approved by the CDM Executive Board.	Para.65 VVM	--	--

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JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

TABLE-1 REQUIREMENTS CHECKLIST			(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	To ensure that the project activity meets this general requirement, the followings shall be confirmed. (a) The selected methodology is applicable to the project activity; (b) The PP has correctly applied the selected methodology.	Para.66 VVM	--	--
	It shall also be ensured that the selected methodology is applicable to the project activity and has been correctly applied with respect to the followings: (a) Project boundary (b) Baseline identification (c) Algorithms and/or formulae used to determine emission reductions (d) Additionality (e) Monitoring methodology	Para.67 VVM	--	--
5.	**Baseline and monitoring methodology**	Para.65-93 VVM	--	--
(b)	**Applicability of the selected methodology to the project activity**	Para.68-77 VVM	--	--
	<Requirement to be validated> The selected baseline and monitoring methodology previously approved by the CDM Executive Board shall be validated to be applicable to the project activity, including that the used version is valid. Specific guidance provided by the CDM Executive Board in respect to any approved methodology shall be applied.	Para.68 VVM Para.69 VVM	--	--
5.1	In section B.1 of the SSC-PDD, please refer to the UNFCCC CDM web site for the most recent list of the small-scale CDM project activity categories contained in Appendix B. The number and the version of the approved methodology that is used (e.g. “Version 09 of AMS-I.D.”) shall be indicated. The methodology shall be ensured to be correctly quoted and applied by comparing it with the actual text of the applicable version of the methodology available on the UNFCCC CDM web site. Referring to the UNFCCC CDM web site for the title and reference list as well as the details of approved baseline methodologies, the following contents shall be indicated in section B.1 of the PDD. • the approved methodology • the version of the methodology that is used • any methodologies or tools which the approved methodology draws upon and their version	SSC-PDD Guidelines Para.70 VVM	OK	
5.2 1)	The choice of methodology shall be justified and the project participants shall show that the project activity meets each of the applicability conditions of the approved methodology or any tool or other methodology component referred to therein in section B.2 of the SSC-PDD.	Para.71 VVM	OK	
2)	The documentation referred to in the SSC-PDD and its content shall be correctly quoted and interpreted in the PDD.	ditto	OK	

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

TABLE-1 REQUIREMENTS CHECKLIST			(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
5.3	In section B.2 of SSC-PDD, the choice of project type and category (hereafter referred to as "project category") for the proposed project activity shall be justified. It shall be demonstrated that the project activity qualifies as a small-scale project activity and that it will remain under the limits of small-scale project activity types during every year of the crediting period: For Type I : Demonstrate that the capacity of the proposed project activity will not exceed 15 MW (or an appropriate equivalent), For Type II: Demonstrate that the annual energy savings on account of efficiency improvements will not exceed 60 GWh (or an appropriate equivalent) in any year of the crediting period, For Type III: Demonstrate that the estimated emission reductions of the project activity will not exceed 60 ktCO2e in any year of the crediting period.	SSC-PDD Guidelines		CL-11
5.	**Baseline and monitoring methodology**	Para.65-93 VVM	--	--
(c)	**Project boundary**	Para.78-80 VM	--	--
	<Requirement to be validated> The PDD shall correctly describe the project boundary, including the physical delineation of the proposed CDM project activity included within the project boundary for the purpose of calculating project and baseline emissions for the proposed CDM project activity.	Para.78 VVM	--	--
5.4 1)	In section B.3 of the SSC-PDD, the project boundary of the project activity based on the guidance of the applicable project category shall be defined. The delineation in the SSC-PDD of the project boundary shall be correct and meet the requirements of the selected baseline methodology, which shall also be demonstrated by documented evidence and corroborated by a site visit.	SSC-PDD Guidelines Para.79 VVM		CL-12 CL-13
2)	All emission sources and GHGs required by the methodology shall be included within the project boundary for the purpose of calculating project emissions and baseline emissions.	Para.79 VVM		CAR-4 CL-12 CL-13
3)	If the methodology allows project participants to choose whether a source or gas is to be included within the project boundary, the project participants shall justify the choice by supporting documented evidences.	ditto		CL-12 CL-13
5.	**Baseline and monitoring methodology**	Para.65-93 VVM	--	--
(d)	**Baseline identification**	Para.81-88 VVM	--	--
	<Requirement to be validated> The PDD shall identify the baseline for the proposed CDM project activity, defined as the scenario that reasonably represents the anthropogenic emissions by sources of GHGs that would occur in the absence of the proposed CDM project activity.	Para.81 VVM	--	--
2.	Any procedure contained in the methodology to identify the most reasonable baseline scenario, shall be correctly applied. If the selected methodology requires use of tools (such as the "Tool for the demonstration and assessment of additionality" and the "Combined tool to identify the baseline scenario and demonstrate additionality") to establish the baseline scenario, the methodology on	Para.82 VVM	--	--

	TABLE-1 REQUIREMENTS CHECKLIST		(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	the application of these tools shall be confirmed. In such cases, the guidance in the methodology shall supersede the tool. The each step in the procedure described in the PDD against the requirements of the methodology shall be checked.			
5.5	In section B.4 of the SSC-PDD, The baseline for the proposed project activity with reference to the chosen project category shall be specified. The key assumptions and rationale shall be explained and justified. It shall be required to illustrate in a transparent manner all data used to determine the baseline emissions (variables, parameters, data sources etc.) preferably in a tabular form	SSC-PDD Guidelines	OK	
5.6	If the methodology requires several alternative scenarios to be considered in the identification of the most reasonable baseline scenario, it shall be determined whether all scenarios that are considered by the project participants and are supplementary to those required by the methodology, are reasonable in the context of the proposed CDM project activity and that no reasonable alternative scenario has been excluded.	Para.83 VVM	OK	
5.7	It shall be determined whether the baseline scenario identified is reasonable by validating the assumptions, calculations and rationales used, as described in the PDD.	Para.84 VVM	OK	
	The documents and sources referred to in the PDD shall be correctly quoted and interpreted. All data used to determine the baseline scenario shall be illustrated in a transparent manner, preferably in a tabular form.	ditto	OK	
5.8	All applicable CDM requirements shall be taken into account in the identification of the baseline scenario for the proposed CDM project activity, including "relevant national and/or sectoral policies and circumstances." (See decision 3/CMP.1, annex, paragraph 45, currently located at <htto://cdmunfccc.int/Reference/COPMOP/08a01.pdf#page=6>, and EB22, annex 3, "Clarificationson the consideration of national and/or sectoral policies and circumstances in baseline scenarios", currently located at <htto://cdm.unfccc.int/EB/022/eb22_repan3.pdf>.)	Para.85 VVM Para.45 CDM/M&P Annex 3 EB22	OK	
5.9	The SSC-PDD shall provide a verifiable description of the identified baseline scenario, including a description of the technology that would be employed and/or the activities that would take place in the absence of the proposed CDM project activity.	Para.86 VVM	OK	
5.	**Baseline and monitoring methodology**	Para.65-93 VVM	--	--
(e)	**Algorithms and/or formulae used to determine emission reductions**	Para.89-93 VVM	--	--
	<Requirement to be validated> The steps taken and equations applied to calculate project emissions, baseline emissions, leakage and emission reductions shall comply with the requirements of the selected baseline and monitoring methodology.	Para.89 VVM	--	--
5.10	The equations and parameters in the SSC-PDD shall be correctly applied by comparing them to those in the selected approved methodology.	Para.90 VVM	OK	

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

TABLE-1 REQUIREMENTS CHECKLIST

No.	Requirement	Refer. Para. VVM	Check Comment (OK/No/NA/Tbv)	ID. No.
	If the methodology provides for selection between different options for equations or parameters, adequate justification shall be provided (based on the choice of the baseline scenario, context of the project activity and other evidence) and the correct equations and parameters shall be used, in accordance with the methodology selected.	ditto	OK	
5.11	The justification shall be given in the PDD for the choice of data and parameters used in the equations.	Para.91 VVM	OK	
	If data and parameters will not be monitored throughout the crediting period of the proposed CDM project activity but have already been determined and will remain fixed throughout the crediting period, it shall be demonstrated that all data sources and assumptions are appropriate and calculations are correct, applicable to the proposed CDM project activity and will result in a conservative estimate of the emission reductions.	ditto	NA	
	If data and parameters will be monitored on implementation and hence become available only after validation of the project activity, it shall be demonstrated that the estimates provided in the PDD for these data and parameters are reasonable.	ditto	OK	
5.12	In section B.6.1 of the SSC-PDD, Explain how the procedures, in the approved project category to calculate project emissions, baseline emissions, leakage emissions and emission reductions are applied to the proposed project activity. Clearly state which equations will be used in calculating emission reductions. Explain and justify all relevant methodological choices, including: • where the category provides different options to choose from (e.g. "combined margin" under AMS I.D); • where the category provides for different default values (e.g. values for MCF under AMS III.E)	SSC-PDD Guidelines	OK	
5.13	In section B.6.2 of the SSC-PDD, This section shall include a compilation of the data and parameters not monitored but determined upfront so as to be available for validation. Data from monitoring (e.g. measurements after the implementation of the project activity) should not be included here but in the table in section B.7.1. This may includes data that is measured, if relevant with sample thereof, and data that is collected from sources such as official statistics, expert judgment, proprietary data, IPCC, commercial and scientific literature. Data that is calculated with equations provided in the approved category or default values specified in the category should not be included in the compilation. Provide for each parameter the chosen value or, where relevant, the qualitative information, using the table provided below. Particularly: -Provide the actual value applied. Where time series of data is used, where several measurements are undertaken or where surveys have been conducted, provide detailed information in Annex 3. -Explain and justify the choice for the source of data. Provide clear and transparent references or additional documentation in Annex 3. -Where values have been measured, include a description of the measurement methods and procedures that comply with the guidance provided under general guidance to indicative small scale methodologies found on the UNFCCC CDM website (e.g. which standards have been used), indicate the responsible person / entity	ditto	OK	

	TABLE-1 REQUIREMENTS CHECKLIST		(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	having undertaken the measurement, the date of measurement(s) and the measurement results. More detailed information can be provided in **Annex 3**.			
5.14	In section B.6.3 of the SSC-PDD, Provide a transparent ex-ante calculation of project emissions, baseline emissions (or, where applicable, direct calculation of emission reductions) and leakage emissions expected during the crediting period, applying all relevant equations. Document how each equation is applied, in a manner that enables the reader to reproduce the calculation. Where relevant, provide additional background information and or data in **Annex 3**, including relevant electronic files (i.e. spreadsheets). If the project activity involves more than one component activity (e.g. one component activity for methane capture applying AMS III.D together with another component for grid connected electricity generation applying AMS I.D) emission reduction calculations for each of the component shall be provided separately in a transparent manner.	ditto		CL-14 CL-15 CL-16
5.15	In section B.6.4 of the SSC-PDD, Summarize the results of the ex-ante estimation of emission reductions for all years of the crediting period, using the table shown in the SSC-PDD Guidelines. If the project activity involves more than one component, a separate table shall be included for each of the component or each of the approved project category that is applied. A table showing the aggregate emission reductions of the project activity shall also be included.	ditto		CL-14 CL-15
6.	**Additionality of a project activity**	Para.94-121 VVM	--	--
	<Requirement to be validated> The PDD shall describe how a proposed CDM project activity is additional. In accordance with decision 3/CMP.1,annex, paragraph 43 "A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity" (see decision 5/CMP.1, annex paragraph 18). While specific elements of the assessment of additionality are discussed in further detail in paragraphs 98-121 in VVM, not all elements discussed below will be applicable to all proposed CDM project activities.	Para.94 VVM Para.43 CDM/M&P	--	--
6.	**Additionality of a project activity**	Para.94-121VVM	--	--
(a)	**Prior consideration of the clean development mechanism** While specific elements of the assessment of additionality are discussed in further detail in Section 6.3 –6.15 below, not all elements	Para.98-104 VVM	--	--
	discussed below will be applicable to all proposed CDM project activities.			
	<Requirement to be validated> If the project activity start date is prior to the date of publication of the PDD for stakeholder comments it shall be demonstrated that the CDM benefits were considered necessary in the decision to undertake the project as a proposed CDM project activity.	Para.98 VVM	--	--

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00

CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)

TABLE-1 REQUIREMENTS CHECKLIST			(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
6.1	The start date of the project activity, reported in the PDD, shall be in accordance with the "Glossary of CDM terms". http://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf Glossary of CDM terms Version 05	Para.99 VVM	OK	
	The starting date of a CDM project activity is the date on which the implementation or construction or real action of a project activity begins. In section C.1 of the PDD, the description should contain not only the date, but also a description of how this start date has been determined, and a description of the evidence available to support this start date.	ditto	OK	
	In particular, for project activities that require construction, retrofit or other modifications, the date of commissioning cannot be considered the project activity start date.	ditto	OK	
6.2	It shall be identified whether it is a new project activity (a project activity with a start date on or after 02 August 2008) in accordance with the guidance from the CDM Executive Board, or an existing project activity (a project activity with a start date before 02 August 2008) (See Annex 22 of EB 49 report : Guidelines on the Demonstration and Assessment of Prior Consideration of the CDM)	Para.100 VVM Annex 22 EB49	OK	
6.3	For a new project activity, for which PDD has not been published for global stakeholder consultation or a new methodology proposed to the CDM Executive Board before the project activity start date, the DOE shall ensure by means of confirmation from the UNFCCC secretariat that PPs had informed the host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. If such a notification has not been provided by the project participants within six months of the project activity start date, the DOE shall determine that the CDM was not seriously considered in the decision to implement the project activity. (See EB 48, annex 62, .Prior consideration of the CDM form, currently located at <https://cdm.unfccc.int/EB/048/eb48_repan62.pdf>, for the standardized form.	Para.101 VVM	OK	
6.4	For an existing project activity, for which the start date is prior to the date of publication of the PDD for global stakeholder consultation, the project participant's prior consideration of the CDM shall be demonstrated by providing the following evidence (preferably official, legal and/or other corporate). In such cases the PP shall provide an implementation timeline of the project in section B.5 of the PDD.	Para.102 VVM	NA	
(a)	Evidence to indicate awareness of the CDM prior to the project activity start date, and evidence to indicate that the benefits of the CDM were a decisive factor in the decision to proceed with the project shall be provided.	ditto	NA	
	Evidence to support this would include, inter alia, minutes and/or notes related to the consideration of the decision by the Board of Directors, or equivalent, of the project participant, to undertake the project as a proposed CDM project activity.	ditto	NA	
(b)	Reliable evidence that must indicate that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.	ditto	NA	

	TABLE-1 REQUIREMENTS CHECKLIST		(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	Evidence to support this should include, inter alia, • contracts with consultants for CDM/PDD/methodology services, • Emission Reduction Purchase Agreements or other documentation related to the sale of the potential CERs (including correspondence with multilateral financial institutions or carbon funds), • Evidence of agreements or negotiations with a DOE for validation services, • Submission of a new methodology to the CDM Executive Board, • Publication in newspaper, • Interviews with DNA, • Earlier correspondence on the project with the DNA or the UNFCCC secretariat.	ditto	NA	
6.	**Additionality of a project activity**	Para.94-121 VVM	--	--
(b)	**Identification of alternatives**	Para.105-107 VVM	--	--
	<Requirement to be validated> The PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required.	Para.105 VVM	--	--
6.5 (a)	The list of alternatives shall includes as one of the options that the project activity is undertaken without being registered as a proposed CDM project activity;	Para.106 VVM	NA	
(b)	The list shall contains all plausible alternatives that are considered, on the basis of local and sectoral knowledge, to be viable means of supplying the outputs or services that are to be supplied by the proposed CDM project activity.	ditto	NA	
(c)	The alternatives shall comply with all applicable and enforced legislation.	ditto	NA	
6.6	In section B.5 of the SSC-PDD, Demonstrate that the proposed project activity is additional as per options provided under attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities. National policies and circumstances relevant to the baseline of the proposed project activity shall be summarized here. **Attachment A to Appendix B** Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers: (a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions; (b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions; (c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions; (d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational	SSC-PDD Guidelines	NA	

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

	TABLE-1 REQUIREMENTS CHECKLIST		(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.			
6.	**Additionality of a project activity**	Para.94-121 VVM	--	--
(c)	**Investment analysis**	Para.108-114 VVM	--	--
	<Requirement to be validated> If investment analysis has been used to demonstrate the additionality of the proposed CDM project activity, the PDD shall provide evidence that the proposed CDM project activity would not be: The most economically or financially attractive alternative; or Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).	Para.108 VVM	--	--
6.7	Project participants can show this through one of the following approaches, by demonstrating that: It should be noted that the EB 51, annex58 paragraph 14 "Guidelines on the assessment of investment analysis", currently located at <http://cdm.unfccc.int/Reference/Guidclarif/reg/reg-guid03.pdf and the requirements of specific methodologies may preclude the use of one of these options in certain scenarios.	Para.109 VVM Annex58 EB51	--	--
(a)	Demonstrate that the proposed CDM project activity would produce no financial or economic benefits other than CDM-related income. Document the costs associated with the proposed CDM project activity and the alternatives identified and demonstrate that there is at least one alternative which is less costly than the proposed CDM project activity;	ditto	NA	
(b)	The proposed CDM project activity is less economically or financially attractive than at least one other credible and realistic alternative;	ditto	NA	
(c)	Financial returns of the proposed CDM project activity would be insufficient to justify the required investment.	ditto	NA	
6.8	The DOE shall comply with the latest version of the "Guidelines on the Assessment of Investment Analysis" as provided by the CDM Executive Board and with other relevant guidance including the latest guidelines on plant load factors "guidelines for the reporting and validation of plant load factors" (See EB 48 report, annex 11 currently located at <http://cdm.unfccc.int/EB/048/eb48_repan11.pdf >.)	Para.110 VVM Annex 58 EB51	--	--
6.9 1)	Project participants should provide spreadsheet versions of all investment analysis. All formulas used in this analysis be readable and all relevant cells be viewable and unprotected.	Annex 58 EB51	NA	
2)	The evidences on which input values in the investment analysis are based shall be provided.	ditto	NA	
6.10 1)	All parameters and assumptions used in calculating the relevant financial indicator shall be validated thoroughly, and the accuracy and suitability of these parameters shall be verified using the available evidence and expertise in relevant accounting practices.	Para.111 VVM	NA	
2)	Input values used in all investment analysis should be valid and applicable at the time of the investment decision taken by the project participant.	Annex 58 EB51	NA	
3)	The cost of financing expenditures (i.e. loan repayments and interest) should not be included in the calculation of project IRR.	ditto	NA	
4)	In the case of project activities for which implementation ceases after the commencement and where implementation is recommenced due to	ditto	NA	

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TABLE-1 REQUIREMENTS CHECKLIST			(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
	consideration of the CDM the investment analysis should reflect the			
3.	economic decision making context at point of the decision to recommence the project. Therefore capital costs incurred prior to the revised project activity start date can be reflected as the recoverable value of the assets, which are limited to the potential reuse/resale of tangible assets.			
5)	Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude), and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets.. Where a variable which constitute less than 20% has a material impact on the analysis, this variable shall be included in the sensitivity analysis. As a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and –10%, unless this is not deemed appropriate in the context of the specific project circumstances.	ditto	NA	
6)	Such evidence for the evaluation of investment analysis as invoices, receipts, price indices, feasibility reports, public announcements, audited actual project cost and annual financial reports shall be provided upon request of the DOE.	ditto	NA	
6.11	The suitability of any benchmark applied in the investment analysis:	Para.112 VVM	--	
1)	In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented.	Annex 58 EB51	NA	
2)	If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used. If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.	ditto	NA	
3)	The effectiveness of the applied benchmark shall be demonstrated with appropriate evidence.	ditto	NA	
4)	The PPs shall demonstrate that it is reasonable to assume that no investment would be made at a rate of return lower than the benchmark by, for example, showing previous investment decisions by themslves involved and demonstrating that the same benchmark has been applied, or if there are verifiable circumstances that have led to a change in the benchmark.	Para.112 VVM	NA	

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00

CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)

	TABLE-1 REQUIREMENTS CHECKLIST		(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
6.12	The CDM Executive Board clarified that in cases where project participants rely on values from Feasibility Study Reports (FSR) that are approved by national authorities for proposed CDM project activities, it is required to ensure that: **(See** the EB 38 report, paragraph 54, currently located at <http://cdm.unfccc.int/EB/038/eb38rep.pdf>.	Para.113 VVM Para.54 EB38	--	--
(a)	The period of time between the finalization of the FSR and the investment decision shall be sufficiently short for the DOE to confirm that it is unlikely in the context of the underlying project activity that the input values would have materially changed;	ditto	NA	
(b)	The values used in the PDD and associated annexes shall be fully consistent with the FSR, and where inconsistencies occur the appropriateness of the values shall be explained.	ditto	NA	
(c)	It shall be confirmed that the input values from the FSR are valid and applicable at the time of the investment decision.	ditto	NA	
6.	**Additionality of a project activity**	Para.94-121 VVM	--	--
(d)	**Barrier analysis (In case applied for Technological barrier, Barrier due to prevailing practice and Other barriers)** Barriers are issues in project implementation that could prevent a potential investor from pursuing the implementation of the proposed project activity. The identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed project activity undertaken without being registered as a CDM project activity.	Para.115-118 VVM	--	--
6.13	**<Requirement to be validated>** If barrier analysis has been used to demonstrate the additionality of the proposed CDM project activity, the PDD shall demonstrate that the proposed CDM project activity faces barriers as below**.**	Para.115 VVM	--	--
	(a) Prevent the implementation of this type of proposed CDM project activity; (See EB 50, annex 13 .guidelines for objective demonstration and assessment of barriers., currently located at <http://cdm.unfccc.int/EB/050/eb50_repan13.pdf>. (b) Do not prevent the implementation of at least one of the alternatives.	Para.115 VVM	NA	
6.14	Issues that have a clear direct impact on the financial returns of the project activity cannot be considered barriers and shall be assessed by investment analysis. This does not refer to either (a) Risk related barriers, for example risk of technical failure, that could have negative effects on financial performance, or (b) Barriers related to the unavailability of sources of finance for the project activity.	Para.116 VVM	NA	
6.15 (a)	The available evidence shall be provided and/or interviews with relevant individuals (including members of industry associations, government officials or local experts if necessary) shall be arranged to demonstrate that the barriers listed in the PDD exist.	Para.117 VVM	NA	
(b)	The existence of barriers shall be substantiated by independent sources of data such as relevant national legislation, surveys of local conditions and national or international statistics.	ditto	NA	

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JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

TABLE-1 REQUIREMENTS CHECKLIST			(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
7.	**Monitoring plan**	Para.122-124 VVM	--	--
	<Requirement to be validated> The PDD shall include a monitoring plan. This monitoring plan shall be based on the approved monitoring methodology applied to the proposed CDM project activity.	Para.122 VVM	--	--
7.1 1)	***Compliance of the monitoring plan with the approved methodology*** (i) The list of parameters required by the selected approved methodology shall be identified.	Para.123 VVM		CL-17 CL-18
	(ii) The monitoring plan shall contain all necessary parameters, and the means of monitoring described in the plan shall complie with the requirements of the methodology;	ditto		CL-17 CL-18
2)	In the section B.7 of the SSC-PDD, The following two sections (B.7.1 and B.7.2) shall provide a detailed description of the monitoring plan, including an identification of the data to be monitored and the procedures that will be applied during monitoring. Please note that data monitored and required for verification and issuance are to be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.	SSC-PDD Guidelines		CL-17 CL-18
3)	In section B.7.1 of the SSC-PDD, Data that becomes available only after validation of the project activity (e.g. measurements after the implementation of the project activity) should be included here. Provide for each parameter the following information, using the table shown in the SSC-CDM Guidelines: • The source(s) of data that will be actually used for the proposed project activity (e.g. which exact national statistics, actual measurement etc.). • Where the parameters are to be measured in accordance with the guidance of the approved project category or the general guidance to the indicative methodologies, specify the measurement methods and procedures including accepted industry standards or national or international standards which will be applied, which measurement equipment is used, how the measurement is undertaken, which calibration procedures are applied, what is the accuracy of the measurement method, who is the responsible person / entity that should undertake the measurements and what is the measurement interval. • A description of the QA/QC procedures (if any) that should be applied. • Where relevant: any further comment. Provide any relevant further background documentation in **Annex 4**.	ditto	OK	
4)	In section B.7.2 of the SSC-PDD, Please provide a detailed description of the monitoring plan. Describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects generated by the project activity. Clearly indicate the responsibilities for and institutional arrangements for data collection and archiving. The monitoring plan should reflect good monitoring practice appropriate to the type of project activity. Provide any relevant further background information in **Annex 4**.	ditto		CL-17 CL-18

JCI CDM Center	APPENDIX A	No : JCI-CDM-VAL-10-061	Rev.No 00
CDM Validation Protocol on (Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station)			

	TABLE-1 REQUIREMENTS CHECKLIST		(OK/No/NA/Tbv)	
No.	Requirement	Refer. Para. VVM	Check Comment	ID. No.
5)	In section B.8 of the SSC-PDD, Please provide date of completion of the application of the methodology to the project activity in *DD/MM/YYYY* Please provide contact information of the persons(s)/entity(ies) responsible for the application of the baseline and monitoring methodology to the project activity and indicate if the person/entity is also a project participant listed in **Annex 1**.	ditto	OK	
6)	***Implementation of the plan*** (i) The monitoring arrangements described in the monitoring plan shall be feasible within the project design;	Para.123 VVM		FAR-1 FAR-2 FAR-3
	(ii) The means of implementation of the monitoring plan, including the data management and quality assurance and quality control procedures, shall be sufficient to ensure that the emission reductions achieved by/resulting from the proposed CDM project activity can be reported ex post and verified.	ditto		FAR-1 FAR-2 FAR-3
8.	**Sustainable development**	Para.125-127 VVM	--	--
	<Requirement to be validated> CDM project activities shall assist Parties not included in Annex I to the Convention in achieving sustainable development.	Para.125 VVM	--	--
8.1	The letter of approval by the DNA of the host Party shall confirm the contribution of the proposed CDM project activity to the sustainable development of the host Party.	Para.126 VVM		CAR-1 CAR-3
9.	**Local stakeholder consultation**	Para.128-130 VVM	--	--
	<Requirement to be validated> Local stakeholders shall be invited by the PPs to comment on the proposed CDM project activity prior to the publication of the PDD on the UNFCCC website. See glossary of CDM terms, currently located at <http://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf>, for definition of stakeholders.	Para.128 VVM Glossary of CDM terms	--	--
9.1 (a)	Comments by local stakeholders that can reasonably be considered relevant for the proposed CDM project activity shall be invited in an open and transparent manner.	Para.129 VVM		CL-19
(b)	The summary of the comments received as provided in the PDD shall be complete.	ditto	OK	
(c)	The project participants shall demonstrate that they have taken due account of any comments received and shall describe/explain this process in the PDD.	ditto	OK	
10.	**Environmental impacts**	Para.131-133 VVM	--	--
	<Requirement to be validated> Project participants shall submit documentation to the DOE on the analysis of the environmental impacts of the project activity in accordance with paragraph 37(c) of the CDM modalities and procedures.	Para.131 VVM Para.37(c) CDM/M&P	--	--
10.1	Project participants shall submit documentation to the DOE on the analysis of the environmental impacts of the project activity	Para.131 VVM		CL-20
10.2	Project participants shall also provide all references to support documentation of a EIA if required by the host Party	Para.132 VVM	OK	

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TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
CAR	**Corrective Action Requests**			
CAR-1	LoA from Host country has not been submitted	1.1 2.1 2.2 8.1	Zambian DNA has approved the project activity and has issued LoA as of 18th June 2012. Copy of LoA is submitted to the DOE for their review.	JCI confirmed the submission of LoA of Zambia. CAR-1 is closed.
CAR-2	The version number of methodology (AMS-I.A) is not appropriate.	4.6	The PDD has been revised to reflect the methodology revision. The latest available version of AMS-I.A. ver16 has been applied.	JCI confirmed the PDD is correctly revised. Therefore CAR-2 is closed.
CAR-3	The title of the project is not consistent between LoA and PDD.	1.1 2.1 2.2 8.1	LoA has been re-issued with the rectified project name to match with the project title in the PDD.	JCI confirmed re-submitted LoA appropriate. CAR-3 is closed.
CAR-4	It is needed to take diesel fuel consumption into consideration of estimation of ex ante project emission and monitoring item.	5.4 2)	Although it is very unlikely to happen, possible diesel fuel consumption in case of emergency ($FC_{diesel,emergency,y}$) is added as part of project emissions for estimation of ex ante project emissions. In addition, it is added to the parameter list for monitoring. PDD is also revised to reflect above addition.	JCI confirmed revision of the PDD with regard to the addition of diesel fuel consumption to the project emission calculation including other relevant part of the PDD. CAR-4 is closed
CL	**Clarification Requests**			

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
CL-1	It is requested to clarify that the backgrounds of this project are described in a Master Plan, in substitution for FSR ? • Location requirement • Statistical flow quantity, rainfall and temperature in the year. • Geological feature • The decision grounds of the electricity generating system, and the • specifications of the equipments • Financial evaluation • Safety of the transmission line • etc.	4.1 4.2	It is to clarify that relevant project background information are presented in Chapter 8 and Chapter 12 of the Study for Development of the Rural Electrification Master Plan in Zambia Final Report (hereafter,"the Master Plan"). Please refer to the following sections in the Master Plan: 8.4.2 Results of Hydropower Potential Survey (1) North-western Province, (b) Mujila Falls Lower provides project summary of Mujila falls 12.2.3. Result of Case Study 1: Mujila Falls Lower Site	Confirmation was made that PP's clarification here with reference to the chapters of the master plan is as sure by JCI. Therefore CL-1 is closed.
CL-2	As for Project Participants, it is required to clarify the entity of ANNEX I country included.	2.1 2.2	No participants from Annex I country. Please note that the project plan to be registered as unilateral CDM project activity.	It is confirmed that the proposed project is unilateral lCDM project activity. CL-2 is closed.
CL-3	Please show the evidence of the current lighting electrification rate. North Western Province:11.1% Zambia:20.3%	4.1	Chapter 4 of the Master Plan is designated to discuss current situation of rural society in Zambia. In the section 4.3. Rural Electrification and Energy Consumption indicates, Table 4-1 summarizes percentage distribution of households by main sources of energy for lighting. (Source of information: Living conditions monitoring survey report 2004, Central Statistical Office, December 2006). As of 2004, the lighting electrification rate in Zambia is 20.3%, the same is 11.1% for North Western	PP's clarification was confirmed referring to the identified table of the master plan. Therefore CL-3 is closed.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
			Province.	
CL-4	It is requested to clarify the energy baseline. Is only cooking and lighting energy assumed as the baseline energy with regard to the use of fossil fuels? How do you judge 11GWh as annual energy baseline?	4.1	The energy baseline in the PDD was assumed based on the project's available annual power generation capacity (1.4MW x 0.9) and the co-efficient (0.9) anticipated during the project lifetime. It is emphasized that 11GWh is an ex-ante assumption of the maximum annual energy baseline possible for the project activity. The actual energy baseline will be determined based on the actual electricity generated and distributed among the four rural communities within the project boundary, which will be monitored and reported at the time of verification. Refer to CL-14	JCI recognized the line of thought of PP regarding the baseline energy with reference to PP's response to CL-14 as well. CL-4 is closed.
CL-5	It is requested to provide the assumed data of the electric consumption in four communities in future.	4.1	Electricity demand forecast of the area where project distributes electricity, i.e. Kanyama, Kakoma, Mujila village, and Kapundu Village, was studied in the Master Plan, and the result is provided in Chapter 12 of the Master Plan. It is anticipated that by year 2030, there will be total of 1416kW electricity demand in the four rural communities where project will supply its generated electricity.	PP is requested to clarify the forecast of electricity consumption (kWh), not capacity (kW). It is required to clarify the anticipated consumption of electricity for the capacity of power generation as of 2030 as shown in the table 12-3 of the master plan. JCI can accept PP's clarification.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
				CL-5 is closed.
CL-6	It is requested to clarify how control the power generation, when a consumption is less than quantity of generation.	4.1	While peak demand is 1400kW, demand of off-peak time zones is about 400 kW. By installing two 700-kW turbines to meet 1400 kW of peak demand, extreme low load operation can be avoided. More specifically, controlling of power generation is possible by changing number of operating units between 1 and 2. Each unit can be operated at 60 to 100% generating capacity, which allows matching with variation in electricity demand. With this configuration, complete blackout during system maintenance or during turbine malfunctioning can also be effectively avoided.	JCI confirmed PP's clarification as appropriate. Therefore CL-6 is closed.
CL-7	Table 1:Plant Information It is requested to clarify the meaning of "Catchment Area", "Discharge 80% of time".	4.2	Catchment area is a hydrological terminology used to describe an extent of land where water from precipitation drains into a body of water. Discharge 80% of time: 80% available discharge Table 1 will be revised to remove some of the non-relevant terms. Both Catchment area and Discharge 80% of time will be removed. Effective Head of 18m in the PDD was wrongly referred from the Master Plan. The correct effective head is 17.1m and the PDD was revised accordingly.	PP's clarification is acceptable and CL-7is closed.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
CL-8	Table 1:Plant Information Please add a column of「Information Source」to Table 1.	4.2	Table 1 in the PDD was revised and a new column of “Information Source” was included and "The Study for Development of the Rural Electrification Master Plan in Zambia final Report" was indicated as the information source. Page numbers of the source are included in the revised PDD.	It is required to give page No of the source so as to easily find for reader in the source. JCI confirmed revised PDD and it can be accepted. CL-8 is closed.
CL-9	Table 1:Plant Information Please add the following items; • Total static investment • Annual operation cost and maintenance cost • Tariff • VAT(value-added tax) • Life time • The number and the model of the turbine • The number and the model of the generator • The generation output voltage	4.2	All information available in the Master Plan are now included in the Table 1. The project does not require conducting investment analysis to prove additionality, therefore financial information is not provided in the PDD. Life time: 40 years (Master Plan, Table 14-1) The number of the turbine: 2 The number of the generator: 2 Model of equipment is not yet decided. Information will be available once the tendering process for the project is concluded.	JCI confirmed all information required is available in the master plan. PP’s response is appropriate, therefore CL-9 is closed.
CL-10	It is requested to clarify the definition of the power capacity (1.4MW). (Just show the calculating formula)	4.2	Chapter 8 of the Master Plan, 8.4.1 Method of Hydropower Potential Estimation provides the general equation used to estimate hydropower potential in relation to the water head, water discharge rate, and the efficiency of turbines and generators. Power capacity (1.4MW) of the project activity was	Justification of the decision of the size of capacity is requested. JCI needs convincing references about this matter. PP’s response is revised and JCI accept it. CL-10 is closed.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
			derived from the hydropower potential calculated based on the expected water discharge, effective head, and efficiency of turbine and generator as follows: P=9.8*Q*H*ηT*ηG Where P: Generating Power (kW) Q: Water Discharge (m3/s), H: Effective Head (m) ηT: Turbine Efficiency (fraction), 0.85 is adopted in the Master Plan ηG: Generator Efficiency (fraction), 0.95 is adopted in the Master Plan 1.4 MW is determined both from maximum demands in 2030 as well as the available flow of water source, detailed in the Master Plan Chapter 12.	
CL-11	It is requested to clarify the rationale of run of river system without a reservoir, though there is a 5 meter weir.	5.3	As documented in the Environmental Project Brief, with the 5 meters weir to be constructed across the river channel, it is expected that depth of the river channel will increases within the immediate natural flooding zone. It is noted that, even before the project implementation, natural flooding zone is inundated during wet season. As such, the project does not result in a new reservoir.	JCI accepted PP's clarification as it is understandable. CL-11 is closed.
CL-12	It is requested to show the electrical single line diagram of the hydro power generation plant.	5.4	Electrical single line diagram of the hydro power generation plant has been submitted to the DOE for their review.	If not available, PP is alternatively requested to detail of electricity meter installation plan (how many, location, etc) with credible evidence.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
				JCI confirmed PP's provision of single line diagram showing necessary information on it. CL-12 is closed.
CL-13	It is requested to show the block or schematic flow diagram showing the components of the proposed plant.	5.4	A figure was added in Section B.7.2 of the PDD showing components of the proposed plant.	JCI considers PP's clarification is acceptable. CL-13 is closed.
CL-14	In the calculation of annual output ($EG_{i,y}$), please clarify the default value of 0.9 on page 13.	5.14 5.15	In the section B.7.1 Ex-ante estimation of annual net electricity generated during the year y was based on the installed capacity and the maximum operation hour per year. A default factor 0.9 was adopted to conservatively adjust the ex-ante value of data for EGi,y, or annual net electricity generated during the year,y. This value is based on the historical river flow data for ten years presented in the Master Plan. Technical validity of the value used for ex-ante calculation has been endorsed by a third party expert, and the document has been submitted to the DOE for its review. Once the project is in operation, annual net electricity generated during the year y will be measured continuously by electricity meter and will be recorded once per month, as stipulated in the PDD, Section B.7.1. Factor of 0.9 used for ex-ante calculation will not be used to quantify annual net electricity generated.	PP is requested to clarify the account of justification of the default value of 0.9. What PO is requested is to provide objective source of the default value (= 0.9) determined by expert or specialist in this technical matter, not a general scheme of ex ante calculation. JCI confirmed the default value can be justified with reviewing relevant part of the Master Plan and the submitted endorsement by the third party. Therefore CL-14 is closed.
CL-15	It is requested to clarify the operational hours, assumed in a year.	5.14 5.15	The assumed operational hours in a year are 8760hrs. This is the maximum operational hours possible in a year. There is sufficient river flow to operate the power	It is requested to clarify the maintenance plan of the plant and other relevant equipment which may

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
			plant continuously throughout a year. For the first 3 years after starting operation, 3 days per 1 year complete shut-down is necessary to check the leakage from steel penstock. Once per 8 years, re-painting of gates and steel penstock is recommended. Other maintenance will be planed during low demand period (when the demand is less than 700kW) with one unit is in operation. Project participant is currently preparing the plant's maintenance procedures. The Power plant maintenance plan will be documented and become available before commissioning of the hydropower plant.	affect the continuation of the plant operation. It is required to clarify or submit the document in which such maintenance plan stated in the left column as PO's response. JCI accept current effort by PO and will leave this comment as one of FARs (FAR-1). Accordingly CL-15 is closed.
CL-16	It is requested to clarify the function of the diesel powered mini-grid.	5.14	Diesel powered mini-grid was mentioned as an excerpt of the approved small scale CDM methodology AMS-I.A. This is not relevant to the project activity.	PP's clarification is confirmed and CL-16 is closed.
CL-17	It is requested to clarify the detailed location of monitoring meter installed in the power plant. Please write it in figure.	7.1	A figure was added in Section B.7.2 of the PDD and location of electricity meter is now included in the figure. Electrical single line diagram of the hydro power generation plant has been submitted to the DOE for their review.	Same comment as CL-12 JCI confirmed submission of requested drawing. CL-17 is closed.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
CL-18	Please show the organizing structure of the CDM team for the monitoring plan implementation in figure.	7.1	Monitoring organization chart for the project activity was included in Section B.7.2 of the PDD. In addition, procedure of how to deal with in the case of meter failure is included in Section B.7.2 of the PDD.At the time of electricity meter failure, data log accumulated in the computer in Mujila Power Station building will be used as the backup. During normal operation, signals of CT (Current Transformer) and VT (Voltage Transformer) will be sent to both electricity meter and to the computer in Mujila Power Station building. Signals sent to the computer are kept as the data log. This data log is the duplicate of the electricity meter readings and can be used to calculate distributed electricity during the event of MWh meter failure. Since CT and VT are not electronic equipment, failure of CT and VT are rarely anticipated.	It is requested to describe about the procedure of how to deal with in the case of failure of a meter in the PDD. PP's clarification explained the procedure of data handling in the case of data failure to satisfactory degree and it can be accepted. CL-18 is closed.
CL-19	How invite the local residents to the public consulting meeting? Please show the letter which was distributed to the local residents.	9.1	Local community leaders were first notified and were invited to attend the local stakeholders' meeting. Local community leaders then invited local residents to attend the meeting. A letter from local community chief was submitted to the DOE for their review, in which the steps taken for holding the local stakeholders meeting is indicated. Following the local custom, local stakeholders in the community were informed about the public meeting through verbal communication. In the attached letter, the community chief indicated that he was invited to the	Relevant documents are to be submitted. JCI confirmed relevant documents submitted and took it as appropriate. CL-19 is closed.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
			meeting by ZESCO verbally. The community chief, then, informed and invited local residents to attend the event.	
CL-20	It is requested to clarify the environmental impacts not be significant.	10.1	Environmental impact assessment of the project activity was conducted in line with Zambian regulation requirement, and documented in Environmental Project Brief. "Zambian Environmental Managing Agency (ZEMA)" (formally "Environmental Council of Zambia"), had issued an approval letter to the project activity. Environmental Project Brief has been submitted to the DOE for their review.	Approval letter is provided and JCI confirmed. EIA Report is requested to submit. JCI confirmed provided EPB which is satisfactory. CL-20 is closed.
CL-21	In the LoA provided, organizations other than ZESCO are missing and it cause inconsistency with PDD. It is requested to clarify the reason of missing and to revise relevant part of PDD accordingly.	2.1 2.2	ZESCO has been the primary project participant. For the purpose of simplification, MEWD and REA were dropped from the project participants.	JCI confirmed the consistency among the revised LoA and the latest version of the PDD in terms of project participant. CL-21 is closed.
FAR	**Forward Action Requests**			
FAR-1	It is requested to prepare “Operation and Maintenance Manual” before completion of implementation of the project.	5.14 5.15 7.1 6) (i), (ii)	Operation and Maintenance Manual will be prepared before due time.	JCI confirmed PO’s response.
FAR-2	It is requested to prepare the “Monitoring Manual” which covers not only CDM operation but also plant operation before completion of implementation of the project.	7.1 7.1 6) (i), (ii)	Monitoring Manual will be prepared before due time.	JCI confirmed PO’s response.
FAR-3	It is required to decide the equipment for	7.1 6)	Purchase specification for the diesel fuel consumption	JCI confirmed PO’s response.

TABLE-2 Resolution of Corrective Actions and Clarification Requests

No. CAR, CL	Clarifications and corrective action requests by validation team	Sec. No. in TABLE-1	Summary of project owner response	Validation team Conclusion
	measuring fuel consumption of diesel engine of which feature is to be as stated in the section B.7.1 in the PDD when its order to a supplier is placed during the project implementation period.	(i), (ii)	meter is to be based on the features described in the section B.7.1 in the PDD	

APPENDIX B

Certificate of Appointment of Validation Team

Project Title	*Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station*
Applied Methodology	*AMS-I.A Ver.14*
	Sectoral Scope 1

Date: 1 Sep 2011

Designated Operational Entity: Japan Consulting Institute (JCI)

Reflecting the competence criteria of JCI in accordance with the latest "CDM Accreditation Standard for Operational Entities", this is to certify the appointment of validation team of JCI specified below for the CDM project activity above, as per CDM Project Activity Registration Form, and Validation Procedure established by JCI CDM Center.

Signature

Akio Yoshida,

Executive Director, JCI CDM Center

Date:

Client: ZESCO Ltd.

Reflecting the curricula vitae provided, this is to agree the validation team of JCI specified below for the CDM project activity above, as per Validation Procedure established by JCI CDM Center.

It is also agreed that Mr. **Mutsuo KATO** of JCI participates in the validation activities of the said project for the quality issues under its quality management scheme.

Signature

(Name) KENNEDY SICHONE

(Title) PROJECT CO-ORDINATOR

Validation Team

Validation Team	Name	Qualified Technical Areas related to the Project
Leader	*Masaki OKADA*	*1.2 Energy generation from renewable energy source*
Member	*Shigeo AOKI*	*1.2 Energy generation from renewable energy source*
	Mitsuo TAKANO	*(Observation)*

Technical Reviewer	*Hideyuki SATO*	*1.2 Energy generation from renewable energy source*

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station

Version 06

Completed: 24 January 2013

A.2. Description of the small-scale project activity:

Rural Electrification by Mujila Falls Lower Zambia Mini-hydropower station (hereafter referred to as the "Project" or "project activity"), located on Mujila River, a tributary to West Lunga river, involves the construction of a mini-hydropower plant with the total installed capacity of 1.4MW in the North Western Province of Zambia. Being developed and managed by ZESCO Ltd. (ZESCO), the largest utility company in Zamiba, the main objective of the Project is to distribute clean, renewable energy based electricity to rural communities without access to national/regional electricity grid, and to contribute to the sustainable development of Zambia which is recognised as a Least Developed Country (LDC).

While the electrification rate of the rural communities in the North Western Province of Zambia remains as low as 11%, which is significantly lower than that of the entire country stands at 20.3%, the electricity demand in the communities covered by the project activity is anticipated to increase up to 1400 kW in year 2030[1]. Stable supply of renewable electricity to the communities will reduce the use of the carbon intensive fuels, thereby contributing to reduced greenhouse gas emissions in the country.

The Project is a Greenfield project and involves construction of a run of river hydropower plant with a total installed capacity of 1.4 MW. The Project site has a record of relatively steady water flow throughout a year and 90% available flow rate of 8.27m^3/s. This abundant water flow allows the maximum estimated generation of approximately 11GWh electricity per annum.

When the project is operated at its maximum capacity, the Project will result in 11,037 tCO_2e of emission reductions per year or 77,259 tCO_2e over a seven-year crediting period.

Scenario existing prior to Project implementation
Prior to the project implementation, energy demand of the communities has been provided by the use of fossil fuels such as kerosene, diesel, or other fuel.

Baseline scenario
The baseline scenario is the same as the scenario existing prior to the Project implementation.

Project scenario
In the Project scenario, a mini-hydropower plant and a power distribution system will be constructed to provide maximum 11GWh per year of electricity to the connected villages.

[1] The Study for Development of rural Electrification Master Plan in Zambia Final Report (The Master Plan), Japan International Cooperation Agency, January 2008, Chapter 12

Contribution to Sustainable Development

The project will provide stable and affordable electricity to four communities of the North Western Province for both domestic and productive activities/applications. It is expected that the Project will provide direct benefits to the local environment as follows:

- ✓ Reduced GHG emissions as a result of the avoided burning of fossil fuels;
- ✓ Reduction in the use of fossil fuels such as kerosene for household cooking, and lighting resulting in less indoor smoke problems, especially for women and children;
- ✓ Reduced danger of in-house fires.

In addition to the environmental benefits the project will create opportunities for economic development by providing up to fifty some employment opportunities throughout the project activity, for temporary positions during the project construction and for permanent positions throughout the project lifetime. Implementation of the project activity also is expected to result in technology transfer and development of know-how to the local engineers for effective operation and maintenance of the project plant.

The project may also lead to alleviation of poverty in the underdeveloped and remote communities of the North Western Province by improving agricultural products and tourism services. Provision of basic amenities such as good quality power supply, television, and possibly mobile phone networks as a result of electrification will contribute to improved quality of life. Improved health and education services are likely to be available to the local people as these remote areas become more attractive places for professionals such as teachers and healthcare workers to live and work.

A.3. Project participants:

The following table provides information on the project participants.

Name of Party involved(*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Zambia (Host)	ZESCO Ltd.	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Republic of Zambia

A.4.1.2. Region/State/Province etc.:

North Western Province

A.4.1.3. City/Town/Community etc:

Mwinilunga District

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

The project will be located in the North-Western Province of Zambia near the Southern boarder of the Democratic Republic of Congo, on the Mujila River; to the north of Mwinilunga town in Mwinilunga District. The mini-hydropower plant is located at the Lower Mujila Falls. The coordinates are: 11°30’52’’S and 24°46’24’’E. The project will primarily provide electricity to four (4) communities, namely Kanyama, Kakoma, Mujila, Kapundu Community:

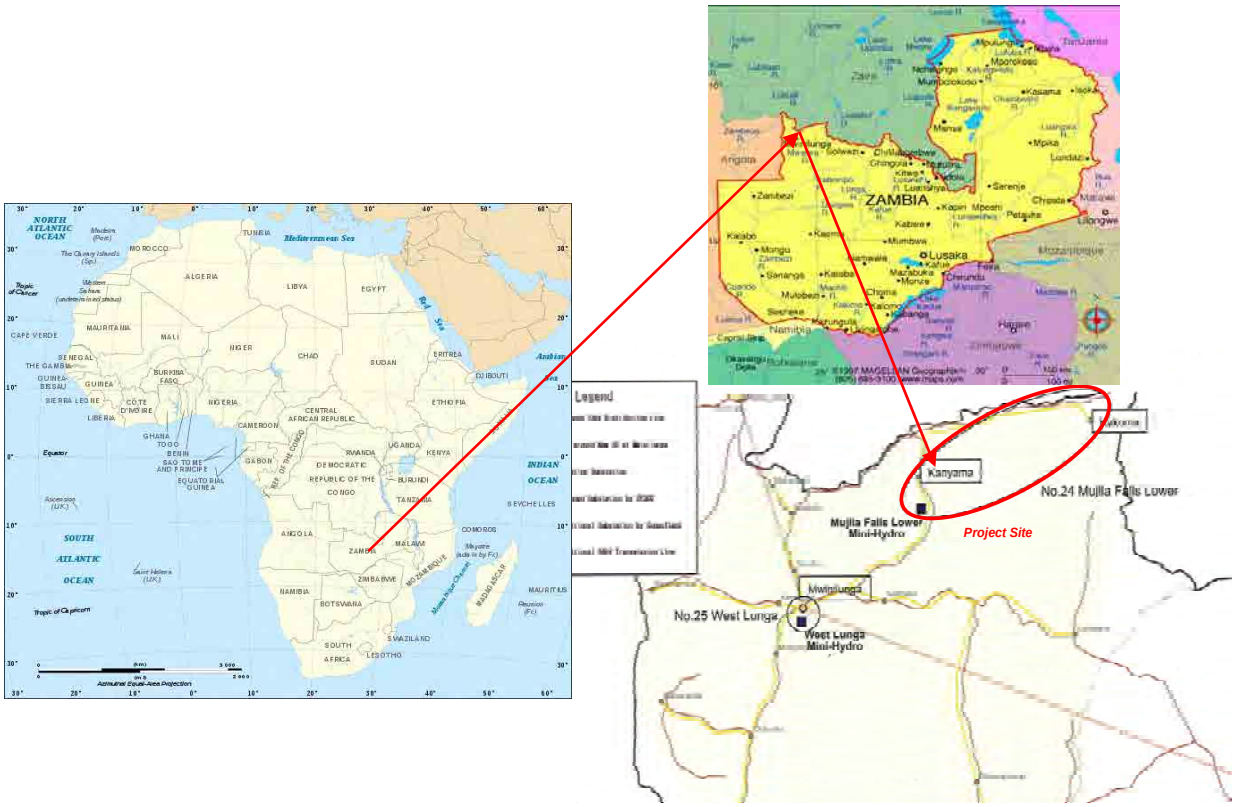

Figure A.1: Map of project location in the North Western Province, Zambia

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The project activity utilizes the hydro potential of the Mujila River for power generation and distributes generated electricity to the four remotely located non-electrified communities. According to the small-scale CDM modalities and procedures, the project activity falls under:

- Type I – Renewable Energy Projects

- Category I.A – Electricity Generation by the User

The mini hydropower plant will be located in a vast flat virgin land upstream. The power generation system will operate on gravitational flow of water with a planned discharge of about half of the river flow.

Technology to be employed by the Project Activity will be imported from overseas. Table 1 below outlines details on the Mujila catchment, discharge, head and capacity as well as information on the power plant.

Table 1: Lower Mujila Falls Mini-hydropower Plant Information

Item	Specification	Source of Information
Generation Capacity	1,400 kW Total (700 kW each)	The Study for Development of the Rural Electrification Master Plan in Zambia Final Report (hereafter "Master Plan"), Chapter 12 Table12-5
Life time	40 years	Master Plan, Chapter 12 Table 12-10
Number of turbine	2	Master Plan, Chapter 12 Table12-5
Number of generator	2	Master Plan, Chapter 12 Table12-5
Design Discharge	10.4 m^3/s	Master Plan, Chapter 12 Table12-5
Effective Head	17.1 m	Master Plan, Chapter 12 Table12-5

With a 5 meter weir to be constructed across the river channel, it is expected that a small area within the immediate natural flooding zone will be permanently inundated. The approximate size of the area of inundation is about 250,000 square meters within the normal flooding zone with the back water effect extending for about 1 km upstream of the weir before the preceding rapids.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

The project activity will employ a 7-year renewable crediting period.

Table 2: Emission reduction of the proposed project during the crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2e
March to December 2015	9,197
2016	11,037
2017	11,037
2018	11,037
2019	11,037
2020	11,037
2021	11,037
January to February 2022	1,840
Total estimated reductions (tonnes of CO_2e)	77,259
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	11,037

A.4.4. Public funding of the small-scale project activity:

The project activity does not result in the diversion of Official Development Assistance (ODA).

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

As defined in the "Guidelines on assessment of debundling for SSC project activities", Version 03, a proposed small-scale project activity is considered a debundled component of a large scale project activity if there is a registered small-scale CDM project activity or an application to register another small-scale project activity:

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

Since none of the above is true for the proposed CDM project activity, it is not a debundled component of a large project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The following approved baseline and monitoring methodology is applied to the Project:

AMS-I.A., "Electricity Generation by the User", Version 16
http://cdm.unfccc.int/UserManagement/FileStorage/07RMU4EPJG2HDFZ5NWVYIAT8OX1CS6

Methodological tool "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02)
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf/history_view

B.2 Justification of the choice of the project category:

AMS-I.A., "Electricity Generation by the User", Version 16, is applicable to the Project as demonstrated in the table below:

AMS-I.A., Ver.16 Applicability Conditions	Compliance
1. This category comprises renewable electricity generation units that supply individual households/users or groups of households/users included in the project boundary.	This project activity consists of the hydro electric power generation that supply individual households and users or groups of households/users included in the project boundary.

AMS-I.A., Ver.16 Applicability Conditions	Compliance
The applicability is limited to households and users that do not have a National/regional grid connection	Prior to implementation of the project activity, the households and users in the project boundary do not have connection to the national/regional grid. Zambia's electricity grid system is interconnected to neighbouring countries as part of the Southern African Power Pool (SAPP), which consists of power systems in southern African Countries[2]. According to the Master Plan, the users in the project boundary may be connected to the national grid sometime around the year 2030, but this is at the planning stage and has not yet been confirmed. The Project's interconnection with the national grid will be reported at the time of verification, if such event occurs in the future.
2.The renewable energy generation units include technologies such as solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which is used on-site/locally by the user, e.g. solar home systems, wind battery chargers. The renewable generating units may be new installations (Greenfield) or replace existing onsite fossil-fuel-fired generation. To qualify as a small-scale project, the total output of the unit(s) shall not exceed the limit of 15 MW.	The renewable energy hydro power generation unit implemented by the project activity is a new installation (Greenfield) project activity. The installed capacity of the generation unit will be 1.4 MW and does not exceed the limit of 15 MW.
3. 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 the reservoir; - The project activity is implemented in an existing reservoir, where the volume of the 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	The project activity is a run of river type hydropower project and no reservoir will be constructed. There will be no change with the volume of the reservoir.

[2] Connected countries includes: Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, Republic of South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe.

AMS-I.A., Ver.16 Applicability Conditions	Compliance
power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	
4. Combined heat and power (cogeneration) systems are not eligible under this category.	The project activity does not involve a combined heat and power (cogeneration) system.
5. 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 unit to be installed consists of a 100% renewable component not exceeding the eligibility limit of 15 MW.
6. Project activities that involve retrofit or replacement of an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	The project activity does not involve any retrofitting or replacement of existing facilities.
7. In the case of project activities that involve the 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 project is Greenfield project and does not involve the addition of renewable energy generation units at an existing facility.

B.3. Description of the project boundary:

According to AMS-I.A., Version 16, Paragraph 7, "the physical, geographical site of the renewable energy generating unit and the equipment that uses the electricity produced delineates the project boundary."

The geographic boundary of the project activity includes the Lower Mujila Falls Mini Hydropower Plant, the new transmission and distribution lines, and four (4) remotely located non-electrified communities in the North Western Province of Zambia. Figure B.1 depicts a graphical representation of the project boundary, as shown below.

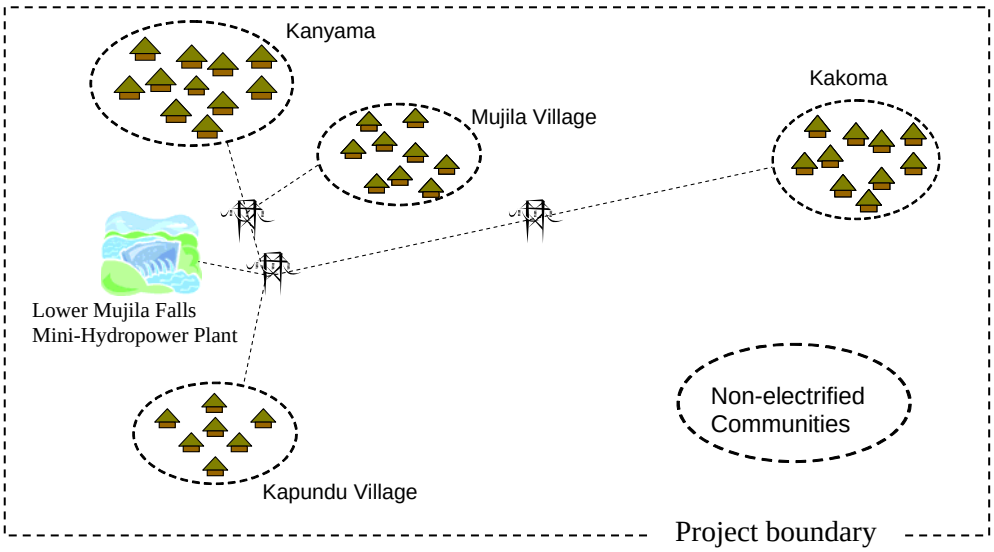

Figure B.1: Project boundary

B.4. Description of baseline and its development:

The baseline is described by Paragraph 8 of AMS-1.A., Version 16 as:

"…the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy…", estimated using one of three possible options. For the project activity, (b) Option 2 is applied, such that the energy baseline is calculated based on annual electricity generation from project renewable energy technologies as per the below:

$$E_{BL,y} = \Sigma_i EG_{i,y} / (1 - l)$$

Where:

$E_{BL,y}$ Annual energy baseline; kWh

Σ_i The sum over the group of I renewable energy technologies (e.g. renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity

$EG_{i,y}$ The estimated annual output of the renewable energy technologies of the group of *i* renewable energy technologies installed; kWh

l Average technical and distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction

The emission baseline is the energy baseline calculated in accordance with Paragraph 8(b) of AMS-I.A. times a default emission factor:

$$BE_{CO2,y} = E_{BL,y} * EF_{CO2}$$

Where:

$BE_{CO2,y}$ Emissions in the baseline in year, *y*; tCO2

$E_{BL,y}$ Annual energy baseline in year, *y*; kWh

EF_{CO2} CO_2 emission factor; tCO_2/kWh

For EF_{CO2}, the default value of 0.8 kg CO2e/kWh under AMS-I.A will be used. .

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The Project is considered additional in accordance with "Guidelines for demonstrating additionality of microscale project activities ", Version 04.0[3] as follows:

"Project activities up to five megawatts that employ renewable energy technology are additional if any one of the conditions below is satisfied:

(a) The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDs) or in a special underdeveloped zone (SUZ) of the host country.

(b) The project activity is an off-grid activity supplying energy to households/communities (less than 12 hrs grid availability per 24 hrs day is also considered as 'off grid' for this assessment);

(c) The project activity is designed for distributed energy generation (not connected to a national or regional grid) with both conditions (i) and (ii) satisfied;

(i) Each of the independent subsystems/measures in the project activity is smaller than or equal to 1,500 kW electrical installed capacity;

(ii) End users of the subsystems or measures are households/communities/SMEs.

(d) The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.

The Project satisfies the conditions (a) above. Zambia is recognised by the UNFCCC as one of the Least Developed Countries (LDC). As such the Project is considered additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline

[3] EB68 Annex 26, http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid22.pdf

As per the applied methodology AMS-I.A., the energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

The project applies Option 2 of AMS-I.A., Version 16 and baseline emissions are calculated based on annual electricity generation from project renewable energy technologies as per the below:

$BE_{CO2,y} = E_{BL,y} * EF_{CO2}$

Where:

$BE_{CO2,y}$ Emissions in the baseline in the year, *y*; tCO_2

EF_{CO2} CO_2 emission factor; tCO_2/kWh (default value of 0.8 kg CO_2e/kWh)

$E_{BL,y}$ Annual energy baseline in year, *y*; kWh

And:

$E_{BL,y} = \Sigma_i EG_{i,y} / (1 - l)$

Where:

$E_{BL,y}$ Annual energy baseline; kWh

Σ_i The sum over the group of *i* renewable energy technologies (e.g. renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity

$EG_{i,y}$ The estimated annual output of the renewable energy technologies of the group of *i* renewable energy technologies installed; kWh. Annual output of the renewable energy technologies for the project activity is estimated based on the available river flow and the generation capacity of the project activity (1.4MW). As such, for ex-ante estimation purpose, it is set at 11,037,600 kWh/y. This value will be rectified by the actual annual output of the renewable energy once project begins operation.

l Average technical and distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction. For the project activity, this value is set at 0.2, which is the default value as per the applied methodology AMS-I.A.version16.

Project emissions

The project activity is a small scale hydropower project with no change in the volume of the reservoir. Therefore, as per the applied methodology AMS-I.A., the GHG emission from the project activity is considered as zero. On the other hand, the project plans to install a diesel engine generator of 50 kVA capacity for emergency purpose. In case of emergency, when all the station power supply is out, the emergency diesel engine generator will be activated. While the project does not plan to activate the diesel

engine generator during the project operation, any diesel fuel combusted during emergency will be counted toward project emissions as per Option B of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) as follows:

$$PE_y = PE_{FC,emergency,y} = \Sigma FC_{diesel,emergyncy,y} \times NCV_{diesel,y} \times EF_{CO2,diesel,y}$$

Where:

PE_y	Project emissions in the year, *y*; tCO_2e
$PE_{FC,emergency,y}$	CO_2 emissions from diesel combustion during emergency in year y
$FC_{diesel,emergency,y}$	Quantity of diesel combusted during emergency in year y
$NCV_{diesel,y}$	Net calorific value of diesel in year y, as per IPCC default value at upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter1 of vol.2 of the 2006 IPCC Guidelines on national GHG inventories
$EF_{CO2,diesel,y}$	CO_2 emission factor of diesel in year y, as per IPCC default value at upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of vol.2 of the 2006 IPCC Guidelines on national GHG inventories

Leakage

In accordance with AMS-1.A., Version 16, if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. This is not the case in this Project and as such leakage emissions are not considered.

Emission reductions

Emission reductions are calculated as:

$$ER_y = BE_{CO2,y} - PE_y - L$$

Where:

ER_y Emission reductions in the year *y*; tCO_2e

$BE_{CO2,y}$ Emissions in the baseline in the year, *y*; tCO_2e

PE_y Project emissions in the year, *y*; tCO_2e

L Leakage in the year, *y*; tCO_2e

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	EF_{CO2}
Data unit:	tCO_2/kWh
Description:	CO_2 emission factor
Source of data used:	Default value (AMS-I.A, Version 16)

Value applied:	0.0008
Justification of the choice of data or description of measurement methods and procedures actually applied :	0.8 kg CO_2e/kWh / 1000 kg/t = 0.0008 tCO_2e/kWh
Any comment:	-

Data / Parameter:	*l*
Data unit:	-
Description:	Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes in isolated areas
Source of data used:	Default value (AMS-I.A, Version 16)
Value applied:	0.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	Reasonable default value for distribution losses on low voltage rural distribution grid. In the absence of the project activity electricity supply would have entailed distribution losses because users are in distributed locations.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

Baseline

$E_{BL,y}$ = $\Sigma_i EG_{i,y} / (1 - l)$

$EG_{i,y}$ = 11,037,600 kWh/y, *ex ante* estimation based on the installed capacity (1.4MW), and the available flow rate. This value will be rectified by the actual annual output of the renewable energy once project begins operation.

l = 0.2, the default value set by the methodology

Therefore:

$E_{BL,y}$ = 11,037,600 / (1 – 0.2)

= 13,797,000 kWh

$BE_{CO2,y}$ = $E_{BL,y} * EF_{CO2}$

= 13,797,000 kWh x 0.0008 tCO_2/kWh

= **11,037 tCO_2**

Project emissions

$PE_y = PE_{FC,emergency,y} = \Sigma FC_{diesel,emergyncy,y} \times NCV_{diesel,y} \times EF_{CO2,diesel,y}$

$= 0\ tCO_2e$

Where the project does not plan to activate the diesel engine generator during the project operation.

Leakage

$L = 0\ tCO_2e$

Emission reductions

$ER_y = BE_{CO\,2,y} - PE_y - L$

$= 11{,}037\ tCO_2e - 0\ tCO_2e - 0\ tCO_2e$

$= 11{,}037\ \mathbf{tCO_2}$

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity Emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
Mar.-Dec. 2015	0	9,197	0	9,197
2016	0	11,037	0	11,037
2017	0	11,037	0	11,037
2018	0	11,037	0	11,037
2019	0	11,037	0	11,037
2020	0	11,037	0	11,037
2021	0	11,037	0	11,037
Jan.-Feb. 2022	0	1,840	0	1,840
Total (tonnes of CO_2e)	0	77,259	0	77,259
Average (tonnes of CO_2e)	0	11,037	0	11,037

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{i,y}$
Data unit:	kWh/y
Description:	Annual net electricity generated during the year, *y*
Source of data to be used:	ZESCO

Value of data	11,037 ,600 *Ex ante* estimation based on the installed capacity and the maximum operating hours per year:1,400 kW x 0.9 x 8,760 hrs/y = 11,037,600 kWh/y This value will be rectified by the project's actual annual output once the project begins operation.
Description of measurement methods and procedures to be applied:	Measured continuously by electricity meters and recorded at least once per day. The accuracy of the meters will be at least class 1.0[4].
QA/QC procedures to be applied:	The electricity meters will be periodically calibrated according to the relevant national or industrial standards and regulations. Calibration will be done at least once per three years, which is the minimum requirement stipulated in the "General guidelines to SSC CDM methodologies (version17)"[5]
Any comment:	As per the historical river flow data, water availability is sufficient to operate the power plant at 90% capacity throughout a year. As the project is not connected to national/regional grid, there is no chance of receiving energy. In case of emergency, emergency diesel power

Data / Parameter:	$FC_{diesel,emergency,y}$
Data unit:	Mass or volume unit per year (ton/yr or m^3/yr)
Description:	Quantity of diesel fuel combusted at the project power plant during emergency in the year y
Source of data to be used:	Onsite measurements
Value of data	0
Description of measurement methods and procedures to be applied:	Monitor continuously. · Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); · Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; · In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked

[4] While the accuracy class of energy meters are not clearly specified in the existing bidding documents, the project developer plans to request the contractor to provide minimum 1.0 class energy meter. Actual accuracy class of the installed energy meters will be verified at the time of verification.

[5] EB61 Report, Annex 21

	with available purchase invoices from the financial records.
Any comment:	The diesel engine generator will only be used for emergency, when all the station power supply is out.

Data / Parameter:	$NCV_{diesel,y}$
Data unit:	GJ per mass or volume unit (e.g. GJ/m^3, GJ/ton)
Description:	Weighted average net calorific value of diesel in year y
Source of data to be used:	IPCC default values for diesel oil at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (Default As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" version 02)
Value of data	43.3 TJ/Gg
Description of measurement methods and procedures to be applied:	Any future revision of the IPCC Guidelines should be taken into account.
QA/QC procedures to be applied:	
Any comment:	"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"version 02, Option B The diesel engine generator will only be used for emergency, when all the station power supply is out.

Data / Parameter:	$EF_{CO2,diesel,y}$
Data unit:	tCO2/GJ
Description:	CO2 emission factor of diesel in year y
Source of data to be used:	IPCC default values for diesel oil at the upper limit of the 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. (Default As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" version 02)
Value of data	74.8 ton/TJ
Description of measurement methods and procedures to be applied:	Any future revision of the IPCC Guidelines should be taken into account.
QA/QC procedures to be applied:	-
Any comment:	"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" version 02, Option B The diesel engine generator will only be used for emergency, when all the station power supply is out.

B.7.2 Description of the monitoring plan:

The net electricity generated by the project activity will be monitored continuously by digital electricity meter(s) at the mini hydropower plant by ZESCO. Designated power plant operator will read the electricity meter situated in the power plant every day, and then record the daily readings to the log book. These recorded data will be sent to ZESCO's project monitoring officer in Lusaka who compiles the aggregate of the electricity generated from the project activity monthly. The monitoring officer will then compile the annual net electricity generation data of the mini hydropower plant into a monitoring report. CDM Project Manager will review the monitoring report.

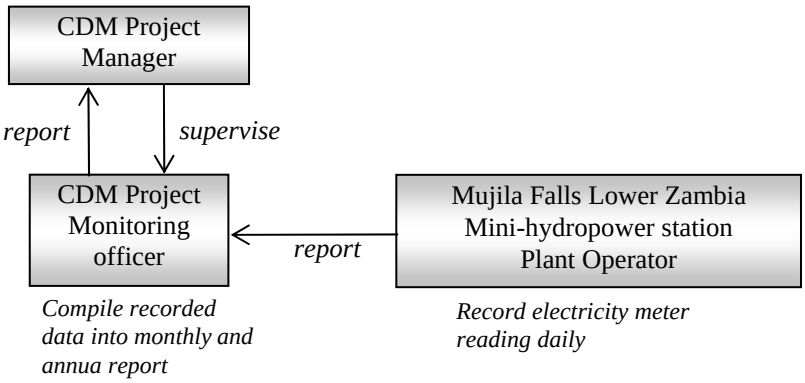

Figure B.2: Monitoring organization chart for the project activity

The electricity meter(s) will be certified, or periodically calibrated according to the ZESCO calibration protocol based on the national industrial standards. Physical location of electricity meter(s) is shown in the Figure B.3 below.

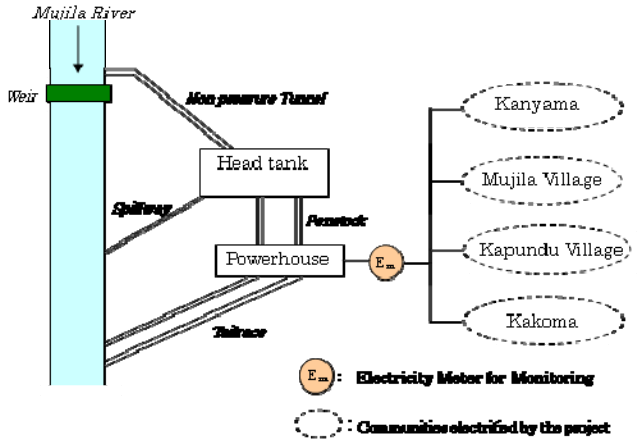

Figure B.3 Location of monitoring meter

33kV T/L MWh meter (E_m) will record the distributed energy. At the time of electricity meter failure, data log accumulated in the computer at Mujila Power Station will be used as the backup. During normal operation, signals of CT (Current Transformer) and VT (Voltage Transformer) will be sent to both electricity meter and to the computer at Mujila Power Station. Signals sent to the computer are kept as the data log. This data log is the duplicate of the electricity meter readings and can be used to calculate distributed electricity during the event of MWh meter failure. Since CT and VT are not electronic equipment, failure of CT and VT are rarely anticipated.

All the data will be stored in an electronic data log at the Lusaka office during the crediting period and two years after the end of the last crediting period.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

The baseline study and monitoring plan above were completed on 22 January 2013:

Clean Energy Finance Division
Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.

kurokawa-ayato@sc.mufg.jp

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

28 February 2013

This is the expected date on which construction and equipment purchase contract for the Project activity will be finalized. This is the earliest date of the real action with significant financial expenditures, which is in line with the definition of the start date of a CDM project activity clarified by the Board.[6]

C.1.2. Expected operational lifetime of the project activity:

30 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01 March 2015, or the actual starting date of the project operation, whichever is later.

C.2.1.2. Length of the first crediting period:

7 years 0 months

[6] EB47 report paragraph 71

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

NA

C.2.2.2. Length:

NA

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

In Zambia, it is a legal requirement under the *Environmental Protection and Pollution Control Act No. 12 of 1990,* that developers should implement projects in line with the provisions of the law. *Section 3 (1) of Statutory Instrument No. 28 of 1997* of the above Act states that "a developer shall not implement a project for which an Environmental Project Brief or an Environmental Impact Statement is required under these Regulations, unless the said Environmental Project Brief or the Environmental Impact Statement has been concluded in accordance with these regulations and the Environmental Council of Zambia has issued a decision letter."

In the category of electrical infrastructure, the types of projects which need Project Briefs are new electricity generation stations, electrical power transmission lines more than 1 km long and surface roads for electrical and transmission lines more than 1 km long. The Project falls within the types of projects which require an Environmental Project Brief (EPB). An Environmental Project Brief highlights the important environmental issues pertaining to the project and the mitigation measures to be taken.

As per the above legal requirement, an Environmental Impact Assessment (EIA) study was conducted and the Environmental Project Brief (EPB) report was prepared and submitted to Environmental Council of Zambia (ECZ) for review and approval. The project was approved by ECZ and to this effect a 'Decision Letter' was given to ZESCO as being confirmation of the approval of the project.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts of the Project are not considered to be significant.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

ZESCO organized a public consultation meeting and was held on 4th November 2010 at Kanyizhiwu Community School in Mwinilunga, Zambia. Invitations were distributed to village heads inviting them to attend. Also the local residents were informed about the meeting through village heads. The meeting

aimed for announcing the proposed project activity and collecting opinions/feedbacks on the project from the local residents. A total of 48 local residents (breakdowns: twenty four male, including village heads, and twenty four female) attended the meeting. Name of the village heads attended to the meeting is provided below:

Village heads:
1. Simone Chimovu
2. Mama Kafwali
3. Tata Kafwali
4. Lastic Kamwana (church leader)

Five officers from ZESCO attended the meeting, as listed below:
1. Mellon H. Chinjila – Environmental Coordinator
2. Martin Sinjala – Chief Civil Engineer
3. Brenda L. Musonda-Chizinga – Senior Social Scientist
4. Lwanda K. Kahongo – Senior Ecologist
5. Fred Mbesuma – Environmental Technologist

The below photos show the village heads and local stakeholders who gathered to attend the local stakeholders' meeting:

Local Stakeholders Meeting①
Village Chief and other meeting attendees

Local Stakeholders Meeting②
Photo of meeting attendees

E.2. Summary of the comments received:

There were no negative comments received during the public consultation meeting. A summary of comments received and responses to all the comments is summarized as follows:

- Question 1 (Local people): How far can we cultivate our fields? How can we know the exact distance where we can cultivate from a dam?
- Answer 1 (ZESCO): Although it depends on which side you cultivate, it will be clear for the local people through the fence being set.
- Question 2 (Local people): Can we cultivate our field in this year?
- Answer 2 (ZESCO): Now you can cultivate your field. Once the project is started, you will not be able to do it. We will take the officers from Ministry of Agriculture and Livestock to assess the damage and compensate for it based on the market value.

- Question 3 (Local people): Should we remove red tapes or leave them in the case of continuing cultivation?
- Answer 3 (ZESCO): Please leave them as they are because the people are still collecting information.
- Comment1 (Local people): We are glad that this project has come here as this will help to supply electricity to the community and overcome the power shortages.

The questions mentioned above were carefully examined and kindly answered by ZESCO. The local people expected that the project will contribute to sustainable development with environmental protection through this project.

E.3. Report on how due account was taken of any comments received:

Due account was taken to all comments and ZESCO has endeavoured to explain all issues raised during the meeting.

- ZESCO committed to assess the damage for the crops and compensate for them based on the market value if the crops which have already been cultivated in the area are damaged.

Based on feedback received after the meeting, the participants' expressed their satisfaction with ZESCO's detailed explanation and gave their support for the Project's implementation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	ZESCO Limited
Street/P.O.Box:	Great East Road, P.O. Box 33304
Building:	Stand No. 6949
City:	Lusaka
State/Region:	Lusaka
Postfix/ZIP:	10101
Country:	Zambia
Telephone:	+260 211 362347
FAX:	+260 211 362317
E-Mail:	mchinjila@zesco.co.zm
URL:	www.zesco.co.zm
Represented by:	Environment and Social Affairs Unit
Title:	Acting Senior Manager
Salutation:	Mr.
Last Name:	Chinjila
Middle Name:	Halubanje
First Name:	Mellon
Department:	Environment and Social Affairs
Mobile:	+260 977/955 849341
Direct FAX:	+260 211 362317
Direct tel:	+260-211-362341
Personal E-Mail:	mchinjila@yahoo.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No additional information is included in this section.

- - - - -

Annex 3

BASELINE INFORMATION

No additional baseline information is included in this section.

- - - - -

Annex 4

MONITORING INFORMATION

No additional monitoring information is included in this section.

- - - - -

CDM: form for proposed new small scale methodologies (F-CDM-SSC-NM) (version 01)

(To be used for proposing a new small scale methodology in accordance with article 15 and 16 of the simplified modalities for small-scale CDM project activity categories. This form is not to be used in case of large scale methodologies).

Name of person/entity submitting this form:	Mitsubishi UJF Morgan Stanley Securities Co., Ltd. Primary contact: Chisato Nakade Secondary contact: Atsuko Nuibe
Title of the proposed small scale methodology:	Rural electrification by extension of existing low carbon intensive electricity distribution network
Please suggest type to which the new proposed methodology (category) belongs to:	☐ Type I Renewable energy projects ☐ Type II Energy efficiency improvements ☒ Type III Other project activities

Information for completing the form

For proposing a new small scale methodology all sections below should be completed. Approved small scale methodologies shall be used as a reference for language and structure used. If necessary, attach files or refer to sources of relevant information.

1. **Technology/measure: please specify and provide reference to the exact technology/measure the proposed small scale methodology is applicable to and describe in detail the applicability conditions of the proposed methodology.**

Technology/measure

1. This category comprises rural electrification in the host country.

2. The project activity aims rural electrification in the host country by extension of the existing electricity distribution network. The electricity distributed by the project activity replaces the fuel that would have been used in the absence of the project activity.

Applicability conditions

This new methodology aims to offer simplified, but conservative, means for quantification of GHG emissions reduction associated with rural electrification project activity conducted in host countries with rich renewable energy resources.

This new methodology can be used for the rural electrification projects which satisfy following applicability conditions:

3. The project does not involve construction of new electricity generation plants/units, but involves the extension of the existing power distribution network in the host country.

4. Existing power plants/units located within the host country connected to the existing electricity distribution network are of primarily renewable sources[1].

5. National power development plan of the host country, if publicly available, confirms that power generation

[1] Examples of renewable sources include, but not limited to, hydro, solar, wind, and renewable biomass.

mix in the host country in the foreseeable future continues to be constituted primarily by renewable sources[2].

6. Electricity distributed by the project activity is quantifiable, and the value is available to the project developer.

7. Electricity procured internationally and consumed by the host country is quantifiable, and the value is available to the project developer.

8. Annual electricity consumption by the host country is quantifiable, and the value is available to the project developer.

9. Geographical area where electricity is supplied by the project activity (i.e. project region) is defined in the PDD.

10. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

2. Boundary: please specify the project boundary of the proposed methodology.

11. The project boundary under the proposed new methodology encompasses the following:
    - The physical extent of the power distribution network extended by the project activity.
    - The physical, geographical site where the extended network distributes electricity (i.e. project region).

3. Baseline: please specify the baseline scenario and the way baseline emissions are calculated.

12. The energy baseline is the fossil fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

13. The energy baseline is calculated using one of the following two options:

14. Option 1: The emission baseline based on the fuel consumed to generate equivalent quantity of electricity distributed by the project activity.

$$BE_{CO2,y} = \Sigma_i ED_{i,y} * EF_{CO2} \quad (1)$$

Where:

$EB_{CO2,y}$	Emissions in the baseline in year y, tCO_{2e}/yr
EF_{CO2}	CO_2 emission factor, tCO_{2e}/MWh
Σ_i	The sum of the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution network to the project region *i* in year *y*, MWh/yr

15. A default value of 0.8 tCO_{2e}/MWh[3] may be used for EF_{CO2} if it is confirmed that the project activity does not replace electricity distribution from stand-alone renewable electricity generation facilities existing in the project region.

16. In case where the project replaces electricity from renewable sources, the default emission factor of 0.8

[2] Examples of renewable sources include, but not limited to, hydro, solar, wind, and renewable biomass.

[3] A default value is derived from diesel generation units, which is adopted in an approved small scale CDM methodology, AMS-I.A.

tCO_{2e}/MWh must be adjusted taking into account the renewable electricity replaced by the project activity.

17. The following procedure is used to adjust the emission factor.

$$EF_{CO2,y} = (1 - \beta) * 0.8 \quad (2)$$

$$\beta = E_{renewable} / \Sigma_i ED_{i,y} \quad (3)$$

Where:

$EF_{CO2,y}$	CO_2 emission factor, tCO_{2e}/MWh
β	Fraction of electricity distributed by the project activity that replaces renewable electricity generated by the existing renewable power generation units.
$E_{renewable}$	Renewable electricity distribution in the project region expected to be replaced by the project activity, MWh/yr This value will be estimated ex-ante using publicly available information and will be fixed throughout the project crediting period. The validity of the estimated value will be examined by the DOE at the time of the validation.
Σ_i	The sum of the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution system to the project region *i* in year *y*, MWh/yr

18. Option 2: The emissions baseline based on the historic fuel consumption in the project region and the CO_2 emission factors for the fuels displaced.

$$BE_{CO2,y} = \Sigma_j FC_{j,baseline} \times NCV_j \times EF_{CO2,j} \quad (4)$$

Where:

$BE_{CO2,y}$	Emissions in the baseline in year *y*; tCO_2
$FC_{j,baseline}$	Amount of consumption of fuel type *j*; mass or volume unit in baseline year, prior to the project implementation. This value will be fixed ex-ante throughout the project crediting period. The validity of the baseline sampling survey will be examined by the DOE at the time of the validation.
NCV_j	Net calorific value of fuel type *j*; gigajoule per mass or volume unit
$EF_{CO2,j}$	CO_2 emission factor of fuel type *j*; tCO_2/GJ
j	Fuel type used for combustion

19. In the case of Option 2, IPCC default values for emission factors may be used.

20. Amount of fuel consumption of fuel type j in baseline year ($FC_{j,baseline}$) is quantified by conducting baseline sampling survey following the relevant guidance provided for small scale CDM project activity[4].

4. Leakage: please specify if leakage emissions can occur and how they should be calculated.

21. No leakage emission is envisaged from the project activity.

5. Project activity emissions: please specify possible project activity emissions and how they should be calculated.

[4] General guidelines for sampling and surveys for SSC project activities (version 01.1) http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid20.pdf

22. This methodology takes account of the project activity emissions relating to the consumption of internationally procured electricity in the host country. This project emission is conservatively quantified by assuming that all internationally procured electricity by the host country is from fossil fuel sources.

23. The project emission is calculated as follows:

$$PE_{CO2,y} = \alpha * ED_{PJ,y} * EF_{CO2,y} \quad (5)$$

$$\alpha = E_{import} / E_{domestic} \quad (6)$$

$$ED_{PJ,y} = \Sigma_i ED_{i,y} / (1 - L) \quad (7)$$

Where:

$PB_{CO2,y}$	Project emissions in year y, tCO_{2e}/yr
α	The fraction of electricity in the host country's annual electricity consumption which is procured internationally
$ED_{PJ,y}$	Amount of electricity distributed in year y by the project activity including distribution loss, MWh/yr
$EF_{CO2,y}$	CO_2 emission factor for the electricity the host country procured internationally, tCO_{2e}/MWh
E_{import}	Amount of electricity the host country procured internationally in a given year for domestic consumption, MWh/yr Data from the latest year with available information is adopted.
$E_{domestic}$	Total amount of electricity the host country consumes domestically in a given year, MWh/yr Data from the latest year with available information is adopted.
Σ_i	The sum of the group of project regions
$ED_{i,y}$	Amount of electricity distributed by the extended electricity distribution system to the project region *i* in year *y*, MWh/yr
L	Average technical distribution losses, expressed as a fraction[5]

24. Only the fraction of the electricity distribution by the project activity that would have been attributed to the internationally procured electricity will lead to project emissions. The fraction of electricity in the host country's annual electricity consumption, α, is adopted for this purpose.

25. For CO_2 emission factor for the electricity the host country procured internationally, $EF_{CO2,y}$, a conservative emission factor of 1.3 tCO_2/MWh shall be applied[6].

6. Monitoring: Please specify which parameters should be monitored and how they should be monitored.

[5] For the project emissions calculation, default value of 20% shall be used as distribution loss.

[6] 1.3 tCO_2/MWh is the conservative default value adopted for project emission calculation in the latest version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

26. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to extrapolate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity. "General guidelines for sampling and surveys for SSC project activities" may be referred for sampling procedures.

27. Monitoring shall consist of the following parameters listed in Table 1 below.

Table 1: Parameters for monitoring

No.	Parameter	Description	Unit	Monitoring /recording Frequency	Measurement Methods and Procedures
1	$ED_{i,y}$	Amount of electricity distributed by the extended electricity distribution system to the project region i in year y	MWh/yr	Continuous measurement by electricity meter(s), aggregated annually	Measured using calibrated electricity meter(s). Meter(s) is/are calibrated in accordance with the host country regulation. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to extrapolate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity (N_{meter}). "General guidelines for sampling and surveys for SSC project activities" may be referred for sampling procedures. Document from electricity authority (or equivalent entity) of the host country may be used in place of direct measurement records of electricity meter. Validity of information source will be verified by DOE at the time of verification. Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method. Where necessary, refer to the "General guidelines for sampling and surveys for SSC project activities". Used for baseline emissions calculation. Monitored only when Option 1 in baseline emission calculation is selected.
2	N_{meter}	Number of electricity meters installed by the project activity	-	Recorded annually	Recorded by project developer
3	E_{import}	Amount of electricity the host country	MWh/yr	The latest data is evaluated	Data is sourced from host country energy statistics.

		procured internationally for domestic consumption		annually	Data from the latest year with available information is adopted.
4	$E_{domestic}$	Amount of electricity the host country consumes domestically	MWh/yr	The latest data is evaluated annually	Data is sourced from host country energy statistics. Data from the latest year with available information is adopted.

7. Project activity under a programme of activities: if the proposed methodology is also intended for application to a project activity under a programme of activities (CPA of PoA) guidance on consideration of leakage when applying to the CPA of PoA shall be provided.

28. There is no additional guidance on consideration of leakage when applying to the CPA of PoA.

Date you are delivering the contribution:	27 June 2011

Information to be completed by the secretariat	
F-CDM-SSC-NM doc id number	
Related to SSC-Submission number	
Date when the form was received at UNFCCC secretariat	

CDM: Recommendation Form for Small Scale Methodologies (version 01) ***(To be used for presenting questions/proposals/amendments to the simplified methodologies for small-scale CDM project activity categories)***	
Date of SSC WG meeting:	22–25 August 2011, SSC WG 33
Title/Subject (give a small title or specify the subject of your submission, maximum 200 characters):	Rural electrification by extension of existing low carbon intensive electricity distribution network
Indicative methodology to which your submission relates (refer the items of Appendix B of the Simplified Modalities and Procedures), if applicable.	Proposal for a new Type III SSC methodology
Name of the authors of the query:	Chisato Nakade / Atsuko Nuibe Institution: Mitsubishi UJF Morgan Stanley Securities Co., Ltd. nakade-chisato@sc.mufg.jp, nuibe-atsuko@sc.mufg.jp

Summary of the query:

Please use the space below to summarize the query related to SSC methodologies/categories SSC Modalities and Procedures provide recommendation/analysis of the SSC WG.

Original text from Stakeholder:

The proposed new small scale methodology aims to offer simplified, but conservative, means for quantification of GHG emissions reduction associated with rural electrification project activity conducted in host countries with rich renewable energy resources.

To date, there is no existing approved CDM methodology which can be applied to the project activity involving rural electrification in the host country by extension of existing electricity distribution network. An approved small scale CDM methodology AMS-I.A may be used for rural electrification project activity involving installation of new electricity generation technology; however, it is not applicable to cases where the projects involve extension of existing electricity distribution network. Thus, a new small scale CDM methodology is proposed.

Applicability conditions

The proposed new small scale methodology is applicable only when the existing electricity distribution network supplies renewable electricity.

Project boundary

The project boundary under the proposed new methodology encompasses the physical extent of the power distribution network extended by the project activity and the physical, geographical site where the extended network distributes electricity.

Additionality

No special comments

Baseline emissions

In the proposed new small scale CDM methodology for the project activity, the electricity supplied by the extended electricity distribution network will replace the fossil fuel consumption of the technology in use

or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

Project emissions

This newly proposed small scale CDM methodology takes account of the project activity emissions relating to the consumption of internationally procured electricity in the host country. This project emission is conservatively quantified by assuming that all internationally procured electricity by the host country is from fossil fuel sources.

Leakage

No special comments

Emission reductions

No special comments

Recommendation by the SSC WG:

Please use the space below to provide amendments/change (in your expert view, if necessary).

Please refer to paragraph 6 of the meeting report of the SSC WG 33 <http://cdm.unfccc.int/Panels/ssc_wg>.

Answer to authors of query by the SSC WG:

Please use the space below to provide answer to the authors of the above query.

The small-scale working group of the CDM Executive Board would like to thank the author for the submission.

In response to SSC-NM068, the SSC WG agreed to seek further clarifications from the PPs for the issues such as:

Technology/measure and applicability conditions

- A threshold for "primarily renewable" should be provided and the applicability condition which check "primarily renewable" in the current and future grid) should be monitored throughout the crediting period. If monitoring of this condition is included, the applicability condition is not needed. Also, the consequence of non compliance should be specified in the methodology;
- Further specification and definition regarding "rural electrification" should be provided in order to ensure that the project activity is related with rural (and not urban) electrification;
- The methodology should have an applicability condition to avoid possible double counting among electricity generation companies, transmission companies, distribution companies, electricity users, and other possible implementers.

Baseline emissions

- Paragraph 15 states: "*15. A default value of 0.8 tCO2e/MWh may be used for EFCO2 if it is confirmed that the project activity does not replace electricity distribution from stand-alone renewable electricity generation facilities existing in the project region.*" It is not clear how it would be confirmed that the project activity does or does not replace renewable generation in the region. One possibility is to check if the production of the renewable facilities existing in the project region before the project activity is the same (or higher) during the crediting period compared whit the historical average. The displacement of existing renewable electricity generation sources (such as renewable based mini-grid, stand alone Solar PV system etc) should be further addressed. The author of the submission may also explain the scenarios under which the existing renewable electricity generation sources are possibly replaced due to the implementation of the project activity.
- For option 2, *FCj,baseline* (i.e. the amount of fuel consumption of fuel type j in the baseline)

could be trend-adjusted based on historical fuel consumption data, similar to AMS-I.A;

- Additional guidance is needed to implement the survey proposed in paragraph 20. The households surveyed should be the ones connected to the grid during the crediting period;
- The Option 2 approach used to determine baseline emissions needs to be further addressed as the procedure proposed has fundamental problems. There is no relationship in the methodology between fossil fuel consumed (determined *ex ante*) and electricity distributed by the project activity. This lack of relationship could lead to situations where small amount of electricity is supplied in to households, and consumption of fossil fuel continues during the crediting period. The procedure provided in the methodology will result in an overestimation of emission reductions.

Project activity emissions

- For project emissions, in case electricity is imported in the country a value of 1.3 tCO_2/MWh is used as emission factor for the electricity imported. In principle, this is a very conservative assumption. However, the implicit assumption is that imports of electricity are not related with this project, as the emissions from the imported electricity are allocated over the whole electricity used in the country. This assumption should be further justified. The PPs may also wish to explore an alternative approach (still simplified and conservative) to estimate project emissions attributable to rural electrification that involves extension of national/regional grid.

Leakage

- The project activity could result in deforestation. Leakage provision to address such a situation should be provided in the methodology.

Monitoring

- For the monitoring of the amount of electricity distributed by the project activity, the proposed source is “document from electricity authority”. This specification should be further clarified. We expect that this parameter is determined based on direct measurement say for example at nearest distribution substation(s).

Minor issues

- It should be clarified that paragraph 18 refers to fossil fuels.

To facilitate the consideration of your response at SSC WG 34, kindly provide your response on or before **20 September 2011** (please refer to paragraph 14 (b) of “Submission and consideration of a proposed new small scale methodology” at <http://cdm.unfccc.int/Reference/Procedures/methSSC_proc03.pdf>).

Signed by the Chair, Ms. Fatou Gaye
Date: 25/08/2011

Signed by the Vice-Chair, Mr. Peer Stiansen
Date: 25/08/2011

Information to be completed by the secretariat	
SSC-Submission number	SSC-NM068
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Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.
2011/11/22

Summary of PP response to SSC-NM068 preliminary recommendation

	Comment by SSC-WG	PP response
Technology/measure and applicability conditions	· A threshold for "primarily renewable" should be provided and the applicability condition which check "primarily renewable" in the current and future grid) should be monitored throughout the crediting period. If monitoring of this condition is included, the applicability condition is not needed. Also, the consequence of non compliance should be specified in the methodology;	Methodology is revised to include monitoring of fraction of domestic renewable and non-renewable electricity supplied to the host country's electricity distribution network. Emissions associated with domestic non-renewable electricity are now factored into the project emission calculations. As suggested by the SSC-WG, this applicability condition was removed in the revised methodology.
	· Further specification and definition regarding "rural electrification" should be provided in order to ensure that the project activity is related with rural (and not urban) electrification;	Definition of "rural electrification" in the context of this methodology has been included in the revised methodology as follow:. 3. Definition of "rural electrification" in the context of this methodology is electrification of communities that does not have access to the host country's electricity distribution network prior to implementation of the project activity.
	· The methodology should have an applicability condition to avoid possible double counting among electricity generation companies, transmission companies, distribution companies, electricity users, and other possible implementers.	To avoid possible double counting among electricity generation companies, transmission companies, distribution companies, and electricity users, it is proposed to include following two new applicability conditions: 12. To avoid possible double counting among electricity generation companies, transmission companies, distribution companies, either all relevant parties are listed as participant to the project activity, or the project developer shall obtain a written consent from other relevant entities stating voluntary release of their right to develop CDM project activity and to claim CER sourced from the same electricity distribution project. 13. End users of the electricity distributed as the result of project activity are not allowed to apply this methodology to claim CER from consumption of electricity distributed by the project activity.

	Comment by SSC-WG	PP response
Baseline emissions	· Paragraph 15 states: "15. A default value of 0.8 tCO2e/MWh may be used for EFCO2 if it is confirmed that the project activity does not replace electricity distribution from stand-alone renewable electricity generation facilities existing in the project region." It is not clear how it would be confirmed that the project activity does or does not replace renewable generation in the region. One possibility is to check if the production of the renewable facilities existing in the project region before the project activity is the same (or higher) during the crediting period compared whit the historical average. The displacement of existing renewable electricity generation sources (such as renewable based mini-grid, stand alone Solar PV system etc) should be further addressed. The author of the submission may also explain the scenarios under which the existing renewable electricity generation sources are possibly replaced due to the implementation of the project activity.	As pointed out in the preliminary recommendation, the new methodology takes into account for the effect of replacement of renewable electricity by the project activity for quantifying the baseline emissions. There are two possible types of renewable electricity which may be replaced by the project activity. One is renewable based mini-grid, and the other is stand alone Solar PV system. <u>Renewable mini-grid</u> The newly proposed methodology aims to assist electrification of non-electrified area in host countries. Under this principle, the area supplied by mini-grid will continue to be supplied by the existing system. The project does not extend the distribution system to the area which is covered by existing mini-grid system. To ensure this condition, it is proposed to include following applicability condition to the proposed methodology: 7. The project does not displace existing renewable based mini-grid electricity. To ensure this condition, existing renewable based mini-grid system and their service area will be identified and confirmed that the project does not provide electricity to those identified area. <u>Stand Alone Solar PV system</u> The project may replace some of the existing stand-alone solar PV systems in the host country. However, it is the implicit assumption for this proposed new methodology that the all replaced stand-alone solar PV systems in the project area where distribution system is extended will be placed to other area with no electricity connection. Therefore the net effect of displacement of stand-alone solar PV system by the project activity would be null. This newly proposed methodology is

	Comment by SSC-WG	PP response
		anticipated to be applied in host countries with area of limited access to electricity. In such countries, any investment made for electricity supply will not be wasted unless additional investment is required to maintain such investment or the system operating life time is expired. Assumption made here is, thus, reasonable and realistic; all sand alone solar PV systems replace by the project would be utilized elsewhere so long as the systems are operational. Documentation proof of reuse of replaced solar PV system may be available. To reflect this condition, baseline emission factor will be adjusted as follows: 23. To quantify renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity ($EG_{renewable,y}$), project developer will prepare a list of existing stand-alone renewable power generation units in the project region for which electricity capacity is available through host country's energy statistic or equivalent document (e.g. host country's electricity development plan). This list shall be prepared ex-ante, validated by the DOE at the time of validation, and fixed throughout the project's lifetime. 24. For each identified existing stand-alone renewable power generation unit in the project region (listed as per paragraph 23), the fate of each relocated/removed unit shall be documented at the time of verification. Among the list of existing stand-alone renewable power generation units, all units removed due to implementation of the project activity shall be sub-listed and the destination of relocation is documented as per host country's electricity authority's records. For the units for which relocation document can not be provided, the baseline emission factor shall be discounted. Units removed due to the expiration of their lifetime shall be exempt from the discount if the expiration of equipment lifetime is confirmed through documented

	Comment by SSC-WG	PP response
		evidence. The renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity ($EG_{renewable,y}$) is determined as follows: $EG_{renewable,y} = \sum_i (EG_{renewable,replaced,i,ave})$ (4) Where: $EG_{renewable,replaced,i,ave}$: Historical average electricity generation of the identified existing stand-alone renewable power generation unit *i*, MWh/yr. The minimum historical annual generation record from three years may be applied, except for the system with less than three years of historical operation record. This value will be determined at the time of validation and fixed throughout the project life time. 25. In case historical electricity generation of the identified existing stand-alone renewable power generation units are available, annual power generation may be estimated using following equation and adopting a conservative load factor. $EG_{renewable,replaced,i,ave} = f \times E_{renewable,replaced,i} \times 8760hr$ **(5)** Where: f: Load factor of the identified existing stand-alone renewable power generation units replaced by the project activity. A conservative estimate shall be made. $E_{renewable,replaced,i}$: Generation capacity of the identified existing stand alone renewable power generation unit *i*, MW

	Comment by SSC-WG	PP response
	· For option 2, FCj,baseline (i.e. the amount of fuel consumption of fuel type j in the baseline) could be trend-adjusted based on historical fuel consumption data, similar to AMS-I.A;	It is proposed that Option 2 is removed from the methodology. As such this issue is no longer relevant.
	· Additional guidance is needed to implement the survey proposed in paragraph 20. The households surveyed should be the ones connected to the grid during the crediting period;	No longer relevant as Option 2 will be removed.
	· The Option 2 approach used to determine baseline emissions needs to be further addressed as the procedure proposed has fundamental problems. There is no relationship in the methodology between fossil fuel consumed (determined ex ante) and electricity distributed by the project activity. This lack of relationship could lead to situations where small amount of electricity is supplied in to households, and consumption of fossil fuel continues during the crediting period. The procedure provided in the methodology will result in an overestimation of emission reductions.	Thank you for pointing out the fundamental problem. Methodology developer is also aware of difficulty of distinguishing amount of fuel consumed in the baseline scenario for heat purpose. To avoid over estimation of baseline emission, it is proposed to remove option 2 all together.
Project activity emissions	· For project emissions, in case electricity is imported in the country a value of 1.3 tCO2/MWh is used as emission factor for the electricity imported. In principle, this is a very conservative assumption. However, the implicit assumption is that imports of electricity are not related with this project, as the emissions from the imported electricity are allocated	The implicit assumption for the project applying this methodology is that the host country is a net electricity exporter, i.e. the host country has surplus electricity generation capacity and the same condition continues even after project implementation. Thus electricity import in the host country is independent of the project activity. To ensure that the project activity only occurs in the host country who are either net

	Comment by SSC-WG	PP response
	over the whole electricity used in the country. This assumption should be further justified. The PPs may also wish to explore an alternative approach (still simplified and conservative) to estimate project emissions attributable to rural electrification that involves extension of national/regional grid.	exporter or who does not import electricity from neighbouring countries, following new applicability condition is suggested to be included: 13. In case the host country of the project activity imports electricity from neighbouring countries, to ensure that the electricity import in the host country is independent of the project activity, the project developer shall confirm that the host country continue to be a net electricity exporting country. This condition shall be confirmed by monitoring both imported and exported electricity of the host country.
Leakage	· The project activity could result in deforestation. Leakage provision to address such a situation should be provided in the methodology.	Provision for the possible leakage emission associated with deforestation due to the project was included in the revised methodology.
Monitoring	· For the monitoring of the amount of electricity distributed by the project activity, the proposed source is "document from electricity authority". This specification should be further clarified. We expect that this parameter is determined based on direct measurement say for example at nearest distribution substation(s).	To ensure that the parameter is determined based on direct measurement, the methodology is suggested to be revised as follows: "Document from electricity authority (or equivalent entity) of the host country, if it is the compilation of direct measurement of electricity distributed by the project activity, may be used in place of direct measurement records of electricity meters."
Minor issues	· It should be clarified that paragraph 18 refers to fossil fuels.	No longer relevant as Option 2 will be removed.

CDM: Recommendation Form for Small Scale Methodologies (version 01)

(To be used for presenting questions/proposals/amendments to the simplified methodologies for small-scale CDM project activity categories)

Date of SSC WG meeting:	30 January–02 February 2012, SSC WG 35
Title/Subject (give a small title or specify the subject of your submission, maximum 200 characters):	Rural electrification by extension of existing low carbon intensive electricity distribution network
Indicative methodology to which your submission relates (refer the items of Appendix B of the Simplified Modalities and Procedures), if applicable.	Proposal for a new Type III SSC methodology
Name of the authors of the query:	Chisato Nakade / Atsuko Nuibe Institution: Mitsubishi UJF Morgan Stanley Securities Co., Ltd. nakade-chisato@sc.mufg.jp, nuibe-atsuko@sc.mufg.jp

Summary of the query:

Please use the space below to summarize the query related to SSC methodologies/categories SSC Modalities and Procedures provide recommendation/analysis of the SSC WG.

Original text from Stakeholder:

The proposed new small scale methodology aims to offer simplified, but conservative, means for quantification of GHG emissions reduction associated with rural electrification project activity conducted in host countries with rich renewable energy resources.

To date, there is no existing approved CDM methodology which can be applied to the project activity involving rural electrification in the host country by extension of existing electricity distribution network. An approved small scale CDM methodology AMS-I.A may be used for rural electrification project activity involving installation of new electricity generation technology; however, it is not applicable to cases where the projects involve extension of existing electricity distribution network. Thus, a new small scale CDM methodology is proposed.

Applicability conditions

The proposed new small scale methodology is applicable only when the existing electricity distribution network supplies renewable electricity.

Project boundary

The project boundary under the proposed new methodology encompasses the physical extent of the power distribution network extended by the project activity and the physical, geographical site where the extended network distributes electricity.

Additionality

No special comments

Baseline emissions

In the proposed new small scale CDM methodology for the project activity, the electricity supplied by the extended electricity distribution network will replace the fossil fuel consumption of the technology in use

or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

Project emissions

This newly proposed small scale CDM methodology takes account of the project activity emissions relating to the consumption of internationally procured electricity in the host country. This project emission is conservatively quantified by assuming that all internationally procured electricity by the host country is from fossil fuel sources.

Leakage

No special comments

Emission reductions

No special comments

Recommendation by the SSC WG:

Please use the space below to provide amendments/change (in your expert view, if necessary).

Please refer to paragraph 5 of the meeting report of the SSC WG 35 <http://cdm.unfccc.int/Panels/ssc_wg>.

Answer to authors of query by the SSC WG:

Please use the space below to provide answer to the authors of the above query.

The small-scale working group of the CDM Executive Board would like to thank the author for the submission.

The SSC WG agreed to recommend a new methodology entitled SSC-III.AW "Electrification of rural communities by grid extension", as contained in annex 1 of the meeting report of the SSC WG 35. The methodology is intended for project activities aimed at the electrification of rural communities which do not have access to a grid. Technology/measures involve the extension of an existing national grid that is predominantly supplied with electricity from renewable energy-based power plants..

Signed by the Chair, Ms. Fatou Gaye

Date: 02/02/2012

Signed by the Vice-Chair, Mr. Peer Stiansen

Date: 02/0/2012

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Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall apply the general guidelines to SSC CDM methodologies and information on additionality (attachment A to Appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

III.AW Electrification of rural communities by grid extension

Technology/measure

1. This methodology comprises electrification of a rural community through extension of a national grid/regional grid (grid hereafter). The electricity distributed by the project activity displaces fossil fuel that would have been used in the absence of the project activity.

2. The applicability is limited to households and users[1] that do not have access to a grid.

3. Emission reductions can only be claimed if the share of electricity generation from renewable energy plants connected to the grid of the host country is greater than or equal to 99%[2] in total electricity generation in the grid of that host country in each year during the crediting period.

4. Cross border electricity export and import by the host country is quantifiable, and the data on import/export is available to the project developer.

5. The project does not involve construction of new electricity generation plants/units, but involves the extension of the existing power distribution network in the host country.

6. The project does not displace existing renewable based mini-grid electricity.[3] To ensure compliance with this condition, existing renewable based mini-grid system and their service area shall be identified and it is confirmed that the project does not provide electricity to the area serviced by the renewable based existing mini-grid system.

7. To avoid possible double counting of emission reduction claims from electricity generation companies, transmission companies, distribution companies, either all relevant parties are listed as participants to the project activity, or the project developer shall obtain a written consent from other relevant entities stating voluntary release of their right to develop CDM project activity and to claim emission reductions from the same electrification project activity. End users of the electricity

[1] It may include households, public buildings, small medium and micro enterprises (SMMEs), and electricity uses may include of interior or street lighting, refrigeration, agricultural water pumps.

[2] The purpose of keeping this threshold stringent is to simplify project emission calculations associated with incremental demand due to the project implementation in the grid and avoid complexity of calculating emissions from the operation of marginal power plants in the system required to cover the project activity demand. The concept of operating margin and build margin in the "Tool to calculate the emission factor for an electricity system" is to estimate baseline emissions and thus it would not be conservative to use the same concept in this methodology for project emissions. The project proponents are however encouraged to submit a request for revision of the methodology to include an alternative threshold or to exclude thresholds altogether with adequate provisions to determine project emissions.

[3] Displacement of standalone/facility scale renewable energy systems (e.g. solar PV system) is not excluded.

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

distributed as a result of project activity are not eligible to apply this methodology to claim emission reductions from consumption of electricity distributed by the project activity.

8. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

Boundary

9. The spatial extent of the project boundary encompasses the following:

(a). The spatial extent of the project boundary includes all power plants within the host country physically connected through transmission and distribution lines to the national electricity system[4] to which the CDM project is being connected to;

(b). The physical sites of the households, public services and other facilities that are supplied with electricity by the project activity (i.e. project region).

Baseline

10. The energy baseline is the fossil fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

11. The emission baseline based on the fuel consumed to generate equivalent quantity of electricity distributed by the project activity is calculated as follows.

$$BE_{CO2,y} = \sum_i ED_{i,y} * EF_{CO2} \quad \textbf{(1)}$$

Where:

$BE_{CO2,y}$	Emissions in the baseline in year y, tCO_2e/yr
EF_{CO2}	CO_2 emission factor, tCO_2e/MWh
$\sum_i$	The sum of the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution network to the project region i in year y, MWh/yr

12. A default value of 0.8 tCO_2e/MWh may be used for EF_{CO2} if it is confirmed that the project activity does not replace electricity distribution from stand-alone renewable electricity generation facilities existing in the project region. The proponent may, with adequate justification use a higher emissions factor from table I.F.1 under category AMS-I.F.

13. In case where the project replaces electricity from renewable sources, the default emission factor of 0.8 tCO_2e/MWh must be adjusted taking into account the renewable electricity replaced by the project activity.

[4] Refer to the most recent version of the "Tool to calculate the emission factor for an electricity system" for the definition of electricity system.

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

14. The following procedure is used to adjust the emission factor.

$$EF_{CO2,y} = (1-\beta) * 0.8 \quad \textbf{(2)}$$

$$\beta = EG_{renewable,y} / \sum_i ED_{i,y} \quad \textbf{(3)}$$

Where:

$EF_{CO2,y}$	CO_2 emission factor, tCO_2e/MWh
β	Discount fraction for electricity distributed by the project activity that replaces renewable electricity generated by the existing stand-alone renewable power generation units (e.g. solar PV system)
$EG_{renewable,y}$	Renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity, MWh/yr
$\sum_i$	The sum of the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution system to the project region *i* in year *y*, MWh/yr

15. To quantify renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity ($EG_{renewable,y}$), project developer will prepare a list of existing stand-alone renewable power generation units in the project region for which electricity generation capacity is available through host country's energy statistics or equivalent document (e.g. host country's electricity development plan). This list shall be prepared *ex ante*, validated by the DOE at the time of validation, and fixed throughout the project's lifetime.

16. For each identified existing stand-alone renewable power generation unit in the project region (listed as per paragraph 15), the fate of each relocated/removed unit shall be documented at the time of verification. Among the list of existing stand-alone renewable power generation units, all units removed due to implementation of the project activity shall be sub-listed and the destination of relocation is documented as per host country's electricity authority's records. For the units for which relocation document can not be provided, the baseline emission factor shall be discounted. Units removed due to the expiration of their lifetime shall be exempt from the discount if the expiration of equipment lifetime is confirmed through documented evidence. The renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity ($EG_{renewable,y}$) is determined as follows:

$$EG_{renewable,y} = \sum_i (EG_{renewable,replaced,i,ave}) \quad \textbf{(4)}$$

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

Where:

$EG_{renewable,replaced,i,ave}$	Historical average electricity generation of the identified existing stand-alone renewable power generation unit *i*, MWh/yr. At a minimum historical annual generation record from three years shall be applied, except for the system with less than three years of historical operation record. This value will be determined at the time of validation and fixed throughout the project life time

17. In case historical electricity generation of the identified existing stand-alone renewable power generation units are not available, annual power generation may be estimated using following equation and adopting a conservative load factor.

$$EG_{renewable,replaced,i,ave} = f * E_{renewable,replaced,i} * 8760 \quad \textbf{(5)}$$

Where:

f	Load factor of the identified existing stand-alone renewable power generation units replaced by the project activity. A conservative estimate shall be made for example through strategic surveys and research conducted by national or local organizations, initiatives by international organizations or non governmental organizations or the project proponent to collect reliable and comprehensive data
$E_{renewable,replaced,i}$	Installed capacity of the identified existing stand alone renewable power generation unit *i*, MW

Baseline emissions from consumers historically connected to a mini-grid (exclusively diesel based)

18. Where the grid electricity extension project displaces an existing mini-grid that is exclusively powered by diesel generators, the baseline for the amount of electricity historically supplied through the mini-grid will be different and base line emissions are calculated based on the historical emissions of the existing mini-grid as follows.

$$BE_{hist,y} = EG_{hist} * EF_{hist} \quad \textbf{(6)}$$

Where:

$BE_{hist,y}$	Baseline emissions from consumers historically connected to a mini-grid (tCO_2)
EG_{hist}	Historical electricity generation from existing mini-grid (MWh)
EF_{hist}	Historical emissions factor for the mini-grid (tCO_2/MWh)

19. The historical emissions factor for the mini-grid is calculated from total fuel consumption and generation from mini-grid connected plants for the most recent three years.

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

$$EF_{hist} = \frac{\sum_{i} \left(FC_{hist,i} * NCV_{i} * EF_{CO2,i} \right)}{\sum GEN_{hist}} \quad \textbf{(7)}$$

Where:

EF_{hist}	Historical emissions factor for the mini-grid (tCO_2/MWh)
$FC_{hist,i}$	Historical consumption of fossil fuel type *i* in all mini-grid plants (tonnes)
NCV_{i}	Net Calorific Value of fossil fuel type *i* (GJ/tonne)
$EF_{CO2,i}$	Emission factor for fossil fuel type *i* (tCO_2/GJ)
GEN_{hist}	Historical electricity generation from all mini-grid plants (MWh)

20. For existing facilities with less than three years of operational data, all historical data shall be available (a minimum of one year data would be required). In the case of no historical data/information on baseline parameters such as efficiency, energy consumption and output (e.g. the available data is not reliable due to various factors such as the use of imprecise or non-calibrated measuring equipment), the baseline parameters can be determined using a performance test/measurement campaign to be carried out prior to the implementation of the project activity. The project proponent may follow the relevant provisions from the "Tool to determine baseline efficiency of thermal and electricity systems".

Leakage

21. Leakage on account of construction of new transmission/distribution lines (e.g. carbon stock loss due to deforestation) shall be calculated using the method indicated in baseline and monitoring methodology AM0045 "Grid connection of isolated electricity systems". If the estimated leakage is within 5% of the estimated emission reductions of the project, then this leakage source may be neglected, otherwise the leakage shall be deducted from the emissions reductions.

Project activity emissions

22. For the period where the host country is a net importer, the project emissions shall be calculated for that period at least on a monthly basis using the following equation. Project emissions are zero during the period the host country is net exporter.

$$PE_{y} = \sum_{t}^{P} ED_{i,t} * EF_{CO2,import,y} \quad \textbf{(8)}$$

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

If $EG_{export,t} > EG_{import,t}$, then $EF_{CO2,import,y} = 0$

Where:

PE_y	Project emissions in year *y*, tCO_2e/yr
$\sum_t^P$	The sum of period during which the country is net importer, *t* can be hourly or daily or monthly
$EG_{import,t}$	Amount of electricity imported into the grid from other countries and monitored hourly or daily or monthly in a given year *y*, MWh
$EG_{export,t}$	Amount of electricity exported from the grid to other countries and monitored hourly or daily or monthly in a given year *y*, MWh
$ED_{i,t}$	Amount of electricity distributed by the extended electricity distribution system to project region i, monitored hourly or daily or monthly in a given year *y*, MWh
$EF_{CO2,import,y}$	CO_2 emission factor for the electricity the host country procured internationally, tCO_2e/MWh (Use 1.3 tCO_2/MWh)

Emission reductions

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

$$ER_y = BE_y - PE_y - LE_y \quad (9)$$

Monitoring

24. Monitoring shall consist of the following parameters listed in Table 1 below.

25. The applicable requirements specified in the "General Guidelines to SSC CDM methodologies" (e.g. calibration requirements, sampling requirements) are also an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participants.

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

Table 1: Parameters for monitoring

No.	Parameter	Description	Unit	Monitoring /recording frequency	Measurement methods and procedures
1	ED_y	Amount of electricity distributed by the extended electricity distribution system to the project region *i* in year *y*	MWh/y	Continuous measurement by electricity meter(s), aggregated hourly or daily or monthly	Measured using calibrated electricity meter(s). Measured from the supply point that serves the project area, whether that is the nearest existing transmission/distribution sub-station, a feeder from that station, or a new branch in a distribution line that serves the project area. The distribution losses shall be deducted from the amount of electricity measured. A default value of 10% shall be used for average annual technical distributions losses. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to estimate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity (N_{meter}). Standard for sampling and surveys for CDM project activities and programme of activities" may be referred for sampling

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

No.	Parameter	Description	Unit	Monitoring /recording frequency	Measurement methods and procedures
					procedures. Validity of information source will be verified by DOE at the time of verification. Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method
2	N_{meter}	Number of electricity meters installed by the project activity	-	Recorded annually	Recorded by project developer
3	$EG_{import,t}$	The amount of electricity the host country imported from other countries in year *y*	MWh/y	Continuous measurement by electricity meter(s) aggregated hourly or daily or monthly	Data is sourced from host country electric authority/utility (e.g. from load dispatch centres)
4	$EG_{export,t}$	The amount of electricity the host country exported to other countries in year *y*	MWh/y	Continuous measurement by electricity meter(s) aggregated hourly or daily or monthly	Data is sourced from host country electric authority/utility (e.g. from load dispatch centres)

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.AW. Electrification of rural communities by grid extension (cont)

No.	Parameter	Description	Unit	Monitoring /recording frequency	Measurement methods and procedures
5		Electricity generation in year *y* from all the power plants (renewable and others), that are within the host country, and are physically connected to the grid to which the CDM project is connected to (as per paragraph 3)	MWh/y	At least monthly, aggregated annually	Data is sourced from host country electric authority/utility (e.g. from load dispatch centres)

Project activity under a programme of activities

26. The methodology is applicable to a programme of activities, no additional leakage estimations are necessary other than that indicated under leakage section above.

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History of the document

Version	Date	Nature of revision
01.0	EB 66, Annex 50 2 March 2012	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		

**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Rural Electrification Project for Clean Energy, Better Living and Sustainable Growth in Bhutan
Version number of the PDD	01
Completion date of the PDD	27/4/2012
Project participant(s)	Bhutan Power Corporation Limited. (BPC)
Host Party(ies)	Bhutan
Sectoral scope(s) and selected methodology(ies)	Sectoral scope 2, AMS-III.AW version01.0
Estimated amount of annual average GHG emission reductions	6,092 ton CO_2e

Note:

- The draft PDD attached to the new methodology submission has been revised using the latest PDD format adopted by UNFCCC.
- This PDD is a draft and is subject to further revision; however, this draft provides the general idea of the final PDD.
- Deforestation related leakage emissions in the PDD were calculated based on following assumptions: (a) 1000 ha as the deforested area, and (b) 75 tC/ha as the carbon intensity for unit deforested area. Determination of the basis for the leakage is the subject for future investigation.
- At this stage, the assumption used for deforestation leakage may be modified upon request of local counterparts.
- Section D (Environmental impact) and Section E (local stakeholder consultation) of the PDD were not required in the draft PDD attached to the new methodology submission. These sections will be updated upon receipt of relevant information from local counterparts.

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SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The objective of the Project activity is to promote electrification of remote rural areas in the Kingdom of Bhutan and replace currently consumed fossil fuel based energy in rural area with renewable energy through extension of the existing low carbon intensive electricity distribution network.

Bhutan is well known for its rich renewable energy potential, especially hydropower. All power units supplying the electricity to the national power distribution network in the country are met from hydropower based generation. The export of Bhutan's surplus hydropower generation has been contributing to reduce GHG emissions in their neighbouring country India, by exporting the majority of the renewable electricity generated in the country. The rural communities in Bhutan, however, have not received the benefits of the country's vast renewable energy potential. The electrification rate in the country remains as low as 54%; over 33,000 households in 1,716 non-electrified rural villages have no access to electricity. In these villages, conventional fuels such as kerosene, diesel, LPG, and candles, are used for lighting, heating, and other purposes, all of which could have been served by the hydropower based renewable electricity.

If the project activity is successfully implemented and the electricity distribution network is expanded to the non-electrified areas in the host country, a large fraction of this conventional fuel currently consumed in rural area of the country will be replaced by the less carbon intensive electricity supplied through the country's power distribution system. The project activity aims to achieve the electrification rate in the country to 100% by electrifying more than 33,000 non-electrified households in rural area, and is expected to result in 6,092 tCO_2e of emission reductions per year on average.

The project activity will be implemented and managed by Bhutan Power Corporation Limited (BPC), one of the largest corporations in Bhutan who solely manages transmission and distribution of power in the country.

The project activity contributes to the sustainable development of Bhutan as follows:

Social benefits:

- Provides rural households access to cleaner, reliable energy;
- Improves the rural living standard in Bhutan, contributing to equalization of the urban and rural disparity;

Environmental benefits:

- Reduces GHG emissions by displacing fossil fuels currently consumed in the non-electrified households in rural region in Bhutan;
- Reduces air pollution due to fossil fuel combustion;
- Improves the indoor hygiene of rural households;

Economic benefits:

- Generates CER revenues, which will be used to maintain the domestic power distribution network;
- Reduces energy cost associated with fossil fuels consumption.

Baseline study for this project activity was conducted by Clean Energy finance Committee, Mitsubishi UFJ Morgan Stanley Securities CO., Ltd., who is the CDM advisor to the Project (not a project participant).

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A.2. Location of project activity

A.2.1. Host Party(ies)

Kingdom of Bhutan

A.2.2. Region/State/Province etc.

The project region is defined as non-electrified area in all the 20 Dzongkhags (equivalent to districts) of the country listed as follows:

Table 1. List of districts in the project region

i	Dzongkhag	i	Dzongkhag
1	Lhuntse	11	Tsirang
2	Pemagatshel	12	Bumthang
3	Samdrup Jongkhar	13	Thimphu
4	Punakha	14	Gasa
5	Sarpang	15	Samtse
6	Trashigang	16	Trongsa
7	Wangdue Phodrang	17	Zhemgang
8	Mongar	18	Paro
9	Dagana	19	Haa
10	Trashiyangste	20	Chukha

A.2.3. City/Town/Community etc.

The non-electrified area in 20 Dzongkha of the country listed in the previous section.

A.2.4. Physical/ Geographical location

The physical locations of each Dzongkgag are showed in Figure A.1.

Figure A.1: Physical location of the project

The Kingdom of Bhutan has an area of 38,394 square kilometers and it lies between 26°45’ N to 28°14’N and 88°45’E to 92°10’E measuring about 170 km north to south and stretching roughly around 300 km

east to west in dimension. The land rises from an elevation of about 160 meters above sea level in the south to more than 7,550 meters above sea level in the north.

A.3. Technologies and/or measures

(1) Types and categories of the small-scale project activity

In accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project activities ("SSC M&P"), the proposed project falls under the following types and categories:

Type III: Other Project Activities
Category (to be assigned): Rural electrification by extension of existing low carbon intensive electricity distribution network.
Sectoral Scope 02 Energy distribution

(2) Technology of the small-scale project activity

The project involves extension of existing low carbon intensive electricity distribution network within the project region. By implementing this project, the same low carbon intensive electricity currently utilized in the existing distribution network will replace the fossil fuel that would have been consumed in the absence of the project activity to generate the equivalent quantity of energy.

The scope of the project activity includes construction of medium voltage (MV: 11kV and 33kV) lines and low voltage (LV: 0.4kV) lines of the distribution line over the project region. The project expects to extend the MV line and LV line about 900km and 1500km respectively.

The project activity will be implemented in two phases.

Phase I: electrification of 17,379 households
Phase II: electrification of 16,057 households

The project region encompasses all 20 Dzongkhags. Numbers of households planned to be electrified by the project activity in each Dzongkhag are shown in the table below[1].

Table 2: Number of households planned to be electrified by the project activity

No	Dzongkhag	Number of Households		
		Phase I	Phase II	Total
1	Lhuntse	778	646	1,427
2	Pemagatshel	1,064	788	1,852
3	Samdrup Jongkhar	1,871	1,198	3,069
4	Punakha	215	16	231
5	Sarpang	794	946	1,740
6	Trashigang	883	812	1,695
7	Wangdue Phodrang	337	683	1,020
8	Mongar	1,007	1,735	2,742
9	Dagana	2,554	1,258	3,812
10	Trashiyangste	847	494	1,341
11	Tsirang	2,591	1,141	3,732

[1] The number of households listed is based on the initial planning of the project activity. The actual number of households electrified by the project activity may be different from the numbers stipulated in the table. The actual figure will be reported in the monitoring report.

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12	Bumthang	591	0	591
13	Thimphu	0	17	17
14	Gasa	0	219	219
15	Samtse	2,223	2,707	4,930
16	Trongsa	1,142	301	1,443
17	Zhemgang	0	1,623	1,623
18	Paro	17	44	61
19	Haa	0	166	166
20	Chukha	465	1,260	1,725
Total		**17,379**	**16,057**	**33,436**

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Kingdom of Bhutan (Host)	Bhutan Power Cooperation Limited (BPC)	No

A.5. Public funding of project activity

The project activity does not result in the diversion of Official Development Assistance (ODA).

A.6. Debundling for project activity

As defined in the "Guidelines on assessment of debundling for SSC project activities" Version 03, a proposed small-scale project activity is considered a debundled component of a large scale project activity if there is a registered small-scale CDM project activity or an application to register another small-scale project activity:

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The proposed project activity is not a debundled component of a large project activity since none of the above conditions applies to the project activity.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

The baseline and monitoring methodologies applied for the project is:

AMS-III.AW version01.0: "Electrification of rural communities by grid extension"

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B.2. Project activity eligibility

The proposed project activity is the electrification of rural villages through extension of the existing low carbon intensive electricity distribution network in Kingdom of Bhutan.

The project meets all the applicability conditions listed in the applied methodology as follows:

AMS-III.AW version01.0 Applicability conditions	Compliance
1. This methodology comprises electrification of a rural community through extension of a national grid/regional grid (grid hereafter).	The proposed project activity is the electrification of rural villages through extension of the existing low carbon intensive electricity distribution network in Kingdom of Bhutan.
2. The applicability is limited to households and users that do not have access to a grid.	The project is to provide access to electricity to the communities where there is no access to a grid prior to the project activity.
3. Emission reductions can only be claimed if the share of electricity generation from renewable energy plants connected to the grid of the host country is greater than or equal to 99% in total electricity generation in the grid of that host country in each year during the crediting period.	The share of electricity generation from renewable energy plants connected to the grid in the host country is greater than or equal to 99% in total electricity generation in the grid in the host country.
4. Cross border electricity export and import by the host country is quantifiable, and the data on import/export is available to the project developer.	Cross border electricity export and import by the host country is quantifiable, and the data on import/export is available to the project developer.
5. The project does not involve construction of new power plants/units, but involves only the extension of the existing power distribution network in the host country.	The project does not involve construction of new power plants/units. Moreover, the project involves only extension of existing power distribution network to supply electricity to remote rural area in Bhutan.
6. The project does not displace existing renewable based mini-grid electricity. To ensure compliance with this condition, existing renewable based mini-grid system and their service area shall be identified and it is confirmed that the project does not provide electricity to the area serviced by the renewable based existing mini-grid system.	The project does not displace existing renewable based mini-grid electricity. Existing renewable based mini-grid system and their service area shall be identified and it is confirmed that the project does not provide electricity to the area serviced by the renewable based existing mini-grid system. Relevant document will be available for DOE's review at the validation.
7. To avoid possible double counting of emission reduction claims from electricity generation companies, transmission companies, distribution companies, either all relevant parties are listed as participants to the project activity, or the project developer shall obtain a written consent from other relevant entities stating voluntary release of their right to develop CDM project activity and to claim emission reductions from the	BPC is responsible for transmission and distribution of electricity in Bhutan. There are no other relevant parties who could be listed as participant to the project activity.

DRAFT

same electrification project activity. End users of the electricity distributed as a result of project activity are not eligible to apply this methodology to claim emission reductions from consumption of electricity distributed by the project activity.	
8. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	The expected emission reduction expected from the project activity is up to approximately 19kt CO_2 equivalent annually, which is less than the limit of 60kt CO_2.

B.3. Project boundary

The spatial extent of the project boundary encompasses the following:
(a). The spatial extent of the project boundary includes all power plants within the host country physically connected through transmission and distribution lines to the national electricity system4 to which the CDM project is being connected to;
(b). The physical sites of the households, public services and other facilities that are supplied with electricity by the project activity (i.e. project region).

B.4. Establishment and description of baseline scenario

As prescribed in the applied methodology AMS-III.AW. version01.0, the energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

Prior to the implementation of the project activity, communities within the project region had no access to the electricity distribution network in the country. In these communities, conventional fuels such as kerosene, diesel, LPG, and candles, are used for lighting, heating, and other purposes which could have been served by the renewable electricity.

B.5. Demonstration of additionality

Following the "Guidelines for demonstrating additionality of microscale project activities ", Version 03[2], Type III project activities that aim to achieve emissions reductions at a scale of no more than 20 ktCO_2e per year, are additional if any one of the following conditions is satisfied:

(a) The geographic location of the project activity is in one of the Least Developed Countries or the Small Island Countries (LDCs/SIDs) or in a special underdeveloped zone of the host country identified by the Government before 28 May 2010;

(b) The project activity is an emission reduction activity with both conditions (i) and (ii) satisfied;
(i) Each of the independent subsystems/measures in the project activity achieves an estimated annual emission reduction equal to or less than 600tCO_2e per year; and

(ii) End users of the subsystems or measures are households/communities/SMEs.

The Project satisfies the conditions (a) above. Bhutan is recognised by the UNFCCC as a Least Developed Country (LDC). The estimated emissions reductions of the project activity are 19 ktCO_2e per

[2] EB63 Report Annex 23; http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid22.pdf

DRAFT

year or 6ktCO_2e per year on annual average basis, which is less than 20 ktCO_2e. As such the Project is considered additional.

Prior consideration of CDM

CDM has been considered seriously prior to the start of the project activity.

B.6. Emission reductions
B.6.1. Explanation of methodological choices

Baseline emissions

As stipulated in AMS-III.AW version01.0 paragraph 10, the energy baseline is the fossil fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy.

The emission baseline based on the fuel consumed to generate equivalent quantity of electricity distributed by the project activity is calculated as follows:

$$BE_{CO2,y} = \sum_i ED_{i,y} * EF_{CO2} \quad (1)$$

Where:

$EB_{CO2,y}$	Emissions in the baseline in year y, tCO_{2e}/yr
EF_{CO2}	CO_2 emission factor, tCO_{2e}/MWh
$\sum_i$	The sum of the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution network to the project region *i* in year *y*, MWh/yr

The project activity does not plan to replace electricity distribution from renewable electricity generation facilities existing in the project region. Therefore, CO_2 emission factor for the project activity will be set to the default value (0.8 tCO2e/MWh) stipulated in the applied methodology. The project will adjust the emission factor following the procedures outlined in AMS-III.AW version01.0 in case where the project replaces electricity from renewable sources:

$$EF_{CO2,y} = (1 - \beta) * 0.8 \quad (2)$$
$$\beta = EG_{renewable,y} / \sum_i ED_{i,y} \quad (3)$$

Where:

$EF_{CO2,y}$	CO_2 emission factor, tCO_{2e}/MWh
β	Discount fraction for electricity distributed by the project activity that replaces renewable electricity generated by the existing stand-alone renewable power generation units.
$EG_{renewable,y}$	Renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity, MWh/yr
$\sum_i$	The sum over the group of project regions
$ED_{i,y}$	Electricity distributed by the extended electricity distribution system to the project region *i* in year *y*, MWh/yr

DRAFT

A list of existing stand-alone renewable power generation units in the project region for which electricity generation capacity is available through host country's energy statistics or equivalent document will be presented to the DOE at the time of validation.

Project emissions

For the period where the host country is a net importer, the project emissions shall be calculated for that period at least on a monthly basis using the following equation. Project emissions are zero during the period the host country is net exporter.

$$PE_y = \sum_{t}^{P} ED_{i,t} \times EF_{CO2,import,y}$$

If $EG_{export,t} > EG_{import,t}$, then $EF_{CO2,import,y} = 0$

Where:

PE_y	Project emissions in year y, tCO_2e/yr
$EG_{import,t}$	Amount of electricity imported into the grid from other countries and monitored hourly or daily or monthly in a given year y, MWh
$EG_{export,t}$	Amount of electricity exported from the grid to other countries and monitored hourly or daily or monthly in a given year y, MWh
$ED_{i,t}$	Amount of electricity distributed by the extended electricity distribution system to project region I, monitored hourly or daily or monthly in a given year y, MWh
$EF_{CO2,import,y}$	CO_2 emission factor for the electricity the host country procured internationally, tCO_2e/MWh (use 1.3 tCO_2e/MWh)

Leakage emissions

As per the applied methodology AMS-III.AW.version01.0, leakage on account of construction of new transmission/distribution lines (e.g. carbon stock loss due to deforestation) shall be calculated using the method indicated in baseline and monitoring methodology AM0045 "Grid connection of isolated electricity systems". If the estimated leakage is within 5% of the estimated emission reductions of the project, then this leakage source may be neglected, otherwise the leakage shall be deducted from the emissions reductions.

$LE_1 = A_{def} \times L_C$

Where:

LE_1	Leakage emissions to be accounted in the first year of project crediting period, in tCO_2e
A_{def}	Area of land deforested, in hectares
L_C	Carbon stock per unit area, in tCO_2/hectare

Emission reductions

The emission reduction from the project activity (ER_y) is calculated as the difference between the baseline emissions ($BE_{CO2,y}$) and the sum of the project emissions ($PE_{CO2,y}$) and leakage (LE).

DRAFT

Emission reductions are calculated as follows:

For the first year of the project crediting period (y=1)

$ER_1 = BE_{CO2,1} - PE_{CO2,1} - LE_1$

Where:

ER_y	Emission reductions in the year *y*; tCO_2e
$BE_{CO2,y}$	Emissions in the baseline in the year, *y*; tCO_2e
$PE_{CO2,y}$	Project emissions in the year, *y*; tCO_2e
LE_1	Leakage emissions to be accounted in the year 1 of the project crediting period; tCO_2e

$ER1 = 0$ if $LE1 > (BE_{CO2,1} - PE_{CO2,1})$ and LE_1 will be offset by emission reductions from subsequent years.

For other years of the project crediting period (y=2 and beyond),

$ER_y = 0$ *if Cumulative ER < 0 for the year until LE1 is fully offset.*

Else,

$ER_y = BE_{CO2,y} - PE_{CO2,y}$

Where:

ER_y	Emission reductions in the year *y*; tCO_2e
$BE_{CO2,y}$	Emissions in the baseline in the year, *y*; tCO_2e
$PE_{CO2,y}$	Project emissions in the year, *y*; tCO_2e

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$EG_{enewable,y}$
Unit	MWh/yr
Description	Renewable electricity generated from existing stand-alone generation units in the project region expected to be replaced by the project activity
Source of data	Power data issued by Department of Renewable Energy (DRE) or BPC
Value(s) applied	0
Choice of data or Measurement methods and procedures	DRE is responsible for renewable electricity generation with less than 25MW capacity. All stand-alone renewable power generation units are managed under DRE, thus DRE is the best source of this information.
Purpose of data	Calculation of baseline emissions
Additional comment	

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Data / Parameter	A_{def}
Unit	hectare
Description	Area of land deforested
Source of data	Project developer
Value(s) applied	1,000
Choice of data or Measurement methods and procedures	Estimated deforested area based on assumption that half of area covered by right of way is subject to deforestation.
Purpose of data	Calculation of leakage emissions
Additional comment	

Data / Parameter	L_C
Unit	tC/hectare
Description	Carbon stock per unit area
Source of data	Project developer
Value(s) applied	75.4
Choice of data or Measurement methods and procedures	Carbon stock per unit area was calculated based on Global Forest Resources Assessment 2010 (FRA 2010) available via FAO website http://www.fao.org/forestry/fra/fra2010/en/
Purpose of data	Calculation of leakage emissions
Additional comment	

B.6.3. Ex-ante calculation of emission reductions

Baseline emissions

The project activity expects to distribute 24,074 MWh of electricity to the communities

$$\beta = EG_{renewable,y} / \sum_i ED_{i,y}$$
$$= 0 / 24{,}074$$
$$= 0$$

$$EF_{CO2,y} = (1 - \beta) * 0.8$$
$$= (1 - 0) * 0.8$$
$$= 0.8$$

$$BE_{CO2,y} = \sum_i ED_{i,y} * EF_{CO2}$$
$$= 24{,}074 * 0.8$$
$$= 19{,}259\ tCO_2e/yr$$

Project emissions

	$EG_{export,month}$	$EG_{import,month}$	**Status**
January			Net export
February			Net export

DRAFT

March			Net export
April			Net export
May			Net export
June			Net export
July			Net export
Augusut			Net export
September			Net export
October			Net export
November			Net export
December			Net export

Because $EG_{export,month} > EG_{import,month}$ throughout the year, then $EF_{CO2,import,y} = 0$

$$PE_y = \sum_t^P ED_{i,t} \times EF_{CO2,import,y}$$

$$= 24{,}074 \times 0$$

$$= 0$$

Leakage

$LE_1 = A_{def} \times L_C$

= 1,000 ha × 276.5 tCO_2e/ha

= 276,500 tCO_2e

Emission reductions

$ER_1 = BE_{CO2,1} - PE_{CO2,1} - LE_1$

$ER_y = 0$ *if Cumulative ER<0 for the year, else,*

$Ery = BE_{CO2,y} - PE_{CO2,y}$

Year (y)	ER_y	*Cumulative ER*	$BE_{CO2,y}$	PE_y	LE_y
2013	0 tCO_2	-267,234 tCO_2	19,259 tCO_2	0 tCO_2	276,500 tCO_2
2014	0 tCO_2	-247,975 tCO_2	19,259 tCO_2	0 tCO_2	0
2015	0 tCO_2	-228,716 tCO_2	19,259 tCO_2	0 tCO_2	0
2016	0 tCO_2	-209,457 tCO_2	19,259 tCO_2	0 tCO_2	0
2017	0 tCO_2	-190,198 tCO_2	19,259 tCO_2	0 tCO_2	0
2018	0 tCO_2	-170,939 tCO_2	19,259 tCO_2	0 tCO_2	0
2019	0 tCO_2	-151680tCO_2	19,259 tCO_2	0 tCO_2	0
2020	0 tCO_2	-132421tCO_2	19,259 tCO_2	0 tCO_2	0
2021	0 tCO_2	-116162tCO_2	19,259 tCO_2	0 tCO_2	0
2022	0 tCO_2	-93903tCO_2	19,259 tCO_2	0 tCO_2	0
2023	0 tCO_2	-74644tCO_2	19,259 tCO_2	0 tCO_2	0
2024	0 tCO_2	-55385tCO_2	19,259 tCO_2	0 tCO_2	0
2025	0 tCO_2	-36126tCO_2	19,259 tCO_2	0 tCO_2	0
2026	0 tCO_2	-16867tCO_2	19,259 tCO_2	0 tCO_2	0
2027	2,392 tCO_2	2,392 tCO_2	19,259 tCO_2	0 tCO_2	0

DRAFT

2028	19,259 tCO_2	21,651 tCO_2	19,259 tCO_2	0 tCO_2	0
2029	19,259 tCO_2	40,910 tCO_2	19,259 tCO_2	0 tCO_2	0
2030	19,259 tCO_2	60,169 tCO_2	19,259 tCO_2	0 tCO_2	0
2031	19,259 tCO_2	79,428 tCO_2	19,259 tCO_2	0 tCO_2	0
2032	19,259 tCO_2	98,687 tCO_2	19,259 tCO_2	0 tCO_2	0
2033	19,259 tCO_2	117,946 tCO_2	19,259 tCO_2	0 tCO_2	0

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2 e)	Project emissions (tCO_2 e)	Leakage (tCO_2 e)	Emission reductions (tCO_2 e)
2013	19,259 tCO_2	0 tCO_2	276,500 tCO_2	0 tCO_2
2014	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2015	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2016	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2017	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2018	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2019	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2020	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2021	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2022	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2023	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2024	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2025	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2026	19,259 tCO_2	0 tCO_2	0 tCO_2	0 tCO_2
2027	19,259 tCO_2	0 tCO_2	0 tCO_2	2,392 tCO_2
2028	19,259 tCO_2	0 tCO_2	0 tCO_2	19,259 tCO_2
2029	19,259 tCO_2	0 tCO_2	0 tCO_2	19,259 tCO_2
2030	19,259 tCO_2	0 tCO_2	0 tCO_2	19,259 tCO_2
2031	19,259 tCO_2	0 tCO_2	0 tCO_2	19,259 tCO_2
2032	19,259 tCO_2	0 tCO_2	0 tCO_2	19,259 tCO_2
2033	19,259 tCO_2	0 tCO_2	0 tCO_2	19,259 tCO_2
Total	404,439 tCO_2	0 tCO_2	276,500 tCO_2	127,939 tCO_2
Total number of crediting years	21			
Annual average over the crediting period	19,259 tCO_2	0 tCO_2	13,167 tCO_2	6,092 tCO_2

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B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

(Copy this table for each data and parameter.)

Data / Parameter	$ED_{i,y}$
Unit	MWh/y
Description	Amount of electricity distributed by the extended electricity distribution system to the project region i in year y
Source of data	Bhutan Power Corporation Limited
Value(s) applied	
Measurement methods and procedures	Measured from the supply point that serves the project area, whether that is the nearest existing transmission/distribution sub-station, a feeder from that station, or a new branch in a distribution line that serves the project area. The distribution losses shall be deducted from the amount of electricity measured. A default value of 10% shall be used for average annual technical distributions losses. When multiple electricity meters are installed for monitoring of electricity distributed by the project activity (e.g. meters are installed for each household), sampling approach may be used to estimate the total amount of electricity distributed by the project activity. The average electricity measured per meter derived from sampling will be multiplied by the total number of meters installed under the project activity (N_{meter}). Standard for sampling and surveys for CDM project activities and programme of activities may be referred for sampling procedures. Validity of information source will be verified by DOE at the time of verification. Calibration record of electricity meter(s) may be checked for a sample of meters selected using simple random sampling method
Monitoring frequency	Measured continuously by energy meters, recorded at least monthly. Recorded data is aggregated and maintained by BPC
QA/QC procedures	Measured using calibrated electricity meter(s). Electricity meter will undergo calibration in accordance with the requirement stipulated by electricity sector in Bhutan
Purpose of data	Calculation of baseline emissions and project emissions
Additional comment	

Data / Parameter	N_{meter}
Unit	-
Description	Number of electricity meters installed by the project activity
Source of data	Project developer's record
Value(s) applied	
Measurement methods and procedures	Recorded by BPC
Monitoring frequency	Recorded annually
QA/QC procedures	
Purpose of data	
Additional comment	

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Data / Parameter	$EG_{import,month}$
Unit	MWh/y
Description	The amount of electricity the host country imported from other countries in year y
Source of data	DRE/BPC
Value(s) applied	
Measurement methods and procedures	Data sourced from host country electric authority/utility
Monitoring frequency	Continuous measurement by electricity meter(s) aggregated monthly
QA/QC procedures	
Purpose of data	Calculation of project emissions
Additional comment	

Data / Parameter	$EG_{export,month}$
Unit	MWh/y
Description	The amount of electricity the host country exported to other countries in year y
Source of data	DRE/BPC
Value(s) applied	
Measurement methods and procedures	Data sourced from host country electric authority/utility
Monitoring frequency	Continuous measurement by electricity meter(s) aggregated monthly
QA/QC procedures	
Purpose of data	Calculation of project emissions
Additional comment	

Data / Parameter	
Unit	MWh/y
Description	Electricity generation in year y from all the power plants (renewable and others), that are within the host country, and are physically connected to the grid to which the CDM project is connected to.
Source of data	DRE/BPC
Value(s) applied	
Measurement methods and procedures	Data sourced from host country electric authority/utility
Monitoring frequency	At least monthly, aggregated annually
QA/QC procedures	
Purpose of data	
Additional comment	

B.7.2. Sampling plan

[If the project plans to adopt sampling for monitoring, this section will be elaborated accordingly.]

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B.7.3. Other elements of monitoring plan

Management structure of CDM project

In order to meet the CDM monitoring and reporting requirements, BPC will implement following monitoring scheme.

Appoint:

1. A CDM Project Director;
2. A Monitoring Manager; and
3. Several Monitoring Engineers within the Project boundary

The functions and respective responsibilities of the above personnel shall be the following:

1. Monitoring Engineers (ME): The Monitoring Engineers (ME) located in the field shall manage the daily operation and maintenance of the project. Meters are installed at each consumer's premise and the ME has the responsibility to carry our meter reading, issuing bills, and collecting the revenue based on the actual consumption of electricity. Therefore, ME shall thus collect the data from the project sites periodically and submit it to the Monitoring Manager. The Managers of the Electricity Services Divisions (ESD) of BPC will be responsible for this work.

2. Monitoring Manager (MM): The MM receives the report from the Monitoring Engineers (ME) based on the stipulated monitoring plan. The Monitoring Manager (MM) shall prepare a monitoring report based on the information submitted by the ME and submits to the CDM Project Director on a monthly and annual basis.

3. CDM Project Director (PD): The Project Director for the CDM project receives periodical reports from the Monitoring Manager and organizes it in the form of a "CDM Project Monitoring Report" to be submitted to the Designated Operation Entity (DOE). Also, the PD shall manage the CDM project coordination with the Government and stakeholders.

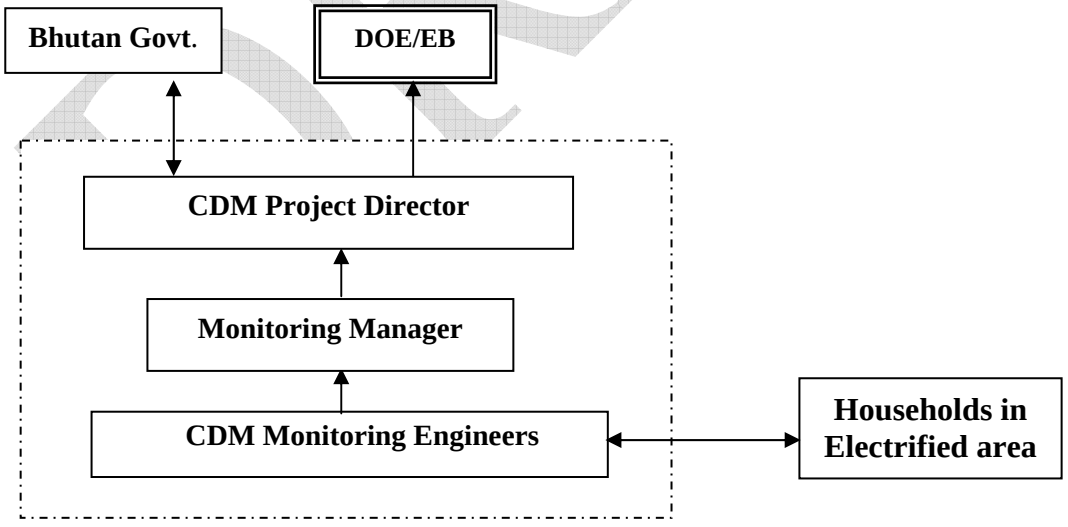

Figure: Operation and Management Scheme

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity

26 February 2010

C.1.2. Expected operational lifetime of project activity

At least 25 years

C.2. Crediting period of project activity
C.2.1. Type of crediting period

Renewable crediting period

C.2.2. Start date of crediting period

01/01/2013 or the date of registration whichever is later

C.2.3. Length of crediting period

21 years

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts

The "Environmental Assessment (EA) Act 2000", together with the "Regulation for the Environmental Clearance of Projects" and "Regulation in Strategic Environmental Assessment" comprises legislation relating to environmental impact assessment (EIA) in Bhutan. The "Sectoral Guideline for Transmission and Distribution Lines" in the 2003 version defines necessary information and shows the format to be used in applications for environmental clearance. Thus applications for environmental clearance of rural electrification projects must be prepared in accordance with the revised guideline.

The project successfully obtained Environmental clearance from NEC, as NEC concluded that the project can satisfy the conditions defied in the Environmental Assessment Act and that negative environmental impacts will be mitigated and acceptable. Copy of environmental clearance will be available for DOE's review upon request.

SECTION E. Local stakeholder consultation
E.1. Solicitation of comments from local stakeholders

As part of the process to obtain environmental clearance, public hearing was held to obtain stakeholders' comments.

E.2. Summary of comments received

There were no negative comments received during the public consultation meeting. A summary of comments received and responses to all the comments is summarized as follows:

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E.3. Report on consideration of comments received

Due account was taken to all comments and BPC has endeavoured to explain all issues raised during the meeting.

Based on feedback received after the meeting, the participants' expressed their satisfaction with BPC's detailed explanation and gave their support for the Project's implementation.

SECTION F. Approval and authorization

The letter of approval from host party is not available at the time of submitting the PDD to the validating DOE.

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Appendix 1: Contact information of project participants

Organization	Bhutan Power Corporation Limited (BPC)
Street/P.O. Box	P.O.Box 580, Below Hotel Taj Tashi
Building	BPC Head Office
City	Thimphu
State/Region	
Postcode	
Country	Bhutan
Telephone	
Fax	
E-mail	
Website	www.bpc.bt
Contact person	
Title	
Salutation	Mr.
Last name	
Middle name	
First name	
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2: Affirmation regarding public funding

Appendix 3: Applicability of selected methodology

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

Appendix 5: Further background information on monitoring plan

Appendix 6: Summary of post registration changes

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02	EB 20, Annex 14 08 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		

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JICA workshop on CDM Capacity Development and Rural Electrification Project in Royal Government of Bhutan

Venue: Namgay Heritage Hotel, Thimphu

Day 1: Tuesday, 17 April 2012

Sl. No	Name	Designation	Organisation	Signature
1	Mr. Karma Tshering	Director	DRE	
2	Mr. Mewang Gyeltshen	Chief Engineer	DRE	
3	Mr. Chhimi Dorji	Executive Engineer	DRE	
4	Mr. Sherab Jamtsho	Dy. Executive Engineer	DRE	
5	Mr. Tilak Sunwar	Program Manager, RE	DRE	
6	Mr. Choten Duba	Civil Engineer	DRE	
7	Ms. Damchu Dema	Electrical Engineer	DRE	
8	Ms. Dechen Pema Yangki	Electrical Engineer	DRE	
9	Ms. Sangay Dema	Electrical Engineer	DRE	
10	Mr. Minjur	Electrical Engineer	DRE	
11	Mr. Tshering Penjor	Mechanical Engineer	DRE	
12	Ms. Tandin Wangmo	Environment Officer	DRE	
13	Ms. Nim Dem	Junior Engineer	DRE	
14	Ms. Tashi Pem	Dy. Executive Engineer	DHPS	
15	Mr. Ngawang Choeda	Dy. Executive Engineer	DHPS	
16	Ms. Tashi Choeden	Electrical Engineer	DHPS	
17	Mr. Phuntsho Namgay	Dy. Executive Engineer	DHMS	
18	Mr. Tashi Namgyal	Electrical Engineer	DHMS	
19	Dasho Bharat Tamang	Managing Director	BPC	
20	Mr. Drukchu Dorji	General Manager, RED	BPC	
21	Mr. Norbu Tshering	General Manager, DCSD	BPC	
22	Mr. Gorab Dorji	General Manager, EDCD	BPC	
23	Mr. Tshering Tenzin	Project Manager, RE JICA-I	BPC	
24	Mr. Sangay Sherpa	Assistant Environment officer	BEA	
25	Mr. Rinchen Dorji	Civil Engineer	BEA	
26	Mr. Tandin Tshering	Asst. Manager(CDM)	DGPC	
27	Ms. Sonam Peldon	Asst. Manager(CDM)	DGPC	
28	Mr. Namgay Dorji	AE	DHPC	
29	Ms. Sonam Lhaden Khandu	CDM Focal Officer	NEC	
30	Ms. Sangay Wangmo	Environment Officer	MHPA	
31	Mr. Lobzang Dorji	Chief Environment Officer	PHPA-I	
32	Mr. Kinley Dorji	Sr. Programme Officer	JICA Bhutan	

33 Mr. Neten Wangchuk Chief Livestock Officer DOL, MOAF

34 Mr. Karma [illegible] EDCD DPC

35 Mr. Tshultrim Dorji, Engineer, MDO BPC

JICA workshop on CDM Capacity Development and Rural Electrification Project in Royal Government of Bhutan

Venue: Namgay Heritage Hotel, Thimphu

Day 2: Wednesday, 18 April 2012

Sl. No	Name	Designation	Organisation	Signature
1	Mr. Karma Tshering	Director	DRE	
2	Mr. Mewang Gyeltshen	Chief Engineer	DRE	
3	Mr. Chhimi Dorji	Executive Engineer	DRE	
4	Mr. Sherab Jamtsho	Dy. Executive Engineer	DRE	
5	Mr. Tilak Sunwar	Program Manager, RE	DRE	
6	Mr. Choten Duba	Civil Engineer	DRE	
7	Ms. Damchu Dema	Electrical Engineer	DRE	
8	Ms. Dechen Pema Yangki	Electrical Engineer	DRE	
9	Ms. Sangay Dema	Electrical Engineer	DRE	
10	Mr. Minjur	Electrical Engineer	DRE	
11	Mr. Tshering Penjor	Mechanical Engineer	DRE	
12	Ms. Tandin Wangmo	Environment Officer	DRE	
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30	Ms. Sangay Wangmo	Environment Officer	MHPA	
31	Mr. Lobzang Dorji	Chief Environment Officer	PHPA-I	
32	Mr. Kinley Dorji	Sr. Programme Officer	JICA Bhutan	
33	Mr. Karma Chophel	Engineer	BPC,	
34	Mr. Tshultrim Dorji	Engineer	BPC	