ザンビア「電力アクセス向上事業」
・ ブータン「地方電化事業」の
CDM 事業登録能力向上支援

最終報告書

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独立行政法人
国際協力機構（JICA）

三菱 UFJ モルガン・スタンレー証券株式会社

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略語表

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. 概要

1.1. 調査背景

国際協力機構（以下 JICA：Japan International Cooperation Agency）は、ブータン国（以下「ブ国」）においては 2004 年－2005 年、ザンビア国（以下「ザ国」）においては、2006 年－2008 年にかけて、貧困度の高い地方農村住民の生活環境の改善及び農村部の経済・社会活動の活性化に寄与することを目的として、「地方電化マスタープラン開発調査」を実施した。同マスタープランに基づき、ブ国においては、2007 年 5 月、地方農村部の配電網の新設・リハビリ（76 箇所、計 2,390km）を行う「地方電化事業」への円借款供与を承諾した。一方、ザ国においては、2009 年 3 月、地方部の配電網延伸（12 箇所、延べ計 459km）・小水力発電建設事業(1 箇所、1,400kW) を行う「電力アクセス向上事業」への円借款供与を承諾した。

上記 2 カ国は、豊富な水力資源を有し、配電網に接続する国内の既存発電施設は水力によるものが大半を占める。このように両国は再生可能電力供給の高いポテンシャルを持つものの、国内住民の多くが電力へのアクセスを持たず、日常生活においてケロシン等の化石燃料に依存している。ブ国における「地方電化事業」及びザ国における「電力アクセス向上事業」は、両国が豊富に有する再生可能資源である水力電力の国内未電化地域への供給を推進するもので、両国住民の生活環境の向上のみならず、温室効果ガス排出削減への寄与が期待できることから、両国の各実施機関（ブ国：経済省再生可能エネルギー局（以下 DRE：Department of Renewable Energy[1]）及びブータン電力公社（以下 BPC：Bhutan Power Corporation）、ザ国：ザンビア電力供給会社（以下 ZESCO：ZESCO Ltd.））は「地方電化事業」及び、「電力アクセス向上事業」の CDM 事業としての国連登録を希望している。

両国実施機関の意向を踏まえ、JICA は当該事業の CDM 登録に必要となるプロジェクト・デザイン・ドキュメント（以下 PDD：Project Design Document）の作成支援のため、2009 年度に、ブ国を対象に「地方電化事業における CDM 事業化に向けた PDD 作成に係る調査」、ザ国を対象に「電力アクセス向上事業における CDM 事業化に向けた PDD 作成に係る調査」（併せて以下「2009 年度 CDM 調査」）を実施したが、これまでブ国及びザ国の CDM 事業の国連登録件数は数件に留まり[2]、当該事業の CDM 登録には、両国関係機関の CDM 登録に係る能力向上に向けた更なる支援が必要と思料された。このため、各事業の国連 CDM 理事会における CDM 事業登録に向け、最新情報に基づく PDD の更新、有効化審査における指定運営組織（以下 DOE：Designated Operational Entity）対応、DOE 指摘に対応する PDD 修正等を行い、当該事業の国連登録手続きの円滑な進行を支援することとなった。JICA は CDM コンサルタントである三菱 UFJ モルガン・スタンレー証券を調査団に選定し、2010 年 10 月より調査（以下「本調査」）を開始した。

[1] 旧経済省エネルギー局（Department of Energy）、2011 年の組織変更以降、地方電化事業を担当。
[2] 2013 年 2 月末日現在、登録済み CDM 案件（POA を含む）全 6,633 件中、ブ国の登録案件は 2 件（Reference number 0062, 2746）、ザ国の登録案件は 3 件（Reference number 2969, 7359, 8060）のみ。

1.2. 調査目的

本調査は、ブ国及び、ザ国の実施機関と協調し、両国において実施される配電網延伸による未電化地域の電化事業、及び、ザ国で実施される 1.4MW 規模の小水力発電建設事業の CDM 事業登録に向けて必要となる新方法論策定及び国連承認申請、有効化審査及び DOE 対応等を支援し、国連登録手続きの円滑な進行のための能力向上を目指すものである。

2009 年度 CDM 調査の結果を踏まえ、ザ国における小水力発電建設事業については既存の国連承認済み方法論を用いて排出削減量の算定が可能なことから、登録に向けた国連手続きである有効化審査を実施し、本調査期間中に当該事業の CDM 登録申請を目指すものである。一方、両国の既存配電網延伸による地方電化事業については、排出削減量算定のために適用可能な既存の国連承認済み方法論が存在しないことから、本調査にて新たに CDM 方法論を策定し、国連による方法論承認を目指すものである。

1.3. 調査内容

今般の調査内容は以下の通り。

<u>ザンビア「電力アクセス向上事業」小水力発電事業 CDM 登録支援</u>

- プロジェクトの現状把握と 2009 年度作成 PDD の精査
- CDM 有効化審査のための PDD 準備
- ザ国 DNA 承認取得手続き支援
- CDM 有効化審査対応
- 国連登録手続き支援

<u>ブータン「地方電化事業」を事例とした既存配電網延伸による地方電化事業 CDM 新方法論作成</u>

- プロジェクトの現状把握と 2009 年度作成 PDD の精査
- 新方法論申請書類作成
- 国連による新方法論審査対応
- 承認済み方法論に基づく PDD ドラフト作成

1.4.　　調査工程

本調査は 2010 年 10 月に開始し、2013 年 3 月に完了している。

本調査の工程を図 1-1 と図 1-2 に示す。

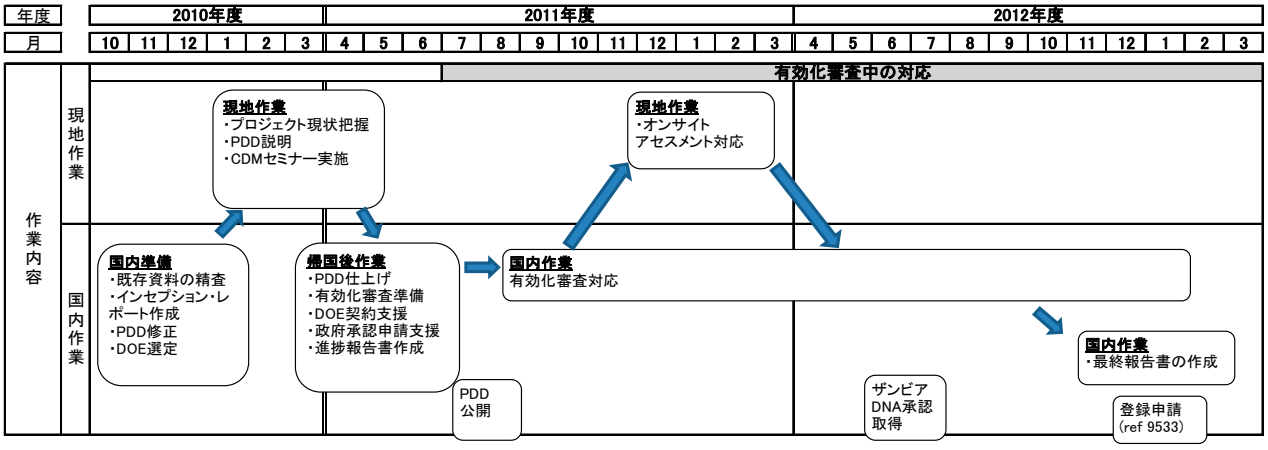

図 1-1：調査行程表　ザンビア「電力アクセス向上事業」小水力発電事業 CDM 登録支援

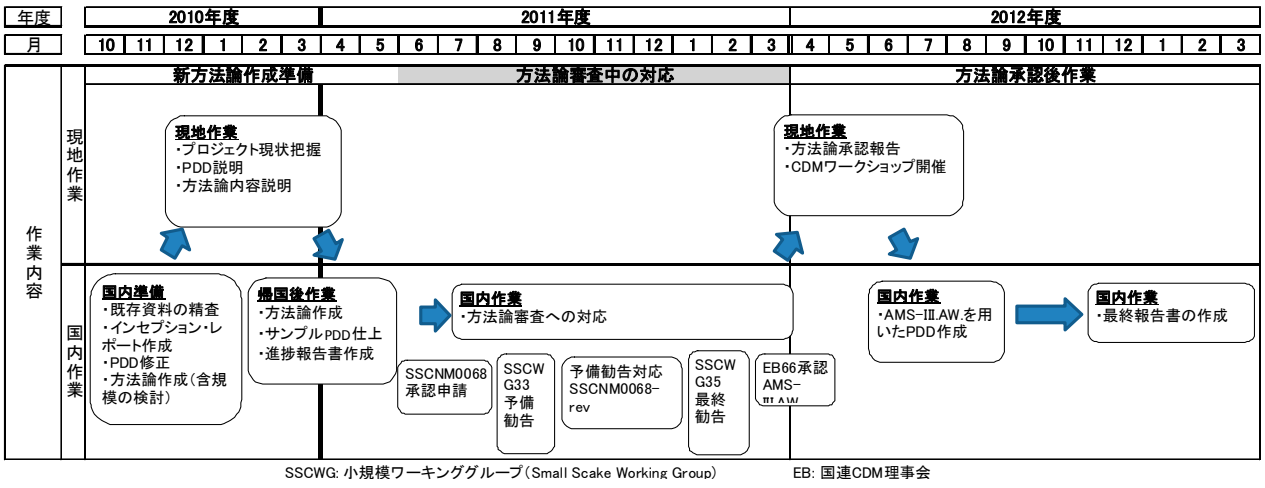

図 1-2：調査行程表　ブータン「地方電化事業」を事例とした既存配電網延伸による地方電化事業 CDM 新方法論作成

2. ザンビア「電力アクセス向上事業」小水力発電事業 CDM 登録支援

2.1. プロジェクト概要

「電力アクセス向上事業」（以下「本プロジェクト」）は、ザ国北西部州において、最大発電容量 1.4MW のオフグリッド水力発電所を建設し、現在家庭で調理や照明に使用されている化石燃料の代替及び、周辺未電化地域の電化を推進するものである。ザ国北西部州の電化率は 8.9%に留まり、地方部の平均電化率 4.5%を上回るものの、都市部電化率 53%を含めたザ国全国平均電化率 21.9%と比較して低い水準となっている[3]。本プロジェクトの実施による未電化地域への電力供給は当該地域住民の生活環境向上に貢献すると期待される。本プロジェクトは JICA の支援の下、ザ国の電力供給会社である ZESCO が実施主体となり実施される。本プロジェクトで電化の対象となるのはザ国北西部州の町 Mwinilunga 郊外に位置する Kanyama、Mujila Village、Kapundu Village、Kakoma の 4 つの未電化地域である。当該事業は対象地域の電力需要に今後 30 年にわたり対応するもので、年間最大 11GWh 程度の電力供給が可能となる。**図 2-1** にザ国地図とプロジェクトによる電化地域を示す。

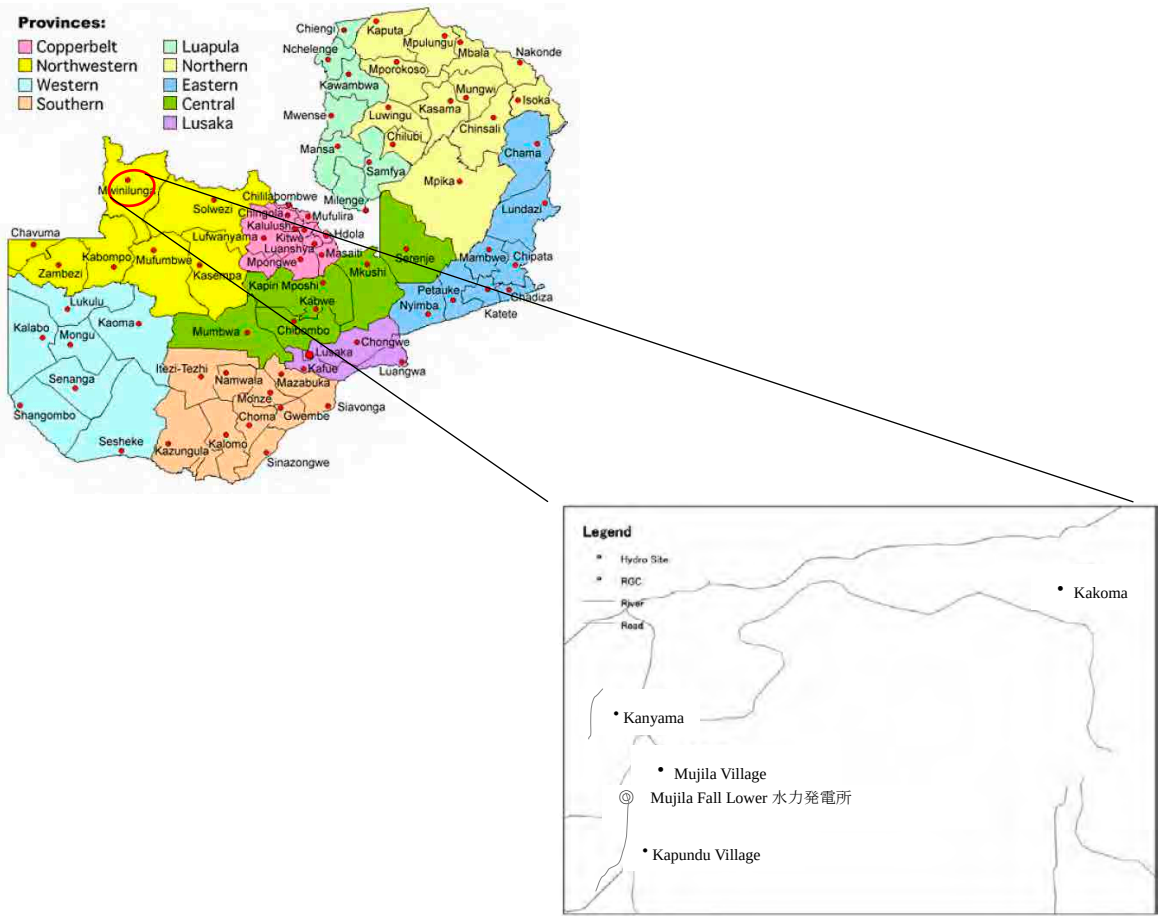

図 2-1：ザ国地図とプロジェクトによる電化地域

出典：JICA ザンビア国地方電化マスタープラン開発調査ファイナルレポート

[3] ザ国電化率は 2010 年 Living Condition Monitoring Survey (LCMS, 2012 年 6 月公表)に基づく。

2.2. 有効化審査に向けた準備

本調査では 2009 年度 CDM 調査で作成された PDD、ZESCO からの聞き取り調査、国連 CDM 理事会等の最新の議論・決定の動向を踏まえ、適用方法論の精査、PDD の修正・変更等有効化審査開始に向けた準備を行った。

2.2.1. 既存方法論精査及び本プロジェクトへの適用方法論

有効化審査に向けた準備の一環として、PDD で用いる既存の国連承認済み CDM 方法論の適用を再確認した。再生可能エネルギー源による小規模発電事業（出力 15MW 以下）を対象とした方法論は、国連にて下記の 3 つの方法論が承認されている。

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

AMS-I.A.は、プロジェクトによる発電をグリッド[4]に接続せず、直接ユーザーに配電する事業を対象としており、AMS-I.D.は、プロジェクトによる発電電力を既存のグリッドに接続するものを対象としている。また、AMS-I.F.は直接ユーザーに配電する事業で既存のグリッド電力、化石燃料ベースの自家発電、または排出係数の高いミニグリッド電力を代替するものを対象としている。

調査団は、本プロジェクトが当面既存のグリッドに接続しないことを ZESCO に確認した。また、本プロジェクトによる水力発電所の発電電力は、既存電源の存在しない未電化地域（Kanyama、Mujla、Kapundu、Kakoma）に直接配電されることから、調査団は AMS-I.A.の適用条件に合致すると判断した。2009 年度 CDM 調査において作成された PDD でも AMS-I.A.が適用されており、本調査でも引き続き、登録に向けて AMS-I.A.の最新版を用いて有効化審査に向けた PDD を完成させることとした。

表 2-1 に方法論 AMS-I.A.の適用条件、及び各適用条件に対するプロジェクトの適合性を整理する。本プロジェクトは AMS-I.A.の適用条件を満たす。AMS-I.A.を Annex A に添付する。

[4] National/regional grid

表 2-1：AMS-I.A.の適用条件とプロジェクトの適合状況

適用条件	プロジェクトの適合状況
1. 当カテゴリーはプロジェクトバウンダリー内の世帯/最終消費者または集落へ電力を供給する再生可能電力生成設備を構成対象とする。 当該方法論の適用はプロジェクト実施前にナショナルグリッド･リージョナルグリッドへの接続していない家屋及び消費者に限定される。	本プロジェクトはプロジェクトバウンダリー内の個人家屋及び最終消費者へ水力発電による電力を供給するものである。 本プロジェクトにより電力供給を受ける地域は未電化地域であり、ナショナルグリッドまたは、リージョナルグリッドに接続していない。マスタープランによれば､2030 年ごろナショナルグリッドに接続される可能性があるが、これは計画段階にあり、その実施は確定していない。このため、現時点で**適用条件を満たす**。
2.再生可能エネルギー源には太陽光、水力、風力、バイオマスガス化などが含まれ、いずれの技術においても、生成された電力は全て発電地点または接続された最終消費者によって消費されること（例えばソーラー住宅システムや風力逐電システムなど)。再生可能発電施設は新規もしくは既存の化石燃料による発電設備の置き換えであること。小規模プロジェクトとして適格であるためには、設備の総出力は 15MW の上限を超えてはならない。	本プロジェクトは新規の水力発電所の設置であり、生成された電力はプロジェクトに接続された最終消費者によって消費される。また、設備の総出力は 1.4MW であり、小規模プロジェクトの上限を超えないことから、**適用条件を満たす**。
3. 水力発電施設の場合、以下の要件のうち少なくとも一つを満たさなければならない。 ① 既存の滞留地において滞留水量を変更することなく実施されること。 ② 既存の滞留地において実施されるもので、滞留水量が増加する場合、発電施設の出力密度[5]が 4W/m^2 より大きいこと。 ③ 新規の滞留地が建設される場合、発電施設の出力密度が 4W/m^2 より大きいこと。	本プロジェクトは流れ込み式の水力発電プロジェクトであり、新たな貯水池の建設、既存貯水池容量の増加を伴わない[6]。よって、左記の適用条件は該当しない。
4. 熱電統合システム（コジェネレーションシステム）は当カテゴリーI.A.の対象外である。	本プロジェクトは熱電統合システム（コジェネレーションシステム）を含まないことから**適用条件を満たす**。
5. 新たに導入される再生可能エネルギー生成設備が再生可能部と非再生可能部分を含む（例えば風力ディーゼル混合設備）場合、小規模 CDM プロジェクトにかかる 15MW の上限値は、再生可能部分に対してのみ適用される。新たに導入される生成設備が再生可能燃料と化石燃料との混合燃焼である場合は、当該設備全体の容量が 15MW の上限値を超えてはならない。	本プロジェクトは出力 1.4MW の水力発電所の設置で 15MW の上限値を上回らないことから**適用条件を満たす**。
6. 再生可能エネルギー生成のために既存施設を改修・	本プロジェクトは既存施設の改修・修

[5] 出力密度：CDM においては、滞留地を伴う水力発電所における滞留地の単位湛水面積当りの出力で、設備容量（単位：W、又はワット）を滞留地の湛水面積（単位：m^2）で除して求める。

[6] プロジェクトにより取水口上流の河川水位の上昇が見込まれるが、上昇後の水位は雨季増水時水位の範囲内であり既存滞留地容量の増加に当たらないと主張し、有効化審査において了承された。

適用条件	プロジェクトの適合状況
修繕することを目的とするプロジェクトは当カテゴリーに含まれるが、小規模プロジェクトとして適格であるためには、改修・修繕される設備の総出力は 15MW の上限を超えてはならない。	繕を行わず、左記の適用条件は該当しない。
7. 既存の再生可能発電設備において再生可能エネルギー生成設備の追加を含むプロジェクトの場合、プロジェクトによる当該設備の追加容量は、15MW 以下であり、既存設備と物理的に区別されなければならない。	本プロジェクトは新規に出力 1.4MW の水力発電所を設置するものであり、左記の適用条件は該当しない。

2.2.2. プロジェクトバウンダリーの設定

方法論 AMS-I.A.の定義に基づき、プロジェクトバウンダリーには本プロジェクトにより導入される発電施設及び、プロジェクトにより電力供給を受ける全ての家屋・施設が包括される。本プロジェクトでは、Mujila Falls Lower 小水力発電所、プロジェクトにより電力供給を受ける Kanyama、Mujila Village、Kapundu Village、Kakoma の 4 つの未電化地域がプロジェクトバウンダリーに含まれる（**図 2-2**）。

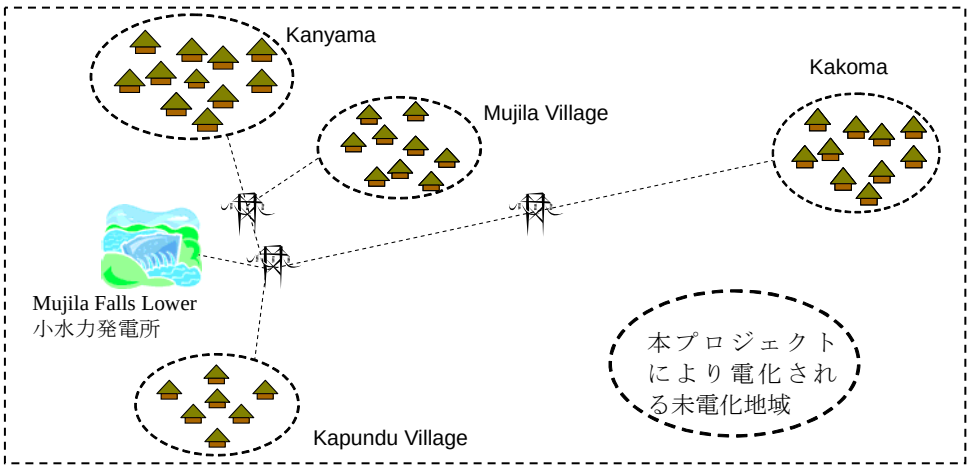

図 2-2：プロジェクトバウンダリー

2.2.3. ベースラインシナリオ

ベースラインシナリオは、CDM プロジェクトが実施されなかった場合に起こりうる仮定のシナリオである。方法論 AMS-I.A.では、現在利用されている技術、もしくは、プロジェクトが実施されなかった場合に利用されたであろう技術がプロジェクトと同じエネルギー量のサービスを提供するのに必要な化石燃料消費をエネルギーベースラインとすることとなっており、エネルギーベースラインの算出方法は次の 3 つのオプションから選択できる。

オプション 1： プロジェクトにより電力供給を受ける消費者の平均電力消費量の推定値からの算出
オプション 2： プロジェクトにより導入される再生可能エネルギー技術による年間発電量からの算出
オプション 3： 現在利用されている技術が代替される場合、過去の燃料消費量の動向を考慮して調整した推定値からの算出

本調査では、プロジェクト実施後のモニタリング等の負荷を勘案し、プロジェクトによる年間発電量を用いるオプション 2 に従ってエネルギーベースラインを設定することとした。オプション 2 によるエネルギーベースラインは、本プロジェクトにより設置される 1.4MW の水力発電所からの年間発電量（推計値）が化石燃料を用いて発電されたと仮定し試算することとなる。

2.2.4. 追加性の証明

本プロジェクトはマイクロスケール CDM に該当することから、「マイクロスケールプロジェクトの追加性証明に関するガイドライン」[7]（以下マイクロスケールガイドライン）に基づき、追加性証明が免除される。

CDM 理事会は CDM 案件の地理的不均衡是正策のひとつとして極小規模（マイクロスケール）CDM プロジェクトに関する手続きの簡素化を検討し、2010 年 5 月開催の第 54 回国連 CDM 理事会会合において、出力 5MW 以下の再生可能エネルギープロジェクト（タイプ I プロジェクト）及び、20GWh/年未満の省エネプロジェクト（タイプ II プロジェクト）について、後発開発途上国(LDC)で実施されるなど、一定の条件を満たす極小規模プロジェクトを対象に、マイクロスケールプロジェクトのための追加性立証に関するガイドライン[8]を承認した。当該ガイドラインはその後改定を経て、現在の再生可能エネルギープロジェクトや省エネプロジェクト以外のプロジェクト（タイプ III プロジェクト）で年間削減量 20kt（CO_2 換算）未満のプロジェクトも対象としたマイクロスケールガイドラインとなった。

マイクロスケールガイドラインによると、出力が 5MW 以下の再生可能エネルギー技術を導入するマイクロスケールプロジェクトについては、下記の 4 つの条件うち 1 つを満たせばプロジェクトは自動的に追加的とみなされる。

1. プロジェクト実施場所が後発発展途上国（LDC）/小島嶼国（SIDS）あるいはホスト国が 2010 年 5 月 28 日以前に特定した特別未開発地域[9]であること。
2. プロジェクトが電力系統に接続せず（off grid、1 日 12 時間未満の系統接続も含む）、家庭や地域に電力を供給する活動であること。

[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 underdevelopment zone

3. 下記の二つの条件を満たすグリッドに接続しない分散型の配電事業であること。
   1） プロジェクト活動内の独立サブシステムの設備容量が 1500kW 以下であること。
   2） サブシステムのエンドユーザーが各家庭 / コミュニティ / 中小企業であること。
4. プロジェクトがホスト国の指定国家機関（DNA）が推奨し国連 CDM 理事会が追加性を承認した特定の再生可能エネルギー技術 / 施策であること。

本プロジェクトは 1.4 MW の水力発電所建設事業であり、ザ国は、国連の定義により LDC に分類される[10]。よってマイクロスケールガイドラインにおけるタイプ I プロジェクトの出力規模に対する制限（5 MW 以下）と上記 1 の条件を満たすため、自動的に追加的であると判断できる。よって、PDD にはこの旨記載した。

2.2.5. 温室効果ガス排出削減量の算定

方法論 AMS-I.A.に従って、本プロジェクトによるベースライン排出量、プロジェクト排出量、リーケージ排出量を下記の通り算定し、PDD に反映した。

1) ベースライン排出量の算定

方法論AMS-I.A.におけるエネルギーベースラインは、プロジェクトが実施されなかった場合に利用されたであろう技術により、本プロジェクトが提供するのとエネルギー等価のサービスを提供するのに必要な化石燃料消費に伴う温暖化ガス排出量である。本プロジェクトではAMS-I.A.のオプション2に基づき、プロジェクトによる年間発電量（設備容量から推定）と方法論既定の化石燃料の排出係数より以下の通り算出した。

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

$BE_{CO2,y}$ y年におけるベースライン排出量、tCO_2
EF_{CO2} CO_2 排出係数; tCO_2/kWh (方法論既定値：0.0008 tCO_2e/kWh)
$E_{BL,y}$ 年間のエネルギーベースライン、kWh

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

$E_{BL,y}$ 年間のエネルギーベースライン、kWh
Σ_i プロジェクトにより導入される再生可能エネルギー技術 i （例：太陽光住宅、太陽熱ポンプ等の技術など。）の総和
$EG_{i,y}$ プロジェクトにより導入された再生可能エネルギー技術 i によるy年の年間発

[10] LDC 国のリスト：http://www.unohrlls.org/en/ldc/25/

電量、kWh.　再生可能エネルギー技術による年間発電量は河川流量に基づく稼動率と設備容量（1.4MW）を基に算出される。事前の試算では、11,037,600kWh/yとする。この値はプロジェクト運転開始後に実際の発電量に置き換えられる。

l　プロジェクトが実施されない場合起こるであろう平均的な技術・配電ロス。本プロジェクトでは方法論AMS-I.A.の既定値である0.2を適用する。

事前の試算は以下の通りとなる。

$E_{BL,y}$ = $\Sigma_i EG_{i,y} / (1 - l)$
= 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) プロジェクト排出量の算定

本プロジェクトは滞留地容積の増加を伴わない小規模の水力発電事業である。したがって、本プロジェクトから方法論 AMS-I.A.に定義されるプロジェクト排出は発生しない。一方で、本プロジェクトは緊急時の電源確保のため 50kVA 規模のディーゼルエンジン発電機の設置を検討している。これは、本プロジェクトによる発電所がグリッドに接続しないことから、本プロジェクトによる水力発電所からの電力供給が完全にストップした場合、別電源からの電力供給が必要となるためである。この様に、本プロジェクトが緊急用に設置するディーゼルエンジン発電機は常時稼動を想定しないが、緊急時のディーゼル燃料消費をプロジェクト排出に勘案するため、「化石燃料燃焼によるプロジェクト CO_2 排出量・リーケージ CO_2 排出量の計算ツール」[11] に基づき下記の通り算出することとし、PDD にその旨記載した:

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

PE_y	y年におけるプロジェクト排出量、tCO_2e
$PE_{FC,emergency,y}$	y年における緊急時のディーゼル燃焼に伴うプロジェクト排出量、tCO_2e
$FC_{diesel,emergency,y}$	y年における緊急時に燃焼されたディーゼルの総量
$NCV_{diesel,y}$	y年におけるディーゼルの真発熱量（NCV：Net Calorific Value）。AMS-I.A.に基づき、IPCCの既定値（2006年IPCCガイドライン[12]第2巻、第1章、表1.2、95%信頼区間の上限値）とする。

[11] Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02)
[12] 2006 IPCC Guidelines for national Greenhouse Gas Inventories (2006, IPCC)

$EF_{CO2,diesel,y}$　　y年におけるディーゼルのCO_2 排出係数。AMS-I.A.に基づき、IPCCの既定値（2006年IPCCガイドライン第2巻、第1章、表1.4、95%信頼区間の上限値）とする。

前述の通り、本プロジェクトにおけるディーゼル発電機は水力発電からの電力供給が不可能になる等の緊急時のみの稼動を計画しており、平常時は稼動しない。よって、事前の試算においてはプロジェクト排出量をゼロとする。

$PE_y = PE_{FC,emergency,y} = \Sigma FC_{diesel,emergyncy,y} \times NCV_{diesel,y} \times EF_{CO2,diesel,y}$
$= 0\ tCO_2e$

3) リーケージ排出量の算定

リーケージとは、プロジェクトバウンダリー外で起こる当該 CDM プロジェクトに起因する GHG 排出である。方法論 AMS-1.A.では、エネルギー生成装置が他の活動から移送してきたものである場合、あるいは既存装置が他の活動に移送される場合、リーケージを考慮することとなっているが、本プロジェクトには該当しない。このことから、本プロジェクトからはリーケージ排出量は発生しない（$L = 0\ tCO_2e$）。この旨、PDD に記載した。

4) 排出削減量の算定

本プロジェクトによる排出削減量は下式にて算出される。

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

ER_y　　y年における排出削減量（tCO_2e）
$BE_{CO2,y}$　　y年におけるベースライン排出量（tCO_2e）
PE_y　　y年におけるプロジェクト排出量（tCO_2e）
L　　y年におけるリーケージ排出量（tCO_2e）

PDD 内の事前の試算結果は以下のとおりとなる。

$ER_y = BE_{CO2,y} - PE_y - L$
$= 11{,}037\ tCO_2e - 0\ tCO_2e - 0\ tCO_2e$
$= 11{,}037\ tCO_2$

なお、PDD 内の事前の試算による排出削減量はプロジェクトの出力規模と最大年間稼動時間に基づくもので、本プロジェクトが年間に獲得可能な最大の排出削減量である。実際の排出削減量は未電化地域の電力需要に基づく本プロジェクトによる年間発電量のモニタリング結果、及び、緊急時のディーゼル発電施設の稼働状況等により下方修正される。

2.2.6. プロジェクト実施期間及びクレジット獲得期間

CDM においてプロジェクトの開始日は、「プロジェクトの実施、又は建設、又は実際の活動を開始した日のうち最も早い日」と定義[13]され、プロジェクト参加者がプロジェクトの実施や建設に関連する支出を行うことを決定した日がプロジェクトの開始日とみなされる。この定義に基づき、本プロジェクトの開始日は建設・調達業務契約締結日とする。事業実施スケジュール見直しの結果、2013 年 2 月末の調印を予定していることを ZESCO に確認した。これにより、本件のプロジェクトの開始日は暫定的に 2013 年 2 月 28 日とし、その旨 PDD に記載した。

また、本プロジェクトによる水力発電所は 2015 年 3 月の運転開始を予定していることから、クレジット獲得期間の開始は 2015 年 3 月 1 日、もしくは実際の稼動開始日のいずれか遅い方として PDD に記載した。

水力発電所の寿命は長く、30 年以上稼動することが見込まれる。このことから、クレジット獲得期間は 2009 年度の PDD 同様、7 年、2 回更新の計 21 年を選択し、本プロジェクトから最も長い排出削減クレジット獲得期間の確保をめざすこととした。

2.2.7. 環境影響及び地元利害関係者のコメントへの対応

ザ国の環境基本法である環境保護と汚染管理法（以下 EPPCA：Environmental Protection and Pollution Control Act, 1990）は 1990 年に発効、本法によりザンビア環境評議会(ECZ：Environmental Council of Zambia)が創設された。ECZ の機能と権限は EPPCA にて規定されており、環境影響評価が必要とされる開発活動について関係者にその実施を要請するなど、ザ国における開発活動の環境クリアランスを担う機関としての機能を有している。また、1997 年に公告された環境影響評価規則（以下 EIA 規則：Environmental Impact Assessment Regulation ）にて、ザ国における環境クリアランス過程の具体的な手続きと ECZ による開発許可取得が必要な開発活動が明示された。EPPCA は 1999 年に一度改訂され、その後、2011 年 4 月に EPPCA に代わる環境基本法として承認された環境管理法（以下 EMA：Environmental Management Act No 12 of 2011）に移行した。その際、ECZ は、機能はそのまま、ザンビア環境管理局（以下 ZEMA : Zambia Environmental Management Agency）へと名称が変更された。

ザ国において小水力発電所の開発は開発許可取得が必要な開発活動の一つとして EIA 規則に列挙されている。本プロジェクトの開発に当たっては当該規則に基づき、案件環境概要（以下 EPB：Environmental Project Brief）のとりまとめ、ZEMA による EPB の審査を受け、開発許可の取得が必要である[14]。

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

[14]EIA 規則において、新規の発電所建設で、送電線の長さが 1 km 以上および送電線建設に必要な舗装道路が 1 km 以上の場合は、EPB の作成が必要とされている。本プロジェクトは EPB が義務付けられているプロジェクトのカテゴリーに該当する。

本プロジェクトについては、マスタープラン策定時に既にザ国の要請に沿った環境クリアランス手続きが実施され、ZEMA の前身である ECZ から 2007 年 11 月 30 日付で開発許可を取得済みであることから、その旨、PDD に記載した。EPB 及び ECZ から取得した開発許可書をそれぞれ Annex B、Annex C に添付する。

CDM の有効化審査の要件の一つに地元利害関係者のコメントを募り、受け取ったコメントに対して適切な考慮を行ったことを示すことがある。このため ZESCO は 2010 年 11 月 4 日に地元利害関係者のために本プロジェクトに関する公開説明会を開催した。本説明会開催の周知は、地域の慣習に従い、まず ZESCO が地域代表者（Village heads）に対して口頭で説明会開催を知らせ、その後、地域代表者から地域住民に周知する形で行なわれた。説明会への参加呼びかけを受けたことを示す、地域代表者からのレターを入手し、説明会参加者名簿と共に DOE に提出した。地域代表者からのレター及び、説明会参加者名簿をそれぞれ Annex D、Annex E に添付する。

公開説明会はプロジェクト実施地点に近いザ国北西部 Mwinilunga 村の Kanyizhiwu Community School にて開催され、周辺集落の村長（Village head）を含む 48 名の地域住民が参加した。また、事業実施者である ZESCO からは土木技師長、上級社会学者、上級生態学者、環境テクノロジスト、環境コーディネーターの 5 名が参加し、地元利害関係者への説明にあたった。

公開説明会における本プロジェクトに対する地域住民からの主な意見・質問の内容は、水力発電所建設の対象となる土地を耕作する農民から代替農地や補償に関するものであった。耕作地移転に対する補償は農業畜産省（MAL：Ministry of Agriculture and Livestock）による査定を経て、補償方法や補償額が決められることを ZESCO が説明し、参加者からの理解を得た。その他の意見は概ね水力発電所の建設により電力供給が安定することを評価する好意的なものであった。公開説明会における地元利害関係者によるコメントと ZESCO による対応を PDD に整理した。写真 2-1 に公開説明会の様子を示す。

地域代表者を囲む参加者

参加者の様子

写真 2-1：ザンビア小水力発電事業　公開説明会の様子

2.2.8. モニタリング計画

1) モニタリング項目

方法論 AMS-I.A.では、以下のいずれかをモニターすることが要求されている。

1. 運転状況を確認するための全システムまたはサンプルの年毎のチェック
2. サンプル内の全システムによる発電量

方法論に提示されているモニタリング要件は、各家庭に太陽光発電設備を設置するなど、複数の発電設備を導入するプロジェクトを想定しており、サンプリングを前提としたモニタリングに言及している。一方、本プロジェクトは小規模水力発電施設を一地点に導入することから、モニタリングにおけるサンプリングは不要である。方法論のモニタリング要件の主旨に沿って、ベースライン排出量算出に必要となる、本プロジェクトにより導入される小規模水力発電施設が未電化地域に供給する年間電力量（プロジェクトによる正味発電量; net electricity generation）のモニタリングを行うこととする[15]。また、ZESCO より発電所の緊急時電源として 50kVA 規模のディーゼル発電機の導入を検討しているとの報告を受けたことから、「化石燃料燃焼によるプロジェクト CO_2 排出量・リーケージ CO_2 排出量の計算ツール」に基づき、緊急時に消費されるディーゼルに係る排出量算出に必要となるパラメーターについてもモニタリング項目に追加した。本プロジェクトにおけるモニタリング項目とモニタリング方法を下記に示す。

パラメーター:	$EG_{i,y}$
単位:	kWh/y
説明:	y 年における年間正味発電量
データソース:	ZESCO
値	11,037,600 事前の試算においては、出力規模（1,400kW×0.9）と最大年間稼働時間（8,760 時間）を想定した（1,400 kW x 0.9 x 8,760 hrs/y = 11,037,600 kWh/y）。プロジェクト稼動開始後は実際の発電量によって置き換えられる。
モニタリング方法、手順:	電力メーターによる継続計測を行い、少なくとも一日に一度累積して記録する。設置する電力メーターの精度はクラス 1.0 以上を確保する[16]。
校正頻度等:	電力メーターの校正はホスト国基準もしくは国際基準に準拠する方法で、定期的に実施する。小規模 CDM のガイドライン[17]に基づき、少なくとも 3 年に 1 度は校正を実施する。

[15] AMS-I.A.内の書きぶりは曖昧だが、未電化地域に分配される正味発電量（Net）をモニタリング対象とすることが妥当と考える。
[16] 本プロジェクトの機器調達契約は未締結であり、導入される機器詳細は未定である。電力メーターの精度については最低でもクラス 1.0 を確保する旨、ZESCO より説明があった。
[17] EB61 Report, Annex 21, “General guidelines to SSC CDM methodologies (version17)”

パラメーター:	$FC_{diesel,emergency,y}$
単位:	ton/年 または m^3/年
説明:	y 年における緊急時にプロジェクトサイトで使用されたディーゼル燃料
データソース:	オンサイトにおける計測
値	0
モニタリング方法、手順	継続的に計測を行う。 モニタリング手法は、「化石燃料燃焼によるプロジェクト CO_2 排出量・リーケージ CO_2 排出量の計算ツール」の既定に準拠するものとする。 • 質量計もしくは容積計を用いる。燃料の供給が毎日燃料タンクを用いて行われる場合、燃料の計測に一定の条件の下、定規ゲージの利用を認める： 定規ゲージが燃料タンクの一部であり、年 1 回以上校正され、燃料供給量が継続的に記録されていること（日報又はシフト毎）。 • エネルギー変換器、ソナー、圧電機器等は定規ゲージにより適切な校正と適切な維持管理がされている場合、使用可とする。 • 重油用予熱器を備えたタンクを使用する場合は代表的な運転条件で校正を行うものとする。
校正頻度等:	計測された燃料使用量を燃料購入記録と燃料保管量の記録と比較することにより、計測による使用量が妥当であることを確認する。 特に CDM プロジェクトのために購入された燃料の購入記録が特定できる場合、計測された燃料使用量と仕入記録のクロスチェックを実施すべきである。

パラメーター:	$NCV_{diesel,y}$
単位:	GJ/m^3 又は GJ/ton
説明:	y 年におけるディーゼル燃料の真発熱量過重平均値
データソース:	IPCC の既定値（2006 年 IPCC ガイドライン[18]第 2 巻、第 1 章、表 1.2、95%信頼区間の上限値）
値	43.3 TJ/Gg
モニタリング方法、手順:	最新の IPCC ガイドラインに準拠することを確認する。
校正頻度等:	IPCC ガイドライン改訂の際には新しい値を適用する。

パラメーター:	$EF_{CO2,diesel,y}$
単位:	tCO2/GJ
説明:	y 年におけるディーゼル燃料の CO_2 排出係数
データソース:	IPCC の既定値（2006 年 IPCC ガイドライン第 2 巻、第 1 章、表 1.4、95%信頼区間

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

	の上限値）
値	74.8 ton/TJ
モニタリング方法、手順:	最新の IPCC ガイドラインに準拠することを確認する。
校正頻度:	IPCC ガイドライン改訂の際には新しい値を適用する。

2) モニタリング実施体制

方法論の要件に沿ったモニタリングの確実な実施のため、ZESCO は**図 2-3** に示す体制によるモニタリングの実施を検討している。

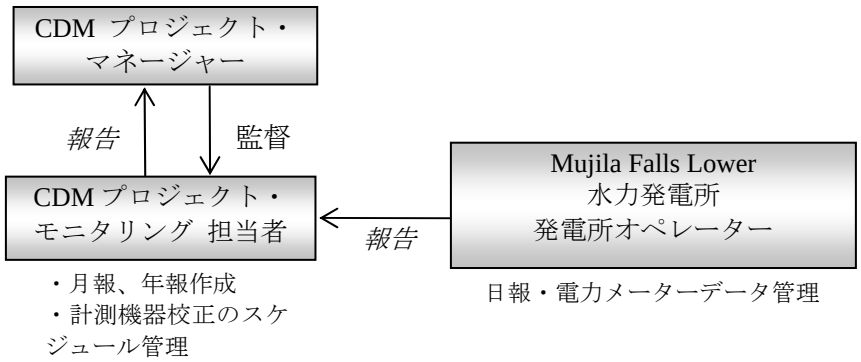

図2-3：モニタリング実施体制

本プロジェクトにより地域に供給される電力量は電力メーターにより継続的に測定され、電子データとして蓄積される。ZESCOが検討中のモニタリング実施体制では、CDMモニタリングの担当に指定された発電所オペレーターが発電所にて本プロジェクトによる分配電力量の電子データが正常に蓄積されていることを確認し、日報の作成を実施する予定である。この日報及び電子データはZESCOのルサカオフィスに送られ、CDMプロジェクト・モニタリング担当者によって月報及び年報に整理される。これらを基に、CDMのためのモニタリング報告書の作成が行なわれる予定である。CDMプロジェクトマネージャーはCDMプロジェクト・モニタリング担当者の報告を受け、モニタリング報告書の内容を承認する役割を果たす。

CDMでモニタリングに用いられる電力メーターは業界基準に則り定期的に校正されることが必要である。ZESCOに対して、電力メーターの校正基準と頻度に関するザ国国内の基準を確認したところ、明確な基準は無いとの回答であった。このため、CDMのモニタリングでは、小規模CDMのガイドラインに基づき、少なくとも3年に1度は校正を実施するとPDDに記載した。校正のスケジュールについてはCDMプロジェクト・モニタリング担当者が管理することとした。

なお、モニターされる全てのデータはクレジット期間終了後2年間、ルサカにあるZESCO事務所に保管されることがCDMの要件の一つとなっている。

本プロジェクトから発生する排出削減クレジット発行のための検証プロセスにおいては、

ZESCOのCDMプロジェクトのモニタリング体制、機器の校正管理方法も審査の対象となる。プロジェクトの適切な運営とモニタリングを証明する一つの手段として、CDMのモニタリング手順をStandard Operating Procedures (SOP)等に文書化し、それに沿ってモニタリングがされていることを示すことは非常に有効である。商業運転が開始するまでには上記のCDMモニタリング実施体制を具体化し、事業開始時点からCDMのための検証に向けたモニタリングデータ収集、モニタリング報告書の準備等が不可欠であることをCDMプロジェクトマネージャー以下、CDMのモニタリングを担う人員が理解、共有することが重要となる。

2.2.9. ザンビア DNA 承認取得

ザ国の国家指定機関（DNA：Designated National Authority）は 国土資源環境保護省（Ministry of Lands, Natural Resources and Environmental Protection）が担っている[19]。現在は CDM 承認の申請数が少ないことから、申請毎にアドホックワーキンググループが招集され、PDD の内容に基づきプロジェクトの審査を行なっている。アドホックワーキンググループでは審査の際のコメントをプロジェクト参加者に提供し、プロジェクト参加者はコメントへの回答や、アドホックワーキンググループからのコメントを PDD へ反映させることができる。その後、DNA 内に設置される CDM 委員会で承認の可否が決定され、最終的な DNA 承認取得の流れになっている。

本プロジェクトは有効化審査開始と同時期の 2011 年 7 月に ZESCO が DNA に PDD を提出し、アドホックワーキンググループからのコメントを入手、調査団がコメントに対する対応を行なった。その後、ザンビア政府組織内の組織変更等も重なり、DNA 承認取得が遅れたが、2011 年 12 月の有効化審査に伴うオンサイトアセスメント実施の際に直接 DNA 担当者に面談し、口頭にて本プロジェクトを承認する旨回答を得た。そして、ザ国 DNA は 2012 年 6 月 18 日付で ZESCO に対し DNA 承認レターを発行した[20]。ザ国 DNA による承認レターを Annex F に添付する。

本プロジェクトはプロジェクト参加者がザ国側の ZESCO のみのユニラテラル CDM プロジェクトであるため、Annex-I 国の DNA 承認は登録時点においては不要である。CER 発行の段階で Annex-I 国側の参加者が加わる場合、改めて Annex-I 国の DNA 承認取得が必要となる。

2.3. 有効化審査の実施

CDM における有効化審査とは、プロジェクト参加者により選定された指定運営機関（DOE：Designated Operational Entity）が、PDD 及び全ての関連文書を審査し、プロジェクトが CDM としての要件を満たしているかどうかを審査する手続きである。

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[19] 2011 年の組織変更に伴い、観光・環境資源省（MTENR: Ministry of Tourism, Environment, Natural Resources）から DNA を引き継いだ。

[20] 承認レターと有効化審査上のプロジェクト名の整合性を取るため、承認レターの再発行を依頼し、2012 年 11 月 12 日付けで再発行された。

調査団は本プロジェクトの有効化審査に向けて、2011 年 2 月より DOE との交渉を開始した。本プロジェクトの DOE には日本プラント協会（JCI: Japan Consulting Institute）を起用することとなった。CDM のルールでは、プロジェクト参加者が直接 DOE と契約締結する必要がある[21]。このため、調査団はプロジェクト参加者である ZESCO と JCI の契約締結の支援を行い、2011 年 7 月 22 日付けで契約締結することができた。契約締結を受け、JCI は 2011 年 7 月 23 日から国連ウェブサイトに本プロジェクトの PDD を公開し、パブリックコメント期間を開始した。4 週間のパブリックコメント期間中、本プロジェクトに対するコメントは寄せられなかった。

有効化審査のためのオンサイトアセスメントが 2011 年 12 月 18 日から 24 日までの日程で実施された。オンサイトアセスメントではプロジェクト実施者である ZESCO、環境クリアランス担当機関である ZEMA、ザンビア DNA である国土・天然資源環境保護省、電力セクター管轄機関であるエネルギー省、地方電化管轄機関である Rural Electrification Authority（REA）の各担当者に対する DOE によるヒアリングが行なわれた。これらのヒアリングにより DOE は本プロジェクトが、CDM としての要件である、①CDM への参加が自主的であること、②ホスト国の定める環境クリアランスを経ていること、③地元利害関係者のコメントを取得し適切に考慮したこと、の 3 点を満たすことを確認した。オンサイトアセスメントの日程を表 2-2 に、DOE による各関係機関との面談の様子を写真 2-2 に示す。

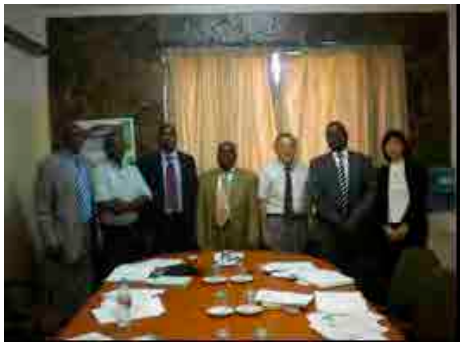
表 2-2：ザンビア小水力発電プロジェクト　有効化審査オンサイトアセスメント日程

年月日	時間	日程
2011 年 12 月 18 日	終日	移動
2011 年 12 月 19 日	午前	移動
	午後	JICA ザンビアオフィス訪問 オンサイトアセスメント準備・ZESCO 顔合せ
2011 年 12 月 20 日	午前	国土・天然資源環境省（ザ国 DNA）訪問
	午後	オンサイトアセスメント準備打合せ
2011 年 12 月 21 日	午前	DOE による面談：REA
	午後	DOE による面談：ザ国 DNA
2011 年 12 月 22 日	午前	DOE による面談：ZEMA（環境クリアランス担当機関）
	午後	DOE による面談：エネルギー省
		DOE による面談：ZESCO
		DOE によるオンサイトアセスメントまとめ
2011 年 12 月 23 日	午前	JICA ザンビアオフィスへ報告
	午後	移動
2011 年 12 月 24 日	終日	移動

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

REA との面談

国土・天然資源環境保護省との面談



ZEMA との面談

エネルギー省との面談

写真 2-2：ザンビア小水力発電事業　CDM 有効化審査オンサイトアセスメント

オンサイトアセスメント終了後、調査団は DOE より本プロジェクトの有効化審査における課題を列挙した有効審査報告書と”Resolution of Corrective Actions and Clarification Requests”を入手し、対応を行なった。DOE により指摘された主な課題とその対応案について表 2-3 にまとめる。

表 2-3：有効化審査における DOE 指摘事項及び対応案

	指摘事項	対応案
1	発電容量を下回る電力需要の場合の発電量制御についての説明。	マスタープラン内の記載に沿って、プロジェクトが 2030 年時点での電力需要 1.4MW に対して 0.7MW の発電施設を 2 基導入することで供給量の制御すること、それぞれ 60～100%での稼動が可能なことから電力需要に見合った稼動が可能となることを説明する。
2	水力発電所の寿命 40 年の根拠について	ザ国には法規制で定められた平均的な水力発電所の寿命は無いが、タービンなどの機器は 30 年、ダム本体は 50 年とするのが慣例である旨、ZESCO から説明を受けた。また、電気工学ハンドブックでは水力発電所の耐用年数を 35 年程度に設定していることから、40 年は妥当と回答し、必要に応じてより保守的な年数に変更する。(保守的に 30 年としてもクレジット期間 21 年を上回るのでプロジェクトのクレジット期間に影響は無い。)

3	発電容量 1.4MW の妥当性について	マスタープランに基づき、1.4MW の発電容量の根拠は有効流量と対象地域の電力需要予測を根拠に決定した旨、回答。
4	5m 高取水堰建設にもかかわらず”reservoir”を伴わない水力発電所であることの説明	プロジェクトの実施に先立ち作成された Environmental Project Brief (EPB)の記載内容に基づき、取水堰設置に伴う水没地域は雨季に水位が上昇した際には水没する”Natural flooding zone”内での水位上昇であることを根拠に、本プロジェクトは”reservoir”を伴わない水力事業であることを主張するが、必要に応じて EPB 記載の水没面積 250,000m^2 を対象に”Power density”を計算すると 5.6W/m^2 であり、4W/m^2 を上回ることから、CDM としての適用条件を満たすことを示す。
5	モニタリングの電力メーターが故障した場合のバックアッププランについて	電力メーター（Wh）が故障した場合も計器用変圧器（VT）及び、変流器（CT）からのシグナルは記録されることから、この記録から供給電力量の算出が可能であること、VT 及び CT は電子機器ではなく故障の可能性はきわめて低いことから、本件では CT、VT のシグナルをバックアップとすることを説明する。

調査団は DOE による指摘事項に対する対応を ZESCO の協力を得て回答し、十分な対応であると判断された。この結果、有効化審査が成功裏に終了、2013 年 1 月 25 日付で JCI より国連 CDM 事務局に登録申請が提出された。

なお、有効化審査を終了するに当たっては、以下の 2 点が今後 CER 発行時の検証時点までに対応が必要な課題として、Forward Action Request（FAR）として挙げられた。

FAR1：オペレーション・メンテナンス手順書の作成
FAR2：モニタリング手順書の作成

オペレーション・メンテナンスマニュアルについては、CDM のために特別に作成する必要はなく、通常 ZESCO が水力発電所を運転、維持管理する際に使用する手順書を代用することが可能である。モニタリング手順書については、CDM でモニタリング項目となっているものを網羅する必要があり、特に、モニタリング機器の校正時期の管理などについて、分かりやすい手順を添えることが望ましい。本プロジェクトの稼働開始は 2015 年 3 月を予定していることから、それまでに作成することが求められる。

有効化審査報告書及び、最終的に登録申請に提出された PDD を Annex G、Annex H として添付する。有効化審査の詳細については有効化審査報告書を参考にされたい。

本プロジェクトには CDM 参照番号 9533（ref 9533）が割り当てられ、現在、登録申請のためのコンプリートネスチェック開始の順番を待っているところである。

登録申請提出後の国連審査の今後の流れは、以下の通りである。

・ コンプリートネスチェック（7 日間）
・ インフォメーション・レポーティングチェック（23 日間）
・ 登録申請のためのコメント期間（28 日間）
・ 登録（登録日は申請提出時点）

コンプリートネスチェックが開始されてから約 2 ヶ月で登録の運びではあるが、現在 650 件ほどの登録申請案件がコンプリートネスチェック開始のスケジュールを待っていることから、コンプリートネスチェック開始まで数ヶ月かかることが予想される。本プロジェクトの国連登録は最短で 2013 年 6 月頃と見込まれる。

2.4. CDM セミナーの開催

本調査の目的の一つに実施機関の CDM キャパシティ向上が挙げられることから、調査団は 2011 年 1 月 30 日から 2 月 5 日の日程で行なわれた第 1 回現地調査において、ザンビアの関係機関に対して CDM セミナーを実施した。本セミナーは 2 月 2 日に実施され、プロジェクト実施者である ZESCO、ザンビア DNA である観光・環境天然資源省[22]（MTENR: Ministry of Tourism, Environment and Natural Resources）、在日本大使館、JICA から参加があった。調査団は本セミナーで世界及びアフリカにおける CDM の実施状況、ザンビアにおける CDM ポテンシャル、プログラム CDM の仕組み、CDM 事例紹介など、CDM に関する幅広い議題についての議論の場を提供した。また、セミナーへの参加を通じて参加者の CDM に関する知見を深め、今後の CDM 登録手続きの円滑な進行を支援することを目指した。

本セミナーにおける主な質疑応答を以下にまとめる。

Q1: （ZESCO）Program CDM について、プロジェクト資金の提供者が一社でない場合でも、プログラム CDM として認められるのか。
A1: （MUMSS）プロジェクトとしてまとめられれば、複数の資金提供者がいても問題はない。

Q2: （MTENR）ザンビアで実施されている Program CDM の中身を知りたい。
A1: （MUMSS）概要について、主に PDD の内容に沿って説明した。

Q3:（在日本大使館）Afforestation and Reforestation の定義とザンビアにおける実施状況を知りたい。
A3:（MUMSS）Afforestation/Reforestation の定義について説明した。

[22] 現在は国土・天然資源環境保護省（Ministry of Lands, Natural Resources and Environmental Protection）が DNA を担当。

（MTENR） ザンビアにおける Forestry の定義がまだ策定されていないものの、当該分野におけるポテンシャルは非常に高いと考える。

Q4: （ZESCO）本プロジェクトでも、CER が発行された場合に販売することを検討することになるが、CER の価格はどのように決まるのか？

A4: （MUMSS）EU-ETS の存在や動向について説明した。ZESCO のプロジェクトのような LDC 国による未電化地域の電化推進のようなものは、案件自体のストーリー性が非常に高いものであり、CER としても価値があると思われると説明した。

Q5:（MTENR）プログラム CDM の有効化審査における DOE の起用について。

A5:（MUMSS）プログラム CDM の審査における DOE の liability の発生について説明した。また、登録後のプログラムへの 2 件目以降の CPA の追加における問題点について説明した。

Q6:（MTENR）ZESCO は今後太陽光やマイクロ水力のプログラム CDM 化を検討することはあるのか。

A6:（ZESCO）太陽光については関心を持っているが、現時点では、Rural Electrification Authority (REA)が担当している。ZESCO は当面、現在の小規模水力発電とグリッド延伸に注力する予定。

3. ブータン「地方電化事業」を事例とした既存配電網延伸による地方電化事業 CDM 新方法論作成

3.1. 調査実施方針

ブ国における地方電化事業並びにザ国での配電網延伸事業は、いずれも現在各家庭で使用されている化石燃料を既存配電網から供給される低排出係数の電力に代替することで、GHG 排出量を削減することを目的としている。ブ国及びザ国の既存配電網に接続する国内の電源は両国ともほぼ全量水力発電により賄われており、且つ両国とも豊富な水力資源に恵まれている[23]ことから、両国においては国内配電網の延伸が将来にわたって GHG 排出量削減に寄与すると予想される。

ブ国とザ国両政府はこのような地方電化事業を CDM として実施することを希望している。特にブ国については 2001 年から 2003 年にかけて実施されたブ国「地方電化マスタープラン調査」において、同国の未電化地域の電化事業への CDM 活用が検討されている。具体的な CDM 化に関する調査は JICA 支援により 2009 年度から実施されてきた。その過程で作成されたドラフト PDD は、既存方法論をあてはめて作成されていたが、適用した既存方法論には改定が必要であるとの調査結果であった。

調査団は 2009 年 CDM 調査の結果を精査し、両国の既存配電網延伸事業の CDM 化においては、新しい CDM 方法論の開発が最も効率的であると判断した。このため調査団は、今回の調査の目標を、既存配電網延伸事業に適用可能な新規 CDM 方法論の開発及び、国連による新規 CDM 方法論の承認に定めた。ブ国とザ国は水力資源に恵まれ、国内の電力需要が水力発電により賄われている点については類似しているが、それぞれが接続する多国間グリッドとの輸出入運用や、ザ国では国内に一部火力発電所が存在する点など、一部相違点がある。このため調査団は、新規 CDM 方法論開発にあたり、適用対象を絞り込み方法論の簡素化を図ることで国連審査にかかる時間を短縮し、調査期間内での国連承認が達成できると考え、本調査ではまずブ国における地方電化事業を前提とした方法論を作成することを提案した。これは一旦方法論が国連に承認されれば、ザ国における地方電化事業の CDM 化のために国連承認済み方法論を改訂することは新規方法論の承認を得るより簡単になると考えられるためである。調査団はこのアプローチで調査を実施することに対して JICA 側の了承を得た。このため、調査団は本調査においてブ国における地方電化事業を前提とし、新方法論を作成し、国連承認を目指した。

ブ国及びザ国の相違点及び類似点を図 3-1 に整理した。

[23] ブ国の包蔵水力は 23GW 以上でこのうち開発済みは 5%程度、多くの優良水力案件が存在する（ブ国地方電化マスタープラン調査ファイナルレポートより抜粋）。また、ザ国の水力ポテンシャル 6GW のうち開発済みはわずか 1.7GW である（ザ国地方電化マスタープラン調査ファイナルレポートより抜粋）。

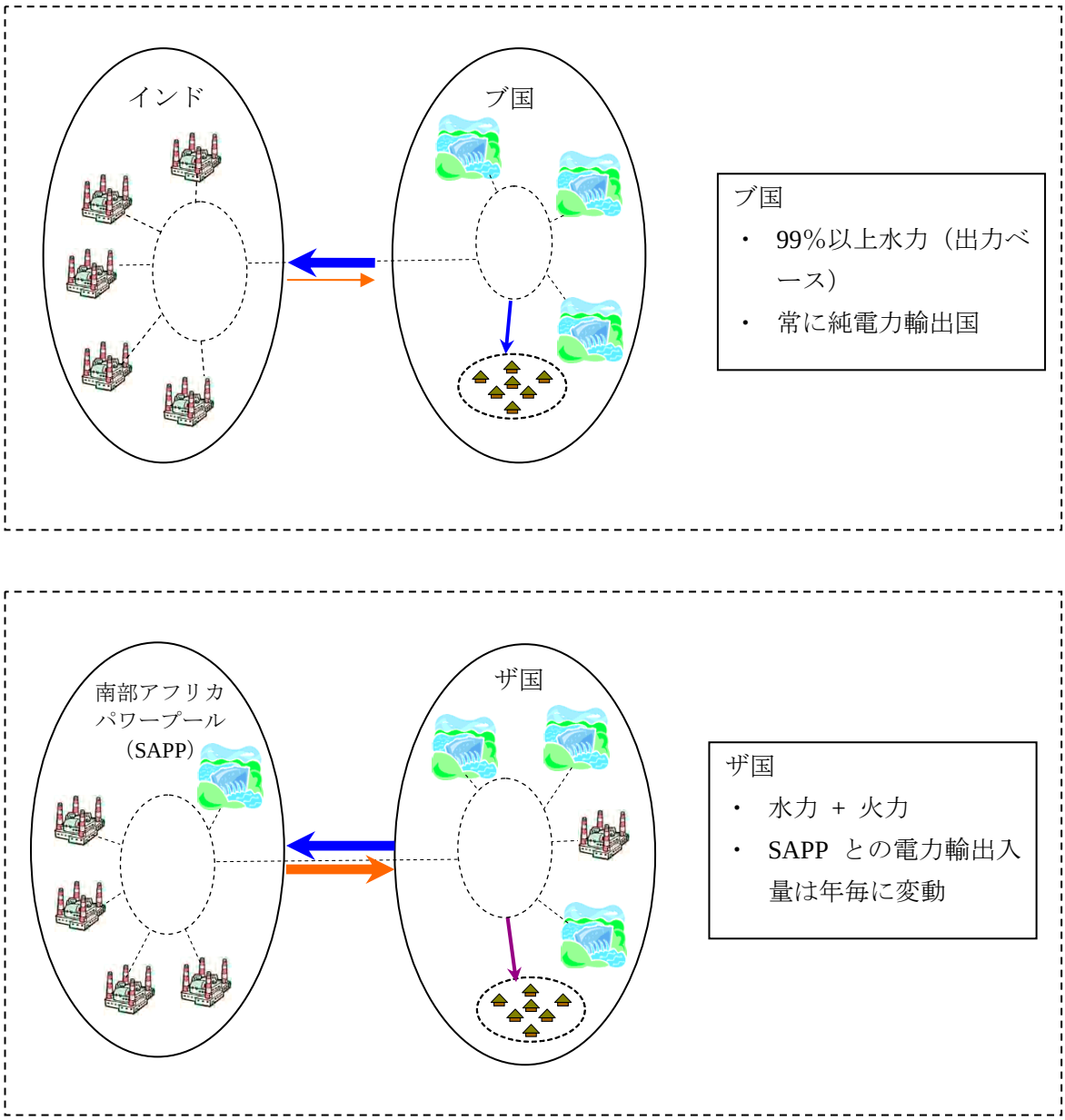


図 3-1：ブ国、ザ国における配電網延伸による地方電化プロジェクトのイメージ

3.2. 既存承認済み CDM 方法論精査

2009 年度の調査では、本地方電化事業に適する既存 CDM 方法論の適用可能性が検討されている。本調査では 2009 年度の調査結果を基に、調査団の見解を整理した。適用可能な既存 CDM 方法論に関する検討結果を表 3-1 にまとめた。

表 3-1：適用可能な既存 CDM 方法論の検討

	既存の CDM 方法論	2009 年度調査における 方法論適用根拠	本調査団見解
ブータン地方電化事業	AMS-I.C. 電力の有無に関らない熱エネルギー生成[24]	家庭内における調理等の熱エネルギー代替という観点から積極的な適用が考えられる。	プロジェクトは次のいずれかに該当することが適用条件の一つに含まれている：1) グリッドへの電力供給、2) オンサイトでの電力及び/或いは熱生成、3) 1) と 2)の組み合わせ。 このプロジェクトはこの適用条件のいずれも満たしていない。 **→当該方法論はグリッド延伸による地方電化事業に適用不可と判断。**
	AMS-I.E. 利用者による熱利用のための非再生可能バイオマスからの転換[25]	現在家庭で使用されている薪は、文献調査から非再生可能バイオマスである可能性が高く、削減ポテンシャルの高さから本方法論の使用を検討すべきである。	方法論では、バイオガス・ストーブやソーラー・クッカー等の再生可能エネルギー技術の導入により非再生可能バイオマスの利用を代替することが条件となっている。水力が主電源の系統の延伸が含まれないため、国連での確認が必要。 **→当該方法論はグリッド延伸による地方電化事業に適用不可と判断。**
ザンビア電力アクセス向上事業	AMS-III.AG 高炭素強度のグリッド電源から低炭素強度の化石燃料への転換[26]	新たにシナリオを追加し、高炭素強度の化石燃料から低炭素強度のグリッド電源への転換を含める改定をすることで適用可能となる。	現在の方法論の適用可能条件に、再生可能エネルギー案件には適用不可との適用条件がある[27]。水力が主電源の系統は再生可能エネルギーであり、当該方法論の適用外であることから、改定を申請しても認められる可能性が低い。 **→当該方法論は水力主体のグリッド延伸による地方電化事業に適用不可と判断。**
	AM0045 独立電力システムのグリッドへの接続[28]	適用条件に未電化地域へのグリッド接続を適用条件に追加し、対象グリッド接続先を独立電力システムだけでなく、未電化	当該方法論は化石燃料ベースの独立した発電所をベースラインの対象としており、左項のような変更或いは適用条件の追加が認められる可能性は低い。

[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

[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 パラグラフ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

	既存の CDM 方法論	2009 年度調査における 方法論適用根拠	本調査団見解
		地域の世帯、商業施設等も含める。また、モニタリングにおいては、グリッドに接続した全世帯が既存の化石燃料の使用をやめ、その電力源を転売しないことを調査する。これらの変更をすることで適用が可能。	**→当該方法論はグリッド延伸による地方電化事業に適用不可と判断。**

表 3-1 からも明らかな通り、ブ国及びザ国の地方電化事業のいずれも、2009 年度 CDM 調査で検討された既存方法論の適用条件を完全に満たしているわけではない。特にブ国で検討された小規模 CDM 方法論の AMS-I.C.は、再生可能エネルギーによる発電・発熱プロジェクトが対象（タイプ I）であるが、本地方電化事業は現在使用されている化石燃料を水力が主電源の既存配電網延伸により代替するものであり、新たな再生可能エネルギーによる発電・発熱施設を建設するものではない。加えて、2009 年度の調査では調理等の熱エネルギーの代替という観点から検討されているが、本プロジェクトにおいて既存配電網から供給されるのは電力であり、その電力がプロジェクトにより電化される地域で使用される熱エネルギーを全て代替するというのは考えにくい。

このように、2009 年度 CDM 調査で精査された現在国連で承認されている方法論は、非再生可能熱エネルギーの再生可能エネルギーによる代替や排出係数の高い火力主体のグリッド電力をバイオマスやバイオガス、天然ガスといった排出係数の低い化石燃料に代替するというものであった。例えば、ザンビア電力アクセス向上事業にて 2009 年度 CDM 調査で検討された方法論のひとつである AMS-III.A.G.は、炭素集約度の高いグリッド電力を炭素集約度の低い化石燃料で代替するものである。その他の国連承認済み CDM 方法論で電化事業への適用の可能性のあるものを整理すると、①新規のグリッド接続再生可能エネルギー発電の導入、②新規の独立再生可能エネルギー発電の導入、③既存グリッドと独立システムの接続があるが、本調査が対象とするブ国やザ国における地方電化事業のように、④既存配電網を延伸し、未電化地域に再生可能エネルギー電力を供給することにより現在使用されている化石燃料を代替するという事業にあてはまる方法論は本調査実施開始時点では存在しない。そこで、調査団は既存方法論の改定ではなく、新たに方法論を作成することを提案し、JICA、ザ国及びブ国の実施機関の了承を得た。

表 3-2 に既存の CDM 方法論で電化事業に適用可能な主な方法論を電化プロジェクトのタイプ毎に整理する。

表 3-2：電化事業に適用可能な主な既存 CDM 方法論

プロジェクトタイプ	該当する既存 CDM 方法論
① 新規のグリッド接続再生可能エネルギー発電導入（含 コジェネ）	AMS-I.D. ACM0002
② 新規の独立再生可能エネルギー発電導入（含 ミニグリッド代替）	AMS-I.A. AMS-I.F.
③ 既存グリッドと独立システムの接続	AM0045
④ 既存グリッドの延伸	既存の CDM 方法論無し **本調査により新方法論提案**

なお、小規模 CDM 方法論には再生可能エネルギー供給施設の導入を伴うプロジェクトに適用されるタイプ I の他にタイプ II と III がある。タイプ II はエネルギー供給又は需要サイドにおける省エネルギープロジェクトが対象であり、タイプ III は I 及び II 以外のプロジェクトタイプで、年間の削減量が CO_2 換算で 60kt 未満のプロジェクトに適用される。小規模方法論タイプ I が対象のプロジェクトは、再生可能エネルギーによる発電・発熱事業であり、タイプ II は省エネプロジェクトに適用されるため、両タイプとも本地方電化事業には不適である。従って、タイプ III のカテゴリーで新方法論を作成することとする。

3.3. ホスト国の特徴

3.3.1. 追加性立証に係るブ国の国情

前述のとおり、2010 年 5 月第 54 回国連 CDM 理事会において、決定 2/CMP.5 及び、決定 3/CMP.6 に基づき承認された、出力 5MW 以下の再生可能エネルギー技術プロジェクト、年間の省エネ規模が 20GWh 以下の省エネプロジェクトを対象としたマイクロスケールプロジェクトのための追加性立証に関するガイドライン（マイクロスケールガイドライン）[29]は、その後の改訂を経て年間削減量 20kt 以下のタイプ III のプロジェクトにも適用範囲が拡がった[30]。この新しいマイクロスケールガイドラインによると、開発途上国の中でも特に開発が遅れている国々を指す後発開発途上国（LDC: Least developed country）にて実施される年間削減量 20kt(CO_2 換算)未満のタイプ III プロジェクトは、自動的に追加的とみなされ、追加性テストが免除される。

[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

調査実施時点において、ブ国は国連の定義[31]に従い、LDC に指定されている[32]。また、グリッド延伸による地方電化事業はタイプ III プロジェクトに分類されることから、DRE、BPC、及び調査団はマイクロスケールガイドラインが当該地方電化事業の CDM 登録のために有益であるとの認識を改めて共有した。

また、DRE によると、メキシコ・カンクンにおける COP16 にてブ国政府代表は「マイクロスケールプロジェクトのための追加性立証に関するガイドライン」の適用範囲を、CDM 登録件数 10 件以下のホスト国で実施されるプロジェクトまで広げるよう訴え、ブ国が LDC を卒業したあともブ国で実施される CDM プロジェクトに対してマイクロスケールガイドラインが引き続き適用可能となるよう働きかけた。これは同国が近い将来 LDC から卒業することを見込んでの働きかけであると考えられるが、直ちに LDC から卒業するとのことではないと DRE に確認できたことから、より短期間で CDM 理事会から方法論承認を得ることに主眼を置き、本調査で作成する新方法論では既存のマイクロスケールガイドラインの適用のみを念頭に、登録実績数の少ないホスト国でプロジェクトを実施する際にマイクロスケールガイドラインに沿って追加性立証を免除する措置については言及しないことで DRE 及び BPC と合意した。

調査団は DRE 及び BPC に対し、プロジェクトのクレジット期間中にブ国が LDC を卒業する場合、国連 CDM 理事会に対して、マイクロスケール CDM プロジェクトに対する追加性立証におけるホスト国が LDC であることの規程について、いつの時点で LDC である必要があるのか（登録時点、投資決定時点など）の確認が必要となる可能性があることを伝えた。

3.3.2. ブ国のグリッドの特徴

現在ブ国で登録されている電力供給に関わる CDM プロジェクトは、グリッドから独立した小規模水力発電プロジェクト[33]と、大規模水力発電所をグリッドに接続し、発電した電力をインドへ売却するプロジェクト[34]の 2 件である。また、新たに大規模水力発電所からインドへの売電プロジェクト 2 件が現在有効化審査中である。

インドへの売電プロジェクトのプロジェクト設計書（PDD）には、ブ国とインド間のグリッドは送電制限（transmission constraint）がなく完全に結合（fully integrated）した多国間の包括グ

[31] 国連による LDC 基準：以下 3 つの基準を満たした国が LDC と認定される。ただし、当該国の同意が前提となる。(1) 一人あたり GNI (2005-2007 年平均) :905 米ドル以下 (2) HAI (Human Assets Index）:人的資源開発の程度を表すために CDP が設定した指標で、栄養不足人口の割合、5 歳以下乳幼児死亡率、中等教育就学率、成人識字率を指標化したもの。 (3) EVI（Economic Vulnerability Index）:外的ショックからの経済的脆弱性を表すために CDP が設定した指標。

[32] ブ国は 1971 年に国連の定める LDC のリストに加えられ、2012 年 12 月現在 LDC である。（国連ホームページ http://www.un.org/en/development/desa/policy/cdp/ldc/profile/country_23.shtml）

[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

リッド（trans-national grid）であり、ブ国からの電力（水力メイン）は、特定の送電線を経て一つの横断電力系統（integrated electricity system）にてインドに送られていると記載されている。このため、インドへの売電プロジェクトでは、ベースラインシナリオにおけるグリッド排出係数の算出に、ブ国国内のグリッド接続発電所（水力）だけでなく火力比率が高いインドのグリッド接続発電所も考慮されており、結果として高いグリッド排出係数が導き出されている。ほぼ 100%水力で賄われるブ国単独のグリッド排出係数をベースラインシナリオの排出係数とする場合はプロジェクト実施による排出削減を見込めないが、インドとの包括グリッドをベースラインとすることで、ブ国内で実施されるグリッド接続の再生可能エネルギー電源建設事業の CDM 事業化が可能となっている。これまでに公表された UNFCCC に登録済み或いは現在有効化審査中のブ国の CDM プロジェクトで用いられている排出係数を表 3-3 にまとめた。これらのプロジェクトのうち、”e7 Bhutan Micro Hydro Power CDM Project” だけがグリッドからは独立した小規模水力発電プロジェクトであり、残りの 3 件はインドへの売電プロジェクトである。

表 3-3：ブ国 CDM プロジェクトにおけるベースラインシナリオのグリッド排出係数

プロジェクトタイトル	タイプ（適用方法論）	ステータス（登録日）	グリッド排出係数
e7 Bhutan Micro Hydro Power CDM Project (Ref#0062)	水力発電 (AMS-I.A.)	登録・発行済（2005/5/23）	0.8kgCO_2/kWh（ディーゼル排出係数に基づく既定値)
Dagachhu Hydropower Project (Ref#2746)	水力発電 (ACM0002)	登録済み（2010/2/26）	1.004tCO_2/MWh (インド-ブ国包括グリッド排出係数)
Substitution of grid generation through transmission of renewable electricity generated in a hydro power generation station	水力発電 (ACM0002)	有効化審査	0.793tCO_2/MWh (インド-ブ国包括グリッド排出係数)
Punatsangchhu-I-Hydroelectric Project	水力発電 (ACM0002)	有効化審査	0.779tCO_2/MWh (インド-ブ国包括グリッド排出係数)

上記のように、ブ国がホスト国となる登録済み CDM プロジェクトでは、ブ国国内で生産された水力発電による電力をインド-ブ国を結ぶ包括グリッドを通してインドに売電し、インド国内の火力電力を代替することにより排出削減を行うものが先行しており、インド-ブ国間の包括グリッドの排出係数（0.78～1.0 tCO_2/MMh）がブ国のグリッド排出係数として CDM では認められている。

一方、本調査が対象とする配電網延伸による地方電化事業は、プロジェクト実施前に化石燃料を使用する未電化地域へ再生可能エネルギーである水力主体の既存配電網を延伸し電力供給することにより化石燃料の使用量の削減を図り、排出削減を実現するものである。もし、この地方電化事業により前述のブ国によるインドへの売電プロジェクトで認められているブ国グリ

ッドであるインド-ブ国間の包括グリッドを延伸すると考えると、ブ国国内の配電網延伸プロジェクトは排出係数の高い電力の消費を促進するプロジェクトとなり、排出削減の効果が期待できないこととなる。しかし実際には、ブ国が国内需要を大きく上回る電力を発電し、隣国インドに供給していることからも明らかなように、ブ国内の地方電化のために国外から電力を調達することは考えにくく、配電網延伸プロジェクトによって供給される電力は全量ブ国国内で生産される水力発電により賄われると考えて間違いない。このことから、調査団は本調査が対象とするブ国における配電網延伸による地方電化プロジェクトの排出削減量算定には、これまでCDM で認められてきたブ国のグリッド排出係数（インド-ブ国包括グリッド排出係数）によらない方法が必要であると考えた。

第 1 回現地調査において、調査団は上記の課題を DRE 及び BPC と協議した。協議において、今後もインドへの売電プロジェクトの CDM 化が進む可能性が高いことに鑑み、登録済み或いは有効化審査中のグリッド排出係数には抵触したくないという意向がブ国側に強いことを確認し、新方法論については、ホスト国内で生産される再生可能エネルギー電力のホスト国内未電化地域への供給を対象とし、他国から供給される電力を排出削減の対象としないことを明確にするため、適用条件に以下を含めることで了解を得た。

- ホスト国内の既存の電力配電網に電力を供給する全ての発電所・施設[35]は再生可能エネルギー源（或いは低炭素源）であること。
- 電源開発計画において、建設が計画されている国内の発電所・施設が再生可能エネルギー源（或いは低炭素源）であることが確認できること。
- ホスト国が他国から調達した電力量が定量可能であり、その電力量がプロジェクト実施者によって確認可能であること。
- ホスト国国内の年間の消費電力量が定量可能であり、その電力量がプロジェクト実施者によって確認可能であること。

これらの適用条件を満たすことによりホスト国国内に設置された電源から供給される電力は再生可能エネルギー由来の電力であり、再生可能エネルギー主体の既存配電網の延伸というプロジェクトシナリオの条件を満たすと考えた。さらに、新方法論にホスト国の年間消費電力量における他国からの電力調達量の割合を明確にする適用条件を盛り込み、再生可能エネルギー由来であることが明確でない、ホスト国が国外から調達する電力についてはプロジェクト排出を算定し、排出削減量から差し引くこととし、方法論の国連承認を目指した。プロジェクト排出量の考え方に関しては、次の「CDM 新方法論構築及び国連承認手続き」の項において詳述することとする。

[35] 物理的にホスト国内に存在するグリッド接続の発電所・施設のみを対象とし、包括グリッドに接続するホスト国外に設置されている発電所・施設は対象外。

3.4. CDM 新方法論構築及び国連承認手続き

3.4.1. 国連小規模方法論パネルに提出された新方法論(SSC-NM0068)

調査団は、ブ国実施機関との協議の上、新方法論 SSC-NM0068「Rural electrification by extension of existing low carbon intensive electricity distribution network（既存の低炭素強度グリッド延伸による地方コミュニティの電化)」を作成し、2011 年 6 月 27 日に国連に提出した。この新方法論は小規模 CDM ワーキンググループ（SSC-WG）による審査を経て 2012 年 3 月に国連 CDM 理事会により承認を受けた。国連による新方法論の評価プロセスを表 3-4 に整理した。

表 3-4：国連による新方法論 SSC-NM0068 評価プロセス

2011 年 6 月	国連に新方法論承認申請提出、整理番号 SSC-NM0068 割当て。
2011 年 8 月	第 33 回 SSC-WG 会合における SSC-NM0068 審査開始、予備勧告の提示。
2011 年 11 月	予備勧告に対する回答・対応案(SSC-NM0068-rev)提出。
2012 年 2 月	第 35 回 SSC-WG 会合にて、SSC-NM0068-rev を承認する最終勧告提示。SC-NM0068-rev を基とする小規模 CDM 方法論 AMS-III.AW “Electrification of rural communities by grid extension---Version 1.0” として CDM 理事会に提案。
2012 年 3 月	第 66 回 CDM 理事会会合において、AMS-III.AW “Electrification of rural communities by grid extension---Version 1.0”[36]承認。

国連に提出した新方法論承認申請書を Annex I として添付する。

新方法論の構成要素について、以下に詳述する。

1） 適用条件

CDM 方法論では当該方法論を適用可能なプロジェクト活動のタイプを特定するための条件（適用条件）を明示する必要がある。調査団は地方電化のための新方法論の適用条件についてブ国実施機関と協議の上、表 3-5 の通り整理し、方法論に組み込んだ。

表 3-5：提案新方法論の適用条件

	SSC-NM0068 の適用条件	所見
1	プロジェクトはホスト国の既存の電力配電網の拡張を行うものであり、新規の発電所／ユニット設置を含まないこと。	タイプ I プロジェクトとの差別化を図るための条件。

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

	SSC-NM0068 の適用条件	所見
2	ホスト国内の既存の電力配電網に接続する発電所／ユニットは主に再生可能エネルギー[37]によるものであること。	プロジェクトにより供給される電力が再生可能電源であることを保証するもの。
3	プロジェクトにより供給される電力量が定量可能であること、また、その定量化された電力量をプロジェクト実施者が確認可能であること。	排出削減量定量化の必要条件。
4	ホスト国の国家電源開発計画が公に利用可能な場合、ホスト国の電源ミックスが将来も引き続き主として再生可能エネルギー[38]により構成されることを確認する。	プロジェクトにより供給される電力が再生可能電源であることを保証するもの。
5	ホスト国が他国から調達した電力量が定量可能であり、その電力量がプロジェクト実施者によって確認可能であること。	ホスト国国内の消費電力量における輸入電力の割合を決定するための必要情報。
6	ホスト国国内の年間の消費電力量が定量可能であり、その電力量がプロジェクト実施者によって確認可能であること。	ホスト国国内の消費電力量における輸入電力の割合を決定するための必要情報。
7	プロジェクト活動が電力を供給する地理的地域が PDD にて定義されること。	プロジェクトバウンダリー明確化のための適用条件。
8	年間排出削減量が 60ktCO_2 以下であること。	タイプ III 小規模 CDM プロジェクト閾値。

2) プロジェクトバウンダリー

プロジェクトバウンダリーには、プロジェクトに起因する主な人為的排出源が含まれる。本調査で提案する新方法論では、以下の通り提案した。

- プロジェクトによって延長される既存配電網。
- プロジェクトによって延長される配電網により電化される地理的地域（プロジェクト地域と定義）。

3) ベースライン及びプロジェクトシナリオ

ベースラインシナリオは、CDM プロジェクトが実施されなかった場合に起こりうる仮定のシナリオである。地方電化プロジェクトにおいては、プロジェクト実施以前に使用されているま

[37] 再生可能エネルギーの例：水力、太陽光、風力、再生可能バイオマスなどを含む。
[38] 再生可能エネルギーの例：水力、太陽光、風力、再生可能バイオマスなどを含む。

たはプロジェクトが実施されなかった場合に採用されるであろう技術がプロジェクトと同じエネルギー量のサービスを提供するのに必要な化石燃料（ケロシン、ディーゼル燃料など）消費がベースラインシナリオと考える。

一方で、プロジェクトシナリオは CDM により実施されるプロジェクトを指す。地方電化プロジェクトにおいては、ホスト国内の既存の低炭素配電網の国内の未電化地域への延伸がプロジェクトシナリオに該当する。

4） 追加性の立証

提案された新方法論における追加性立証手順は既存の CDM ガイドラインに従うものとした。プロジェクト活動の規模などの条件によって、下記の小規模またはマイクロスケールプロジェクトのための追加性に関するガイドラインいずれかの適用を前提とする。

- 小規模 CDM の追加性立証ガイドライン[39]
- マイクロスケール CDM の追加性立証ガイドライン[40]

小規模 CDM の追加性立証ガイドラインにおいては、プロジェクト参加者は、以下に定義される「障壁」が最低一つ存在するため、CDM でなければ当該プロジェクトが実施されないことを説明する必要がある。

投資障壁：	当該プロジェクトと比較して採算性がよく実現可能性が高い代替シナリオが存在する。
技術的障壁：	当該プロジェクトで採用する新技術のリスクを低減する代替シナリオが存在する。
一般的な慣行に伴う障壁：	一般的な慣行、既存の規制、政策的な必要性から採用される代替案が存在する。
その他の障壁：	プロジェクト実施者が特定するその他の障壁によってプロジェクトが実施されなかった場合に排出量が増大する。

マイクロスケール CDM の追加性立証ガイドラインにおいては、年間削減量 20kt（CO_2 換算）未満のプロジェクト（タイプ III プロジェクト）について、下記の条件を満たすものは自動的に追加的とみなされる。

1. プロジェクト実施場所が後発発展途上国（LDC）/小島嶼国（SIDS）あるいはホスト国

[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

が 2010 年 5 月 28 日以前に特定した特別未開発地域[41]であること。

2. 下記の二つの条件を満たす年間排出削減量 20ktCO$_2$e 以下のタイプ III プロジェクト
   1) プロジェクト内の独立サブシステムの年間排出削減量が 600tCO$_2$e 以下であること。
   2) サブシステムのエンドユーザーが各家庭 / コミュニティ / 中小企業であること。

マイクロスケール CDM の追加性立証ガイドラインに基づいて追加性立証の免除を受けられない場合は、小規模 CDM の追加性立証ガイドラインに沿ってプロジェクトの追加性を立証する必要がある。

5） ベースライン排出量算出

本プロジェクトのエネルギーベースラインは配電網延伸対象地域における化石燃料の継続使用に伴うエネルギー消費である。新方法論ではベースライン排出量算出手法として次の 2 つのオプションを提案することとした。

オプション 1: プロジェクトにより分配されるのと同じ電力量を化石燃料により発電した場合の化石燃料使用量に基づきベースライン排出量を算出する。

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

$EB_{CO2,y}$	y 年におけるベースライン排出量, tCO$_2$e/年
EF_{CO2}	CO$_2$ 排出係数, tCO$_2$e/MWh,
$\sum_i$	プロジェクト地域の総和
$ED_{i,y}$	y 年におけるプロジェクト地域 *i* に供給される電力量, MWh/年

新方法論は、プロジェクトが独立系再生可能エネルギー発電（グリッド未接続の太陽光発電、小規模水力発電など）からの電力を代替しないことが確認できる場合は、CO$_2$ 排出係数に既定値の 0.8 tCO$_2$e/MWh[42] を使用することを可能としている。 また、プロジェクトがグリッドに接続しない再生可能エネルギー発電からの電力を代替する場合、既定値を以下の手順で調整することで、新方法論が適用できるよう考慮した。

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

$EF_{CO2,y}$	CO$_2$ 排出係数, tCO$_2$e/MWh

[41] Special underdevelopment zone

[42] 新方法論では、承認済み小規模方法論 AMS-I.A.のディーゼル発電を念頭においた既定値を採用する。なお、方法論の簡素化の観点から、より排出係数の高い他の燃料がベースラインシナリオにて使用される場合もこの既定値を使用することとしている。ベースラインシナリオにおける排出係数の変更には方法論の改訂申請を行う必要がある。

β	プロジェクトにより分配される電力のうち、再生可能エネルギーによる電力を代替する割合
$E_{renewable}$	プロジェクト地域内で分配される再生可能エネルギーによる電力量、MWh/年（この値は事前にホスト国の公開情報を用いて推定する。評価の有効性は有効化審査時に DOE によって検証することとする。）
$\sum_i$	プロジェクト地域の総和
$ED_{i,y}$	y 年におけるプロジェクト地域 i に供給される電力量、MWh/年

オプション 2: プロジェクト地域における過去の燃料使用量と使用燃料の排出係数からベースライン排出量を求める。

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

$BE_{CO2,y}$	y 年におけるベースライン排出量、tCO_2e/年
$FC_{j,baseline}$	プロジェクト実施以前のベースラインとなる燃料 j の消費量、t/年または m^3/年（この値は事前にサンプリング調査を実施し、固定される。サンプリング調査の有効性は有効化審査時に DOE が検証するものとする。）
NCV_j	燃料 j の真発熱量、GJ/t または GJ/m^3
$EF_{CO2,j}$	燃料 j の CO_2 排出係数、tCO_2/GJ
j	プロジェクト地域で使用された燃料タイプ

オプション 2 を採用する場合、排出係数には IPCC の既定値の使用を認めることとした。また、ベースラインにおける燃料消費量は「CDM 活動及びプログラム CDM 活動におけるサンプリングと調査のためのガイドライン」[43]に則り行うサンプリング調査によって決定するものとした。

6） プロジェクト排出量算出

提案の新方法論では、ホスト国が国外から調達した電力の消費に起因するプロジェクト排出を算定に含めることとした。ホスト国が国外から電力を調達する場合、プロジェクトにより供給される電力量全量がホスト国内の再生可能エネルギーによる電力であることを示すことは難しい。このため、一部は国外から調達された電力により供給されると考え、プロジェクト排出の対象とみなすことにより、より保守的な方法論とすることが出来ると考えた。このため、新方法論では、プロジェクトにより供給された電力量全量に、国内の年間電力消費量に占める国外調達電力量の割合（α）を掛け合わせて得られる電力量をプロジェクト排出量の対象とした。また、ホスト国外から調達された電力は全て化石燃料を燃料とする発電所のものとして扱い、国外調達電力の排出係数には「電力消費によるベースライン排出量・プロジェクト排出量・リ

[43] General guidelines for sampling and surveys for SSC project activities (version 02.0) , EB69 Annex 05 http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid48.pdf

ーケージ排出量の計算ツール」[44]で採用されている最も保守的な排出係数である 1.3 tCO_2/MWh を適用することとした。新方法論では、以下の手順でプロジェクト排出を算定することとした。

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

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

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

$PE_{CO2,y}$	y 年におけるプロジェクト排出量、tCO_2e/年
α	国内の年間電力消費量に占める国外調達電力量の割合
$ED_{PJ,y}$	配電ロスを勘案したプロジェクトによる年間配電量、MWh/年
$EF_{CO2,y}$	ホスト国が国外から調達する電力の排出係数、tCO_2e/MWh
E_{import}	ホスト国が国内消費のため国外から調達する年間電力量、MWh/年 入手可能な最新の年間データを使用する。
$E_{domestic}$	y 年におけるホスト国の年間消費量、MWh/年 入手可能な最新の年間データを使用する。
$\sum_i$	プロジェクト地域の総和
$ED_{i,y}$	y 年においてプロジェクト地域 i に配電網延伸によって供給される年間電力量、MWh/年
L	平均配電ロス（割合）[45]

7） リーケージ排出量算出

リーケージとは、プロジェクトバウンダリー外で起こる当該 CDM プロジェクトに起因する GHG 排出である。CDM においては、電力セクタープロジェクトでリーケージの要因となると考えられる発電所建設に起因する排出についてリーケージに含めなくて良いことになっている[46]。この先例に倣い、本プロジェクトについてはリーケージが起こることは想定されない。新方法論においては、方法論の簡潔にするためにもリーケージに伴う排出は無いこととした。ただし、新方法論を審査する小規模ワーキンググループ（SSC-WG）からリーケージの考慮を勧告された場合は必要に応じて方法論を修正することとする。

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[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

[45] 提案方法論は国連承認済みの小規模 CDM 方法論である AMS-I.A.に準拠し、既定値として 20%を採用する。

[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

8）モニタリング

調査団は新方法論構築にあたり、プロジェクト実施後のモニタリングの簡素化を目指した。配電網延伸による地方電化プロジェクトでは、プロジェクトにより供給される電力量をモニターする必要がある。この電力量のモニタリング方法として、新方法論はプロジェクトによって複数の電力メーターが設置される場合（例えば、電化される各家庭に電力メーターを設置する場合など)、プロジェクトにより供給される電力量の総量を求めるためにサンプリングによるモニタリングを提案した。サンプリングにより電力メーター当たりの平均的な電力量を確定し、電力メーター設置台数と掛け合わせることでプロジェクトにより供給される電力量総量を算出することが可能となる。この際、サンプリング方法については CDM の「サンプリング及び調査のためのガイドライン」[47]を参照することとした。新方法論におけるモニタリング項目、モニタリング方法・手順等を表 3-6 にまとめた。

表 3-6：新方法論が提案するモニタリング項目一覧

No.	パラメーター	概要	単位	モニタリング/記録頻度	モニタリング方法・手順
1	$ED_{i,y}$	延伸された配電網によりプロジェクト対象地域 i で供給された電力量	MWh/年	電力メーターによる継続計測、年間値として集積	ホスト国法規制に基づいて校正された電力メーターによりモニターされること。 複数の電力メーターが設置される場合（例えば、電化される家庭毎のメーター設置など)、サンプリングによるモニタリングの適用を認める。この場合、サンプリングは「サンプリングと調査のためのガイドライン」に基づき、実施されること。 ホスト国の公的な電力管轄機関が発行する統計資料を電力メーターによる直接測定の代用とすることを認める。この場合、使用する統計資料の妥当性について、検証時に DOE が審査するものとする。 複数の電力メーターが設置され、サンプリングによるモニタリングを採用する場合、電力メーターの校正記録は”simple random sampling” 手法によって選択されたメータ

[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

					ーの校正記録確認で代用することを認めるものとする。
2	N_{meter}	プロジェクトにより設置された電力メーターの数	-	毎年確認、記録する	プロジェクト実施者により毎年確認されるものとする。
3	E_{import}	国外からホスト国内消費のために調達された電力量	MWh/年	最新の年間データに基づく	情報源はホスト国のエネルギー統計に基づくものとする。利用可能な最新の年の情報に基づくものとする。
4	$E_{domestic}$	ホスト国内の消費電力量	MWh/年	最新の年間データに基づく	情報源はホスト国のエネルギー統計に基づくものとする。利用可能な最新の年の情報に基づくものとする。

3.4.2. SSC-NM0068 に対する小規模方法論パネルの評価(予備勧告[48]及び最終勧告[49])

小規模方法論パネル（以下、SSC-WG）は2011年8月開催の第33回会合において、本調査による新方法論 NM0068 を審議し、承認勧告に向けた改善案としてNM0068に対する予備勧告を提供した。SSC-WGは新方法論の適用条件、プロジェクト排出量の考え方、リーケージ排出、及びモニタリング手法に対して改善案を提案した。調査団は、SSC-WGの提案内容についてホスト国実施機関と協議し、2011年11月21日に予備勧告に対する対応案と対応案を盛り込んだ新方法論(SSC-NM0068-rev）をSSC-WGに提出した。SSC-WGは2012年2月開催の第35回会合において、SSC-NM0068-revを承認する最終勧告を行った。SSC-WGによる予備勧告、予備勧告に対する対応案、最終勧告をそれぞれAnnex J、Annex K、Annex Lとして添付する。

SSC-WGによる予備勧告と調査団による対応策案、さらにSSC-WGによる最終勧告について以下にまとめた。

1) 適用条件に関する指摘事項その 1

SSC-WGによる予備勧告:	適用条件の一つである、既存グリッドに接続するホスト国内の発電施設が「主として再生可能エネルギー電源であること」の判断基準を方法論で提供する必要がある。クレジット期間を通して「再生可能エネルギー構成比」をモニターすることにより、適用条件としてリストする必要が無くなる。ホスト国のグリッドが「主として再生可能エネルギー電源」でない期間についての取り扱いを方法論で提供する必要がある。
予備勧告に対する調査団による	「既存グリッドに接続するホスト国内の発電施設が主として再生可能エネルギー電源であること」を適用条件から削除することを提案した。また、「ホ

[48] Preliminary recommendation
[49] Final recommendation

対応案:	スト国グリッドの再生可能エネルギー構成比」をモニターし、再生可能エネルギー源以外の既存グリッド電源によって供給されたと考えられる電力量についてプロジェクト排出量の対象とすることを提案した。改訂案を方法論に盛り込み、SSCNM-0068-revとして提示した。
SSC-WGによる最終勧告:	「ホスト国における電力グリッドの再生可能エネルギー構成が99%以上の年においてのみ、排出削減量の請求が認められる」ことを適用条件に加え、方法論の適用範囲を狭めるとともに、プロジェクト排出量の算出を回避することにより方法論の簡素化を図ることを勧告した。
調査団コメント	SSC-WGは対象となるグリッドの再生可能エネルギー構成比が99%以上であることを認識しており、簡素化した方法論を承認後、改めて再生可能エネルギー構成比率が99%より低いケースへ適用範囲を広げることを勧告した。再生可能エネルギー構成比が99%以上の国は限られており、方法論適用可能な国が限定される。

2) 適用条件に関する指摘事項その２

SSC-WGによる予備勧告:	地方電化事業に関わる複数の関係者による排出削減の重複計上を回避するための手当てを方法論で提供する必要がある。
予備勧告に対する調査団による対応案:	排出削減の重複計上を回避するため、発電会社、送配電会社など、地方電化の実施主体となりうる団体について、全ての事業実施主体がプロジェクト参加者となるか､プロジェクトのCDM化を別途行わないことの書面による同意を入手することとする。
SSC-WGによる最終勧告:	調査団が提案した適用条件を採用した。
調査団コメント	特になし

3) “地方電化”の定義について

SSC-WGによる予備勧告:	「地方電化」の定義の明確化により、方法論が対象とする電化事業の明確化を図る必要がある。
予備勧告に対する調査団による対応案:	「地方電化」の定義として、「プロジェクト実施以前にホスト国のグリッドに接続していない地域の電化」を方法論で明記することを提案した。
SSC-WGによる最終勧告:	地方電化の定義については最終勧告では議論されなかった。
調査団コメント	特になし

4) プロジェクト排出量に関する指摘事項

SSC-WGによる予備勧告:	新方法論で提案されたプロジェクト排出量の算定手法は、ホスト国における国外電力調達がプロジェクト（地方電化）と無関係に起こることを仮定するが、この仮定の妥当性についてさらに説明が必要。

予備勧告に対する調査団による対応案:	新方法論が対象とするのは恒常的に電力を国外に供給する純電力輸出国において、国内需要に国産の再生可能エネルギーを提供する事業と考える。また、ホスト国による電力輸入は一部の産業におけるピーク需要対応のため、単発的に発生するものを想定しており、プロジェクトが対象とする一般家庭への電力供給が恒常的な電力輸入につながる場合を想定していない。しかしながら、電力輸入とプロジェクトの関係性を完全に否定することは困難なことから、純電力輸出国であることを電力統計データから示し、ホスト国が純電力輸出国である場合のみ方法論を適用できるとする適用条件を追加することを提案した。
SSC-WGによる最終勧告:	SSC-WGはホスト国が電力の純輸入国である期間について、その期間にプロジェクトにより分配される電力が全て輸入電力によるものとしてプロジェクト排出に勘案する手順を提案した。
調査団コメント	ホスト国内の電力輸出入の収支に関するデータの入手が必要となる。

5) リーケージ排出量に関する指摘事項

SSC-WGによる予備勧告:	プロジェクト実施に伴い森林伐採の可能性があることから、森林伐採によるリーケージの定量化手法を方法論で提供する必要がある。
予備勧告に対する調査団による対応案:	既存承認済み方法論AM0045” Grid connection of isolated electricity systems”を参考に、プロジェクトによる森林伐採面積と単位面積当たりの炭素貯蔵量減少量からリーケージ排出を算出する手順を提案。この際、プロジェクトにより一時的に減少する炭素貯蔵量を相殺する
SSC-WGによる最終勧告:	方法論の簡素化の観点からAM0045の手順に基づきリーケージを算出することとし、リーケージ回避の手順については明記されなかった。プロジェクトによる排出削減量の5%以内であればリーケージ排出量の勘案は不要。
調査団コメント	森林伐採のリーケージ排出量をプロジェクトによる排出削減量から差し引くことは、期待される排出削減量に大きな影響を及ぼすと考えられる。リーケージ排出量の算定には、森林伐採面積と単位面積当たりの炭素貯蔵量減少量が必要となる。

6) モニタリングに関する指摘事項

SSC-WGによる予備勧告:	提案された方法論ではプロジェクトにより分配される電力量のデータソースとして、ホスト国の送配電管轄機関または官公庁の電力統計データの使用を認めているが、データソースについてより詳細な指定が必要。電力データは変電所での測定など、電力メーターにより直接測定されるべきと考える。
予備勧告に対する調査団による対応案:	モニタリングに関する方法論内の記載を“ホスト国の電力統計データが電力メーターにより直接測定されたデータを編集したものであれば、電力メーターの直接測定記録に代用可能とする”と変更し、プロジェクトにより分配される電力を求めるモニタリングは直接的または間接的に電力メーターの測定結果によるものとする。

SSC-WGによる最終勧告:	プロジェクトによる電力供給量のモニタリングは電力メーターによる直接測定に限定することを示唆。送配電端の電力メーターを使用する場合は配電ロス10%を考慮することとする。電化される各家庭に電力メーターを設置しモニタリングを行なう場合など、複数の電力メーターを設置する場合、サンプリングによるモニタリングをみとめることとする。サンプリングを行う際はCDMのサンプリングと調査に関するガイドラインに基づきサンプリングを行うこととする。電力メーターの校正記録については、単純無作為抽出法により抽出された電力メーターの校正記録を確認することで可とする。
調査団コメント	プロジェクトにより分配される電力は電化される各家庭/施設にて個々に設置される電力メーターでモニターするか、送配電端に別途電力メーターを設置する必要がある。特に、各家庭に設置される個々の電力メーターのサンプリングを行なう場合は、その手順を明確にし、CER発行のための根拠資料として十分な質の確保が求められる。

3.4.3. 国連による審査結果(承認済み小規模方法論 AMS-III.AW)

国連 CDM 理事会は第 65 回会合において、SSC-WG による承認勧告を容認し、SSC-NM0068-rev を基とした AMS-III.AW “Electrification of rural communities by grid extension---version 1.0”（以下、AMS-III.AW）を承認した。 AMS-III.AW は国家/地方グリッドの延伸による地方電化事業に適用可能な方法論として国連承認を受けた最初の CDM 方法論である。AMS-III.AW を Annex M として添付する。

以下に、AMS-III.AW の構成要素を整理する。

1） 適用条件

AMS-III.AW の適用条件は表 3-7 に示すとおりである。

表 3-7：AMS-III.A.W.の適用条件

	適用条件	SSC-NM0068 との比較
1.	国家/地方グリッドの延伸に伴う地方コミュニティの電化プロジェクトに適用される。	SSC-NM0068 に基づく。 対象プロジェクトの明確化
2.	グリッドに接続していない家庭やユーザーへの電力供給に適用される。	SSC-NM0068 に基づく。 対象プロジェクトの明確化
3.	グリッドに接続するホスト国内の発電施設の設備容量における再生可能エネルギー構成比率が 99%以上	SSC-WG の勧告によるもの。 方法論簡素化

	の年においてのみ、排出削減量の請求が認められる。	
4.	ホスト国の国境を越えた電力輸出入の定量化が可能であり、プロジェクト参加者がこれらのデータを入手できること。	SSC-NM0068 に基づく。 ホスト国が純電力輸入国となる時期の確認のため。
5.	プロジェクトは、新規の発電施設の建設を伴わず、ホスト国の既存の配電網を延伸するものである。	SSC-NM0068 に基づく。 対象プロジェクトの明確化
6.	プロジェクトは、既存の再生可能エネルギーベースのミニグリッドによる電力を代替しない。既存の再生可能エネルギーベースのミニグリッドシステムとサービス提供地域の特定とプロジェクトがその地域に配電しないことを確認する必要がある。	SSC-WG の勧告によるもの。 ベースライン排出量算定方法の正当性裏づけ。
7.	排出削減量のダブルカウントを避けるため、全ての事業実施関係者（発電会社、配電会社、送電会社など）をプロジェクト参加者とするか、プロジェクト参加者が書く関係者と書面を取り交わし、プロジェクトの CDM 化の権利を放棄し、将来にわたってプロジェクトからの排出削減クレジットを請求しないことを約束する必要がある。また、プロジェクトにより電力供給を受ける最終消費者はこの方法論を用いてプロジェクトの CDM 化を行うことはできない。	SSC-WG の勧告によるもの。 排出削減量のダブルカウント回避
8.	方法論は年間排出削減量が 6 万トン(二酸化炭素換算)以下のプロジェクトに適用される。	SSC-NM0068 に基づく。 小規模 CDM タイプ III プロジェクト閾値

2） プロジェクトバウンダリー

AMS-III.AW では、プロジェクトバウンダリーにはホスト国内に位置し、プロジェクトに電力供給するホスト国グリッドに接続する全ての発電施設が含まれる。また、プロジェクトにより電力供給を受ける全ての最終電力消費者を含む。

3） ベースラインシナリオ

AMS-III.AW では NM0068 にて提案の通り、プロジェクトが無かった場合に利用されたであろう技術がプロジェクトと同じエネルギー量のサービスを提供するのに必要な化石燃料消費をエネルギーベースラインと定義する。

4） 追加性の立証

AMS-III.AW では、追加性の立証は、NM0068-rev にて提案の通り、既存の CDM ガイドラインに従って行うこととする。プロジェクト活動の規模などの条件によって、下記の小規模またはマイクロスケールプロジェクトのためのガイドラインの適用が想定される。

- 小規模 CDM の追加性立証ガイドライン
- マイクロスケール CDM の追加性立証ガイドライン

5） ベースライン排出量

AMS-III.AW では、ベースライン排出量の算出方法として NM0068-rev にて提案した 2 つのオプションのうち、オプション 1 のみが採用された。また、AMS-III.AW は新たなオプションとして、過去にディーゼル発電によるミニグリッドシステムに接続していた最終電力消費者がプロジェクトにより再生可能エネルギー主体のグリッド電力の供給を受けることになる場合、ディーゼル発電ミニグリッドシステムの過去の排出記録に基づき、ベースライン排出量を算定する手順を提供している。

AM-III.AW において、エネルギーベースラインは、プロジェクトにより分配されるのと同じ電力量を化石燃料により発電した場合の化石燃料使用量であるとの考えに基づき、下記の通り、ベースライン排出量を算出する。

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

$EB_{CO2,y}$	y 年におけるベースライン排出量、tCO_2e/年
EF_{CO2}	CO_2 排出係数、tCO_2e/MWh,
$\sum_i$	プロジェクト地域の総和
$ED_{i,y}$	y 年におけるプロジェクト地域 *i* へ分配される電力量、MWh/年

また、プロジェクトがグリッドに接続しない再生可能エネルギー発電からの電力を代替しないことが確認できる場合は、CO_2 排出係数に既定値の 0.8 tCO_2e/MWh を使用する。プロジェクトがグリッドに接続しない再生可能エネルギー発電からの電力を代替する場合、既定値を以下の手順で調整する。

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

$EF_{CO2,y}$	CO_2 排出係数、tCO_2e/MWh
β	プロジェクトにより分配される電力のうち、再生可能エネルギーによる

	電力を代替する割合
$E_{renewable}$	プロジェクト地域内で分配される再生可能エネルギーによる電力量、MWh/年 (この値は事前にホスト国の公開情報を用いて推定する。評価の有効性は有効化審査時に DOE によって検証することとする。)
$\sum_i$	プロジェクト地域の総和
$ED_{i,y}$	y 年におけるプロジェクト地域 i にて分配される電力量、MWh/年

AMS-III.AW では過去にディーゼル発電によるミニグリッドシステムに接続していた消費者がプロジェクトにより再生可能エネルギー主体のグリッド電力の供給を受けることになる場合は以下の方法によりベースライン排出量を算定する。

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

$EB_{hist,y}$	過去にディーゼルミニグリッドシステムに接続していた消費者のための y 年におけるベースライン排出量、tCO_2e/年
EG_{hist}	ディーゼルミニグリッドシステムの過去の発電量、MWh/年
EF_{hist}	ミニグリッドシステムの CO_2 排出係数、 tCO_2e/MWh

ミニグリッドシステムの排出係数は以下の手順にて算出する。

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

EF_{hist}	ミニグリッドシステムの CO_2 排出係数、tCO_2e/MWh
FC_{hist}	ディーゼルミニグリッドシステムで消費される燃料 i の消費量、トン
NCV_i	燃料 i の新熱量、GJ/トン
$EF_{CO2,i}$	燃料 i の排出係数、tCO_2/GJ
GEN_{hist}	ミニグリッドシステムの CO_2 排出係数, tCO_2e/MWh,

6) プロジェクト排出量

AMS-III.AW では、ホスト国が純電力輸入国である場合にプロジェクトにより分配される電力が輸入電力であると仮定し、以下の手順に基づきプロジェクト排出量の算出が求められる。

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

もし、$EG_{export,t} > EG_{import}$ であれば、

$EF_{CO2,import,y} = 0$ とする。

PE_y	y 年におけるプロジェクト排出量、tCO_2e/年
$\sum_t^P$	年間においてホスト国が純電力輸入国である期間の総和、集計期間 t は時間毎、日毎、月毎から選択する。
$EG_{import,t}$	国外から調達された電力量、MWh、輸出入収支を確認する際の集計方法は時間毎、日毎、月毎のいずれかを選択する。
$EG_{export,t}$	ホスト国からの輸出電力量、MWh、輸出入収支を確認する際の集計方法は時間毎、日毎、月毎のいずれかを選択する。
$ED_{i,t}$	延伸された配電網からプロジェクト地域 i に供給される電力量、MWh、輸出入収支を確認する際の集計方法は時間毎、日毎、月毎のいずれかを選択する。
$EF_{CO2,import,y}$	ホスト国が国外から調達する電力の CO_2 排出係数、1.3 tCO_2e/MWh を適用する。

7） リーケージ排出量

AMS-III.AW では、既存の承認済み CDM 方法論 AM0045 の手順に則り、プロジェクトによる森林伐採に関わるリーケージの算出が求められる。リーケージ排出量がプロジェクトによる想定排出削減量の 5%以内であれば、リーケージ排出量は免除される。

AM0045 の手順は以下の通り。

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

LE_1	プロジェクト開始時に計上される、森林伐採に伴うリーケージ排出量、tCO_2e
A_{def}	プロジェクトによる森林伐採対象面積、ヘクタール
L_C	単位面積当たりの炭素貯蔵量、tCO_2e/ヘクタール

8） 排出削減量

AMS-III.AW では、排出削減量は下式によって算出する。

$$ER_y = BE_y - PE_y - LE_1$$

9） モニタリング

AMS-III.AW でモニタリングが求められる項目を表 3-8 に列挙する。

表 3-8：AMS-III.AW モニタリング項目一覧

No.	パラメーター	概要	単位	モニタリング/記録頻度	モニタリング方法・手順
1	ED_y	延伸された配電網によりプロジェクト対象地域 i で供給された電力量	MWh/年	電力メーターによる継続計測、年間値として集積	ホスト国法規制に基づいて校正された電力メーターによりモニターされること。 複数の電力メーターが設置される場合（例えば、電化される家庭毎のメーター設置など)、サンプリングによるモニタリングの適用を認める。この場合、サンプリングは「サンプリングと調査のためのガイドライン」に基づき、実施されること。 ホスト国の公的な電力管轄機関が発行する統計資料を電力メーターによる直接測定の代用とすることを認める。この場合、使用する統計資料の妥当性について、検証時に DOE が審査するものとする。 複数の電力メーターが設置され、サンプリングによるモニタリングを採用する場合、電力メーターの校正記録は”simple random sampling”手法によって選択されたメーターの校正記録確認で代用することを認めるものとする。
2	N_{meter}	電力メーターの設置数	-	毎年確認、記録する	プロジェクト実施者により毎年確認されるものとする。
3	$EG_{import,t}$	ホスト国の輸入電力量	MWh/年	電力メーターによるモニタ	ホスト国の電力管轄機関をデータソースとすることが

				リング、時間単位、日単位、月単位から選択可	できる。
4	$EG_{export,t}$	ホスト国の輸出電力量	MWh/年	電力メーターによるモニタリング、時間単位、日単位、月単位から選択可	ホスト国の電力管轄機関をデータソースとすることができる。
5		グリッド接続のホスト国内発電施設の年間発電量合計	MWh/年	最低月単位、1年分を集計	ホスト国の電力管轄機関をデータソースとすることができる。

3.4.4. 承認された新方法論 AMS-III.AW の課題

調査団により提出された新方法論案の承認過程において、いくつかの修正案が AMS-III.AW に反映された。調査団が提案した方法論からの主な修正点を表 3-9 に整理した。

表 3-9：AMS-III.AW にて採用された修正案と必要なアクション一覧

	AMS-III.AW にて採用された修正案	**必要なアクション**
適用条件：	ホスト国における電力グリッドの再生可能エネルギー構成が99%以上の年のみ、排出削減量の請求が認められる。	ホスト国の発電構成における再生可能エネルギーの割合が 99%以上であることを毎年確認する。
プロジェクト排出量：	ホスト国が純電力輸入国である期間について、プロジェクト排出を月単位で勘案するものとする。ホスト国が純電力輸出国である月についてはプロジェクト排出をゼロとみなす。	プロジェクト実施期間中のホスト国の輸出入電力収支のデータが必要となる。ホスト国が純電力輸入国である期間について、保守的な排出係数 1.3 tCO_2/MWh を用いてプロジェクト排出量を算出し、排出削減量に勘案する。
リーケージ排出量：	配電網敷設に伴う森林伐採による炭素貯蔵量減少をリーケージ排出として排出削減量から控除すること。ただし、プロジェクトによる排出削減量の5%以内である場合は控除不要。	リーケージ排出量算出のため、配電網敷設に伴う森林伐採該当範囲の面積と単位面積当りの炭素貯蔵量の変化の情報が必要となる。リーケージ排出量は有効化審査の時点で定量化し、排出削減量に反映させ

		る。大規模な森林伐採を伴う場合、リーケージ排出量が年間排出削減量を上回り、一時的な「負の排出削減」を生じることが考えられる。この場合、全てのリーケージ排出量による排出増大分は全量排出削減量によって相殺される必要がある。

3.4.5. 承認済み方法論 AMS-III.AW に基づく PDD の修正

新方法論承認申請のために作成した PDD を承認された AMS-III.AW の要件に基づき修正した。その際、2012 年 4 月開催の第 66 回国連 CDM 理事会にて採用された新しい PDD フォーマットを用いた。プロジェクトによる排出削減量も同様に AMS-III.AW.の要件に沿って，当該プロジェクトによるベースライン排出量、プロジェクト排出量、リーケージ排出量を下記の通り算定し、PDD に記載した。

1) ベースライン排出量の算定

プロジェクトにより新たに電力供給を受ける 33,436 世帯の平均電力消費量を 60kW/月[50]と仮定し、24,074 MWh の電力がプロジェクトによりホスト国内に供給されると仮定し、また、既存のオフグリッドの再生可能電力の代替は起こらないと仮定し、ベースライン排出量を下記の通り算定した。

$\beta = EG_{renewable,y} / \sum_i ED_{i,y}$
$= 0 / 24,074$
$= 0$

$EF_{CO2,y} = (1 - \beta) * 0.8$
$= (1 - 0) * 0.8$
$= 0.8$

$BE_{CO2,y} = \sum_i ED_{i,y} * EF_{CO2}$
$= 24,074 * 0.8$
$= 19,259\ tCO_2e/yr$

[50] BPC に対する聞き取り調査に基づく想定値。但し、プロジェクト実施後は電力供給量を実測。

2) プロジェクト排出量の算定

ホスト国が年間通して常に電力輸出国であるとの前提に立ち、プロジェクト排出量を以下の通り算定した。

年間を通して輸出電力量が輸入電力量を上回る（$EG_{export,month} > EG_{import,month}$ ）ことから、プロジェクト排出量算定のための排出係数はゼロとなる（$EF_{CO2,import,y} = 0$）。よって、プロジェクト排出量はゼロである。

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

3) リーケージ排出量の算定

前項にて述べたとおり、新方法論として申請した NM0068 が国連承認される過程で AMS-III.AW ではプロジェクト導入に伴う森林伐採によるリーケージ排出を勘案することとなった。リーケージ排出量の算出には森林伐採面積及び、単位面積当たりの炭素貯蔵量が必要となる。プロジェクト実施前の試算条件として、下記を使用し、リーケージ排出量を算定した。

(a) 森林伐採面積：1,000 ヘクタール[51]
(b) 単位面積当たりの炭素貯蔵量：75.4tC/ヘクタール[52].

上記の試算条件のもと計算すると、森林伐採に伴うリーケージは 276,500 tCO_2e となる。

$$LE_1 = A_{def} \times L_C$$
$$= 1{,}000 \text{ ha} \times 276.5 \ tCO_2e/ha$$
$$= 276{,}500 \ tCO_2e$$

4) 排出削減量の算定

本プロジェクトによる排出削減量は下式にて算出される。

$$ER_y = BE_y - PE_y - LE_1$$

[51] Master Plan Chapter 14.3.1 Table 14.3.1、全対象面積の一部が森林伐採対象と仮定した。
[52] データソース：Global Forest Resources Assessment 2010 (FRA 2010) available via FAO website, http://www.fao.org/forestry/fra/fra2010/en/

ER_y　　y年における排出削減量（tCO_2e）
$BE_{CO2,y}$　　y年におけるベースライン排出量（tCO_2e）
PE_y　　y年におけるプロジェクト排出量（tCO_2e）
LE_1　　1年目に計上するリーケージ排出量（tCO_2e）

PDD 内の事前の試算は以下のとおりとなる。

$ER_1 = BE_{CO2,1} - PE_{CO2,1} - LE_1$
$ER_y = 0$　*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
1年目	0 tCO_2	-267,234 tCO_2	19,259 tCO_2	0 tCO_2	276,500 tCO_2
2年目	0 tCO_2	-247,975 tCO_2	19,259 tCO_2	0 tCO_2	0
3年目	0 tCO_2	-228,716 tCO_2	19,259 tCO_2	0 tCO_2	0
4年目	0 tCO_2	-209,457 tCO_2	19,259 tCO_2	0 tCO_2	0
5年目	0 tCO_2	-190,198 tCO_2	19,259 tCO_2	0 tCO_2	0
6年目	0 tCO_2	-170,939 tCO_2	19,259 tCO_2	0 tCO_2	0
7年目	0 tCO_2	-151680tCO_2	19,259 tCO_2	0 tCO_2	0
8年目	0 tCO_2	-132421tCO_2	19,259 tCO_2	0 tCO_2	0
9年目	0 tCO_2	-116162tCO_2	19,259 tCO_2	0 tCO_2	0
10年目	0 tCO_2	-93903tCO_2	19,259 tCO_2	0 tCO_2	0
11年目	0 tCO_2	-74644tCO_2	19,259 tCO_2	0 tCO_2	0
12年目	0 tCO_2	-55385tCO_2	19,259 tCO_2	0 tCO_2	0
13年目	0 tCO_2	-36126tCO_2	19,259 tCO_2	0 tCO_2	0
14年目	0 tCO_2	-16867tCO_2	19,259 tCO_2	0 tCO_2	0
15年目	2,392 tCO_2	2,392 tCO_2	19,259 tCO_2	0 tCO_2	0
16年目	19,259 tCO_2	21,651 tCO_2	19,259 tCO_2	0 tCO_2	0
17年目	19,259 tCO_2	40,910 tCO_2	19,259 tCO_2	0 tCO_2	0
18年目	19,259 tCO_2	60,169 tCO_2	19,259 tCO_2	0 tCO_2	0
19年目	19,259 tCO_2	79,428 tCO_2	19,259 tCO_2	0 tCO_2	0
20年目	19,259 tCO_2	98,687 tCO_2	19,259 tCO_2	0 tCO_2	0
21年目	19,259 tCO_2	117,946 tCO_2	19,259 tCO_2	0 tCO_2	0

リーケージ排出量が全量相殺されるまで排出削減は発生しない。PDD で使用した試算条件では、プロジェクト開始後 15 年目に初めて正の排出削減が発生する[53]。

[53]進行中の有効化審査は、プロジェクトによる炭素吸収源の喪失に該当する地域は限定的である（配電網延伸地域での森林伐採が必ずしもプロジェクトに起因するものではない）との判断から、現時点では 1 年目より排出削減が見込める方向で現在進んでいる。しかし、今後 CDM 登録までに、プロジ

5) 有効化審査に向けての課題

AM-III.AW を適用する場合、リーケージ排出量によりプロジェクトから得られる排出削減量が大きく左右されることから、リーケージ排出量算出に必要となる配電網敷設に伴う森林伐採該当面積と配電網敷設範囲の単位面積当たりの炭素貯蔵量の算出を行うための調査の実施が必要である。

また、プロジェクト排出量算出のため、ホスト国の電力輸出入の収支を時間単位、日単位、月単位でみることのできるデータの収集が必要である。

さらに、ベースライン排出量となるプロジェクトにより供給される電力量のモニタリング方法について、どの地点で電力メーターを取り付けるのか、どのような体制でモニタリングを行うのか、各家庭に設置される電力メーターによってモニタリングを行なう場合、モニタリグにサンプリングをどのように取り入れるのか、実施計画と体制を整える必要がある。

また、有効化審査に先立ち、PDD セクション E（地元利害関係者のコメントへの対応）とセクション D（環境影響）を完成させる必要がある。

AMS-III.AW に基づき改訂した PDD を Annex N として添付する。

3.5. CDM ワークショップの開催

ブ国では2011年の組織再編の結果、再生可能エネルギー省（以下DRE：Department of Renewable Energy）が設立され、エネルギー省（Department of Energy）に代わり、地方電化事業の責任機関となった。新たにブ国の実施機関となった DRE は新組織及び関連機関の CDM キャパシティ向上のため、調査団に対して CDM に関するワークショップの開催を要請した。本調査の目的の一つに実施機関の CDM キャパシティ向上が挙げられることから、調査団は 2012 年 4 月 15 日から 21 日に実施した第 2 回現地調査中の 4 月 17 日と 18 日にかけて、2 日間の CDM ワークショップを開催した。両日ともに DRE、BPC をはじめ、関係機関から 30 名程度の参加があった。ワークショップへの参加者リストを Annex O として添付する。

3.5.1. ワークショップ議題と日程

調査団はワークショップの議題と日程についてDRE及びBPCと協議の上、CDMに関する様々なバックグラウンドを持つ出席者の要望にこたえるべく、2 日間の日程で CDM の紹介から実例まで幅広い議題を抽出し対応した。ワークショップの議題及び日程は以下の通り。

ェクトによる森林伐採がより大きなリーケージ排出につながると判断される可能性も引き続き残る。

第 1 日: 2012 年 4 月 17 日、火曜日

時間	議題
09:00-09:15	**ワークショップ日程/JICA 調査の紹介**
09:15-10:30	**議題 1：CDM 概観及び 2013 年以降の温暖化削減への取り組みの展望** - 後発開発途上国（LDC）における CDM - プログラム CDM について - 第 2 約束期間及び 2020 年以降の新しい市場メカニズムについて
	質疑応答
10:30-11:00	休憩
11:00-12:30	**議題 2：地方電化プロジェクトと新 CDM 方法論の開発** - 新方法論開発の成果 - 新 CDM 方法論のブ国の地方電化事業への適用
	質疑応答
12:30-13:30	昼食
13:30-15:30	**議題 3：CDM プロジェクトの設計、事例** - 事例 1：太陽光発電プロジェクト - 事例 2：小規模水力発電プロジェクト - 事例 3：バイオガス回収及び有効利用 質疑応答
15:30-16:00	休憩
16:15-16:30	第 1 日終了挨拶 /ワークショップ第 2 日の日程紹介

第 2 日: 2012 年 4 月 18 日、水曜日

時間	議題
09:00-09:15	**ワークショップ日程/JICA 調査の紹介**
09:15-10:15	**議題 4： CDM に適用可能な各種方法論の解説** - 事例 1： 方法論 AMS-I.J “太陽熱温水供給システム” - 事例 2： 方法論 AMS-III.AA “改修技術を用いた交通部門のエネルギー効率改善活動”
10:15-10:30	休憩.
10:30-12:00	**議題 4： CDM に適用可能な各種方法論の解説**（続き） - 事例 3： 方法論 AMS-III.AJ “固形廃棄物からの物質の回収･リサイクル”
	質疑応答
12:00-13:00	昼食
13:00-14:15	**議題 5： CDM のモニタリングと検証手続き**
	質疑応答
14:15-14:30	Conclusion/Closing

3.5.2. ワークショップにおける主な質疑

ワークショップでは参加者から活発な発言があり、意見交換や質疑応答が行われた。主な質疑を以下にまとめた。 また、ワークショップの様子を写真 3-1 に示す。

議題１：CDM 概観、2013 年以降の温暖化削減への取り組みの展望

- 小規模プロジェクトのバンドリングスキーム及びプログラム CDM の組成方法について、多くの質問と関心が寄せられた。特に、バンドリングについては、小規模のプロジェクト複数をまとめ、一つのプロジェクトと実施することにより、CDM の手続きコスト（有効化審査費用、登録費用など）の削減が可能であることから、比較的規模の小さい案件の実施に適していることが評価された。
- マイクロスケールの CDM 案件に適用される実質的な追加性証明の免除措置（一定の条件を満たせば自動的に追加性があるとみなされる）について、CDM に精通している参加者から、CDM の精神との乖離を危惧する指摘があった。
- 中国の CDM の実施状況が世界でも突出している主な理由（要因）について質問があった。特に中国で初期の頃から政府をあげて CDM を推進する動きがあり、ホスト国承認の取得もスムーズに行われていることを説明した。参加者によるとブ国では NEC(環境省)が DNA としてホスト国承認を出す立場にあるが、環境省自体の人員不足、全省庁の中でも最も多くの業務を抱えていることなどから、ホスト国承認が下りるまでに非常に多くの月日がかかることが指摘された。
- 複数国がホスト国となっているプログラム CDM において、登録申請時に全てのホスト国承認が必要であるかどうか、DNA から質問があった。現時点で明確に定められた規定は無いが、基本的にそのように考えると回答した。ブ国がホスト国として列挙されているプログラム CDM が 3 件有効化審査に出ているが、いずれもブ国以外の国の事業者がプログラム提案者になっているもので、ブ国側でこれら 3 件のプログラムの存在を認識している参加者は一人もいなかった。
- 日本政府が進める二国間取引（BOCM）について、CDM で上手くいっていないプロジェクトを BOCM に乗り換えて推進することが可能であるかどうか質問があった。CDM の煩雑さを認識している参加者からは、BOCM のアイデアを評価する声が聞かれた。
- BOCM における MRV と国連で提唱されている MRV との違い、CDM 方法論の違いについて質問があった。

議題２：地方電化プロジェクトと新 CDM 方法論の開発

- 承認された方法論で、グリッドの延伸に伴う森林伐採の影響をリーケージとして差し引く必要がある点について、水力発電等との取り扱いの違いについて質問があった。水力発電等を対象とした再生可能エネルギー方法論はプロジェクトの建設に伴う排出の考慮は求められていないと説明した。
- 森林伐採に伴うリーケージの算定に用いる森林密度の係数について、検証の都度見直しが必要か、その際、どのような手順となるのか質問があった。リーケージ最初の年の排出削減量から差し引くこととなっており、モニタリングが不要であることを説明した。

・ ホスト国の電力が net import (近隣国からの買電が売電を上回る) の場合において考慮すべきプロジェクト排出量の係数（1.3tCO_2/MWh）について、この数字を実際の排出係数に基づいて事業者ごとに算定した数字を適用化可能かどうか質問があった。現時点では、固定されているが、方法論の改定申請が認められれば、プロジェクト固有の数字を使える可能性もあることを説明した。

議題 3：CDM プロジェクトの設計、事例 (太陽光、小規模水力、バイオガス)

・ 小規模水力発電について、数百キロワットレベルのミニハイドロの普及を目指すプロジェクトも推進していることから､バンドリングのスキームを用いて CDM を推進する可能性が期待できると参加者からのコメントがあった。
・ ブ国エネルギー省で推進中の大規模水力発電プロジェクト（発電された電力がブ国からインドに売電される）について、ブ国政府のホスト国承認のみならず、インド政府のホスト国承認の必要性について質問があった。基本的に両国必要と思われるが、早急に DOE を通じて国連に確認をとり、必要であれば対応を進めるよう、助言した。
・ ケーススタディで採り上げた三つのプロジェクトタイプのうち、ブ国においては、バイオガス回収が最も実現可能性が高いと思われるというコメントがあった。また、メタンの放出回避量の算出について、家畜の種類により異なる係数が適用されるのかどうか質問があった。方法論は多種の家畜を対象とした共通の係数となっていることを説明した。ブ国における主な家畜は牛であるが、一般的に放牧による飼育であることを考慮すると当該方法論を適用してメタン回避を請求することは難しいと考えられると説明した。

議題４：CDM に適用可能な各種方法論の解説　(太陽熱温水器、交通、廃棄物リサイクル)

・ 交通分野のプロジェクトの先進例として採り上げたインドの地下鉄回生ブレーキ導入プロジェクトについて、CDM における ODA 案件の適用について質問があった。ODA 案件であっても、両国政府の書面による承認等を通じ、CDM 化が可能であること説明した。現在ブ国エネルギー省で推進中の水力発電の一つについて、インド政府からの資金が入っており、この点で DOE の審査が難航しているという相談があった。
・ 交通分野の CDM はブ国において関心が高く、ポテンシャルが高いと考えていると、参加者からコメントがあった。また、ブ国国籍の事業家が開始する電気タクシー（当初 10 台）の展開について、CDM 化の可能性が高いことを議論した。また、ブ国政府の交通マスタープラン（通信省が管轄）において、BRT[54]の普及を検討する動きがあると参加者から紹介があった。当社がラオスにおいて実施している交通 NAMA のプロジェクト例について説明した。
・ 廃棄物リサイクルの方法論について、ブ国での現状ではプラスティック製品はすべて海外から調達、また、使用済みのものは再度海外に売却されていることから、ポテンシャルは低いと思われとの参加者からのコメントがあった。また、方法論に基づく排出削減量が極めて低いことからも、CDM による同種のプロジェクトの推進があまり期待できないのではないかということだった。

[54] BRT: バス・ラピッド・トランジット（バスによる大量旅客高速輸送）

議題５：CDM のモニタリングと検証手続き

・ モニタリング結果の検証を受けるタイミングについて、一定の制限があるかどうか、参加者から質問があった。検証を受け発行されるまでに要する時間や、検証の度にかかる指定運営組織（DOE）の費用等を考慮すると、年に一度程度を目処に実施する事業者が多いことを説明した。また、一度の検証から創出が期待される排出削減（CER）量も、検証の頻度の検討を左右することを説明した。

写真 3-1：ブ国における CDM ワークショップ風景

4. 考察

4.1. ザンビア「電力アクセス向上事業」小水力発電事業 CDM 登録支援

ザ国の「電力アクセス向上事業」の一部である Mujila Falls Lower 小水力発電所建設事業の CDM 事業登録に向けた有効化審査は本調査内に終了し、登録申請の提出が出来た。現在、本プロジェクトは CDM 参照番号 9533 が割り当てられ、登録申請の書類審査の順番を待っており、早くて 2013 年 6 月に登録される見通しである。

本プロジェクトは発電所建設の調印を 2013 年 2 月末に控え、調印後建設が開始される予定である。運転開始は 2015 年 3 月を予定しており、CDM 登録から水力発電所の運転開始まで 2 年弱の期間がある。本件の CDM 化の真の目的は国連登録ではなく、プロジェクトによる排出削クレジットを実現することであり、事業開始後のモニタリング、検証手続きを経て CER が発行されることが最も重要である。

4.2. ブータン「地方電化事業」を事例とした既存配電網延伸による地方電化事業 CDM 新方法論作成

小規模 CDM 方法論 AMS-III.AW(グリッド延伸による地方コミュニティの電化)の承認は、国内のエネルギー供給がほぼ 100%再生可能資源であるホスト国に対して、CDM 参加の新たな機会を提供したといえる。一方、当該方法論承認の課程で国連 SSCWG は提案された方法論に配電網敷設に伴う森林伐採によるリーケージ排出を排出削減量から差し引くことを承認方法論に組み込み、配電網延伸による地方電化事業の CDM 化にハードルを課した形となった。特にプロジェクトの配電網敷設対象地域に森林が多く含まれる場合、CDM としての実現性に大きく影響を及ぼすものと危惧される。このため、今般承認された小規模 CDM 方法論 AMS-III.AW はリーケージの影響が少ない、森林伐採を伴わない砂漠地帯や草原地帯などでの配電網延伸事業の CDM 事業化により適していると言える。

一方、AMS-III.AW はプロジェクトによるリーケージ排出量算定に必要となる森林伐採対象地域の面積と単位面積当たりの炭素損失量の決定方法について詳細な手順を提供していない。このため、説得力のある論拠を示せば、プロジェクト実施者の考え方に基づきリーケージ排出量を算定する余地が残っている。特に森林伐採面積についてはプロジェクトによって配電網が敷設される地域でも、明らかに森林に該当しない地域や、その森林伐採がプロジェクトによるものではないと論理的に説明が出来る地域をリーケージ排出量算定の対象外とすることが可能と考えられる。例えば、プロジェクトにより伐採された木材が有効利用され、別の地点で起こったであろう森林伐採を相殺すると説明できる場合などは該当する森林伐採地域を除外できる可能性がある。当該プロジェクトに対するリーケージの影響を正確に判断するためには、プロジェクト特有の情報に基づく十分な調査検討が必要であると考える。

このように、AMS-III.AW を用いて配電網延伸による地方電化事業の CDM 事業化を目指すにあたっては、森林伐採に係るリーケージ排出量を正確な定量化が重要であるが、このためには、リーケージ排出量算出に用いられる二つの要素であるプロジェクトによる森林伐採面積と単位面積あたりの炭素損失量を正確に把握することが不可欠である。また、リーケージ排出量を最小限に抑えることが配電網延伸プロジェクトの CDM 事業化の実現可能性を高めることとなることから、プロジェクトによる配電網延伸敷設面積のうち、プロジェクト実施以前に道路等に整備された地域や、森林に該当しない地域、さらに、伐採された木材が有効活用された地域などを除外し、プロジェクトによる森林伐採面積の対象を最小化する検討が重要となる。

さらに、プロジェクトによる排出削減量を最大とするための方法として、更新可能なクレジット期間を採用し、最大 21 年間にわたりクレジットの回収を目指すことが挙げられる。更新可能なクレジット期間は固定クレジット期間（10 年）と比べて排出削減を長期にわたり請求できるメリットがあるが、クレジット期間の更新に際しては、国連の定める更新手続きに沿って更新手続きを行う必要がある。この際、プロジェクトの国連登録時の PDD を更新時点で有効な方法論のバージョンに基づき修正し、プロジェクトによる排出削減量を再度定量化する必要があるが、方法論が大きく修正され、適用条件等がプロジェクトと合致しなくなってしまうなど、最新の方法論がそのままプロジェクトに適用できない場合は CDM 手続きに基づく逸脱申請を行うなど、更なる手続きが必要になる場合がある。「登録済み CDM プロジェクトのクレジット期間の更新手順」（バージョン 6）[55]によると、クレジット期間の更新にあたっては、ベースラインシナリオそのものの再評価を行う必要はなく、クレジット期間更新時点でのベースライン排出量の更新をすればよいことになっている。また、クレジット期間の更新を行う意図がある場合は、プロジェクト参加者は現在のクレジット期間が終了する 6～9 ヶ月前に、改訂された PDD と選定した DOE に関する情報を専用ウェブサイトを用いて CDM 理事会に提出することが必要であることから、手続きの時期を逸さぬようにスケジュール管理をする必要がある。

調査団は新方法論申請のために作成されたブ国の配電網延伸による地方電化事業のための PDD を国連承認された AMS-III.AW に基づき修正した。プロジェクトによる排出削減量を最大とするため、修正版の PDD ではプロジェクトのクレジット期間に 21 年（7 年、2 回更新）を採用することとした。森林が国土の 60%以上を占めるブ国の場合、森林伐採にともなうリーケージの影響は大きく、現時点の試算では、リーケージを勘案しない場合の排出削減量年間 19,000tCO_2e に対し、森林伐採のリーケージを勘案する場合、平均的な年間排出削減量が 6,000 tCO_2e まで縮小することが想定される[56]。

[55] EB 63, Annex 29: http://cdm.unfccc.int/Reference/Procedures/reg_proc04.pdf
[56] 森林伐採面積：1,000 ヘクタール、伐採地域の炭素密度を 75.4tC/ヘクタールと仮定した場合の試算。プロジェクト開始から 15 年目まではリーケージ排出量相殺のため、排出削減は発生しない。

5. 結論と提言

本項では、本調査の結果をまとめるとともに、排出削減に向けた国内及び国際動向を踏まえ、両国における CDM 事業化に向けての展望及び課題について述べる。

5.1. 調査結果のまとめ

5.1.1. ザンビア「電力アクセス向上事業」小水力発電事業 CDM 登録支援

ザンビア「電力アクセス向上事業」水力発電事業 CDM 登録支援は調査期間内に国連登録申請の目標を達成した。国連による書類審査、登録申請のコメント期間を経て最短で 2013 年 6 月の登録を見込んでいる。国連登録から 2015 年 3 月に予定のプロジェクト稼働開始まで約 2 年間あることから、この期間にプロジェクトのモニタリングに向けて着実に準備を行うことが重要である。有効化審査において、今後対応が必要な課題として、水力発電所の運転・点検手順書及びモニタリング手順書の整備が挙げられた。通常の水力発電事業の要件に追加して、CDM 事業として排出削減クレジット実現に必要なモニタリング機器の定期的な校正やモニタリングデータの管理などを盛り込み整備することが求められる。本プロジェクトからの排出削減クレジット発行の実現に向けて、CDM 有効化審査における支援に続き、CER 発行申請に向けての支援提供が望まれる。

5.1.2. ブータン「地方電化事業」を事例とした既存配電網延伸による地方電化事業 CDM 新方法論作成

調査団と実施機関は本調査では地方電化事業の CDM 化に向けた適用可能方法論の国連承認までを実施することで合意した。本調査によって策定された既存グリッド延伸による地方電化事業のための CDM 方法論は調査期間中 AMS-III.AW “Electrification of rural communities by grid extension---version 1.0”として国連に承認された。この方法論は既存グリッド延伸による電化事業に適用可能な最初の CDM 方法論である。

本調査においては、適用可能な方法論が存在しなかったため、既存配電網延伸による地方電化事業の CDM 化に向けた有効化審査の実施に一足飛びに進むことが出来なかった。調査団は地方電化のための CDM 方法論の国連承認の目的を達成し、続く配電網延伸による地方電化事業の CDM 化に向けた有効化審査実施への道筋を作ることが出来た。

方法論承認の課程で本プロジェクトの CDM 登録を成功させるには配電網延伸に伴う森林伐採の影響を詳細に調査する必要があることがわかった。本調査で対象となった既存配電網延伸による地方電化事業の CDM 登録について、実施機関が必要な支援を受け、有効化審査の実施と

国連登録が行われることが望まれる。これについて調査団はブ国実施機関に働きかけ、引き続き日本国政府の支援により本プロジェクトの有効化審査の実施を進めるべく、日本政府が主催する CDM 実現可能性調査公募への応募を勧めた。本プロジェクトは CDM 実現可能性調査公募に採択され、現在、森林伐採による影響の調査も含め、有効化審査が実施されている最中である。今後国連によりプロジェクトの CDM 登録がされるまで断定は出来ないものの、CDM 実現可能性調査における森林伐採による影響の調査の結果、配電網敷設地域でプロジェクトによる炭素吸収源の喪失に該当する地域は限定的であるとの判断から、リーケージ排出量を勘案してもクレジット期間 1 年目より年間約 19,000 トンの排出削減を見込む方向で有効化審査が進行中である[57]。

5.2. 両国における CDM 事業化に向けての展望と課題

5.2.1. CDM の制度及び市場の動向と本調査プロジェクトへの影響

① 京都議定書第二約束期間の CDM と日本の立場

2012 年 11 月 26 日から 12 月 8 日まで、カタール・ドーハにおいて、国連気候変動枠組条約第 18 回締約国会議（COP18）、京都議定書第 8 回締約国会合（CMP8）等が行われた。

ドーハ会議では、前年のダーバン合意[58]を受け、2015 年までの交渉を進める作業計画に合意すると同時に、2020 年までの取り組みを決定した。第二約束期間設定のための京都議定書の改正については、同期間中の各国の排出抑制及び削減に関する約束が記載された附属書 B を含む改正案が成果文書 として採択され、第二約束期間の長さは 2013 年から 2020 年までの 8 年とすることが決定された。第二約束期間に参加しないという日本の立場は改正された付属書 B に反映された。日本をはじめ第二約束期間に参加しない先進国、及び途上国は自主的な削減目標・行動を掲げているカンクン合意に基づき、新しい枠組みが運用開始する 2020 年まで気候変動対策を進めることとなった。

ドーハ会議では、クリーン開発メカニズム（CDM）について、第二約束期間に参加しない国も CDM プロジェクトに参加して 2013 年以降の CDM クレジット（CER）を原始取得（自国に転送）することが可能であることが確認された。また、一旦第二約束期間不参加国の国別登録簿内に入った CER は、国外への移転は認められないが、現行の国連ルール上は、国内事業者間での国内取引に制約はなことから、国内で自主的な削減目標達成への利用など、今後 CER の国内利用が可能となることが期待される。

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[57] 有効化審査中の公開 PDD：
http://cdm.unfccc.int/Projects/Validation/DB/RAF02M1RO8Q7V2WW1RPI9ZB6U3QWM2/view.html 進行中の有効化審査は、現時点では 1 年目より排出削減が見込める方向で現在進んでいるが、今後 CDM 登録までに、プロジェクトによる森林伐採がより大きなリーケージ排出につながると判断される可能性も引き続き残る。

[58] 2011 年の南アフリカで開催された COP17 において採択された「ダーバン合意」で 2015 年に全ての締約国が参加する新しい枠組みを採択し、2020 年から運用開始されることとなった。

なお、第二約束期間に参加する先進国で 2020 年までの削減遵守目標を挙げる地域は欧州連合（EU）とオーストラリアに加え、リヒテンシュタイン、モナコ、ノルウェー、及びスイスがある。

② CER の市場と規制

EU は 2005 年 1 月からキャップ＆トレード方式の欧州連合域内排出量取引制度（EU-ETS）を導入し、第 2 フェーズ（2008 年から 2012 年まで）を経て 2013 年から第 3 フェーズに入った[59]。EU-ETS では、CER の取得・提出を削減実績としてカウントすることが認められている。CER の価格は、投資家の動向に左右されるが、中でも、市場として最も早くから確立し、取引量の点でも支配的な地位を占める EU-ETS の動向に大きく左右されてきた。

EU-ETS では、2013 年 1 月から、工業ガスプロジェクト[60]の CER 及び、2013 年以降登録の CDM プロジェクト由来の CER が原則使用不可になるなど、適格条件が規定された。しかし、LDC 国のプロジェクトや EU と二国間合意した国の CER は、例外的に 2013 年以降の登録でも EU-ETS での使用が認められることとなった。

EU-ETS に加え、今後、CER の利用が可能となる市場として、オーストラリアの排出権市場が挙げられる。オーストラリアでは 2011 年 10 月に温暖化ガスを排出する企業に負担を求める炭素価格制度に関連した一連の法案が可決されたことを受け、2012 年 7 月より炭素価格制度（炭素税）が導入された。これにより、温暖化ガスが比較的多い企業は 1 トン当り 23 オーストラリアドルの支払が求められ、負担額は 2014 年にかけて毎年 2.5%引き上げられる予定である。その後、2015 年 7 月より排出権価格が市場の需給で決まる排出量取引制度（ETS）へ移行することが予定されているが、これに合わせて CER を含む国際排出権の一部使用が可能となる見通しである。

また、前述の通り、第二約束期間に参加しない国も CDM プロジェクトに参加して 2013 年以降の CDM クレジット （CER）を原始取得（自国に転送）することが可能であり、例えば、今後日本の自主目標達成への CER 利用が可能となった場合、日本においても CER の需要が見込めると考える。

③ EU-ETS における CER 価格の推移と LDC の CER 価格

排出権価格は 2011 年央以降の下落に続き、最安値を探る動きを続けている。2009 年頃の金融機関を巡る不安が広がった際（いわゆる“リーマンショック”）には大幅に下落し、第一回目の下落トレンドとなった。その後、約 2 年間、景気の回復期待に支えられ横ばいの推移を続けたが 2011 年後半の半年間は、欧州の一部の財政問題が拡大する懸念が広がる中、2 回目の下落トレンドを形成した。その後、2012 年の前半は踊り場の様相となったが反転のきっかけはなく、

[59] EU-ETS へは EU 加盟国に加え、リヒテンシュタイン、ノルウェーなど、EU 非加盟国も参加している。また、スイスは独自の ETS を持つが、EU-ETS との相互リンクに向け、現在協議中である。
http://www.bafu.admin.ch/emissionshandel/10923/index.html?lang=en

[60] HFCs 及びアジピン酸 N_2O プロジェクト

夏場以降は再び最安値を探る動きとなった。2013 年 2 月現在、先物 12 月限は 0.3 ユーロ台、スポット価格は 0.1 ユーロ台を推移している。欧州のアナリストの見通しは、2013 年の平均 0.71 ユーロである。グラフで示した先物価格は現在、2013 年 12 月に CER 価格が 0.33 ユーロになると見通していることを表している。また、現在、スポット取引の CER 価格は 0.11～0.12 ユーロ程度とされている。CDM 事業者にとっては、CER の価格が事業推進のインセンティブとなっていたが、現在はそのインセンティブが著しく低下した状態である。

図 5-1：CER 先物価格推移（2011 年から 2013 年 2 月まで）

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

上述の通り、最安値圏で推移している CER 価格の大幅な改善は一般的には見通しづらい。しかしながら、EU-ETS による適格条件の規定により 2013 年 1 月から、工業ガスプロジェクトの CER が使用不可となったことに伴い、今後 EU-ETS 市場への CER 供給量が大幅に縮小することが見込まれることや、長期的には欧州経済の回復も見込まれること、さらには、2015 年 7 月 1 日以降はオーストラリアの排出権市場でも CER の取り扱いが一部可能となることから、CER の需給バランスの大きなズレは軽減される方向にあるといえる。また、LDC の CER は、先進国が目標達成・遵守のために使用するのではなく、後開発途上国の持続可能な発展を支援するという観点から、別の価格形成がされていくことが今後十分に期待しうるものと思料される。

④　本調査プロジェクトから期待される CDM 収益

本調査が対象とするブ国の地方電化事業及びザ国の小規模水力発電事業から見込まれる CDM による CER の売却による収益の見込みを現時点の CER 価格を含めいくつかのシナリオについて表 5-1 に示した。

表 5-1：本調査プロジェクトから期待される CDM 収益

プロジェクト	年間 CER[61] （tCO_2e/年）	CER 売却による収益見込		
		2013 年 2 月 スポット価格 （0.10€/tCO_2e）	2011 年前半 レベルの価格 （10€/tCO_2e）	LDC 独自の CER 価格形成がなされた場合
ザンビア「電力アクセス向上事業」小水力発電事業	11,037	1,103.7 €/年	110,370 €/年	未知数*
ブータン 「地方電化事業」	19,259[62]	1,925.9 €/年	192,590 €/年	未知数*

*未知数ながら LDC 支援の観点から相応に高い価格で購入意向を示す投資家が出てくることが期待される。

5.2.2. CDM プロジェクトの地理的不均衡是正に向けた国連の動き

排出権市場における LDC の CER 価格に関する動向に加え、CDM の制度においても LDC における CDM 実施を支援する取り組みが進められている。これまで、CDM プロジェクトが特定の国（中国、インドなど）に集中し、持続可能な開発が求められる LDC 等で実施されない地理的不均衡が CDM の課題であった。2013 年 2 月現在において、CDM の全登録件数は 6,602 件に上るが、このうち LDC がホスト国となっている登録案件は 78 件と全体の 1%に留まる。CMP では、この CDM の地理的不均衡の是正について、継続的に検討しており、以下のような取り組みの実施を決定している。

① 極小規模プロジェクトに対する追加性証明の免除

CDM において、CDM の支援が無ければプロジェクトの実施がなされないことを証明する、追加性の証明はプロジェクトの CDM 事業登録を求めるプロジェクト実施者の大きな負担となっていた。CDM 理事会は CDM 案件の地理的不均衡是正策のひとつとして極小規模（マイクロスケール）CDM プロジェクトに関する手続きの簡素化を検討し、出力 5MW 以下の再生可能エネルギープロジェクト（タイプ I プロジェクト）、20GWh/年未満の省エネプロジェクト（タイプ II プロジェクト）、及び、再生可能エネルギープロジェクトや省エネプロジェクト以外のプロジェクト（タイプ III プロジェクト）で年間削減量 20kt（CO_2 換算）未満のプロジェクトについて、後発開発途上国(LDC)で実施されるなど、一定の条件を満たす極小規模プロジェクトを対象に、

[61] 有効化審査中の PDD における年間 CER 量。（実際の電力供給量に基づく下方修正の可能性有）
[62] 進行中の有効化審査は、現時点では 1 年目より排出削減が見込める方向で現在進んでいるが、今後 CDM 登録までに、プロジェクトによる森林伐採がより大きなリーケージ排出につながると判断された場合、CER 発生はクレジット期間開始後 16 年目以降となり、クレジット期間平均の年間 CER は約 6,000 トンが見込まれる。

マイクロスケールプロジェクトのための追加性立証に関するマイクロスケールガイドライン[63]を承認した。このガイドラインの導入以降、LDC における CDM プロジェクトの実施数は確実に増えつつある[64]。

本調査が対象とするザ国小規模水力プロジェクトは有効化審査において、このマイクロスケールガイドラインに則り、追加性立証を免除された。今後もこのガイドラインの適用により事業者の CDM 登録までの負担を軽減することが出来ると考える。

② 標準化ベースライン（Standardized baseline）の導入

2010 年 CMP6 において、これまでプロジェクト毎であったベースライン排出量の設定方法を標準化する標準化ベースラインの導入が決定した。これにより、環境十全性を担保しながら、CDM プロジェクト活動による排出削減量の算定や追加性証明が容易になることが期待できる。締約国、プロジェクト参加者、国際的産業機関、オブザーバー機関はホスト国の DNA（指定国家機関）を通じて新たな方法論又は既存の方法論に適用可能な標準化ベースラインの提案を行うことが出来る。EB は必要に応じて関連 DNA と協議し、LDC や SIDS、CDM プロジェクト登録件数 10 件未満の国に適用できる方法論、及び登録件数が少ない CDM プロジェクトタイプや地域（特に、独立システムにおけるエネルギー生成、交通、及び農業の各分野）に適用可能な方法論を優先して、標準化ベースラインを開発することとなっている。なお、標準化ベースラインの適用は、ホスト国 DNA の判断に委ねられる。

2013 年 2 月現在、承認済みの標準化ベースラインは存在しないが、下表に示す 4 件の提案について、国連 CDM 理事会が審査を実施中である。

表 5-2：現在審査中の標準化ベースライン[65]

Reference	提案内容	提案者	審査状況
PSB-0001	炭生産のための標準化ベースライン	ウガンダ DNA	イニシャルアセスメント終了
PSB-0002	エチオピアにおけるクリンカー製造のための標準化ベースライン	エチオピア DNA	イニシャルアセスメント終了
PSB-0003	南部アフリカパワープールのグリッド排出係数のための標準化ベースライン	ボツワナ DNA	イニシャルアセスメント終了
PSB-0004	カンボジアの精米所におけるエネルギー消費に関する標準化ベースライン	カンボジア DNA	イニシャルアセスメント終了

[63] 2010 年 5 月の EB54 にて承認。最新は Guidelines for demonstrating additionality of microscale project activities (version 04), EB 68, Annex 26
[64] 2004 年 11 月の CDM 第 1 号登録以降、ガイドラインが導入された 2010 年 5 月までの LDC 案件の登録件数は 15 件。以降、2013 年 2 月までに 78 件に増加した。
[65] http://cdm.unfccc.int/methodologies/standard_base/index.html

PSB-0003 の南部アフリカパワープール（SAPP）のための標準化ベースラインは国連環境計画 Risoe センター（URC：UNEP Riso Center）が SAPP 事務局と共同で開発したものであるが、南部アフリカ地域の多国間グリッドである SAPP の排出係数を標準化ベースラインによって固定することにより、SAPP に接続し、標準化ベースラインに賛同する 9 カ国[66]においてプロジェクト毎のグリッド排出係数算出が不要となる。ザ国は SAPP に接続しており、今後この標準化ベースラインが承認されると、これまでザ国では困難と考えられてきたグリッド接続の再生可能エネルギー事業（水力発電所建設）の CDM 事業化が容易になると考えられる。

③ CDM ローン制度（CDM Loan scheme）[67]

CMP6 にて、「CDM 登録件数 10 件未満の国における CDM プロジェクトの開発を支援するためのローン制度の運用に関する手引・手順」が採択された。これに基づき、2012 年 4 月 CDM ローン制度が発足した[68]。CDM ローン制度は原則無利子のローンを、CDM 登録件数 10 件未満の国における CDM プロジェクトに提供する。ローンの対象となる活動は、PDD の開発コスト、該当プロジェクトの有効化審査・第 1 回検証までのコストである。プロジェクト毎に必要コストが変わることから、明確な融資金額の上限は定められておらず、融資審査の過程で金額の妥当性が判断されることとなる。貸付金は第 1 回の CER 発行から 12 ヶ月以内に返済することとなっているが、発行された CER から十分な収益が得られない場合、ローンの返済期限は第 1 回発行から最大 36 ヶ月まで延期することが可能である。ローン契約においては、プロジェクト実施者の CDM 手続きを支援する CDM コンサルタントが事前に選定され、ローン契約に名を連ねることとなっている。

ブ国、ザ国はいずれも CDM ローン制度への申請資格を有する[69]ことから、今後この制度を活用し、初期費用負担の軽減により CDM 事業実施が後押しされることが期待される。ただし、無利子ではあるが、返済を求められるローンであることから、返済計画を十分検討の上申請する必要がある。

5.2.3. CDM 実施における両国の強み及び課題

上記の通り、2013 年以降に登録される CDM 事業のうち、唯一 LDC における CDM 事業に関しては EU-ETS において引き続き取引されることが明確になっている。ブ国及び、ザ国は LDC に該当することから、両国から今後発生する CER は、欧州の需要家よる使用が引き続き可能である。また、CDM の仕組みそのものも LDC における CDM 実施を後押しする方向である。

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[66] ボツワナ、コンゴ民主共和国、レソト、モザンビーク、ナミビア、南アフリカ、スワジランド、ザンビア、ジンバブエ
[67] http://www.cdmloanscheme.org/
[68] http://cdm.unfccc.int/press/releases/2012_08.pdf
[69] http://www.cdmloanscheme.org/eligible-countries

そもそもLDCにおけるCDM事業はまとまったCER量が期待できる規模のプロジェクトは少なく、量よりも質を問われる事業であるといえる。CERの量は期待できなくとも、LDCの持続的な発展につながる事業に温暖化対策のお墨付きを与えるCDM事業化に対しては、GHG削減目標達成を目的としたCER取得とは別の観点から、同事業に賛同し、支援を希望する企業は潜在的に存在すると考える。上述の通り、CER価格が低迷する現状では資金面において事業を下支えする役割をCDMが担うことは難しい状況である。しかしながら、こうしたLDCに対する企業のニーズが顕在化することにより、これまでのCERとは異なる価格形成がされ、CDMによるプロジェクト採算性向上の後押しも期待できよう。また、国連によるLDCにおけるCDM実施を後押しする制度上の支援を利用することにより、これまでよりもLDCにおける事業のCDM化のハードルは低くなっているといえる。このようにLDCであることが、CDM事業化に向けた両国の強みであると考える。

なお、ブ国、ザ国を含めたLDCでCDM実施を継続するための課題は、引き続きPDD作成、有効化審査対応、CER発行に向けたモニタリング及び、検証への対応など、一連のCDM手続きに関する知見の蓄積と、CDM登録及びCER発行に向けた諸手続きの初期費用の確保であると考える。本調査はCDM登録に向けた実務に対する支援に加え、ホスト国に対するCDMキャパシティの向上を目的としたもので、両国のニーズに合致した調査であったといえる。今後はCDM登録後のモニタリング及びCER発行に向けた検証及び認証手続きの円滑な進行のための能力向上も課題となろう。今後の初期投資費用の確保には本調査に類似の支援に加え、国連によるCDMローン制度の活用や、LDCからのCERに対する評価向上に期待するところである。

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)

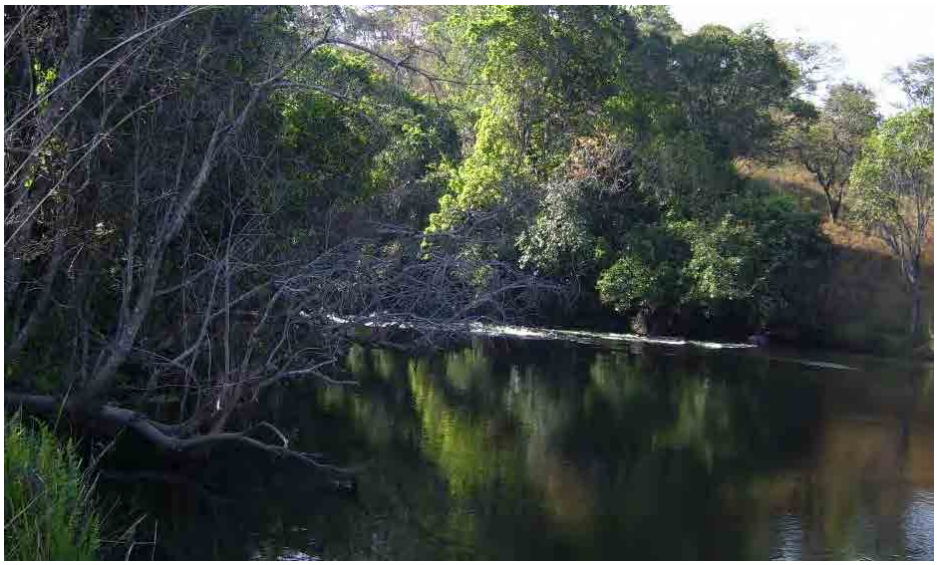
History of the document: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities

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

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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).

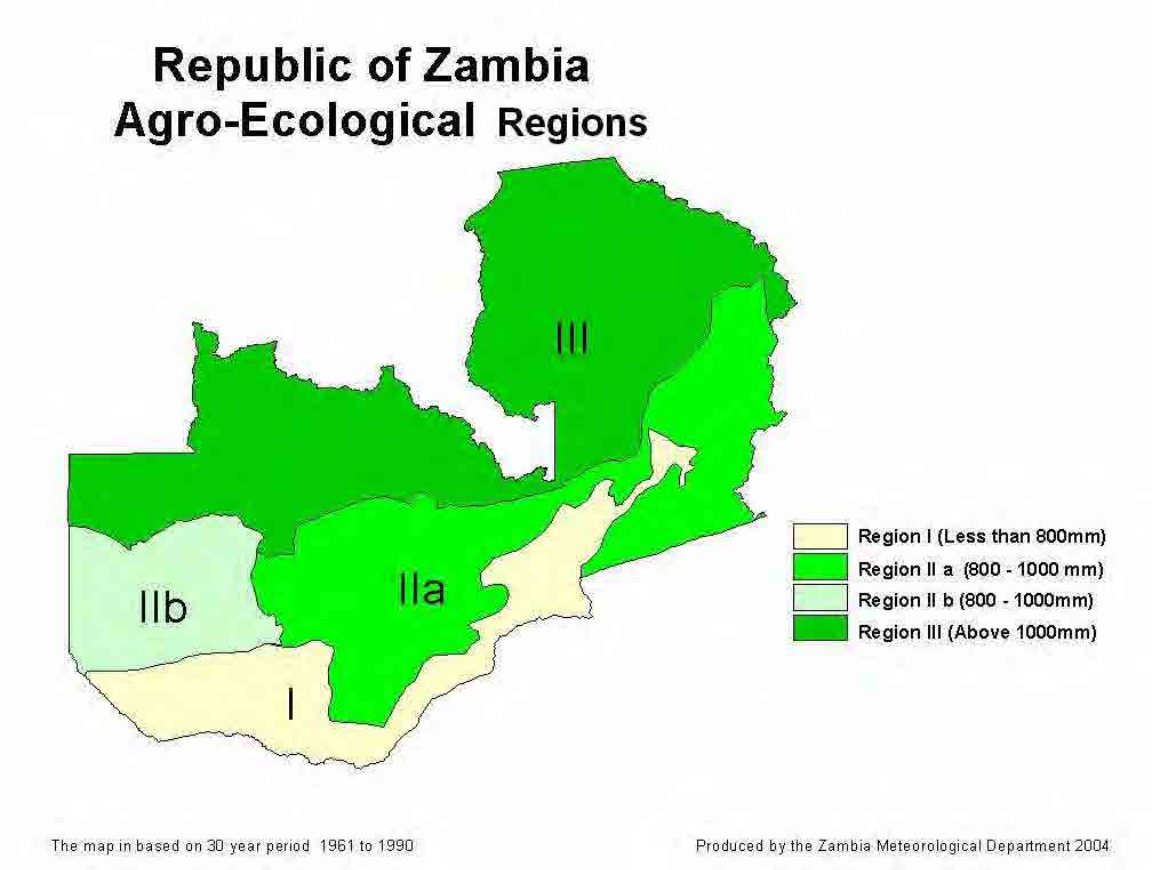

Figure 1: Agro-ecological Regions of Zambia

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.

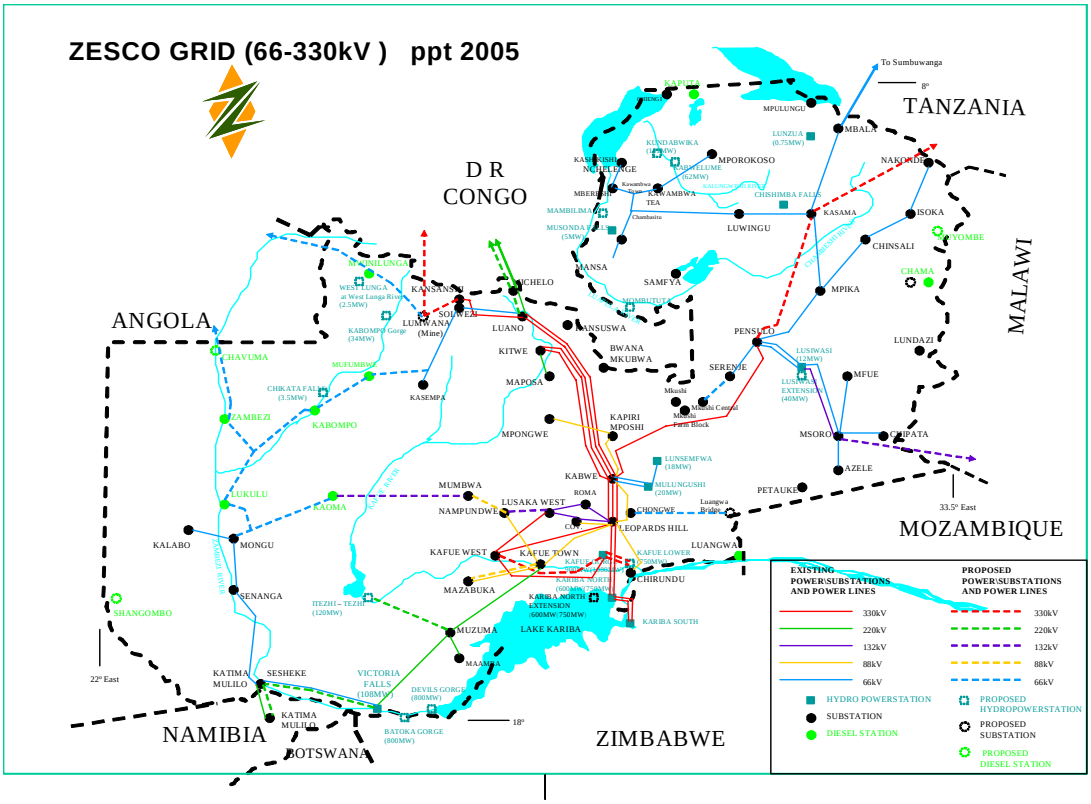

Figure 2 ZESCO Limited power grid

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.

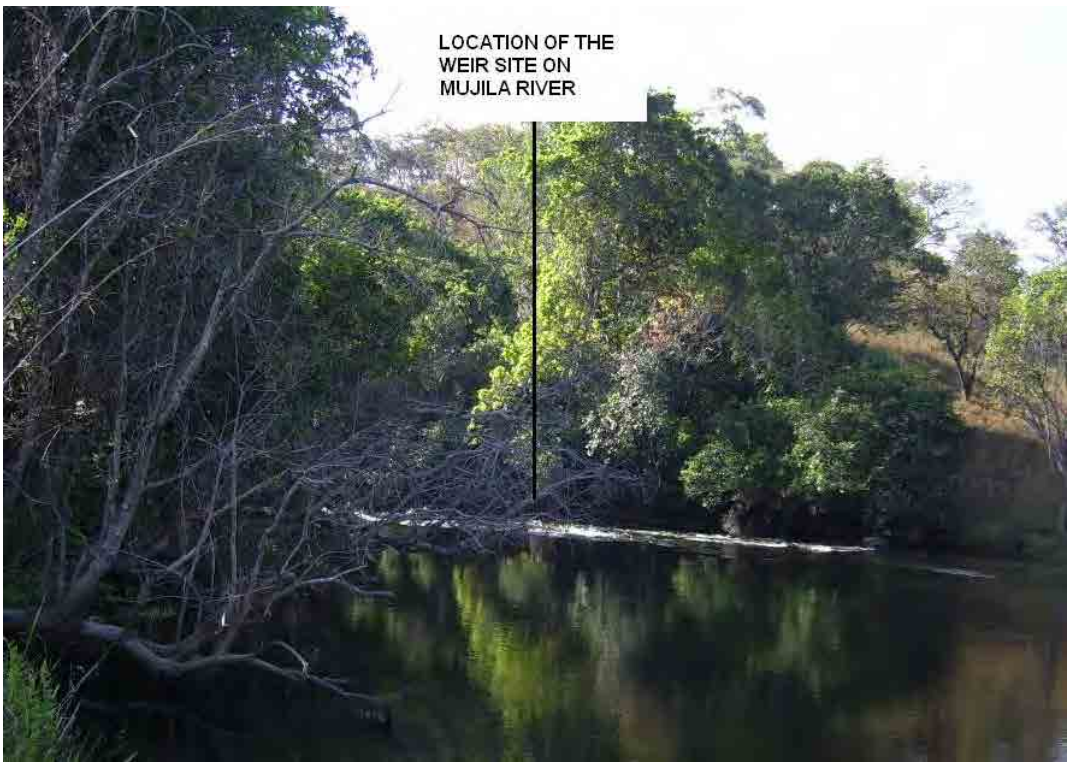

Figure 5: Proposed location of the Weir on Mujila River

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.

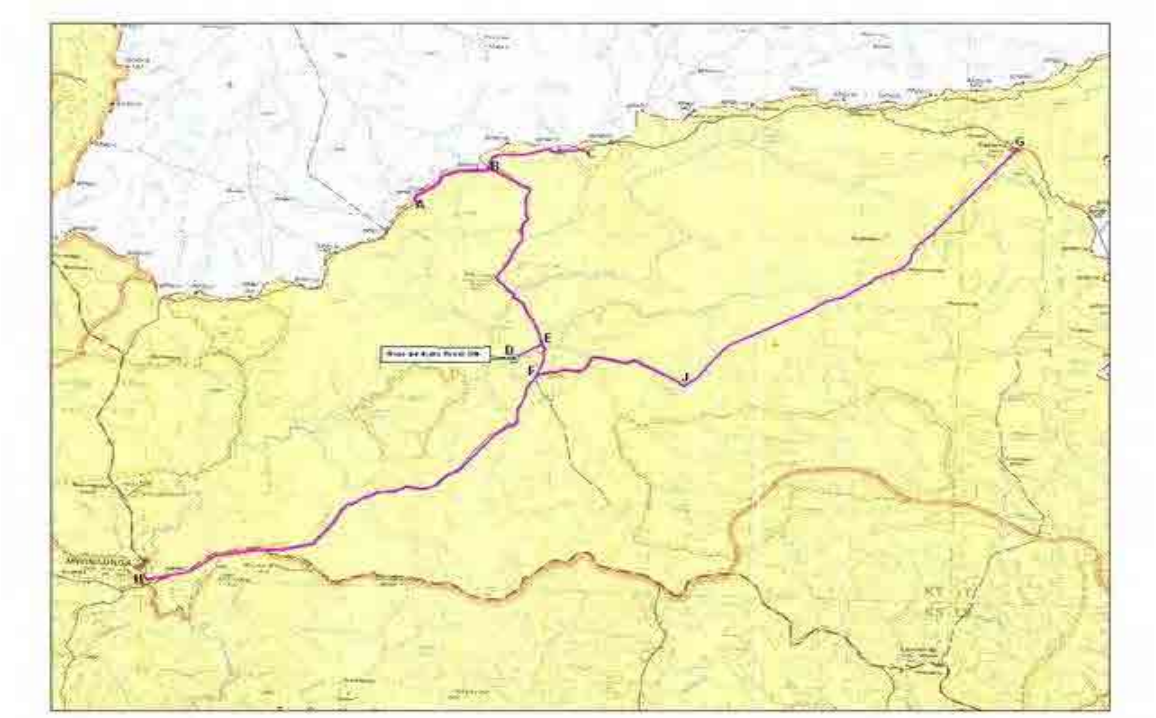

Figure 6: Location of Mujila Mini-Hydropower Station and proposed electricity grid

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

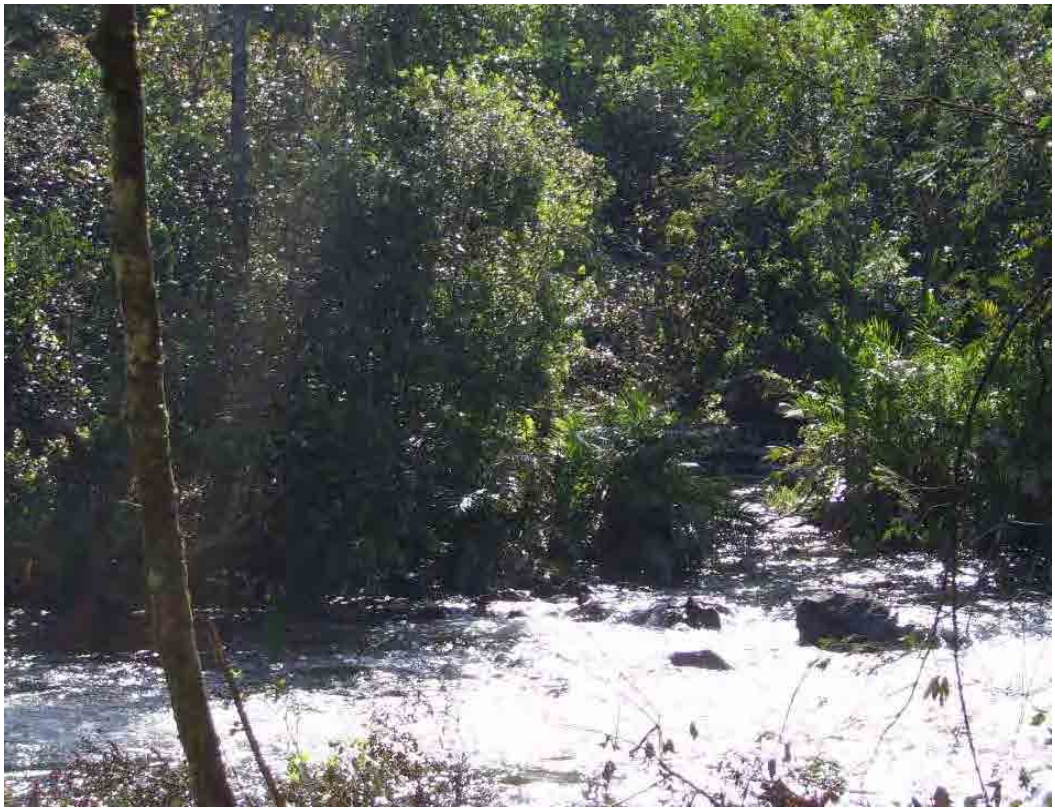

Figure 11: Riverine riparian forests along the Mujila stream

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.

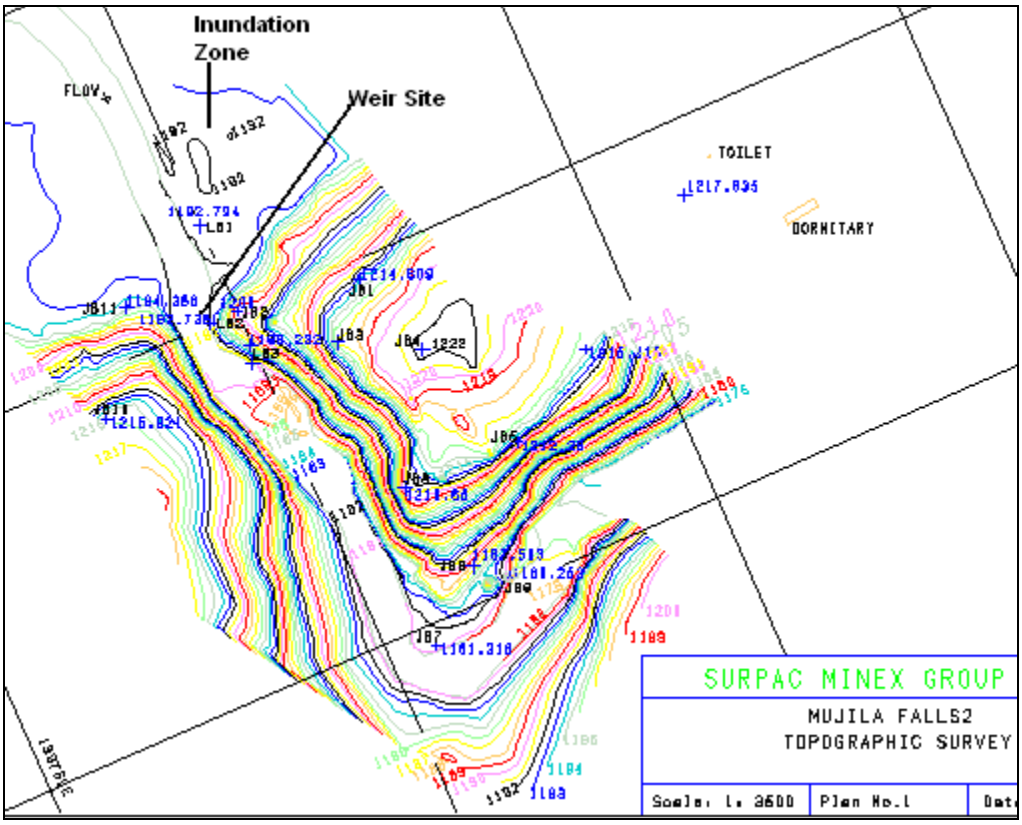

Figure 21: Topographical survey diagram showing weir site and the zone of inundation

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

Ansell, W.F.H. (1960). *Mammals of Northern Rhodesia*, Government Printers. Lusaka.

Caruthers, V (1998). Flowers and Grasses, Ferns and Fungi, Southern African Green Guide. National Book Printers, Western Cape, South Africa.

CSO. (1994). *National Census of Agriculture (1990/92). Part II census report volume 1*, Lusaka. Zambia.

CSO. (2003). *2000 Census of Population and Housing Summary Report.* Lusaka.

Davies, H.D. (1971). *Zambia in Maps*. Hodder and Stoughton. London.

Environmental Protection and Pollution Control Act, CAP 204 of the Laws of Zambia. Government Printers, Lusaka.

Fanshawe, D.B (1971). Useful trees of Zambia for the agriculturalist, Government Printer, Lusaka.

Glasson, J. Therivel, R. And Chadwick, A. (1994). *Introduction to Environmental Impact Assessment*. University College London (UCL) press. London.

Government of Zambia. 1976. Vegetation map of Zambia (1:500 000), Lusaka.

Jeffery, R., Monro, R. And O'keeffe, L (Editors)(1991). *A guide to common Wild Mammals of Zambia*. Wildlife Conservation Society of Zambia. Lusaka.

Mpakateni, J. (1994). Some mammals of Zambia, Zambia Printing Company Limited, Lusaka, Zambia.

Newman, K. (1983). Newman's Birds of Southern Africa, Southern Book Publishers , Cape Town, South Africa.

Norplan & ZESCO, (2000), Small Hydropower pre-investment Study-North-Western Province, Zambia.

Phillipson, D. W. and N. M. Katenekwa, N.M. (1972). National Monuments of Zambia, National Heritage Conservation Commission, Livingstone, Zambia.

Rural Electrification Fund Committee. (1995). *Guidelines on Selection of Rural Electrification Projects for funding by Government*. Ministry of Energy and Water Development. Lusaka.

Tokyo Electric Power Company (2007): Rural Electrification Master Plan Study in Zambia, Interim Report.

Utsugi K and Mazingaliwa K (2002), Field Guide to Zambian Fishes, Planktons and Aquaculture, JICA. Zambia.

Veldkamp, W.J. (1987). *Soils of Zambia.* Soils Bulletin No. 13 (2nd Edition), Soil Survey Unit, Mount Makulu. Chilanga. Zambia.

Walmsley Environmental Consultants.1997. Environmental Project Brief for a route Selection study of 132kV power line from Livingstone to Katima Mulillo. Watermeser Rivonia, South Africa.

Wildlife Conservation Society of Zambia (1991). A Guide to Common Wild Mammals of Zambia, associated Printers Limited, Kitwe, Zambia.

Yachiyo Engineering Co., 1995, The National Water Resources Master Plan in Zambia, Ministry of Energy and Water Development, Mulungushi House, Lusaka, Zambia.

ZESCO Limited. 1997. Development Options for the Sub-Transmission System into Lusaka.

ZESCO Limited. 1998. Rehabilitation of Kafue Gorge Hydropower Station Bidding Documents for Civil, Road and Mechanical Works TD92-93 Volume 1(2), Lusaka.

ZESCO Limited. 1999. Environmental Project Brief for the rehabilitation of Kafue Gorge Hydropower Station.

ZESCO. 2000. E*nvironmental Impact Assessment for the development of Hydroelectric Power in Luapula and Northern Provinces*

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

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

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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.

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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.

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	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	

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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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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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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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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	

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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	

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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	--	--

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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	

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	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	

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	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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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

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	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:

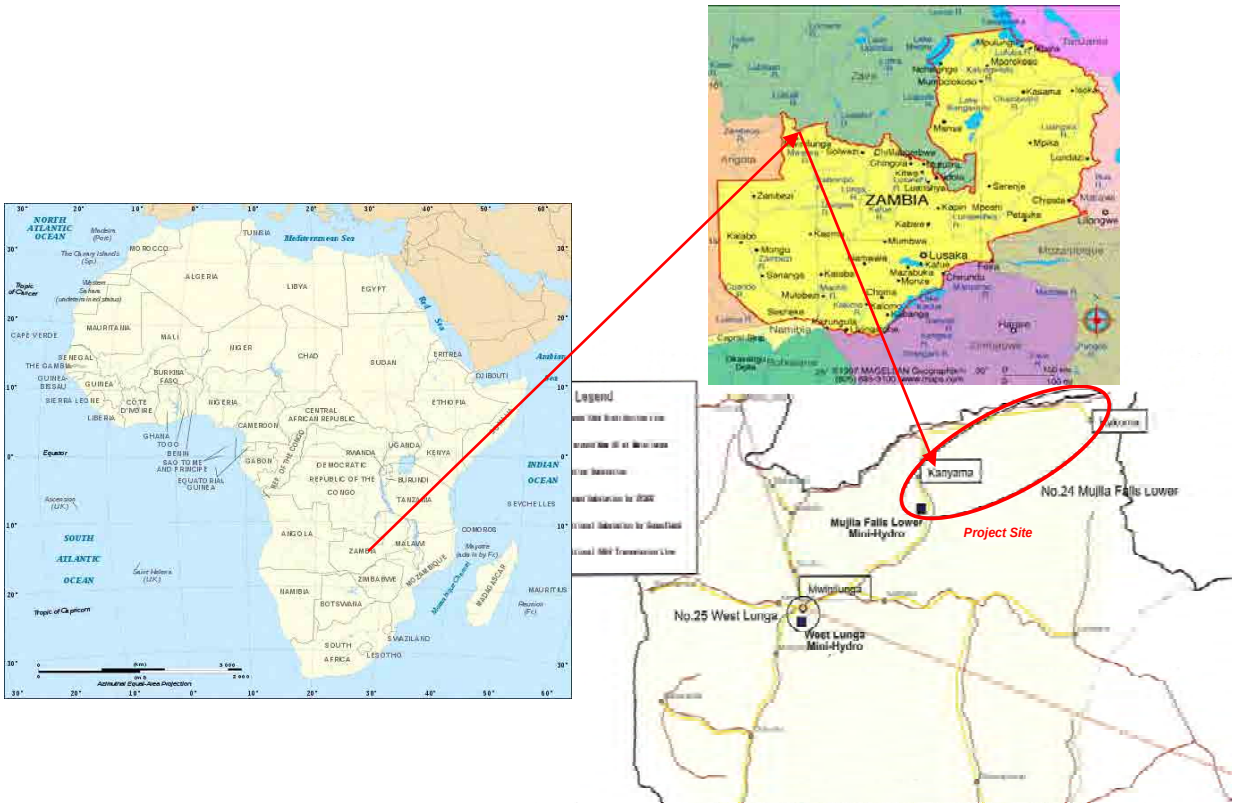

Figure A.1: Map of project location in the North Western Province, Zambia

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.

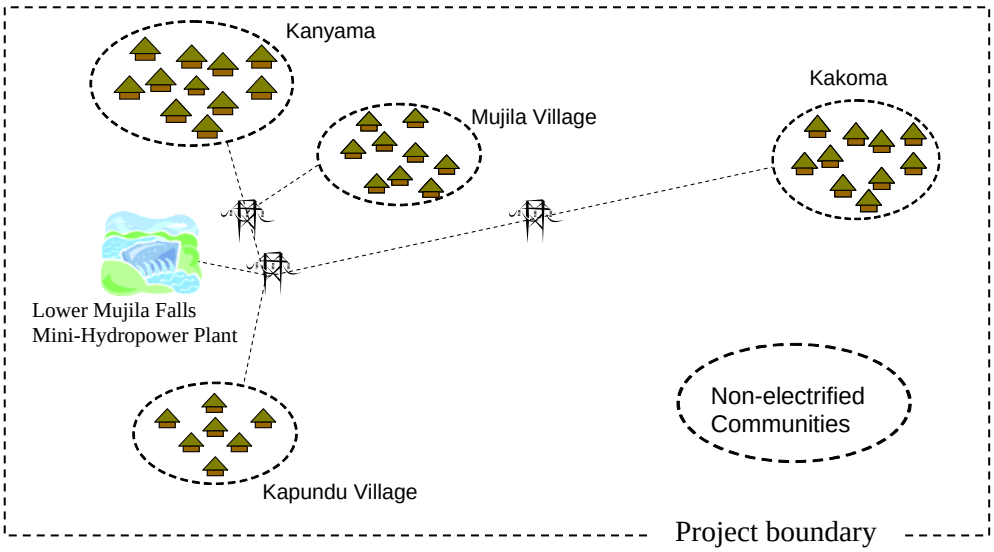

Figure B.1: Project boundary

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.

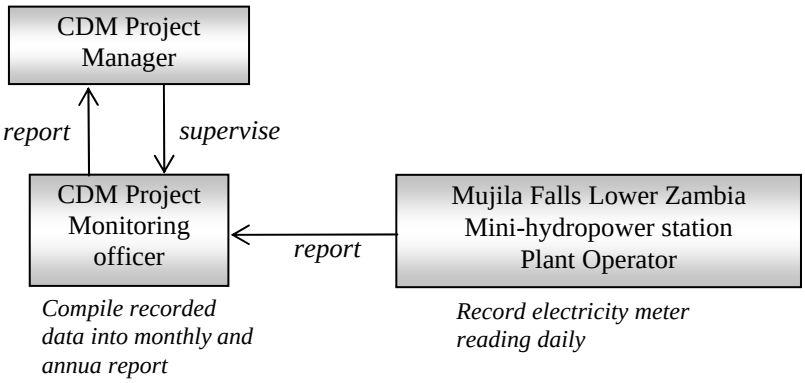

Figure B.2: Monitoring organization chart for the project activity

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.

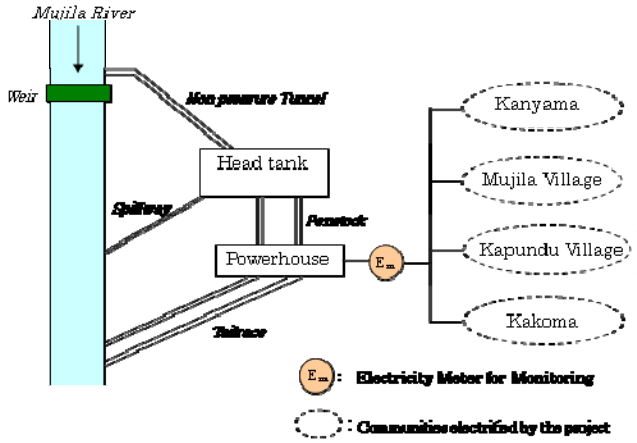

Figure B.3 Location of monitoring meter

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

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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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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
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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
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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.

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).

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.

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"

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.

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

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

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).

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	

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

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

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

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	

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.]

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.

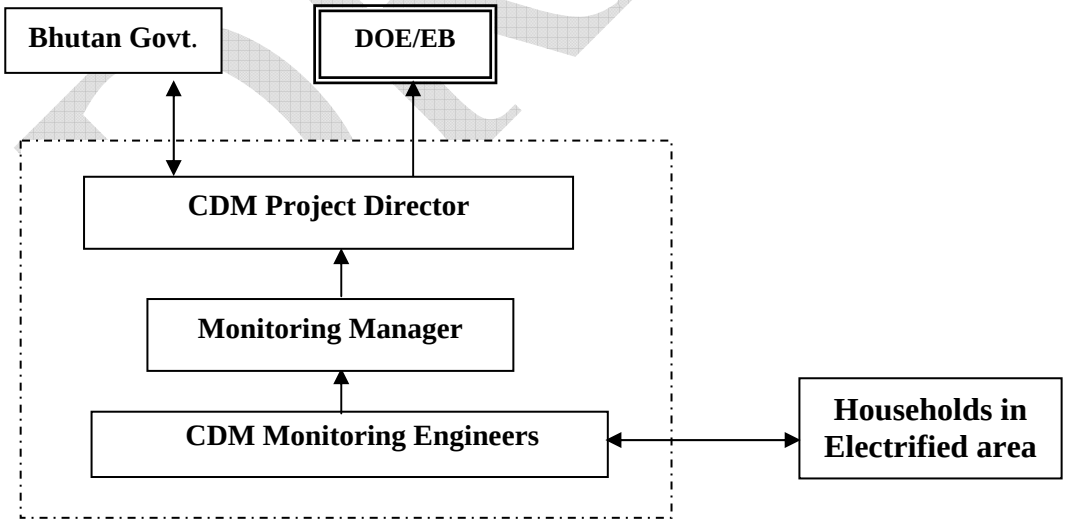

Figure: Operation and Management Scheme

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:

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		

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	
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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	